Regulations and Curriculum for

Bachelor of Technology (B.Tech.)
in
Civil Engineering

Version 2022.03

NITTE
(Deemed to be University)

(Established under Section 3 of UGC Act, 1956)
Placed under Category 'A' by MHRD, GoI | Accredited with 'A+' Grade by NAAC

Regulations and Curriculum for

Bachelor of Technology (B. Tech.)

Choice Based Credit System (CBCS)
Effective from AY 2022-23

NITTE
(Deemed to be University)

(Deemed to be University under Section 3 of UGC Act, 1956)
(Placed under Category 'A' by MHRD, Govt. of India, Accredited with 'A+' Grade by NAAC)
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VISION

To build a humane society through excellence in the education and healthcare

MISSION

To develop
Nitte (Deemed to be University)
As a center of excellence imparting quality education,
Generating competent, skilled manpower to face the scientific and social challenges with a high degree of credibility, integrity,
ethical standards and social concern

Regulations and Curriculum
B. Tech. Degree Programs
Choice based Credit System
(CBCS)

Effective from

Academic Year

2022 – 2023

Curriculum for Acquiring Professional Skills (CAPS)

With Scheme of Teaching & Examination

REGULATIONS: 2022

COMMON TO ALL

B. Tech. DEGREE PROGRAMS

CHOICE BASED CREDIT SYSTEM

(CBCS)

Version 2022.03

Choice Based Credit System (CBCS)

1. Choice for the selection of courses during each semester.
2. Choice in planning the academic activities by selecting desired number of courses per semester.
3. Balanced curriculum with engineering, science, humanities, and management courses.
4. Project based learning (PBL) which focusses on experiential learning.
5. Opportunities to study inter-disciplinary courses.
6. Enabling slow learners by offering important courses in all semesters.
7. Optional Summer semester.
8. Opportunity to get associated in research projects to acquire research experience.
9. Value addition with Honors / Minor credentials.

Curriculum for Acquiring Professional Skills (CAPS)

1. Practicing outcome-based education (OBE) where Courses made student-centric rather than teacher-centric.
2. Provisions for courses integrated with Lab/ PBL component.
3. Focus on experiential learning.
4. Ability enhancement and skill development courses as per National Education Policy (NEP) 2020.
5. Focus on Industry Internship and Research Internship.
6. Students to work on real world/interdisciplinary problems in major project.
7. Importance is given to creativity, innovation, and development of entrepreneurship skills.

Key Information

Program Title	Bachelor of Technology Abbreviated as B. Tech.
Short description	Four-year, eight semester Choice Based Credit System (CBCS) type of Undergraduate Engineering Degree Program with English as medium of instruction.
Program Code	14ENGR04D2
Revision version	2022.03 These regulations may be modified from time to time as mandated by the policies of the University. Revisions are to be recommended by the Board of Studies for Civil Engineering and approved by the Academic Council.
Effective from	09-03-2024
Approvals	• Approved in the 51st meeting of Academic Council of NITTE (Deemed to be University), held on 19-09-2022 and vide Notification of NITTE (DU), N(DU)/REG/AC-NMAMIT/2022-23/233 dated 12-10-2022. • Notification of Nitte (DU), N(DU)/REG/AC/-SA/2022-23/909 dated 24-04-2023. • Approved in the 54th Academic Council meeting of NITTE (Deemed to be University), held on 24.06.2023 and vide Notification of Ref: N(DU)/REG/AC-NMAMIT/2022-23/1264 dated 18.07.2023. • Approved in the 56th Academic Council meeting of NITTE (Deemed to be University), held on 23.02.2024 and vide Notification Ref: N(DU)/REG/AC-NMAMIT/2023-24/925 dated 09.03.2024.
Program offered at	NMAM Institute of Technology, Off -Campus Centre, Nitte, 574110, Karkala Taluk
Grievance and dispute resolution	All disputes arising from this set of regulations shall be addressed to the Board of Management. The decision of the Board of Management is final and binding on all parties concerned. Further, any legal disputes arising out of this set of regulations shall be limited to jurisdiction of Courts of Mangalore only.

CONTENTS

PREAMBLE

NMAM Institute of Technology (NMAMIT) was established in 1986 and is located at Nitte and off-campus center of NITTE (Deemed to be University), accredited by National Assessment & Accreditation Council (NAAC) with 'A+' grade. NMAMIT is recognized by the All-India Council for Technical Education (AICTE), New Delhi.

The Bachelor of Technology (B. Tech.) Programs focus on Pursuing Excellence, Empowering people, and Partnering in Community Development. Out of eleven UG Programs i.e., Artificial Intelligence & Machine Learning (AM), Artificial Intelligence & Data Science (AD), Biotechnology (BT), Computer & Communication Engineering (CC), Computer Science & Engineering (CS), Civil Engineering (CV), Electronics & Communication Engineering (EC), Electrical & Electronics Engineering (EE), Information Science & Engineering (IS), Mechanical Engineering (ME) and Robotics & Artificial Intelligence (RI), all seven eligible UG Programs i.e., BT, CS, CV, EC, EE, IS and ME are accredited by NBA, New Delhi under Tier - I category till 30th June 2025.

The curriculum is jointly approved by members of the Board of Studies (BoS) and Academic Council drawn from academia, Industry, Alumni, and working professionals from Industry, and has been designed to integrate hands-on practical training with the concepts of theory courses to enhance the learning experience.

The Curriculum focuses on students Acquiring Professional Skills (CAPS) through rigorous theoretical training using innovations in pedagogy, experiential learning, active learning, collaborative learning, critical thinking, project planning, Project Based Learning (PBL), Ability enhancement courses for skill-building, effective communication, professional practice, creativity & innovation and developing entrepreneurial skills.

The focus of the Institution is to impart Quality Education to generate competent, Skilled, and Humane Manpower to face emerging Scientific, Technological, Managerial and Social Challenges with Credibility, Integrity, Ethics, and Social Concern.

In the present scenario, students wish to make plans for a bright future. However, student aspirations and industry demands are highly diverse. Employers expect the graduates possess multi-disciplinary competency, Information and Communication Technology (ICT), and leadership skills. In this context, NMAMIT offers the opportunity to the students to select the courses of their choice and helps them in grooming to have well-rounded personalities and become industry ready.

Efforts have been made to make the syllabus compliant with international professional societies.
As part of providing quality engineering education, at NMAMIT, Nitte, it has initiated the Choice Based Credit System (CBCS) into its academic curriculum. By this, the students can register for courses of their choice and alter the pace of learning within the broad framework of academic courses and credit requirements. CBCS allows students to plan for their academic load and alter it as they progress in learning. Students also have the option of choosing courses from a pool of courses within each classification. Ample options are given to choose interdisciplinary courses from other programs which will help the student to develop additional skills. Slow learners will also be benefitted since important courses are offered in all semesters. This arrangement helps the

students to re-register and clear the backlog courses in the subsequent semester. Suitable provisions are made for fast learners to associate them with research activities of faculty members and contribute to research beyond the working hours.

A faculty advisor helps the student in identifying the courses to be studied in each semester based on program requirements, course prerequisites, student's interest in various disciplines, past academic performance, and courses offered by the departments.

Learning becomes more 'experiential' by carrying out labs associated with theory, mini-projects, and Project Based Learning (PBL) as a part of many courses which enhances the capability of students in understanding and apply Engineering /Technology concepts to solve real life-problems. Hence students will develop the ability to apply the gained knowledge in multi-disciplinary projects and be able to take up major projects based on real-world problems and come up with better solutions while addressing social concerns.

REGULATIONS

COMMON TO ALL B. Tech. (CBCS) DEGREE PROGRAMS OF

NITTE (Deemed to be University)

1. INTRODUCTION

1.1 The general regulations are common to all B. Tech. (CBCS) Degree Programs conducted at the NMAM Institute of Technology (NMAMIT), off-campus center of NITTE (Deemed to be University) and shall be called "B. Tech. Regulations".

1.2 The provisions contained in this set of regulations govern the policies and procedures on the Registration of students, imparting instructions of courses, the conduct of the examination & evaluation, certification of student performance, and all amendments related to the said Degree program(s).

1.3 This set of Regulations, on approval by the Academic Council and Governing Council, shall supersede all the corresponding earlier sets of regulations of the B. Tech Degree program of NITTE (Deemed to be University) along with all the amendments thereto, and shall be binding on all students undergoing the Graduate Degree Program(s) (Choice Based Credit System) conducted at the NMAMIT, Nitte with effect from its date of approval. This set of Regulations may evolve and get modified or changed through appropriate approvals from the Academic Council / Governing Council from time to time and shall be binding on all stakeholders (The Students, Faculty, Staff of Departments of NMAMIT, Nitte). The decisions of the Academic Council/ Governing Council shall be final and binding**.**

1.4 To guarantee fairness and justice to the parties concerned given the periodic evolutionary refinements, any specific issues or matters of concern shall be addressed separately, by the appropriate authorities, as and when found necessary.

1.5 The Academic Council may consider any issues or matters of Concern relating to any or all the academic activities of Engineering courses for appropriate action, irrespective of whether a reference is made here in this set of Regulations or otherwise.

1.6 The program shall be called **Bachelor of Technology,** abbreviated as B. Tech. (Program Specialization).

2. ELIGIBILITY FOR ADMISSION

Sl. No	Program	Duration	Eligibility
1	B. Tech.	4 years	Passed 10+2 examination with Physics/ Mathematics / Chemistry/ Computer Science/ Electronics/ Information Technology/ Biology/ Informatics Practices/ Biotechnology/Technical Vocational subject as per Table-1 Obtained at least 45% marks (40% marks in case of candidates belonging to reserved category) in the above subjects taken together.
2	B.Tech. (Lateral Entry to Second year)	3 years	Passed Minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks in case of candidates belonging to reserved category) in relevant branch of Engineering and Technology. (The University will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to prepare Level playing field and desired learning outcomes of the program)

Table-1
Academic Level and Credit Framework for admission to Bachelor of Technology (B. Tech.) degree program

Sl. No.	Academic Level	Desired Entry Qualifications at different levels.	NHEQF / NSQF Level at Exit	Unified Credit Level (UCF) at Exit
1	12th Std.	-	4	4
2	First Year B. Tech. Degree	12th Completed (NHEQF /UCF level 4 completed)	5	4.5
3	Second Year B. Tech. Degree	A candidate with a Diploma in the appropriate branch of Engineering /Equivalent Vocational or Technical Program with NHEQF level 5/UCF level 4.5 completed	6	5

2.1 Qualifications from foreign countries

Candidates with qualifications from educational institutions outside of India may be admitted to the program(s) subject to the establishment of equivalence by the university. The Program Committee will evaluate and establish the eligibility of such candidates.

3. PROGRAM PATHS, EXIT OPTIONS, AND DURATION OF THE B. TECH. PROGRAM

3.1 Program paths, exit options.

Sr. No	Academic Level	Entry Level Qualifications	Qualifications at Exit	NCrF Level
1	1st yr. of UG Degree	A candidate completing 10+2 years with Diploma of Vocation or passed 12th std. or equivalent vocational training with NCrF level 4	**UG Certificate***	4.5
2	2nd yr. of UG Degree	A candidate with Diploma in appropriate branch of Engineering/ UG Certificate/ Equivalent Vocational or Technical Program NCrF level 4.5	**UG Diploma (Engg.)***	5.0
3	3rd yr. of UG Degree	A candidate with 10+3+1/12+2/ UG Diploma (Engg.) in appropriate domain with NCrF level 5	**B. Sc (Engg.)***	5.5
4	Final yr. of UG Degree	A candidate with 3 yrs. Bachelor degree in Vocation / B.Sc. (Engg.) with NCrF level 5.5	**B. Tech (on completion of 160 credits with a minimum CGPA of 5)**	6
	Final yr. of UG Degree with Honors	A candidate with 3 yrs. Bachelor degree in Vocation / B.Sc. (Engg.) with NCrF level 5.5	**B. Tech** (Honors) 178 credits (Additional 18 credits over and above 160 credits in the same discipline	6
	Final yr. of UG Degree with a minor in (Other Discipline).	A candidate with 3 yrs. Bachelor degree in Vocation / B.Sc. (Engg.) with NCrF level 5.5	B. Tech with Minor 178 credits. Additional 18 credits over and above 160 credits in other disciplines	6

*** It is mandatory to earn 10 credits through internship/ Training/ specialized courses before the award of Qualifications at exit.**

3.2 Duration of the B. Tech. program

(a) The B. Tech Program shall extend over a period of a total duration of 4 years for students admitted during the first year of the program.

(b) The total duration shall be 3 years for students admitted to the second year under the lateral entry scheme.

(c) The maximum period which a student can take to complete a full-time academic program is eight years / Six years for Lateral entry diploma students for B.Tech.

(d) Each year shall have the following schedule with 5 ½ days a week. Suggested break down of Academic Year into Semesters

1.	No. of Semesters / Year	There are three semesters in an academic year. Two Main semesters (Odd, Even) followed by a summer semester. Normally the Odd Semester will be from August to December and Even Semester from January to May during a calendar year. The optional summer semester is offered during the vacation period of the even semester. The summer semester is offered considering the demand for such courses of needy students, subject to the availability of time, faculty, and other resources under a fast-track mode as the available instructional days during even semester vacation periods are less. However, the number of instructional hours needed to cover the syllabi shall be maintained (equivalent to that in the regular semester) with a greater number of instruction hours per week. (Note: The summer semester is primarily to assist slow learners and/or failed students in the main semesters. The summer semester may be used to arrange Add-On courses for other students and/or for deputing them for practical training elsewhere)
2.	Semester Duration	Main semester (Odd, Even) each 20 Weeks; Summer Semester 8 Weeks
3.	Academic Activities (Weeks)	**ODD / EVEN Semester** Registration of Courses & Course Work (16) Examination Preparation and Examination (04) Total (20) **Summer Semester** Registration of Courses & Course Work (05) Examination Preparation and Examination (03) Total (08) **Declaration of results:** 02 weeks from the date of the last examination **Inter-Semester Recess:** After each Main Semester (02) **Total Vacation:** 10 weeks (for those who do not register for the summer semester) and 4 weeks (for those who register for the summer semester)

(Note: In each semester, there will be provision for students to register for courses at the beginning, dropping of courses in the middle, and withdraw from courses towards the end, under the advice of a faculty member. These facilities are expected to enhance the learning capabilities of students, minimizing their chances of failure in courses registered and ensuring their better monitoring by Faculty Advisors).

A candidate shall be allowed a maximum duration of eight years from the first semester of

admission to become eligible for the award of a Bachelor's degree.
The calendar of events in respect of the program shall be fixed by the Institution from time to time, but preferably in line with the suggested academic calendar of the NITTE (Deemed to be University).

4. DEGREE PROGRAMS

4.1 Undergraduate B. Tech. Degree Programs are offered in the following disciplines by the respective program hosting departments listed below:

i)	Biotechnology Engineering	(BT)
ii)	Computer Science & Engineering	(CS)
iii)	Computer Science & Engineering (Cyber Security)	(CB)
iv)	Civil Engineering	(CV)
v)	Electronics & Communication Engineering	(EC)
vi)	Electronics & Communication (Advanced Communication Technology)	(AC)
vii)	Electronics Engineering (VLSI Design and Technology)	(VT)
viii)	Electrical & Electronics Engineering	(EE)
ix)	Information Science & Engineering	(IS)
x)	Mechanical Engineering	(ME)
xi)	Artificial Intelligence and Machine Learning Engineering	(AM)
xii)	Computer and Communication Engineering	(CC)
xiii)	Robotics and Artificial Intelligence Engineering	(RI)
xiv)	Artificial Intelligence and Data Science	(AD)
Other teaching departments are –		
i)	Chemistry	(CY)
ii)	Humanities	(HU)
iii)	Management and Social Sciences	(MG)
iv)	Mathematics	(MA)
v)	Physics	(PH)

4.2 The provisions of these regulations shall apply to any new discipline that may be introduced from time to time and appended to the above list.

5. CREDIT SYSTEM

In the Credit System, the course work of students is unitized, and each unit is assigned one credit after a student completes the teaching-learning process as prescribed for that unit and is successful in its assessment.

5.1 Credit Definition: The following widely accepted definition for credit can provide good flexibility to the students and strengthens CBCS under the University. Here, one unit of course work and its corresponding one credit (while referring to the main semester) shall be equal to:

- Four-credit theory courses shall be designed for 50 hours of the Teaching-Learning process.
- Three-credit theory courses shall be designed for 40 hours of the Teaching-Learning process.

- Two-credit theory courses shall be designed for 25 hours of the Teaching-Learning process.
- One credit theory course shall be designed for 15 hours of the Teaching-Learning process.

The above figures shall also be applicable in the case of the summer semester. Other student activities which are not demanding intellectually, or which do not lend to effective assessment, like practical training, study tours, and attending guest lectures shall not carry any credit.

5.2 Credit Assignment and Lower & Upper Limits for Course Credits Registration in a Semester

All courses comprise of specific Lecture/Tutorial/Practical/Project (L-T-P-J) schedule. The course credits are fixed based on the following norms.

Lecture / Tutorials / Practical:

- 1-hour Lecture per week is assigned 1.0 Credit.
- 2-hour Tutorial session per week is assigned 1.0 Credit.
- 2-hour Lab. Session/project work per week is assigned 1.0 credit.

For example,

- A theory course with L-T-P schedule of 3-2-0 hours will be assigned 4.0 credits.
- A laboratory practical course with L-T-P schedule of 0-0-2 hours will be assigned 1.0 credit.
- Calculation of Contact Hours / Week – A Typical Example

  Example:

  An LTP-C of 2-2-2-4 means 2 instructional units based on classroom lecture (L), one instructional unit of the tutorial (T), and one laboratory (P) based instructional unit all delivered during a calendar week and repeated for the entire duration of the semester to earn 4 credits (C) after passing the course.
- As advised by the faculty advisor, a student may register, between a minimum of **16 credits and up to a maximum of 28 credits.**

The maximum number of credits a student can register during a summer semester shall be 16. However, in special cases, the student may be permitted to register additional credits with the approval of the Department Undergraduate Committee (DUGC). There is no minimum number of credits fixed for course registration during the summer semester.

6. REGISTRATION

6.1 Every student after consulting his/ her Faculty Advisor in the parent department shall register for the approved courses (core and elective) to earn credits for meeting the requirements of a degree program at the commencement of each Semester on the days fixed for such registration and notified in the academic calendar. Students who fail to register on or before the specified date will be allowed to register within one week of the last date by paying a late fee. Such courses together with their grade and credits earned will be included in the grade card issued by the University at the end of each semester, like ODD, EVEN, and summer and it forms the basis for determining the student’s performance in that semester.

6.1.1 Each course will be identified by a unique Course Code of seven alpha-numerals (two alphabets followed by 5 digits). The alphabets reflect the discipline to which the course belongs. The first numeral (after the alphabet) indicates the learning level (based on prerequisites) of the course, and the rest of the three numerals indicate a running serial number. Each course also has its version to track the revisions carried out in its syllabus over time as represented by the last numerical separated by a hyphen (-). Example: EE1001-1 represents the course offered by EE Dept., Level-1, course serial number is 001 and the version is 1.

6.2 Mandatory Pre-Registration for higher semester

To facilitate proper planning of the academic activities of the Semester, the students must declare their intention to register for courses of higher semesters (3rd and above) at least two weeks before the end of the current semester choosing the courses offered by each department in the next higher semester which is displayed on the Department Notice Board at least 4 weeks before the last working day of the semester.

Registration to a higher semester is allowed only if the student fulfills the following conditions.

- Satisfied all the academic requirements to continue with the program of studies.
- Cleared all Institute, hostel, and library dues and fines, if any, of the previous semester.
- Paid all required fees of the Institute and the hostel for the current semester.
- Has not been debarred from registering on any specific grounds by the Institute.

6.3 Registering for Backlog Courses

i) Students who have not cleared a course (Theory/ Lab/ project) are shown with “F” grade. A course having an ‘F’ grade will be considered as a backlog and it has to be re-registered in the subsequent semesters. F-graded courses are eligible to register for the next level course (pre-requisite is met).

ii) Re-registration fee will be as per the university norms existing at the time of re-registration. When a course is re-registered, the evaluation marks of that course shall be treated as canceled/ reset.

iii) To provide an early opportunity for students to clear their backlog of courses, efforts will be made to offer as many courses as possible during Odd, Even and summer semesters.

7. ADD/DROP/AUDIT OPTIONS

7.1 Registration of courses

Each student shall have to register for course work at the beginning of a semester within 2 to 3 days of commencement after discussing with the course teacher and under faculty advice. The permissible course load is to be either average credits (20) or to be within the limits of minimum (16) and maximum (28) credits.

7.2 DROP-option.

During a specified period in the middle of a semester student’s performance in CIE is reviewed by the faculty advisor. Following a poor performance by a student, he/she can be facilitated to drop identified course(s) (up to the minimum credits specified for the semester). Such course(s) will not be mentioned in the Grade card. Such courses are to be re-registered by these students and taken up for study at a later point in time.

7.3 Withdrawal from courses (Letter Grade “W”)

During a specific period specified towards the end of the semester, a student’s performance in CIE is reviewed by the faculty advisors. Following a poor performance by a student in the identified course (s) he/she is advised to withdraw from such course(s) (up to the minimum credits specified for the semester) with a mention in the Grade card (Grade "W"). Such courses to be re-registered by these students and taken up for study at a later point in time.

7.4 AUDIT-option (Letter Grade "U")

A student can register for courses for audit only, to supplement his/her knowledge and/or skills. The audit courses shall not be considered in determining the student's academic performance (SGPA and CGPA) in the semester. "U" grade is awarded to such courses and will be reflected in the grade card on satisfying the attendance requirements and CIE requirements. The candidate need not appear for SEE in such courses. However, CORE courses shall not be made available for audit.

8. COURSE STRUCTURE:

8.1 Types of courses

A "Course" is defined as a unit of learning that typically lasts one semester, led by one or more teachers, for a fixed roster of students. A course has identified course outcomes, modules/units of study, specified teaching-learning methods, and assessment schemes. A course may be designed to include lectures, tutorials, practical, laboratory work, field work, project work, internship experiences, seminars, self-study components, online learning modules, etc. in any combination.

The following types of courses are included in the B. Tech. program:

a) **Humanities, Social Sciences, and Management Courses (HSMC):** These are common courses for all disciplines.

b) **Basic Science Courses (BSC):** Physics, Chemistry, and Mathematics: These are mandatory for all disciplines.

c) **Engineering Science Courses (ESC):** Basics of Electrical/ Electronics/ Civil/ Mechanical/ Computer Engineering, etc. These are mandatory for all disciplines.

d) **Professional Core Courses (PCC):** These are the professional Core Courses, relevant to the chosen specialization/ branch. The core courses shall be compulsorily studied by students, and it is mandatory to complete them to fulfill the requirements of a Program.

e) **Professional Elective Courses (PEC):** These are professional Electives, relevant to the chosen specialization/branch and can be chosen from the pool of courses. It shall be supportive to the discipline providing extended scope/enabling exposure to some other discipline /domain and nurturing student proficiency skills.

f) **Open Elective Courses (OEC):** These are the Elective Courses from other technical areas and/ or emerging fields. Students of other departments shall opt for these courses for fulfilling the eligibility and prerequisites mentioned in the syllabus.

g) **Integrated Professional Core Courses (IPCC):** It refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC shall be 04 considering L: T: P as 3:0:1 or L: T:P as 2:1:1, (where L, T, and P represent credits not hours per week).

h) **Holistic Education Courses (HEC):** These courses are designed to look into the emotional, social, ethical and academic needs of students in an integrated learning format. It helps in the engagement of all aspects of the learner including body, mind and spirit.

i) **Vocational Education Courses (VEC):** These courses are designed to prepare students for jobs that are based on manual or practical activities, traditionally non-academic related to a specific trade, occupation or vocation.

j) **Emerging Technology Courses (ETC):** These courses are designed to teach students about developing technologies that will be available within the next five to ten years and are expected to create significant social or economic effects.

k) **Programming Language Courses (PLC):** These courses are designed to teach students languages that can be used to communicate with computers for developing and working on different applications.

l) **University Core Courses (UCC): These are compulsory core courses with common course codes across all the disciplines:**

   i. **Project Work (PROJ):** Provide experiential learning opportunities for students. Students are required individually, or in a small group, to select and complete a project that may include review, design, development, curation, analysis, etc. with the application of skills and knowledge relevant to the area of study. Mini-project and Project work carried out at the parent Institution, or any university / Government recognized organization without affecting the regular class work.

   ii. **Internship (INT):** The internship (a form of experimental learning) program is a workplace-based professional learning experience that offers supervised exposure to real-life work experience in an area related to the field of study or career interest. An internship may be undertaken at a workplace such as an industry/R&D organization/Government organization, or any other reputed organization/ institution recognized for the purpose by the University. The internship program not only helps fresh pass-outs in gaining professional know-how but also benefits corporate sectors. The internship also enhances the employability skills of the student passing out from Technical Institutions.

m) **Mandatory Non-Credit Courses (MNC):** These courses are mandatory, without the benefit of a grade or credit, passing each mandatory course is required to qualify for the award of a degree.

   - Assessment of these courses is conducted in the college and will include Continuous Internal Evaluation (CIE). University Semester End Evaluation (SEE) may not be necessary for these courses.
   - A minimum of 40% of the prescribed marks of CIE and SEE (If any) are required to secure a passing grade in these courses.
   - The ‘PP’ grade is awarded for a Pass in the course and the ‘NP’ grade is awarded for a Fail in the course. In case an ‘NP’ grade is awarded, the student has to re-register for the same course wherein he has no alternative options.
   - The “PP” and “NP” grades do not carry grade points and are hence not included in the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) computations. However, such non-credit mandatory courses are required to be included in the students’ performance records (transcript) with Pass or Fail (PP or NP).
   - Courses that come under this category are the following.

- Engineering Visualization, Employability Skill Development, Environmental Science, Kannada etc.

(e) **Ability Enhancement Courses (AEC)** These courses are designed to help students to enhance their skills in language, communication, personality development, etc. They also promote a deeper understanding of courses like social sciences, ethics, culture, human behavior human rights, and the law. Ability Enhancement Courses are based upon the content that leads to Knowledge enhancement.

8.2 Typical Breakdown for the B.Tech. Degree Curriculum:

Sl. No.	Course Category	Credit Range	Suggested Credits
1.	Basic Science Courses (BSC)	18-23	22
2.	Engineering Science Courses (ESC)	10-15	13
3.	Emerging Technology Courses (ETC)	03-05	03
4.	Programming Language Courses (PLC)	03-05	03
5.	Professional Core Courses (PCC)	52 - 58	55
6.	Professional Elective Courses (PEC)	12-18	15
7.	Open Elective Courses (OEC)	6	6
8.	Humanities, Social Sciences and Management courses (HSMC)	09-15	12
9.	Ability Enhancement Courses (AEC)	9	9
10.	Mandatory Non-credit Courses (MNC)	Non-Credit	0
11.	Holistic Education Courses (HEC)	2	1
12.	Vocational Education Courses (VEC)	1	1
13.	Project Work (PROJ) (UCC)	10-12	10
14.	Internship (INT) (UCC)	8-12	10
15.	Note: **Student can register between 16 to 28 credits per semester**		**160**
	Total minimum Credits to be earned: 160		

i) The Department Undergraduate Committee (DUGC) will discuss and recommend the exact credits offered for the program for the above components, the semester-wise distribution among them, as well as the syllabi of all undergraduate courses offered by the department from time to time before sending the same to the Board of Studies (BOS). The BOS will consider the proposals from the departments and make recommendations to the Academic Council for consideration and approval.

8.3 The earned Credit Requirements for the B.Tech. Degree is 160.

Degree is awarded by prescribing the total number of credits to be earned, rather than by using the program duration, giving flexibility to a student to plan their career.

8.4 Program structure and suggested Course offerings

I SEMESTER													
Sl. No.	**Course and Course code**		**Course Title**	**Teaching Dept.**	**Teaching Hours/Week**				**Examination**				**Credits**
					Theory Lecture	**Tutorial**	**Practical/ Drawing**	**PBL**	**Duration in hr**	**CIE Marks**	**SEE Marks**	**Total Marks**	
					L	**T**	**P**						
1	BSC	MA1001-1	Matrix Algebra and Calculus	MAT	3	0	0	0	3	50	50	100	3
2	BSC	CY1001-1	Engineering Chemistry	CHE	3	0	2	0	3	50	50	100	4
3	ESC	CS1001-1	Problem Solving Through Programming	CS	3	0	2	0	3	50	50	100	4
4	ESC	EE1001-1	Basic Electrical Engineering	EE	3	0	2	0	3	50	50	100	4
5	ESC	ME1003-1	Elements of Mechanical Engineering	ME	3	0	0	0	3	50	50	100	3
6	AEC	BT1001-1	Biology for Engineers	BT	1	0	0	0	1	50	50	100	1
7	AEC	IS1001-1	IT Skills	IS	1	0	2	0	3	50	50	100	2
8	MNC	CV1002-1	Environmental Studies	CV	1	0	0	0	1	50	0	50	0
9	MNC	UM1001-1	Skill Development Lab - I	Any	0	0	2	0	0	50	0	50	0
				TOTAL	**18**	**0**	**10**	**0**	**20**	**450**	**350**	**800**	**21**

II SEMESTER													
Sl. No.	**Course and Course code**		**Course Title**	**Teaching Dept.**	**Teaching Hours/Week**				**Examination**				**Credits**
					Theory Lecture	**Tutorial**	**Practical/ Drawing**	**PBL**	**Duration in hr**	**CIE Marks**	**SEE Marks**	**Total Marks**	
					L	**T**	**P**						
1.	BSC	MA1003-1	Differential Equations and Laplace Transforms	MA	3	0	0	0	3	50	50	100	3
2.	BSC	PH1001-1	Engineering Physics	PH	3	0	2	0	3	50	50	100	4
3.	ESC	CV1001-1	Elements of Civil Engineering	CV	3	0	0	0	3	50	50	100	3
4.	ESC	EC1001-1	Basic Electronics	EC	3	0	0	0	3	50	50	100	3
5.	ESC	EC1002-1	Applied Digital Logic Design	EC	2	0	2	0	3	50	50	100	3
6.	HSMC	HU1001-1	Technical English	HU	1	0	2	0	3	50	50	100	2
7.	HSMC	HU1002-1	Constitution of India	HU	1	0	0	0	1	50	50	100	1
8.	MNC	ME1003-1	Engineering Visualization	ME	1	0	0	0	0	50	0	50	0
9.	MNC	UM1002-1	Skill Development Lab-II	Any	0	0	2	0	0	50	0	50	0
				TOTAL	**17**	**0**	**8**	**0**	**19**	**450**	**350**	**800**	**19**

Mandatory Internship-I*								
10	INT	UC1001-1	Internship – I	Mandatory Intra Institutional Internship of duration (80 - 90 Hours) to be completed during I & II Semesters. *The grades will be included in the IV semester grade card (Refer 11.5.2 for details)	100	--	100	2

III Semester														
Sl. No	**Course Type**	**Course Code**	**Course Title**	**Teaching Department**	**Teaching Hours /Week**				**Examination**				**Credits**
					Lecture	**Tutorial**	**Practical/ Drawing**	**PBL**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total**	
					L	**T**	**P**	**J**					
1	BSC	MA2003-1	Vector Calculus and Complex Functions	MA	3	0	0	0	3	50	50	100	3
2	IPCC	CV2001-1	Building Materials and Construction	CV	2	2	2	0	3	50	50	100	4
3	IPCC	CV 2002-1	Fluid Mechanics and Hydraulics	CV	2	2	2	0	3	50	50	100	4
4	PCC	CV 2105-1	Concrete Technology	CV	2	2	0	0	3	50	50	100	3
5	PCC	CV 2102-1	Strength of Materials	CV	3	0	0	0	3	50	50	100	3
6	PCC	CV 2602-1	Computer Aided Civil Engineering Drawing	CV	0	0	2	0	3	50	50	100	1
7	HSMC	HU1004-1	Universal Human Values	HU	1	0	0	0	1	50	50	100	1
8	AEC	ME1654-1	Innovations and Design Thinking	ME	1	0	0	0	1	50	50	100	1
9	MNC	HU1003-1	Kannada (Balake /Samskrathika)	HU	1	0	0	0	-	50	-	50	0
				Total	**15**	**6**	**6**	**-**	**20**	**450**	**400**	**850**	**20**
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs													
10	MNC	MA1011-1	Bridge Course – Calculus and Laplace Transforms	MA	3	0	0	0	3	100	0	100	0

IV Semester														
Sl. No	Course Type	Course Code	Course Title	Teaching Department	Teaching Hours / Week				Examination					Credits
					Lecture	Tutorial	Practical/ Drawing	PBL	Duration in hours	CIE Marks	SEE Marks	Total	
					L	T	P	J					
1	BSC	MA2009-1	Probability Theory and Computational Mathematics	MA	3	0	0	0	3	50	50	100	3
2	IPCC	CV 2003-1	Public Health Engineering	CV	3	0	2	0	3	50	50	100	4
3	IPCC	CV 2004-1	Geodetic Engineering	CV	2	2	2	0	3	50	50	100	4
4	PCC	CV 2103-1	Structural Analysis - I	CV	3	0	0	0	3	50	50	100	3
5	PCC	CV 2107-1	Remote Sensing Image Acquisition, Analysis and Applications	CV	3	0	0	0	3	50	50	100	3
6	PCC	CV 2601-1	Basic Materials Testing Lab	CV	0	0	2	0	3	50	50	100	1
7	HSMC	HU2001-1	Enhancing Self-Competence	HU	2	0	0	0	3	50	50	100	2
8	HEC	HU1005-1	Essence of Indian Culture	HU	1	0	0	0	-	50	0	50	0
9	VEC	CV1551-1	Department specific Vocational Education Course – (Construction Practice)	CV	0	0	2	0	3	50	50	100	1
10	UCC	UC1001-1	Internship – I (Activity based Internship)	CV	Mandatory Intra Institutional Activity based Internship of 2 weeks duration (80 - 90 h) to be completed during the vacations of I & II Semesters. Lateral entry students have to complete the Internship - I during the vacation of III semester				-	100	0	100	2
Total					**17**	**2**	**8**	**0**	**24**	**550**	**400**	**950**	**23**
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs														
11	MNC	MA1013-1	Bridge Course – Probability and Differential Equations	MA	3	0	0	0	-	100	0	100	0

V Semester														
Sl. No	**Course Type**	**Course Code**	**Course Title**	**Teaching Department**	**Teaching Hours /Week**				**Examination**					**Credits**
					Lecture	**Tutorial**	**Practical/ Drawing**	**PBL**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total**		
					L	**T**	**P**	**J**						
1	IPCC	CV 2005-1	Design of RC Structural Elements	CV	3	0	2	0	3	50	50	100		4
2	IPCC	CV 2006-1	Geo Technical Engineering	CV	3	0	2	0	3	50	50	100		4
3	PCC	CV 2106-1	Transportation Engineering	CV	3	0	0	0	3	50	50	100		3
4	PCC	CV 2603-1	Extensive Survey Project and software lab	CV	0	0	2	0	3	50	50	100		1
5	PEC	CV XXXX-1	Professional Elective-I [Group-1]	CV	3	0	0	0	3	50	50	100		3
6	HSMC	HU1006-1	Introduction to IPR	Any Dept.	1	0	0	0	1	50	50	100		1
7	AEC	XXx6xx-1	Program Specific Ability Enhancement Course	CV	1	0	2	0	3	50	50	100		2
		ME1659-1	Research Methodology	Any Dept.	2	0	0	0		50	50	100		
8	AEC	HU1007-1	Social Connect & Responsibility	Any Dept.	1	0	0	0	1	50	50	100		1
9	AEC	UM1003-1	Employability Skill Development	CV	1	0	0	0	-	50	-	50		1
				Total	**16/17**	**0**	**8/6**	**-**	**20**	**450**	**400**	**850**		**20**

VI Semester														
Sl. No	**Course Type**	**Course Code**	**Course Title**	**Teaching Department**	**Teaching Hours/Week**				**Examination**					**Credits**
					Lecture	**Tutorial**	**Practical/ Drawing**	**PBL**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total**		
					L	**T**	**P**	**J**						
1	IPCC	CV 2007-1	Design of Steel Structural Elements	CV	2	0	2	0	3	50	50	100		4
2	PCC	CV 2104-1	Structural Analysis - II	CV	3	0	0	0	3	50	50	100		3
3	PCC	CV 2604-1	Geomatics Lab with project-based learning	CV	0	0	2	0	3	50	50	100		1
4	PEC	CV XXXX-1	Professional Elective - II [Group-1]	CV	3	0	0	0	3	50	50	100		3
5	PEC	CV XXXX-1	Professional Elective -III [Group-2]	CV	3	0	0	0	3	50	50	100		3
6	OEC	XXX5XX-1	Open Elective –I	CV	3	0	0	0	3	50	50	100		3
7	HSMC	MG1001-1	Engineering Project Management	CV	3	0	0	0	3	50	50	100		3
8	AEC	HU1008-1	Life skills for Engineers	Any Dept.	1	0	0	0	1	50	50	100		1
			Total		**18**	**0**	**4**	**-**	**22**	**400**	**400**	**800**		**21**

VII Semester														
Sl. No	Course Type	Course Code	Course Title	Teaching Department	Teaching Hours /Week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	PBL	Duration in hours	CIE Marks	SEE Marks	Total	
					L	T	P	J					
1	IPCC	CV 2008-1	Quantity Surveying and Estimation	CV	3	0	2	0	3	50	50	100	4
2	PCC	CV 2605-1	Concrete and Highway Materials Testing Lab	CV	0	0	2	0	3	50	50	100	1
3	PEC	CV XXXX-1	Professional Elective – IV [Group-1]	CV	3	0	0	0	3	50	50	100	3
4	PEC	CV XXXX-1	Professional Elective – V [Group-2]	CV	3	0	0	0	3	50	50	100	3
5	OEC	XXX5XX-1	Open Elective –II	CV	3	0	0	0	3	50	50	100	3
6	HSMC	MG1003-1	Management & Entrepreneurship	CV	3	0	0	0	3	50	50	100	3
7	HEC	HU1009-1	Indian Knowledge Systems	Any Dept.	1	0	0	0	-	50	0	50	1
8	UCC	UC3001-1	Major Project Phase I	CV	-	-	4	-	-	100	0	100	2
Total					**16**	**0**	**8**	**0**	**18**	**450**	**300**	**750**	**20**

VIII Semester													
Sl. No	Course Type	Course Code	Course Title	Teaching Department	Teaching Hours /Week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	PBL	Duration in hours	CIE Marks	SEE Marks	Total	
					L	T	P	J					
1	UCC	UC2001-1	Internship- II (Societal internship and Research/Industry Internship)	Mandatory Societal internship for 2 weeks (80 – 90 h) and Research Internship / Industry Internship of 6 weeks (240 – 270 h) or Research Internship / Industry internship for a total of 8 weeks (320 – 360 h) to be completed in one/two stretches during the vacation periods between IV to VII semesters.					3	50	50	100	8
2	UCC	UC3002-1	Major Project Phase II	Student should carry out project in research institute/ industry/ intra institute Canter of Excellences. Two contact hours /week for interaction between the project guide and students.					3	100	100	200	8
Total					-	-	-	-	-	**150**	**150**	**300**	**16**

8.5 Eligibility for submission of Project Work Report

i) Project work during the 8th semester shall be taken up batch-wise and report can be submitted for evaluation only on completion of a minimum of **122 credits** and for Diploma lateral entry students (those who have joined the second year B.Tech.) the same is **88 credits.**

ii) Project work can be carried out as domain-specific /interdisciplinary under the guidance of faculty/ faculty members. They can also opt for an advanced Internship or research Internship in an Industry / Research Institution/Center of excellence.

iii) Project viva-voce examination shall be conducted individually.

8.6 ELECTIVES

i) A candidate shall take electives in each semester from groups of electives, commencing from the 5th semester.

ii) The minimum number of students to be registered for any Elective offered shall not be less than fifteen (15) and should not exceed forty (40).

iii) A candidate shall opt for his/her choice of electives and register for the same at the beginning of each of the 5th to 7th semesters if pre-registration is not done. The candidate is permitted to opt for a change of elective within 15 days from the date of commencement of the semester as per the academic calendar of the college.

9. ATTENDANCE REQUIREMENT:

9.1 Each semester is considered as a unit and the candidate has to put in a minimum attendance of 85% in each subject with a provision of condoning 10% of the attendance by the Principal for reasons such as medical grounds, participation in University level sports, cultural activities, seminars, workshops, and paper presentation.

9.2 The basis for the calculation of the attendance shall be the term prescribed by the institution by its calendar of events. For the first semester students, the same is reckoned from the date of admission to the course.

9.3 The students shall be informed about their attendance position in the first week of every month by the College so that the students shall be cautioned to make up for the shortage.

9.4 A candidate having a shortage of attendance (<75%) in any course(s) registered shall not be allowed to appear for SEE of such course(s). Such students will be awarded an **'N' grade** in these courses.

9.5 He/she shall have to repeat those course(s) with an 'N' grade and shall re-register for the same course(s) core or elective, as the case may be when the particular course is offered next either in a main (odd/even) or summer semester.

9.6 Attendance in CIE and SEE:

Attendance in all examinations both CIE and SEE of each course registered shall be compulsory and there shall not be any provision for re-examinations. Any student against whom any disciplinary action is pending shall not be permitted to attend any SEE in that semester.

10. WITHDRAWAL FROM THE PROGRAM

10.1 Temporary Withdrawal

a) A student who has been admitted to a degree program of the college may be permitted once during the course to withdraw temporarily, for one semester, on the grounds of prolonged illness or grave calamity in the family, etc., provided –

i. The student applies to the College within 6 weeks of the commencement of the college stating fully the reasons for withdrawal together with supporting documents and endorsement from his parent/guardian.
ii. The College is satisfied with the genuineness of the case and that even by considering the expected period of withdrawal, the student can complete the program requirements (160 credits) within the time limits specified by the university.
iii. The student does not have any dues or demands at the College / University including tuition and other fees as well as library material.
iv. A student availing of temporary withdrawal shall be required to pay such fees and/or charges as may be fixed by the college until his/her name appears on the student's roll list. The fees/charges once paid shall not be refunded.
v. A student will be entitled to avail of the temporary withdrawal facility only once during his/her studentship. However, any other concession for the concerned student shall have to be approved by the academic council.

10.2 Permanent Withdrawal

Any student who withdraws the admission before the closing date of admission for the Academic Session is eligible for the refund of the deposits only. Fees once paid will not be refunded on any account.

Once the admission for the year is closed, the following conditions govern withdrawal of admissions.

i) A student who wants to leave the College for good will be permitted to do so (and take a Transfer Certificate from the College, if needed), only after clearing all other dues if any.
ii) Those students who have received any scholarship, stipend, or other forms of assistance from the College shall repay all such amounts.
iii) The decision of the Principal of the College regarding the withdrawal of a student is final and binding.

11. EVALUATION SYSTEM

11.1 The Academic Performance Evaluation of a student shall be according to a Letter Grading System, based on the Class Performance Distribution.

11.2 The Letter grades O, A+, A, B+, B, C, P, and F indicate the level of academic achievement, assessed on a decimal (0-10) scale.

11.3 The Letter grade awarded to a student in a course, for which he has registered shall be based on his performance in quizzes, tutorials, assignments, etc., as applicable, in addition to two mid-semester examinations and one semester-end examination. The distribution of weightage among these components may be as follows.

Semester End Examination (SEE)		:	50% (50 marks)
Continuous Internal Evaluation (CIE)		:	50% (50 marks)
CIE for Non-PBL Courses			
i)	Quizzes, Tutorials, Assignments, Seminars, etc.	:	10 marks
ii)	Mid-semester Examinations	:	40 marks
CIE for PBL/IPCC Courses			
i)	Project Based Learning (PBL)	:	50 marks
ii)	Mid-semester Examinations	:	40 marks
iii)	Quizzes, Tutorials, Assignments, Seminars, etc.	:	10 marks
60% weightage for theory + 40% weightage for PBL/Practical			

Any variation, other than the above distribution, requires the approval of the pertinent DUGC and Academic Council.

11.4 The letter grade awarded to a student in a 0-0-P (Practical) course, is based on an appropriate continuous evaluation scheme that the course instructor shall evolve, with the approval of the pertinent DUGC and the performance in SEE held on the specified period in a semester.

11.5 **Evaluation Scheme** *(Refer to Appendix-B for detailed evaluation guidelines)*: The course Instructor shall announce in the class and/or display at the Notice board/faculty door/website the details of the Evaluation Scheme, including the distribution of the weightage for each of the components and method of conversion from the raw scores to the letter-grades within the first week of the semester in which the course is offered so that there are no ambiguities in communicating the same to all the students concerned.

i) **Internship:** Mandatory Internship is in two parts. Internship-I (2 weeks) and Internship-II (8 weeks)

ii) **Internship-I**

- All the students admitted to the 1st semester of engineering programs shall have to undergo Internship-I of 02 weeks (or 80 to 90 hrs duration) during the first year. The internship shall include Inter / Intra Institutional activities. A viva – voce examination (Presentation followed by question-answer session) shall be conducted during the 2nd semester (for lateral entry students, during the 3rd semester) and the prescribed credit shall be included in the 4th-semester grade card.
- All the students admitted to the 3rd semester of Engineering programs (Lateral Entry Category) shall have to undergo a mandatory internship of 02 weeks (during the 3rd semester or the intervening period of the 3rd and 4th semesters). The internship shall include Inter/Intra Institutional activities.
- The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up / complete the internship shall be declared to fail and shall have to complete it during subsequent University examinations after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the student's internship progress and interact to guide them for the successful completion of the internship).
- **Procedure for the Evaluation of Internship-I**
  a) Students should submit the reports immediately on completion of the Internship to the respective mentors.

b) The Examination of the internship will be carried out by the mentor.

c) The Internship-I shall be slated for 100 marks CIE only and will not have SEE.

d) Internship-I marks are based on CIE marks (25 marks for the first presentation, 25 marks for the second presentation, and 50 marks for the report and final presentation).

e) A Viva-Voce examination is conducted during I/II/III Semesters (Presentation followed by question-answer session) and the prescribed credit shall be included in the IV semester grade card.

iii) **Internship-II**

- All the students admitted to engineering programs shall have to undergo Internship-II of 08 weeks during the second and third year of their Engineering studies.
- During the intervening period of the IV & V semesters and VI & VII semesters, students shall be ready for industrial experience. Therefore, they shall choose to undergo 8 weeks Internship involving Innovation / Entrepreneurship/ or short-term (about 2 weeks) societal-related activities and 6 weeks Industry Internship.

iv) **Project work evaluation:** The evaluation of CIE of the project work shall be based on the progress of the student in the work assigned by the project supervisor, periodically evaluated by him/her together with a department committee constituted for this purpose. Seminar presentation, project report, and final oral examination conducted by the project evaluation committee at the department level shall form the SEE of the project work.

v) In the case of other requirements, such as seminar, field work, or comprehensive viva voce, if any, the assessment shall be made as laid down by the DUGC/Academic council.

vi) There shall be no re-examination for any course in the credit system.
However, students

- who have abstained from attending CIE or SEE without valid reasons (“N” grade), or
- who have failed (F grade) to meet the minimum passing standards prescribed for CIE and/or SEE or
- who have been detained for shortage of attendance or who have withdrawn (W grade) who have dropped any course shall be required to re-register for such course(s) and go through CIE and SEE again and obtain a grade equal to or better than “P” Grade in each case.
- While such students should re-register for the same course(s) if core, they can re-register for the alternative course(s) from among the elective courses, as the case may be. The re-registration shall be possible when the particular course is offered again either in a main (Odd/Even) or summer semester.

11.6 Qualifying standards

Evaluation Method	Qualifying Standard
Sessional (CIE)	Score: ≥40% (≥20 marks)
Terminal (SEE)	Score: ≥40% (≥20 marks)
For securing a final Pass	Total **40 % of the Course maximum marks (100)** i.e., the sum of the CIE and SEE marks prescribed for the Course is desired.

11.7 Grading System

The letter grade awarded to a student for his/her performance in a course is based on Absolute Grading.

i) Absolute Grading – Letter Grade and its range

The grade point scale for absolute grading

Marks Range (%)	Grade Point	Letter Grade	Descriptor
90 & above	10	O	Outstanding
80-89	9	A+	Excellent
70-79	8	A	Very Good
60-69	7	B+	Good
55-59	6	B	Above Average
50-54	5	C	Average
40-49	4	P	Pass
00-39	0	F	Fails
Absent	0	AB	Absent

CGPA	Classification
7.00-& above	**First Class with Distinction**
6.00-6.99	**First Class**
5.00-5.99	**Second Class**
CGPA < 5.00*	**Academic Probation / Non-compliance**

* If a student secures CGPA< 5.0 at any point time during his/her studies, he/she will be on Academic Probation/Noncompliance (refer to sections 14.2 and 17.3 for more details.)

ii) **Grade "N":** A candidate having a shortage of attendance (<75%) in any course(s) or CIE marks less than 40% shall not be allowed to appear for SEE of such course(s). Such students will be awarded an 'N' grade in these courses with a grade point of 0.

iii) The grade points are given above help in the evaluation of credit points earned by the student in a course as the credit points are equal to the number of credits assigned to the course multiplied by the grade points awarded to the student in that course. This shall be used in Arriving at the credit index of the student for that semester, as it is the total of all the credit points earned by the student for all the courses registered in that semester.

11.8 Earning of Credits

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range of O-P. The letter grade "F" in any course implies the failure of the student in that course and no credits earned.

i) The Transitional Grades "I", "W" and "X" would be awarded by the teachers in the following cases. These would be converted into one or the other of the letter grades (O-F) after the student completes the course requirements.

ii) **Grade "I"**: To a student having attendance ≥85% and CIE ≥70%, in a course, but remained absent from SEE for valid & convincing reasons acceptable to the College, like:

a) Illness or accident, which disabled him/her from attending SEE.

b) A calamity in the family at the time of SEE required the student to be away from the College.

c) However, the committee chaired by the Principal is authorized to relax the requirement of CIE ≥ 70% if the student is hospitalized or advised long-term rest after discharge from the hospital by the Doctor.

d) Students who remain absent for Semester End Examinations due to valid reasons and those who are absent due to health reasons are required to submit the necessary documents along with their request to the Controller of Examinations to write Makeup Examinations within 2 working days of that examination for which he or she is absent, failing which they will not be given permission.

iii) **Grade "W":** To a student having satisfactory attendance at classes, but withdrawing from that course before the prescribed date in a semester under Faculty Advice

iv) **Grade "X":** To a student having attendance ≥85% and CIE ≥70%, in a course but SEE performance could result in an F grade in the course. **(No "F" grade will be awarded in this case, but the student's performance record is maintained separately).**

11.9 Summer / Fast Track semester

i) The students who have satisfied CIE and Attendance requirements for the course/s and obtained an F grade in SEE are permitted to appear directly in ensuing examination/s as backlog paper/s. The students need not re-register for such course/s in the summer / fast track semester. In case the student wishes to improve CIE/ he/she has to re-register for the summer / regular semester as and when offered next.

ii) The student who obtains required attendance and CIE in the summer semester, but obtains an 'F' grade in SEE; is permitted to appear for SEE subsequently as backlog course/s. The student need not repeat the course for Attendance and CIE.

iii) The course/s for which the student does not possess satisfactory attendance and CIE score shall be marked as 'N' on the Grade sheet. Such students are not permitted to SEE for the Courses marked as 'N' on the Grade sheet. The students have to re-register only for course/s marked as 'N' in the summer/ subsequent semester whenever that course is offered and obtain the required CIE and attendance. Subsequently, they are eligible to appear for SEE in such course/s.

iv) Courses with Transitional Grades viz "W", "I", and "X" are also eligible to register in the summer semester in case they wish to improve their score in CIE.

v) All courses may not be offered in the summer semester. It is the discretion of the University to offer the courses based on the availability of resources. The Institutes shall notify timetable for the summer semester well in advance.

vi) Summer Semester is optional; it is for the student to make the best use of the opportunity.

vii) A student is permitted to register for a maximum of 16 credits in the Summer / fast track semester.

viii) A student has to choose those courses which are offered by the Institution in a given summer Semester.

ix) In the summer semester, each course needs to be offered for the required number of lectures/ tutorial/ laboratory hours as prescribed in the syllabus.

11.10 Grade Card

Each student shall be issued a Grade Card at the end of each semester. This will have a list of all the courses registered by a student in the semester, together with their credits, the letter grades with grade points awarded. Only those courses registered for credit and having grade points shall be included in the computation of the students' performance like SGPA and CGPA and the courses are taken for audit will not form part of this computation. The results of mandatory courses, which are of the non-credit type shall also be reflected in the Grade card as PP (for Passed) or NP (for not passed). **Each UG student shall have to obtain the grade PP in each mandatory course to qualify for the Degree awarded by the university.**

11.11 Re-evaluation and paper seeing.

Re-evaluation is permitted only for theory papers. The University, on receiving application within the stipulated time and remittance of a prescribed fee for re-evaluation, shall permit re-evaluation for the course/s applied. The marks obtained after re-evaluation shall be the final marks awarded.

11.12 The Make-Up Examination

The Make-Up Examination facility would be available to students who may have missed attending the SEE of one or more course(s) in a semester for valid reasons and given the "I" grade; Also, students having the "X" grade shall be eligible to take advantage of this facility. **The makeup examination would be held as per dates notified in the Academic Calendar during the summer semester.** However, it would be possible to hold a makeup examination at any other time in the semester with the permission of the Academic Council of the College. In all these cases, the standard of makeup examinations shall be the same as the regular SEE for the course(s).

a) All the "I" and "X" grades awarded to the students would be converted to appropriate letter grades after the make-up examinations. Any outstanding "I" and "X" grades after the last scheduled make-up examinations shall be automatically converted to "F" grades.

b) All the "W" grades awarded to the students would be eligible for conversion to the appropriate letter grades only after the concerned students re-register for these courses in a main/ Summer semester and fulfill the passing standards for their CIE and (CIE+SEE).

11.13 Rules for grace marks

i) Grace marks up to 1% of the maximum total marks of the courses for which he/she is eligible and have registered (non-credit courses excluded) in the examination or 10 marks whichever is less shall be awarded to the failed course(s), (with a restriction of a maximum of 5 marks per course) provided on the award of such grace marks the candidate passes in that course(s).

12. EVALUATION OF PERFORMANCE

The overall performance of a student will be indicated by two indices:
SGPA; which is the Semester Grade Point Average, and CGPA which is the Cumulative Grade Point Average.
SGPA for a semester is computed as follows.

$$SGPA = \frac{\sum[(Course\ Credits) \times (Grade\ Point)] \text{ (for all courses in that semester)}}{\sum[Course\ Credits]}$$

CGPA is computed as follows:

$$CGPA = \frac{\begin{array}{c}\sum[(Course\ Credits) \times (Grade\ Point)] \\ \text{(for all courses excluding those with F grades until that semester)}\end{array}}{\begin{array}{c}\sum[Course\ Credits] \\ \text{(for all courses excluding those with F grades until that semester)}\end{array}}$$

13. COMMUNICATION OF GRADES

The SGPA and CGPA respectively, facilitates the declaration of academic performance of a student at the end of a semester and the end of successive semesters. Both would be normally calculated to the second decimal position.

14. REQUIREMENTS FOR VERTICAL PROGRESSION (PROMOTION / ELIGIBILITY TO HIGHER SEMESTERS)

14.1 All students are promoted to the next semester or year of their program, irrespective of their academic performance.

14.2 However, at any stage of his/her study, if a student reaches a CGPA below 5.00, the student will be on Academic Probation and is permitted to register for a maximum of 16 credits during odd semester of an academic year. However, the student has the choice to re-register for the courses/courses in which he/she has obtained an ‘F’/ ‘N’ grade.

14.3 A Student shall be declared fail if he/she

(i) Has not satisfied the CIE requirements of any Course/s.

(ii) Has not appeared for the SEE even after satisfying the attendance and CIE requirements.

14.4 Vertical Progression for regular students who have taken admission to the first year: Normally a student is expected to complete a minimum of 85% of credits by the end of the 7th semester. However, **for submission of B.Tech. Major Project in 8th semester, the student should have completed at least 122 credits.**

14.5 Vertical Progression in case of Diploma students admitted to Second year (lateral entry):

i) Lateral entry students should complete at least 85% of credits by the end of the 7th semester. However, for **submission of B.Tech. Major Project in 8th semester, the student should have completed at least 88 credits.**

ii) Diploma students should register for mandatory non-credit Mathematics Courses Bridge Courses (i) Calculus and Laplace Transforms and (ii) Probability and Differential Equations prescribed during III and IV semesters respectively. They shall attend these bridge course classes during the respective semesters to satisfy attendance and CIE requirements.

iii) Completion of Mathematics Courses Bridge Courses (i) Calculus and Laplace Transforms and (ii) Probability and Differential Equations shall be mandatory for the award of the degree.

14.6 Termination from the program

A student shall be required to withdraw (discontinue) from the program and leave the college on the following grounds.

i) Failure to secure a minimum CGPA of 5.0 at the end of 8 years (6 years for lateral entry students).

ii) Failure to earn 160 credits (120 for lateral entry students) in 8 years (6 years for lateral entry students) of duration from the year of admission including the duration of temporary withdrawal (leave of absence).

iii) Absence from classes for more than **six weeks at a time** in a semester without leave of absence being granted by competent authorities.

iv) Failure to meet the standards of discipline as prescribed by the college from time to time.

15. AWARD OF CLASS

Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or classes awarded as in the conventional system of declaring the results of university examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class and Second Class. This can be seen in the following Table.

Percentage Equivalence of Grade Points (For a 10-Point Scale)

Grade Point	Percentage of Marks*	Class
$\geq$ 7.00	$\geq$ 70%	First class with Distinction
$\geq$ 6.00	$\geq$ 60%	First Class
5.0 $\geq$ CGPA <6.00	50$\geq$ Percentage < 60%	Second Class

Percentage * = (CGPA) x 10

16. APPEAL FOR REVIEW OF GRADES

a. The entire process of evaluation shall be made transparent, and the course instructor shall explain to a student why he/she gets whatever grade he/she is awarded, if and when required. A mechanism for the review of grades is incorporated into the evaluation system. However, before appealing for such review, a student shall first approach the concerned course Instructor and then the concerned DUGC, with the request to do the needful; and only in situations where satisfactory remedial measures have not been taken, the student may then appeal to the Department Academic Appeals Boards (DAAB) before the date specified in Academic Calendar, by paying the prescribed fees.

b. The fee for such an appeal will be decided by the Senate from time to time. If the appeal is upheld by DAAB, then the fee amount will be refunded to the student.

17. AWARD OF DEGREE

17.1 B.Tech. Degree

a) Students shall be declared to have completed the Program of B.Tech. degree and is eligible for the award of degree provided the students have undergone the stipulated Course work of all the semesters under the Scheme of Teaching and Examinations and have earned the prescribed number of credits (160 credits for regular students registered for 4-year degree programs & 120 for lateral entry students).

b) For the award of a degree, a CGPA≥5.00 at the end of the Program shall be mandatory.

c) Completion of Additional Mathematics I and II shall be mandatory for the award of degree to lateral entry diploma students.

d) Earning of Activity Points:

i. Every student entering 4-year degree program should earn 100 activity points & every student entering 4-year degree program through Lateral Entry should earn 75 activity points as per the AICTE Activity Point Program for the award of an Engineering degree.

ii. The activities can be spread over the years (duration of the program) at any time during the semester weekends and holidays, as per the interest & convenience of the students from the year of entry to the program.

iii. The Activity Points earned shall be reflected on the student's eighth-semester Grade Card.

iv. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression.

v. In case students fail to earn the prescribed activity Points before the commencement of 8th-semester examinations, the eighth-semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of a degree only after the release of the Eighth semester Grade Card.

17.2 Honours/ Minors Degree

17.2.1 B.Tech. (Honours) Degree

i. Students must earn a minimum of 18 additional credits in his/her major program discipline entitles a student to get an 'Honours' credential.

ii. Students have to pay additional fees for all the courses registered for 'Honours'.

iii. Students with a minimum of 7.5 CGPA and no backlog at the end of the 4^{th}

semester will qualify for registering for courses under the 'Honours credential.

iv. Students shall register for 'Honours' courses from the 5th semester onwards.

v. Students should register for additional courses and plan to take courses that are prescribed under that 'Honours' list as per 'pre-requisite' courses to earn the 'Honours' credential.

vi. Students who wish to acquire an 'Honours' credential need to carry out 'Honours' course registration along with their regular semester course registration.

vii. He/she accumulates credits by registering for the required courses, and if the requirements for 'Honours' are met within the prescribed minimum time limit of the program, the 'Honours' will be awarded along with the degree.

viii. Also, the student should meet the following **requirements to become eligible for the 'Honours award.**
- Minimum CGPA of 7.5 in this major discipline at the end of the 8th semester
- Minimum CGPA of 7.0 in the registered 'Honours' courses

ix. In case a student withdraws from the 'Honours' registration in the middle of the program, the 'Honours' courses completed will be converted to 'Audit' courses and indicated accordingly in subsequent Grade Sheets and Consolidated Grade Sheets.

x. It must be noted that the 'Honours' award will be mentioned in the Degree Certificate as **"Bachelor of Technology in (specialization) with Honours".**

xi. This fact will also be reflected in the Consolidated Grade Sheet under a separate heading 'Honours' with similar details shown for other credited courses and the CGPA for 'Honours' will be indicated at the end of the list of courses under 'Honours'.

xii. The grades obtained in the courses credited towards the 'Honours' award are not counted and shall not influence the GPA/ CGPA of the 'program' student has registered.

17.2.2 Minor Degree

i. Students have to earn a min of 18 additional credits from the courses focused on discipline other than his/her major program discipline entitles a student to get a 'Minor' credential.

ii. Students have to pay additional fees for all the courses registered for 'Minor'.

iii. Students with a minimum of 5.0 CGPA and no backlog at the end of the 3rd semester will only qualify for registering for the course under the 'Minor' credential.

iv. Students shall register for 'Minor' degree courses from the 4th semester onwards.

v. All Departments will offer 'Minors' in their varied disciplines and will prescribe what set of courses and/or projects is necessary for earning a minor in that discipline.

vi. Students should register for additional courses and plan to take courses that are prescribed under that 'Minors' list as per 'pre-requisite' courses to earn the 'Minor' credential.

vii. If any of the courses listed under the 'minor' option is a course listed under his/her curriculum as PCC then the student cannot opt for that 'Minor', since all minor courses need to be earned as additional courses to his/her program curriculum and depts decision is final and binding.

viii. Students who wish to acquire a 'Minor' can register for 'Minor' courses along with their regular semester course registration.

ix. Also, the student should have a minimum **CGPA of 5.0 in the 'Minor' courses registered to become eligible for the Minor credentia**l. This fact will also be reflected in the Consolidated Grade Sheet under a separate heading 'Minor in (specialization)'.

x. If the course requirements for a particular 'Minor' are met within the prescribed minimum time limit of the program, the minor will be awarded along with the degree, and it will be mentioned in the **Degree Certificate as "Bachelor of Technology in (Major discipline) with Minor in (specialization)."**

xi. In case a student withdraws from the 'Minor', the 'Minor' courses completed, will be converted to 'Audit' courses and indicated accordingly in subsequent Grade Sheets and Consolidated Grade Sheets.

xii. The grades obtained in the courses credited towards the 'Minor' award are not counted and shall not influence the GPA/ CGPA of the program the student has registered for.

17.2.3 Additional norms for Honours/Minors

i. Students shall register for additional courses to earn Honours/Minors in consultation with their Class Advisor from the list of courses suggested by the DUGC.

ii. DUGC may recommend Massive Open Online Courses (MOOCs)/ SWAYAM/ NPTEL courses to students who wish to register for Honours/Minors after justifying and establishing the equivalence of the curriculum. The decision of DUGC should be communicated to the Dean of Academics and Controller of Examinations for seeking approval.

iii. A maximum of 40% credits prescribed for Honors/Minors may be earned through MOOCs/ SWAYAM/ NPTEL

iv. Students may choose to take up additional course work, from the MOOCs courses list suggested by various departments (which can be from SWAYAM/NPTEL) with proctored examinations as approved by the University and complete the same before the last working day of the VIII semester with a final score (online assignments: 25 % + Proctored examination: 75 %) leading to the following certificates: Completed the course (40-59)– ELITE (60 to 75 %) or ELITE + SILVER (76 to 89 %) or ELITE + GOLD (≥ 90 %)

v. In case, in MOOCs (ex: Coursera), there is no proctored examination, the University will conduct a SEE as deemed to be fit for the award of Credits

vi. The Credit equivalence for online courses shall be as follows –

- 4 weeks of online course duration – 1 credit (approx. 13-14 hours)
- 8 weeks of online course duration – 2 credits (approx. 26-28 hours) and

- 12 weeks of online course duration – 3 credits (approx. 39-42 Hours)

17.3 Noncompliance

17.3.1 Noncompliance of CGPA ≥ 5.00 at the end of the Program

a) Students, who have completed all the courses of the Program but do not have a CGPA ≥ 5.00 at the end of the Program, shall not be eligible for the award of the degree.

b) In the cases of 17.3 (1), a student shall be permitted to appear again for SEE in course/s (other than Internship, Technical seminar, Project (Mini and Major), and Laboratories) of any Semester/s without the rejection of CIE marks for any number of times, subject to the provision of a maximum duration of the Program to make up the CGPA equal to or greater than 5.00 for the award of the Degree.

c) Students shall obtain written permission from the Controller of Examinations to reappear in SEE to make up the CGPA equal to or greater than 5.00.

d) In case, the students earn improved grade/s in all the reappeared course/s, the CGPA shall be calculated considering the improved grade/s. If it is ≥5.00, the students shall become eligible for the award of the degree. If CGPA <5.00, the students shall follow the procedure laid in 17.3.1 (b).

e) In case, the students earn improved grade/s in some course/s and the same or lesser than the previously earned pass grade/s in the other reappeared course/s, the CGPA shall be calculated considering the improved grade/s and the pass grades earned before the reappearance. If it is ≥5.00, the students shall become eligible for the award of the degree. If CGPA<5.00, the students shall follow the procedure laid in 17.3.1 (b).

f) In case, the students earn improved grade/s in some courses and fail in the other reappeared course/s, the CGPA shall be calculated by considering the improved grade/s and the previously earned pass grade/s of the reappeared course/s in which the students have failed. If it is≥5.00, the students shall become eligible for the award of the degree. If CGPA <5.00, the students shall follow the procedure laid in 17.3.1 (b).

g) In case, the students fail (i.e., earns an F grade) in all the reappeared course/s, pass grade/s of the course/s earned by the students before reappearance shall be retained. In such cases, the students shall follow the procedure laid in 17.3.1 (b).

17.3.2 Noncompliance with Project/ Mini project

The project/mini project shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the mini-project shall be declared to fail in that course and shall have to complete the same during subsequent University examinations after satisfying the Mini-project requirements.

17.3.3 Noncompliance of Internship

All the students of B. Tech shall have to undergo mandatory Internship-I and Internship-II for a total of 10 weeks to earn a total of 10 credits in parts during the vacations at the end of the 1/2/3 academic year. The evaluation of Internship shall be during IV and VIII semesters. The internship shall be considered mandatory for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail in that Course and shall have to complete the same during subsequent University examinations after satisfying the internship requirements.

The maximum duration for a student for complying with the Degree requirements is 16 – semesters from the date of first registration for his/ her first semester (8 years from the date of admission to the first year, (12 semesters / 6 years from the date of admission for lateral entry student)).

18. GRADUATION REQUIREMENTS AND CONVOCATION

18.1 A student shall be declared to be eligible for the award of the degree if he/she has:

a) Fulfilled "Award of Degree" Requirements
b) No Dues to the College, Departments, Hostels, Library, Central Computer Centre and any other centers
c) No disciplinary action is pending against him/her.

18.2 The award of the degree must be recommended by the Governing council.

18.3 **Convocation:** Degree will be awarded to the students who have graduated during the preceding academic year. Students are required to apply for the Convocation along with the prescribed fees, after having satisfactorily completed all the degree requirements (refer to "Award of Degree") within the specified date to arrange for the award of the degree during convocation.

19. AWARD OF PRIZES, MEDALS, CLASS & RANKS

19.1 For the award of Prizes and Medals, the conditions stipulated by the Donor may be considered as per the statutes framed by the University for such awards. Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or Class awarded as in the conventional system of declaring the results of University examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class, and Second Class as described in Section 15.

19.2 An attempt means the appearance/registration of a candidate for an examination in one or more courses either in part or failing a particular examination.

i) A candidate who fails/remains absent (after submitting exam application) in the main examination and passes one or more subjects/courses or all subjects/courses in the supplementary/Make-up examination such candidates shall be considered as taken more than an attempt.

19.3 Merit Certificates and University Medals/ will be awarded based on overall CGPA, governed by the specific selection criteria that may be formulated by the University for such Medals / Awards.

i) Only those candidates who have completed the Program and fulfilled all the requirements in the minimum number of years prescribed (i.e., 3 years for Diploma lateral entry students or 4 years for students who joined after the 12th standard) and who have passed each semester in the **first attempt** are eligible for the award of Merit Certificates and /or University Medals.

ii) Candidates with W, N, I, X & F grades and who passes the courses in the subsequent/supplementary/make up examinations are not eligible for the award of Gold Medal or Merit Certificate.

20. CONDUCT AND DISCIPLINE

20.1 Students shall conduct themselves within and outside the premises of the College in a manner befitting the students of an Institution of National Importance.

20.2 **As per the order of the Honorable Supreme Court of India, ragging in any form is considered a criminal offense and is banned. Any form of ragging will be severely dealt with.**

20.3 The following acts of omission/ or commission shall constitute a gross violation of the Code of Conduct and are liable to invoke disciplinary measures:

i. Ragging.
ii. Lack of courtesy and decorum; indecent behavior anywhere within or outside the campus.
iii. Willful damage or stealthy removal of any property/belongings of the College/Hostel or fellow students/citizens.
iv. Possession, consumption, or distribution of alcoholic drinks or any kind of hallucinogenic drugs.
v. Mutilation or unauthorized possession of Library books.
vi. Noisy and unseemly behavior, disturbing studies of fellow students.
vii. Hacking in computer systems (such as entering into another Person's area without prior permission, manipulation and/or Damage of computer hardware and software, or any other Cybercrime, etc.).
viii. Plagiarism of any nature.
ix. Any other act of gross indiscipline as decided by the Senate from time to time.
x. Use of Mobile in the college Academic area.
xi. Smoking in College Campus and supari chewing.
xii. Unauthorized fundraising and promoting sales.
xiii. Commensurate with the gravity of the offense the punishment may be: reprimand, expulsion from the hostel, debarring from an examination, disallowing the use of certain facilities of the College, rustication for a specified period or even outright expulsion from the College, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.

20.4 For an offense committed in (i) a hostel (ii) a department or a classroom and (iii) elsewhere, the Chief Warden, the Head of the Department, and the Dean (Academics), respectively, shall have the authority to reprimand or impose fine.

20.5 All cases involving punishment other than reprimand shall be reported to the principal.

20.6 Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Controller of Examinations for taking appropriate action.

20.7 **Note:** Students are required to be inside the examination hall 20 minutes before the commencement of the examination. This is applicable for all examinations (Semester end/Supplementary/makeup) henceforth. Students will not be allowed inside the examination hall after the commencement, under any circumstances.

****

APPENDIX - A

Definitions, terminology, and abbreviations

1. **Nitte DU / University**
   a. Refers to Nitte (Deemed to be University)

2. **BoM**
   a. Refers to Board of Management of Nitte (Deemed to be University)

3. **BoS**
   a. Refers to the Board of Studies in Civil Engineering

4. **Institute/Institution**
   a. Refers to NMAM Institute of Technology, Nitte

5. **Program**
   a. A range of learning experiences over a specified period, leading to the award of a degree/diploma/certificate. A program is completed when the courses that make up the program are completed, and other requirements as specified in the program regulations are met.

6. **Course**
   a. A unit of learning that typically lasts one semester, led by one or more teachers, for a fixed roster of students. Often referred to as a “subject”. A course has identified course outcomes, modules/units of study, specified teaching-learning methods, and assessment schemes. A course may be designed to include lectures, tutorials, practical, laboratory work fieldwork, project work, internship experiences, seminars, self-study components, online learning modules, etc. in any combination.

7. **Semester**
   a. An academic session, usually of 16 weeks duration, with a minimum of 90 working days during which coursework and assessments are to be completed. Typically, two semesters make up an academic year, with the first of these referred to as the Odd Semester and the second as the Even Semester.

   b. An additional short semester (usually 8 weeks) may be offered between an even semester and subsequent odd semester (in the interval between two academic years) and is termed a summer semester. The summer semester is offered to enable students to register for:
      i. Fast-tracked courses required for clearing backlog courses.
      ii. Fast-tracked courses for earning additional credit / completing non-credit mandatory requirement.
      iii. Value added courses.
      iv. The courses offered in summer semesters are bound by the same regulations as that of regular semesters, except that they are run at an accelerated pace to provide the required contact hours and conduct assessments within the 8 weeks.

8. Credit

a. A unit by which the course work is measured. It determines the number of hours of formal learning (contact hours) required per week. Credits are calculated based on the concept of "notional learning time". Notional learning time is the number of hours that a learner is expected to spend, on average, to achieve the specified learning outcomes of the course. This may comprise a variable combination of scheduled learning activities, (lectures, seminars, labs, etc.) and self-directed learning time (reading required before classes, working on assignments, examination preparation, and completion of assessments).

9. Credit equivalence of notional learning time for different types of activities

a. The credit values assigned to various teaching-learning activities are as follows:

Type of teaching-learning	Nature of activity	No. of contact hours per week equivalent to one credit	The total number of contact hours over a 16-week semester is equivalent to one credit
Lectures / Seminars / synchronous virtual classes / synchronous webinars	Scheduled instruction	1:1	16
Tutorials	Scheduled instruction	2:1	32
Supervised Demonstrations /Laboratory sessions / Studio / Workshops / Workplace simulation / Skill Practice Sessions	Scheduled instruction	2:1	32
Supervised Field visits/community visits/Internships	Scheduled instruction	3:1	48
Scheduled self-directed study (individual or group)	Scheduled instruction	2:1	32
Asynchronous E-Learning modules (structured self-directed study	Independent learning	2:1	32
Student Seminar	Independent /small group learning	2:1	32
Project work/dissertation	Independent /small group learning	3:1	48
Internship for credit	Industry placement/ Research Internship	3:1	48

10. Choice-based credit system (CBCS)

A program structure for higher education requires students to earn a minimum of credits by completing various types of courses, including electives, which facilitate a student to have some freedom in selecting his/her own choices, within as well as across disciplines.

11. Course Registration

Refers to formal registration of the Courses in the study every semester (Credits and Audit) by every student under the supervision of a faculty advisor. The institution will maintain records of the same and communicate them to the University.

12. Learning outcomes

a. Program Outcomes (PO) - Statements defining the skills, knowledge, and attitude that graduates of a program will be able to demonstrate upon completing the program
b. Course Outcomes (CO) - Statements defining the skills, knowledge, and attitude that students will be able to demonstrate upon completing the course. COs are mapped to the POs such that attaining the course outcomes leads to the attainment of program outcomes.
c. Attainment of POs-COs is mapped to the POs such that attaining the course outcomes leads to the attainment of program outcomes.

13. Evaluation

For all courses, the evaluation will be based on both formative assessment (Continuous Internal Evaluation, CIE) and summative assessment (Semester End Evaluation, SEE). Weightage for CIE and SEE will be 50% each

13.1 Continuous Internal Evaluation (CIE)

Refers to the periodic and continuous *formative assessment* of students' performance during the semester by the teacher(s) of the course to provide timely feedback to students and for guiding "course corrections" by the teachers. The assessment methods may include tests, quizzes, assignments, project evaluations, portfolio evaluations, seminar assessments, etc. CIE will have a weightage of 50% in the determination of the final grading of the course.

13.2 Semester End Evaluation (SEE)

Refers to a *summative assessment* that covers the entire course syllabus, conducted by the University, at the end of the semester. Appropriate assessment methods aligned with the learning domain and teaching-learning methods are to be used. CIE will have a weightage of 50% in the determination of the final grading of the course.

14. Grading

Course Grade refers to a qualitative measure of performance of a student in each course, based on the percentage of marks secured in Continuous Internal Evaluation (CIE) and Semester End Evaluation (SEE). A Letter grade is awarded for each course.

15. Semester Grade Point Average (SGPA)

Refers to the measure of a student's academic performance in a semester. It is calculated based on the credits and the grades obtained in the courses offered in the semester.

16. Cumulative Grade Point Average (CGPA)

Refers to the measure of the cumulative performance of a student in all the previous semesters and is computed from the 2nd semester onwards. It is calculated based on the credits and the grades obtained in all the courses taken.

17. Academic Bank of Credits (ABC)

The Academic Bank of Credits is a national-level facility for "credit transfer". It is provided by the Ministry of Education, Govt. of India, to promote the flexibility of the curriculum framework and interdisciplinary/multidisciplinary academic mobility of students across the Higher Education Institutions in the country. The banking and redemption of credits through ABC will be governed by the University's guidelines.

APPENDIX-B

Evaluation Guidelines

CIE and SEE details for various types of courses.

1. Theory: PCC/IPCC/PEC/OEC

1.1. Scheme of examinations: CIE+SEE =50+50=100 marks

1.2. Continuous internal evaluation (CIE):

1.2.1. CIE (PCC/PEC/OEC)

Type of Questions	Questions to be set (Can have sub-questions a and b)	Questions to Be answered	Marks per question	Total marks
Mid Sem Exam-1				
40% of the total syllabus (Unit-1) (15 Teaching hours)				
Descriptive Part-1	2	1	10	10
Descriptive Part-2	2	1	10	10
Mid Sem Exam-2				
40% of the total syllabus (Unit-2) (15 Teaching hours)				
Descriptive Part-1	2	1	10	10
Descriptive Part-1	2	1	10	10
TASKS				
TASK	The task comprises 5 class tests/quizzes/assignments conducted for each unit for a max mark of 10. All tests/quizzes/Assignments are compulsory			10
Maximum Marks				**50**

1.2.2 CIE (IPCC/PBL)

Type of Questions	Questions to be set (Can have sub-questions a and b)	Questions to be answered	Marks per question	Total marks
Mid Sem Exam-1				
40% of the total syllabus (Unit-1) (15 Teaching hours)				
Descriptive Part-1	2	1	10	10
Descriptive Part-2	2	1	10	10
Mid Sem Exam-2				
40% of the total syllabus (Unit-2) (15 Teaching hours)				
Descriptive Part-1	2	1	10	10
Descriptive Part-1	2	1	10	10
Task	The task comprises 5 class tests/quizzes/assignments conducted for each unit for a max mark of 10. All tests/quizzes/Assignments are compulsory.			10
Maximum Marks				**50**
60% weightage, converted to 30 marks				
Practical/Project Based Learning (PBL)				
Practical/PBL	Practical/PBL (comprises of implementation of theoretical concepts through projects/problem solving)			**50**
40% weightage, converted to 20 marks				
Maximum Marks [30 (Theory)+ 20 (Practical/PBL)]				**50**

1.2.3 Semester End Evaluation (SEE): 3 Hours Duration

Type of Questions	Module & Teaching hours	Questions to be set (Can have sub-questions a, b, and c)	Questions to be answered	Marks per question	Total marks
MCQ	Entire Syllabus	10 or 20	All Questions	2 or 1	20
Descriptive	• Unit-1 • 15 teaching hours	3	2	16	32
Descriptive	• Unit-2 • 15 teaching hours	3	2	16	32
Descriptive	• Unit-3 • 10 teaching hours	2	1	16	16
				Maximum Marks	**100**
SEE Marks with 50% Weightage					**50**

1.2.4 CIE & SEE for various types of courses

Sl. No.	Courses		Evaluation scheme			
			CIE (Minimum eligibility marks 40% of Max marks		SEE (Minimum Passing marks 40 % of Max marks)	
			Max Marks	Min eligibility marks required	Max Marks	Minimum passing marks required
1	Integrated Professional Core Course (IPCC)	Theory	30	12	50	20
		Practical	20	08	---	---
		Total	50	20	50	20
2	PCC with PBL component	Theory	30	12	50	20
		PBL component	20	08	--	--
		Total	50	20	50	20
3	PCC/PEC/OEC		50	20	50	20
4	Laboratory		50	20	50	20
5	Drafting		50	20	50	20
6	Mini Project		100	40	---	---
7	Inter/Intra Institutional Internship (2 weeks)		100	40	---	---
8	Industrial/Govt./ NGO/MSME/ Rural Internship/ Innovation / Entrepreneurship (In single or two stretches =Total of 8 weeks)		100	40	100	40
9	Research Internship/ Advanced Industry Internship/Project work		100	40	100	40
10	Seminar		100	40	---	---

All university examinations (SEE) shall be conducted for a maximum of 100 marks. For assigning the letter grade the university examination marks secured by a student, except in the case of serial no. 06, 07, and 10 shall be reduced to 50 marks and added to CIE marks. If the total marks result in a fraction during reduction, it shall be rounded off to the nearest higher value.

2 Laboratory/Practical Course

2.1 Split-up of Marks for evaluation of Practical for 50 CIE marks and 50 SEE marks.

2.2 Split-up of Marks for evaluation of Laboratory work:

2.2.1 Laboratory in-charge faculty will follow rubrics given in the Tables below for an evaluation of laboratory courses

2.2.2 In the case of Practical, the IA marks shall be based on laboratory observation, records, viva, and at least one practical test.

2.2.3 Continuous Evaluation in every lab session will be done using the format mentioned in the Table to evaluate PO9 (Individual and teamwork) and PO10 (Communication).

2.2.4 Rubrics used for continuous Evaluation of **laboratory courses involving experiments with hardware**

<table>
<tr><th colspan="3">Lab conduction and Record</th><th colspan="3">Lab Internal Assessment</th></tr>
<tr><td colspan="3">Split-up: 60% (30 Marks) of Maximum CIE marks (50).

Each experiment is to be evaluated for conduction with an observation book and record write-up (30 marks per experiment). The final marks for conduction and record are the average of all the specified experiments in the syllabus.</td><td colspan="3">Split-up: 40% (20 Marks) of Maximum CIE marks (50). One test of 20 Marks
In the test, conduction of the experiment and acceptable result with viva-voce will carry a weightage of 60% per experiment, with the rest 40% for procedural knowledge and regularity of the student.</td></tr>
<tr><th>Rubrics per experiment</th><th>Marks Distribution</th><th>Remarks</th><th>Rubrics</th><th>Marks distribution</th><th>Remarks</th></tr>
<tr><td>Circuit</td><td>02</td><td rowspan="7">Evaluation of Record write-up to include weightage for submission on time, neatness, etc.</td><td>Write-up</td><td>04</td><td rowspan="7"></td></tr>
<tr><td>Design</td><td>02</td><td>Conduction</td><td>10</td></tr>
<tr><td>Procedure</td><td>02</td><td rowspan="4">Results</td><td rowspan="4">06</td></tr>
<tr><td>Conduction</td><td>06</td></tr>
<tr><td>Viva</td><td>06</td></tr>
<tr><td>Record write-up</td><td>12</td></tr>
<tr><td>Total Marks</td><td>30</td><td>Total Marks</td><td>20</td></tr>
</table>

2.2.5 Split-up of Marks used for continuous Evaluation of laboratory involving experiments with software

Rubrics for Split up of Marks	Methodology / Process Steps per Experiment	Marks
#R1	Observation, Write up of Procedure / Algorithm/ Program execution, and Conduction of experiment	12
#R2	Viva – Voce	06
#R3	Record writing	12
	Total Marks for each experiment	30
#R4	Internal Test: Lab Internal Assessment	
	(i) Write-up of Procedure/Program/Algorithm	04
	(ii) Conduction/Execution	10
	(iii) Viva-Voce	06
	Total Marks	20

3. Internship and Evaluation

3.1 Introduction

The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge. Developing an internship policy is an impactful strategy for creating a future talent pool for the industry. The internship (a form of experiential learning) program not only helps fresh pass–outs in gaining professional know-how but also benefits corporate sectors. The internship also enhances the employability skills of the student passing out from Technical Institutions.

The following list provides a brief illustrative overview of the knowledge, skills, work habits, and character traits commonly associated with 21st-century skills and to be acquired by graduates:

- Critical thinking, problem solving, reasoning, analysis, interpretation, and synthesizing information.
- Scientific literacy and reasoning, the scientific method.
- Research skills and practices, interrogative questioning.
- Creativity, artistry, curiosity, imagination, innovation, and personal expression.
- Information and communication technology (ICT) literacy, media and internet literacy, data interpretation and analysis, and computer programing.
- Oral and written communication, public speaking and presenting, listening.
- Economic and financial literacy, entrepreneurial skills.
- Global awareness, multicultural literacy, humanitarianism.
- Environmental and conservation literacy, ecosystems understanding.

- Civic, ethical, and social-justice literacy.
- Leadership, teamwork, collaboration, cooperation, and facility in using virtual workspaces.
- Perseverance, self-direction, planning, self-discipline, adaptability, initiative.
- Health and wellness literacy, including nutrition, diet, exercise, and public health and safety.

The internship experience will augment the outcome-based learning process and inculcate various attributes mentioned above in a student in line with the graduate attributes defined by the NBA as well as NEP 2020

Following are the intended objectives of internship training.

(i) Expose Technical students to the industrial environment, which cannot be simulated in the classroom, and hence create competent professionals in the industry.

(ii) Provide possible opportunities to learn, understand and sharpen the real- time technical/managerial skills required at the job.

(iii) Expose to the current technological developments relevant to the subject area of training.

(iv) Use the experience gained from the industrial internship in discussions held in the classrooms.

(v) Create conditions conducive to the quest for knowledge and its applicability on the job.

(vi) Learn to apply technical knowledge in real industrial situations.

(vii) Gain experience in writing reports on technical works/projects.

(viii) Expose students to the engineer's responsibilities and ethics.

(ix) Familiarize with various materials, processes, products, and their applications along with relevant aspects of quality control and safety measures.

(x) Promote academic, career, and/or personal development.

(xi) Expose the students to future employers.

(xii) Make students available to the industry for employment.

(xiii) Understand the psychology of the workers and their habits, attitudes, and approach to problem-solving.

(xiv) Understand the social, economic, and administrative considerations that influence the working environment of industrial organizations.

3.2 Academic credit framework for the internship and project work undergone as part of the B.Tech. program.

- A minimum of 20 credits of Internship/ Entrepreneurial activities / Project work/ Seminar and Inter/ Intra Institutional Training may be counted towards B. Tech. degree program
- Here, 1 credit is equivalent to a minimum of 40-45 hours of work. Therefore, a full-time intern is expected to spend 40 - 45 hours per week on Internship, Training, Project work, Seminar activities, etc. This will result in about 800 to 900 hours of total internship and project duration for the B. Tech program.
- To derive the benefits of an internship, it is introduced in two/ three stages of the B.Tech. program.
- Internships may be full-time or part-time; they are full-time during the summer vacation and part-time during the academic session. The curriculum is flexible to adjust internship

duration. Therefore, opportunities must be provided for experiences that cannot be anticipated when planning the course.

- The departments have the flexibility to schedule internships, Project work, Seminars, etc. according to the availability of the opportunities. However, the suggested minimum requirement regarding Internship duration and credits are as given in Table -B1.

Table-B1 Suggested Credit Framework for Internship and Project work.

Sl. No.	Title	Schedule	Duration	Activities	Credits
1	Internship-I	Ongoing First-year academic session/ Summer vacation after 2nd Semester/ vacation during 3rd semester (for lateral entry students	02 weeks	Inter/ Intra Institutional Activities (Evaluation in 4th semester)	02
2	Internship-II	a) Summer vacation after 4th Semester	02-04 weeks	Industrial/Govt./ NGO/ MSME/ Rural Internship/ Innovation / Entrepreneurship/ social internship	---
		b) Summer vacation after 6th Semester	04-06 weeks	Industrial/Govt./ NGO/ MSME/ Rural Internship/ Innovation / Entrepreneurship	
		c) Total of a) and b) at the beginning of the 8th semester	08 weeks	Evaluation in 8th Semester	08
3	Project work	6th Semester	6 hours/week	Mini -Project	02
		8th Semester	16 weeks	Extended Industry Internship /Research Internship/ Project work	10
				Report preparation and writing	
				Seminar	01
Total Credits					**23**

Table-1 states that during the ongoing/ summer vacations after the 2nd Semester, students are required to be involved in Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions, etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working for consultancy/ research project within the institutes and Participation in all the activities of Institute’s Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos, etc.

During the summer vacation after the 4th / 6th semester, students are ready for industrial experience. Therefore, they may choose to undergo Internship / Innovation / Entrepreneurship related activities.

Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry.

3.3 Internship Supervision

i) The internship shall be carried out under the supervision of a faculty mentor. The faculty mentor/guide should,

ii) Serve as a teacher, mentor, trainer, critic, leader, and boss.

iii) Provide sufficient time to guide the interns. (Interns are students or a trainee who does a job to gain work experience)

iv) Play a vital role, along with the Training and Placement Officer, in providing internship opportunities for the students.

v) Exhibit qualities such as leadership, strong communication skills, and patience.

vi) Provide a letter of recommendation in due consultation with students and the industrial organization (if possible) where the internship is intended to be carried out, endorsed by the authority (Principal/Institution Internship Coordinator).

3.3.1 Each faculty mentor shall supervise the students/Student batches allotted to them. Often, the supervision may be by an external expert. In such cases, the faculty mentor shall jointly guide the student/s without causing miscommunications/embarrassment to either side.

3.3.2 Depending on the activity taken up by the students, the internship shall be carried out individually or in batches having not more than three students.

3.3.3 Faculty Mentor, along with the external expert, shall scrupulously evaluate the work of an individual student or students of a batch and maintain the relevant documents.

3.3.4 For allotment of CIE marks, the institutions shall prepare the rubrics for each activity offered by the institution as given in Table - B2. The marks shall be allotted by the Internship committee designated by HOD in consultation with the mentors.

3.3.5 For all activities conducted by the institution, the attendance of the students shall be maintained by the faculty and maintained in their respective departments.

3.4 Internship-I (Activity based Internship)

While intra-activities are within the institution, inter-activities shall be between the concerned institution and neighboring institutions. Intra and Inter activities are the activities that are the impetus to learning techniques. It adds to the comprehensive growth of the mind and associated activities.

As the students are on the verge of learning technical aspects and have a limited period of internship, it is preferable to expose students to polygonal activities instead of one type of activity. Therefore, activities completed by the students shall not be one type of activity but can be few within the period of the internship. In this regard, Intra and Inter-Institutional activities shall be completed under the supervision of a faculty on a self-learning basis.

The faculty have to kindle the latent abilities of the students, encourage, guide, supervise and shape them to achieve the desired result. Therefore, a learning agenda in the form of specific learning objectives and outcomes shall be prepared before the start of the internship.

Whatever the activity/activities that are/are done under Intra and Inter-Institutional activities, should ignite the inquisitiveness to learn, enhance the knowledge, thinking ability and imagination, planning, application of mind, execution ability, innovation attitude, listening and understanding, vocabulary, personal expression, public speaking, written communication, oral presentation of the subject matter, acquire leadership qualities and teamwork requirements, responsiveness, ethics, etc.

3.4.1 List of proposed activities

a. Activities concerned with the works of Indian scholars like Charaka and Susruta, Aryabhata, Bhaskaracharya, Chanakya, Madhava, Patanjali, Panini, and Thiruvalluvar, among numerous others
b. Activities such as training with higher Institutions or Soft skill training
c. Contribution at incubation/ innovation /entrepreneurship cell of the institute.
d. Learning at Departmental Lab/Tinkering Lab/ Institutional workshop.
e. Working for consultancy/ research projects within the institute.
f. Learning MS Word, Excel, Microsoft equations, MS drawing tools, MS Powerpoint, etc.
g. Coding.
h. Mini projects using commercially available assembled electronic products.
i. Debates, quizzes, and group discussions: On technical topics already studied (both in Kannada and English).
j. Essay competitions: Both in Kannada and English on technical topics already studied.
k. Survey and study of published literature on the assigned topic: Technical paper survey, Preparation of synopsis. Exposure to technical paper publications.
l. Photography.
m. Short film production: Contemporary aspects, technical aspects, etc.
n. Internship in Disaster Management.
o. Solar energy connected activities that help the common man.
p. Working with Smart City Administration.
q. Hackathon (it is a design sprint-like event in which computer programs and others involved in software development, including graphic designers, interface designers, project managers, and others, often including domain experts collaborate intensively on software projects).
r. Industrial Safety, Fire Safety, Electrical Safety, Chemical Process Safety, Food Safety, etc.
s. Internship and project work in Indian Knowledge System related Areas/Topics.
t. Industrial visits to Small Scale Industries/ Factories/ Cottage Industries/substation visits etc., and submission of the report.

3.5 Documents to be submitted by Students for Internship Evaluation

3.5.1 Student's Diary

The main purpose of writing a daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the student's thought process and reasoning abilities. The students shall record in the daily training diary the day-to-day account of the observations, impressions, information gathered, suggestions given, if any, and activities carried out. It should contain sketches and drawings related to the observations made by the students. The daily training diary should be signed after every day or at least twice a week by the faculty/ in charge of the section (external expert) where the student has been working.

Student's Diary should be submitted by the students along with attendance records. It shall be evaluated based on the following criteria:

i) Regularity in the maintenance of the diary.
ii) Adequacy and quality of information recorded.

iii) Drawings, sketches, and data were recorded.
iv) Thought processes and recording techniques were used.
v) Organization of the information

3.5.2 Internship report

After completion of the Internship, the student shall prepare, with a daily diary as a reference, a comprehensive report in consultation with the mentor/s to indicate what he/she has observed and learned in the training period along with the internship outcomes. The training report should be signed by the mentor. The Internship report shall be evaluated based on the following criteria and/or other relevant criteria about the activity completed.

i) Originality.
ii) Adequacy and purposeful write-up.
iii) Organization, format, drawings, sketches, style, language, etc.
iv) Practical applications, relationships with basic theory, and concepts taught in the appropriate course.
v) Variety and relevance of learning experience.

Procedure for the Evaluation of Internship-I

a) Students should submit the reports immediately on completion of the Internship to the respective mentors
b) The Examination of the internship will be carried out by the mentor
c) The Internship-I shall be slated for 100 marks CIE only and will not have SEE.
d) Internship-I marks are based on CIE marks (25 marks for the first presentation, 25 marks for the second presentation, and 50 marks for the report and final presentation).
e) A Viva-Voce examination conducted during the I/II/III Semesters (Presentation followed by question-answer session) and the prescribed credit shall be included in the IV semester grade card.

3.5.3 Assessment Rubrics for evaluation of Internship-I (Intra and Inter-Institutional Activities)

Table – B2 Internship-I Assessment Rubrics
Scheduled during the first year (Prescribed Period 02 weeks and Prescribed credits: 02)

Sl No	Sub Activity Head	Performance/ Appraisal	Assessment Rubrics (Allotted marks decide the letter	Proposed Document as Evidence	Evaluated by
1	Inter/ Intra Institutional Workshop/ Training.	Excellent	80 to 100	**(i)** Student's Diary and **(ii)** Internship Report along with the certificate issued from the relevant authorized	Institute Faculty (mentor) together with
		Good	60 to 79		
		Satisfactory	40 to 59		
		Unsatisfactory and fail	< 39		
2	Working for consultancy/ Research project.	Excellent	80 to 100		
		Good	60 to 79		
		Satisfactory	40 to 59		
		Unsatisfactory and fail	< 39		
3	Festival (Technical /	Excellent	80 to 100		

	Business / Others) Events.	Good	60 to 79	Authority	External Expert, if any.
		Satisfactory	40 to 59		
		Unsatisfactory and fail	< 39		
4	Contribution in Incubation/ Innovation/ Entrepreneurship Cell.	Excellent	80 to 100		
		Good	60 to 79		
		Satisfactory	40 to 59		
		Unsatisfactory and fail	< 39		
5	Learning at Departmental Lab/Tinkering Lab/Institutional workshop.	Excellent	80 to 100		
		Good	60 to 79		
		Satisfactory	40 to 59		
		Unsatisfactory and fail	< 39		
6	Other than the above five activities	Excellent	80 to 100		
		Good	60 to 79		
		Satisfactory	40 to 59		
		Unsatisfactory and fail	< 39		
Note: The total CIE marks shall be the sum of marks allotted to completed activities by the student.					

3.6 Internship-II: (Societal internship and Research/Industry Internship) (08 weeks) [Scheduled during the intervening period of IV & V semester and VI & VII semester]

During the intervening period of the IV & V semesters and VI & VII semesters, students shall be ready for industrial experience. Therefore, they shall choose to undergo an Internship involving Innovation / Entrepreneurship/short-term (about 2 weeks) societal-related activities. Students may choose to work on innovation or entrepreneurial activities, or both resulting in start-up or undergo internship with industry/NGO/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry.

3.6.1 Innovation

Innovation refers to a new or improved product or process or a combination thereof that differs marginally or significantly from the unit's previous product. An innovation center is a place where students are encouraged to implement the innovative ideas formed through imagination, brainstorming sessions, design thinking, and associated activities to bring them to reality. It is a place, where creative minds are shaped.

3.6.2 Entrepreneurship

Entrepreneurship refers to setting up a new business or business and taking on financial risks in the hope of profit. It involves investment to undertake production along with arranging inputs like land, labour, material, and capital, introducing new techniques and products, identifying new sources for the enterprise, etc.

3.6.3 Incubation Center

An organized unit designed for innovation as well as to accelerate the growth and success of new entrepreneurial companies through mentorship and an array of business support resources and services that could include physical space, capital, coaching, common services, and networking connections.

3.6.4 Startup

An entity that develops a business model based on either product innovation or service innovation and makes it scalable, replicable, and self-reliant.

An entity shall be considered a Startup

i) Up to ten years from the date of incorporation/ registration, if it is incorporated as a private limited company (as defined in the Companies Act, 2013) or registered as a partnership firm (registered under section 59 of the Partnership Act, 1932) or a limited liability partnership (under the Limited Liability Partnership Act, 2008) in India.

ii) Turnover of the entity for any of the financial years since incorporation/ registration has not exceeded one hundred crore rupees.

iii) The entity is working towards innovation, development, or improvement of products or processes, or services, or if it is a scalable business model with a high potential for employment generation or wealth creation.

iv) Provided that an entity formed by splitting up or reconstruction of an existing business shall not be considered a Startup.

3.6.5 Societal (Social) related activities

Short-term internships (about 2 weeks) in villages, slums, or urban areas can be under social internship. The internship will be more fruitful if students work in teams. The teams can select one or more fields to do their best in the field of agriculture, watershed management, wastelands development, non-conventional energy, low-cost housing, sanitation, nutrition and personal hygiene, schemes for skill development, income generation, blood bank, government schemes such as

i) (Swachch Bharat: Swachh Bharat Mission, Swachh Bharat Abhiyan, or Clean India Mission is a country-wide campaign to eliminate open defecation and improve solid waste management.

ii) Accessible India: Accessible India Campaign or Sugamya Bharat Abhiyan is a program to serve the differently able community of the country.

iii) Digital India: A campaign to ensure the Government's services are made available to citizens electronically by improved online infrastructure and by increasing Internet connectivity or making the country digitally empowered in the field of technology.

iv) Beti Bachao and Beti Padhao: A campaign of the Government of India that aims to generate awareness and improve the efficiency of welfare services intended for girls in India.

v) Environment and Energy Conservation and Education, legal aid, consumer protection, and allied field including Indian Red Cross Society, National Cadet Corps, Bharat Scouts, and Guides.

Societal activities are one of the NBA graduate attributes that are part of PO6 and PO7, which are reproduced below.

vi) PO-6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

vii) PO-7: Environment and Sustainability: Understand the impact of the professional engineering solution in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development. The long-term goal under Societal (social work) related activities, particularly in a rural area, results in a rural internship. In urban areas, the student may adopt slum/ economically weaker section areas for short duration social internship to uplift the living conditions.

Given the above, internship coordinators should encourage students to take up a societal internship as far as possible.

3.6.6 Places for Innovation/Entrepreneurial Activities

Students shall carry out Innovation or Entrepreneurial activities or both at the Incubation Center and Entrepreneurship Cell of the parent institution or elsewhere such as ATAL Incubation Centers [A flagship of Atal Innovation Mission (AIM), NITI Aayog for promoting the culture of innovation and entrepreneurship in India], institutes of national importance, public sector units, IT companies, government organizations, and non-governmental organizations, industries including MSME, etc.

- **Institutes should deter students to opt for internships at places established for commercial benefits.**

3.6.7 Industrial Internships

The gap between the theoretical knowledge obtained in the classrooms and the practical skills required in the actual workplace scenarios is fast growing. This has put forth varied challenges to graduating students when it comes to job placements. As institutes cannot have a relevant facility to expose students to a real-time industrial environment, an industrial internship is an appropriate solution.

The main objective of the industry internship is to ensure that the intern is exposed to a real job world environment and gains practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned.

3.6.7.1 Industry Internship Benefits

i) Have ample opportunities to attend seminars, symposiums, workshops, etc. This in turn provides an opportunity to establish rapports with professionals and pioneers in their respective fields for further growth.

ii) Have wide scope to publish paper/s in journals.

iii) Good recommendation letter/s that increase the prospectus for further internships, higher studies, and placements.

iv) Helps to acquire team spirit, motivated acts, techniques to resolve conflicts, etc.

v) Helps to develop a lot of leadership skills.

vi) Increases the prospect of placement in the same concern, provided the intern has exhibited a clear understanding of basics and completed the internship.

vii) Fosters to substantiate the issues with facts and figures.

For AICTE Internship opportunities refer to https://internship.aicte-india.org/

3.6.8 Assessment Rubrics for Innovation / entrepreneurship/ Societal Internship Activities

Once the internship begins, the students are required to maintain a diary/journal and submit a report regularly to the guide. These reports should summarize the activities in which the student was involved during the previous week's period. At the end of the internship, each student is required to submit a hard copy of the consolidated diary/journal and report for evaluation. The report should indicate the learning and achievements of the internship.

Table – B3 Innovation/entrepreneurship/ Societal Internship Activities and Assessment Rubrics Scheduled during the intervening period of IV & V semester and VI & VII Sem (Prescribed Period 08 weeks: Credits 08)				
Sub Activity Head	**Performance/ Appraisal**	**Assessment Rubrics**	**Proposed Document as Evidence**	**Evaluated by**
(1) Development of new product/ Business Plan/ registration of start-up/societal internship	Excellent	80 to 100	(i) Student's Diary and (ii) Internship Report or the activity report along with Certificate or Declaration from relevant Authorized Authority. Wherever only Certificate is issued, Assessment shall be at the institute as per (i) and (ii) to decide the letter grade.	(i)Institute Faculty (mentor) together with External Expert if any.
	Good	60 to 79		
	Satisfactory	40 to 59		
	Unsatisfactory and fail	< 39		
(2) Internship with Industry/ Govt. / NGO/ PSU/ Any Micro/ Small/Medium Enterprise.	Excellent	80 to 100		
	Good	60 to 79		
	Satisfactory	40 to 59		
	Unsatisfactory and fail	< 39		
Note: **(i)** The total CIE marks shall be the sum of marks allotted to successfully completed activities by the student.				

3.7 Research Internships / Extended Industry Internships

3.7.1 Research Internship /Extended Industry Internship of sufficient duration encourages students early on in their careers. Its main goal is to allow improving their analytical and technical skills in an international environment. An internship can be in an industry or at an appropriate workplace.

3.7.2 Research internships and industrial internships have different purposes and come with a set of benefits. A prior experience in any field is always preferred over a fresh start. Therefore, one of them can be selected depending on the interest the students have. Internships pose unexpected challenges and make students think appropriately, tackle difficulties with ease, and act in a scholarly way to get past the hurdles and practical constraints. An internship is always beneficial however good or bad it is.

3.7.3 Internships not only enhance one's learning but also identifies him/her as someone who commits to approaching a project and completing it with or without guidance. Internship learning is an impetus for professional development.

3.7.4 While a research internship is a stepping stone to higher studies, an industry internship is a pathway to a placement. Those who are self-motivated and interested in searching for new things that are original and unique can choose a research internship. Those who are interested in real industry- experience and aspire to get a job soon after graduation can choose an industry internship.

3.7.5 Research Internships (Also known as dissertation internships) are focused research projects that push students' intellectual abilities beyond those driven by the classroom. Often, a research internship typically helps solve problems that are usually part of major research projects. It involves a short theoretical or experimental research project supervised by a researcher.

3.7.6 The research internships, under the advice of a faculty supervisor, can be one's own selected project or a project on which a Researcher is researching, or a new project/real-world project offered by an organization. The research area may be about single or multidisciplinary fields such as science, technology, engineering, mathematics, management, and business studies. Research internships can be carried out either individually or in teams (not exceeding 3 or 4 students).

3.7.7 Research internship opportunities, before graduation, maybe in a laboratory of college, a research institute, or a company's R & D department. Apart from fixed working hours of the day of an organization, the researcher can devote sufficient time to other research-related activities for early and successful completion of the Research Internship.

3.7.8 Necessary Skills for Research Internship and Industrial Internship

For the internships to progress without hurdles and for successful completion, the Researchers should maintain a harmonious relationship with the guide/s, administrators, co-workers, and others, and strictly adhere to the rules and regulations of the workplace. The other skills required or acquirable during the Internship are,

1. Good Communication skills.
2. Attention to detail.
3. Planning and scheduling.
4. Documentation.
5. Critical thinking.
6. Data collection.
7. Data analysis.
8. Ability to maintain quality, safety, and/or infection control standards.
9. Appreciating and practicing ethical issues.

3.7.9 Responsibilities of an Intern

Interns,

1. If working with a researcher, shall assist the researcher in an ongoing research project or work collaboratively in designing a new project of mutual interest.
2. Shall engage in literature survey and get an insight of the research work at the initial stages.
3. Shall compile data, sort, file, implement ideas with minimal guidance and assist write papers.
4. Shall become familiar with several tools [meters (Electrical and Electronics, mechanical, computer, etc.)] used in data collection, software, graphic software, Statistical Package for the Social Sciences (SPSS) software [IBM's statistical software platform], etc.
5. Shall attain skills with Microsoft Word Office, Excel, PowerPoint, Outlook, etc.
6. Shall give a mid-term oral presentation to a committee for review and feedback.
7. Shall attend discussions, meetings, symposiums, classroom lectures, etc., to learn new scientific techniques, design experiments, analyze results, and formulate different hypotheses.
8. Shall learn to write reports and be able to correspond independently.
9. Shall manage time effectively.
10. Shall keep a track of the progress of the project.
11. Shall develop integrative thinking.

3.7.10 Research internship Outcomes

1. Generating technical paper/s and publishing in refereed journal/s.
2. Possibility of acquiring intellectual ownership and patent.
3. Build a prototype for an idea on which the research was carried out.
4. File patent/s.
5. Add academic knowledge to the field.
6. Enhanced ability in arranging meetings, presentations, seminars, training, etc.
7. Improved conscientiousness and ethics.

3.7.11 Research internships Benefits

1. Are a great way to pursue an academic career in teaching and research, as a Research Scientist at a Research Organization, Company, Industry sector, etc.
2. Establish professional networks for a future career.
3. Pave the way to join a research team and work alongside leading experts in the field.
4. Introduced to new ideas through interaction with like-minded students and others.
5. Develop research skills and knowledge in a specific area of interest.
6. Provide opportunities for growth, achievement, and personal development.
   Offer an opportunity to publish a research paper that will boost the resume while applying for Post Graduate Studies

4. Evaluation Procedure of UC3001-1 Research Internship /Extended Industry Project/Internship/Project work (16 weeks)

4.1 The students pursuing the course UC3001-1 shall submit the diary recordings of day-to-day activities to the concerned guide, reporting progress achieved in the course and seeking guidance to proceed with the internship. The interns should provide all the details to the guide so that he/she can discuss with the employer to make the internship successful.

4.2 The intern should constantly update the guide about the progress of the internship. The guide should know the intern's internship tasks, duties, responsibilities, and potential projects. The evaluation of interns and their internship progress should be honest and constructive.

4.3 The hardcopy or softcopy of the diary maintained by the interns must be signed at regular intervals by the guide.

4.4 Regarding the intern's feedback, the guides should propose changes in internship activities so that they are helpful to the internship.

4.5 Illustrations, drawings, photos, forms, samples, classified materials, etc., are to be included in the report only after obtaining the consent of the concerned authorities and should indicate the source of all such material. The final report should also be submitted to the place where the internship was carried out. The report should avoid a tone that is predominantly cynical or unduly critical of the employer or of those with whom the student intern has worked. The content of the report must be based on interns' own work.

4.6 Continuous Internal Evaluation (CIE)

The guides should evaluate the interns using the following as well as any other appropriate methods;

a) Punctuality of intern.
b) Conduct and character.
c) Tactfulness and politeness with colleagues and the public.
d) Attitude regarding professionalism.

e) Inquisitiveness and eagerness to learn.
f) Research attitude.
g) Problem-solving techniques.
h) Innovation mindset.
i) Time management and meeting deadlines.
j) Receptiveness to feedback and critiques.
k) Ability to work in a team as a member.
l) Ability to work without supervision.
m) Supervisory skills and leadership skills.
n) Judgment and decision-making skills.
o) Writing skills, oral communication skills, technical communication skills, computer skills, analysis skills, and business writing skills.
p) Appropriateness of technical skills.
q) Familiarization with writing technical papers, standards, codes, etc.
r) Reading Behavioural attitude.
s) Outcomes.
t) Successes and failures experienced

4.7 Recommendation letter

The guide must state whether the intern,

a) Exceeded the expectations of the internship.
b) Met the expectations of the internship.
c) Did not meet the expectations of the internship.
d) Did work to a satisfactory level.
e) Did an unsatisfactory internship.

In the end, the guide should issue a recommendation letter.

4.8 Assessment of CIE marks

4.8.1 **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the internship, shall be based on the evaluation of the diary, presentation skill, and viva-voce in the ratio of 50:25:25.

4.8.2 **Interdisciplinary:** The CIE marks awarded for the internship, shall be group-wise at the institution level with the participation of all guides of the internship. Participation of external guide/s, if any, is desirable.

4.8.3 The CIE marks awarded for the internship, shall be based on the evaluation of the diary, presentation skill, and viva-voce in the ratio of 50:25:25.

4.9 Assessment of SEE marks

4.9.1 Single discipline: Contribution to the internship and the performance of each group member shall be assessed individually in the semester-end examination (SEE) conducted at the department. Marks shall be awarded based on the evaluation of the report, presentation skill, and viva-voce in the ratio of 50:25:25.

4.9.2 Interdisciplinary: Contribution to the internship and the performance of each group member shall be assessed individually in the semester-end examination (SEE) conducted separately at the departments to which the student/s belongs. Marks shall be awarded based on the evaluation of the report, presentation skill, and viva-voce in the ratio of 50:25:25.

4.10 Evaluation of research Internship/Extended Industry Internship/Project Work:

Split-up of marks for evaluation of Project work for 100 CIE marks and 100 SEE marks

Split up	Rubrics		Marks
Report (50 Marks)	Content Development	Abstract/ Synopsis Write-up	10
		Selection of Topic/ Relevance of the subject to the concerned discipline	05
		Problem Identification	05
		Objectives and Methodology	05
	Problem-Oriented Exposition	Literature Survey (Papers/Sites/Sources Surveyed)	10
		Documentation/ Systematic Approach	10
		Results (with inferences, Conclusions, etc.)	05
Project Presentation Skill (25 Marks)		Quality of preparation of presentation	05
		Communication Skills	05
		Technical knowledge and awareness	05
		Individual involvement	10
Viva- Voce (25 Marks)		The clarity in answering questions relating to fundamentals and concepts	10
		The clarity in answering the questions related to the project	05
		The understanding ability of the questions asked	05
		The confidence in answering the questions asked.	05
		Total Marks	100

NITTE (Deemed to be University)

Established under Section 3 of UGC Act 1956
Accredited with ‘A+’ Grade by NAAC

NMAM INSTITUTE OF TECHNOLOGY

Off-Campus Centre, Nitte - 574 110, Karnataka, India

B.Tech. Syllabus

Effective from

Academic Year

2022 – 2023

Curriculum for Acquiring Professional Skills (CAPS)

With Scheme of Teaching & Examination

Course Numbering Scheme

<table>
<tr><th colspan="2">Branch Code</th><th>Course Level</th><th colspan="3">Course Code</th><th>Separator</th><th>Version</th></tr>
<tr><th>Letter</th><th>Letter</th><th>Number</th><th>Number</th><th>Number</th><th>Number</th><th>-</th><th>Number</th></tr>
<tr><td>Branch Code</td><td colspan="7">CV is 2 Letter code for the Department of Civil Engineering</td></tr>
<tr><td>Course Level</td><td colspan="7">Course Level is a 1-digit number that can have a value between 1-4 and indicates the prerequisite of a course.
Level-1 courses are basic courses with no courses as pre-requisites
Level-2 course(s) have Level-1 course(s) as prerequisites
Level-3 course(s) have Level-2 course(s) as prerequisites
Level-4 course(s) have Level-3 course(s) as prerequisites</td></tr>
<tr><td>Course Code</td><td colspan="7">Course Code is a 3 Digit number that can have a value between 001-999 and indicates the number assigned to a course based on the following guidelines

001-199 is assigned to Professional Core Courses
001-099 for Integrated Professional Core Courses [4 Credit]
101-199 for Professional Core Theory Courses [3 Credit]

201-499 for Professional Elective Courses
201-299 Electives under Group I
301-399 Electives under Group II
401-499 for future use

501-550 for Open Elective Courses

551 – 599 for Vocational Education Courses

601-650 for Professional Core Lab Courses [1 Credit]

651-699 for Ability Enhancement Courses

701-799 for Courses offered to Honours Program</td></tr>
<tr><td>Separator</td><td colspan="7">“_” is used as a separator between the Course code and the version</td></tr>
<tr><td>Version</td><td colspan="7">Version is a 1-digit number that can have a value between 1-9 and indicates minor revisions of the same course.</td></tr>
</table>

NITTE (Deemed to be University) | NMAM INSTITUTE OF TECHNOLOGY

Scheme & Syllabus for

B. Tech. (Civil Engineering)

DEPARTMENT OF CIVIL ENGINEERING

2022-23

B. Tech in DEPARTMENT OF CIVIL ENGINEERING

Vision

To uphold the Department as a leader in community development through innovation and excellence in diverse areas of Civil Engineering to meet the global challenges and market demands.

Mission

1. To provide the students a strong theoretical knowledge and practical skills to understand the basic concept and fundamentals of various Civil Engineering subjects.
2. To be competent and skilled enough to take the challenges in Research, Consultancy and Entrepreneurship.
3. To encourage the students in developing professional ethics through discipline and principles.

Programme Educational Objectives (PEOs)

The graduates of the program will be

PEO1	Equipped with fundamentals of civil engineering along with interdisciplinary science, engineering and management concepts.
PEO2	Equipped with advanced and emerging field of civil engineering practices to compete and match with the industrial requirements.
PEO3	Competent enough to conceive the ideas, prepare plan, design, execute, monitor and manage the project with the effective utilization of resources such as men, material, machine and money along with time effectively.
PEO4	Continue to learn and adapt to suit the needs and challenges of real-world problems and come up with optimal solutions.

Programme Outcomes (POs)

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO1	Ability to apply the knowledge of Civil Engineering domains, conduct experiments, analyze, interpret data and design the system components.
PSO2	Enrich the knowledge in Structural, Geo technical, Transportation, Environmental Engineering, Water Resources, Infrastructure and Development, Surveying and Geo-informatics by means of innovative practices.
PSO3	Competency to plan, produce detailed drawings, write specification, prepare cost estimates, selection of materials, schedule work plans, execute and value real properties.

B. Tech. in Civil Engineering

CREDIT DISTRIBUTION

No.	Course Category	Credit Range	Suggested Credits
16.	Basic Science Courses (BSC)	18-23	22
17.	Engineering Science Courses (ESC)	10-15	13
18.	Emerging Technology Courses (ETC)	03-05	03
19.	Programming Language Courses (PLC)	03-05	03
20.	Professional Core Courses (PCC)	52 - 58	55
21.	Professional Elective Courses (PEC)	12-18	15
22.	Open Elective Courses (OEC)	6	6
23.	Humanities, Social Sciences and Management courses (HSMC)	09-15	12
24.	Ability Enhancement Courses (AEC)	9	9
25.	Mandatory Non-credit Courses (MNC)	Non-Credit	0
26.	Holistic Education Courses (HEC)	2	1
27.	Vocational Education Courses (VEC)	1	1
28.	Project Work (PROJ) (UCC)	10-12	10
29.	Internship (INT) (UCC)	8-12	10
30.	Note: **Student can register between 16 to 28 credits per semester**		**160**
	Total minimum Credits to be earned: 160		

Course Numbering Scheme

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</table>

Scheme & Syllabus
(I Year)

B. Tech. (CV): Scheme of Teaching and Examinations 2022-26

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2022 - 23)

GROUP – 1

I SEMESTER														
Sl. No.	**Course and Course code**		**Course Title**	**Teaching Dept.**	**Teaching Hours/Week**				**Examination**					**Credits**
					Theory Lecture	**Tutorial**	**Practical/Drawing**	**PBL**	**Duration in hr**	**CIE Marks**	**SEE Marks**	**Total Marks**		
					L	**T**	**P**							
1.	BSC	MA1001-1	Matrix Algebra and Calculus	MA	3	0	0	0	3	50	50	100		3
2.	BSC	CY1001-1	Engineering Chemistry	CH	3	0	2	0	3	50	50	100		4
3.	ESC	CS1001-1	Problem-Solving through Programming	CS	3	0	2	0	3	50	50	100		4
4.	ESC	EE1001-1	Basic Electrical Engineering	EE	3	0	2	0	3	50	50	100		4
5.	ESC	ME1003-1	Elements of Mechanical Engineering	ME	3	0	0	0	3	50	50	100		3
6.	AEC	BT1001-1	Biology for Engineers	BT	1	0	0	0	1	50	50	100		1
7.	AEC	IS1001-1	IT Skills	IS	1	0	2	0	3	50	50	100		2
8.	MNC	CV1002-1	Environmental Studies	CV	1	0	0	0	1	50	0	50		0
9.	MNC	UM1001-1	Skill Development Lab-I	Any	0	0	2	0	0	50	0	50		0
				TOTAL	**18**	**0**	**10**	**0**	**20**	**450**	**350**	**800**		**21**

MATRIX ALGEBRA & CALCULUS

Course Code	**MA1001-1**	**Course Type**	**BSC**
Teaching Hours/Week (L: T:P)	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mathematics

Course Objectives:

1.	This course will enable the students to master the basic tools of differential calculus, infinite series, elementary linear algebra, partial differentiation, multiple integration and become skilled for solving problems in science and engineering.

UNIT-I

Matrices	**8 Hours**

Elementary transformation of a matrix, Echelon form and rank of a matrix. Consistency and solution of system of linear equations; Gauss elimination method and approximate solution by Gauss Seidel method. Eigen values and eigen vectors of square matrices, Rayleigh's power method to find the largest eigen values and eigen vectors of square matrices.

Sequences and Series	**7 Hours**

Convergence and divergence of infinite series. Tests for convergence of positive term series- comparison test, D-Alembert's ratio test and Cauchy's root test. Power series- Taylor's theorem for a function of single variable with remainder (without proof), expansion of functions into Taylor's and Maclaurin's series.

UNIT-II

Differential Calculus	**7 Hours**

Polar curves, angle between the radius vector and the tangent, angle of intersection of two curves. derivatives of arcs, radius of curvature - cartesian, parametric and polar forms. Rolle's Theorem (without proof), mean value theorems and applications to simple problems.

Partial Differentiation	**8 Hours**

Partial derivatives of simple functions, total differentiation - differentiation of composite and implicit functions, Jacobians. Taylor's theorem for functions of two variables, maxima and minima for functions of two variables, Lagrange's method of undetermined multipliers (with one subsidiary condition).

UNIT-III

Multiple Integrals	**10 Hours**

Double integrals and triple integrals, evaluation by change of order of integration, change of variables and applications to area and volume. Beta and Gamma functions and their properties.

Course Outcomes: At the end of the course student will be able to

1.	Solve the system of linear equations and find eigen values and eigen vectors of the given matrix.
2.	Develop the power series of the given function and understand the concept of convergence and divergence of series.
3.	Apply the concept of radius of curvature and mean value theorems.
4.	Learn the concept of partial differentiation of a function with two or more independent variables, apply them to solve engineering problems and examine the given function for its extrema.
5.	Apply the notion of multiple integrals to find areas and volumes.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
↓ Course Outcomes													**1**	**2**	**3**

MA1001-1.1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
MA1001-1.2	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
MA1001-1.3	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
MA1001-1.4	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
MA1001-1.5	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley and Sons, 10th Edition (Reprint), 2016.
2.	B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publications, 43rd Edition, 2015.

REFERENCE BOOKS:

1.	G.B. Thomas and R.L.Finney, “Calculus and Analytic geometry”, Pearson, 2002.
2.	T. Veerarajan, “Engineering Mathematics”, McGraw-Hill, New Delhi, 2008.
3.	B. V. Ramana, “Higher Engineering Mathematics”, Tata Mc Graw –Hill, New Delhi,2010.
4.	N.P. Bali and M.Goyal, “A text book of Engineering Mathematics”, Laxmi Publications, 2010.

E Books / Moocs/ NPTEL

1.	http://nptel.ac.in/courses/111107108/
2.	https://nptel.ac.in/courses/122101003

Engineering Chemistry

Course Code:	**CY1001-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L: T: P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Chemistry

Course Objectives:

1.	a) Know the basics of electrochemistry and its usage in the working of fuel cells and modern-day batteries. b) Gain knowledge of the harmful effects of corrosion on metal and techniques used in preventing it, including metal finishing.
2.	a) Get acquainted with the different types of industrially important polymers along with their characteristic properties. b) Know the requirements of boiler feed water.
3.	a) Get the knowledge on the different chemical fuels and related parameters. b) Know the basics of liquid crystals. c) Understand the different routes of nonmaterial synthesis.

UNIT-I

ELECTROCHEMICAL CELLS — **04 Hours**

Introduction, Derivation of Nernst equation for single electrode potential. EMF of the cell, Numerical problems. Construction and working of calomel electrode, Measurement of single electrode potential. Ion-selective electrode-definition, construction, and working of the glass electrode. Determination of pH using a glass electrode.

BATTERY TECHNOLOGY — **04 Hours**

Introduction to battery, battery characteristics, Classification of batteries primary, secondary and reserve batteries. Construction, working and applications of Lithium-ion battery, and Flow batteries-Construction, working and applications of Vanadium flow battery. Fuel cells-Introduction, construction, working, and uses of Methanol-Oxygen fuel cells.

CORROSION SCIENCE — **04 Hours**

Corrosion-definition, Electro-chemical theory of corrosion, Factors affecting the rate of corrosion. Differential metal corrosion-galvanic series, Differential aeration corrosion-Water line and pitting corrosion. Stress corrosion. Corrosion Control: Protective coatings; Inorganic coating - Anodizing and Phosphating. Metal coating - Galvanization and Tinning, cathodic protection.

METAL FINISHING — **03 Hours**

Introduction to metal finishing, Polarization, decomposition potential, and over-voltage. Electroplating, effect of plating variables on the nature of electrodeposit, Electroplating of Chromium, Electroless plating-advantages, Electroless plating of copper on PCB.

UNIT-II

POLYMERS — **07 Hours**

Definition, Classification, free radical mechanism of polymerization with examples. Emulsion polymerization. Glass transition temperature. Structure and property relationship.
Synthesis, properties, and applications of PMMA, Polycarbonate Elastomers–Definition, Synthesis, and applications of Butyl rubber and Silicone rubbers.
Adhesives-Synthesis and applications of Epoxy resins. Polymer Composites: Introduction, synthesis, properties, and applications of carbon fiber.
Conducting polymers-definition, applications. Mechanism of conduction in polyacetylene.

WATERCHEMISTRY — **07 Hours**

Impurities in water, Water analysis - Determination of Hardness, determination of Dissolved Oxygen by Winkler's method, Boiler feed water, and boiler problems – scales and sludges, boiler corrosion. External treatment - hot lime soda process, Ion-exchange method. Internal treatment - phosphate conditioning, colloidal conditioning, Calgon conditioning. Desalination of seawater - Electro dialysis and reverse osmosis. Sewage treatment: Primary, secondary, and tertiary treatment.

NANOMATERIALS	**02 Hours**

Introduction, classification of nanomaterials. Synthesis of nanomaterials by microwave, combustion, chemical vapour deposition, and sol-gel methods. Applications of nanomaterials.

UNIT-III

CHEMICALFUELS	**06 Hours**

Introduction, definition, classification of fuels. Calorific value-definition, Gross, and Net calorific values. Determination of calorific value of a solid/liquid fuel using a Bomb calorimeter. Numerical problems. Petroleum cracking-fluidized bed catalytic cracking. Reformation of petrol. Knocking and its harmful effects. Prevention of knocking, power alcohol and biodiesel.

LIQUIDCRYSTALS	**03 Hours**

Introduction, classification-Thermotropic, and Lyotropic with examples. Types of meso phases-nematic, chiral nematic, smectic, and columnar. The chemical constitution of liquid crystals. Electro-optic effect of liquid crystals. Applications of liquid crystals in display systems.

Suggested List of Experiments

	PART A
VOLUMETRIC ANALYSIS	
1.	Determination of Total Hardness of a sample of water using disodium salt of EDTA.
2.	Determination of percentage of Copper in brass using standard sodium thiosulphate solution.
3.	Determination of Iron in the given sample of Haematite ore solution using potassium dichromate crystals by external indicator method.
4.	Determination of manganese dioxide in pyrolusite using standard potassium permanganate solution.
5.	Determination of Chemical Oxygen Demand (COD) of the given industrial waste Water sample.
6.	Determination of nitrogen ammonia in a given sample of fertilizer using a standard hydrochloric acid solution.
	PART B
INSTRUMENTAL ANALYSIS	
1.	Potentiometric estimation of FAS using standard K2Cr2O7 solution.
2.	Colorimetric determination of iron.
3.	Conduct ometric estimation of an Acid mixture using standard NaOH solution.
4.	Determination of pKa of a weak acid using pH meter.
5.	Determination of the viscosity coefficient of a given liquid using Ostwald's viscometer.
6.	Flame photometric estimation of sodium in the given sample of water.

Course Outcomes: At the end of the course student will be able to

1.	a. Understand the basic components of electrochemical cells and thereby relate their principles to modern batteries and fuel cells. b. Identify the different types of corrosion, techniques generally used for its prevention, and understand the metal surface modification techniques like electroplating and electro less plating.
2.	a. Analyze the different types of polymers, their synthetic routes, and applications. b. Understand the prime problems faced in boiler feed water and subsequent remedial measures undertaken, analyze the quality of water. c. Identify the synthetic approaches undertaken for designing nanomaterials.

3.	a. Identify the methodologies used to analyze as well as improvise on chemical fuels. b. Understand the applications of liquid crystals in display systems.
4.	Understand the different types of volumetric titrations for the estimation of composition in materials for accurate results.
5.	Handling different types of instruments for analysis of materials using small quantities involved for quick and accurate results.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CY1001-1.1															
CY1001-1.2															
CY1001-1.3															
CY1001-1.4															
CY1001-1.5															

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Engineering Chemistry by P.C. Jain & Monica Jain., Dhanpat Rai Publications, New Delhi.2015
2.	Engineering chemistry by R V Gadag & A Nityananda Shetty., IK International Publishing House Private Ltd. New Delhi.2016.
3.	Physical Chemistry, by P.W. Atkins, Oxford Publications (Eighthedition-2006)

REFERENCE BOOKS:

1.	Chemistry for Engineering Students by B.S. Jai Prakash, R. Venugopal, Sivakumaraiah &Pushpa Iyengar., Subhash Publications, Bangalore.2016.
2.	Principles of Physical Chemistry by B. R. Puri, L. R. Sharma & M. S. Pathania., S. Chand & Co. Pvt. Ltd. NewDelhi.1998.
3.	Liquid crystals and plastic crystals, Vol-I, edited by G. W. Gray and P. A. Winsor, Ellis Horwood Series in Physical Chemistry, New York.2010,(p.No.106-142).
4.	Corrosion Engineering by M. G. Fontana, McGraw HillPublications.2006.
5.	Polymer Science by F. W. Billmeyer., JohnWiley &Son’s.2016
6.	Engineering Chemistry by O. G. Palanna; Tata McGraw Hill Education Private Limited, New Dehli.2016.
7.	G. A. Ozin & A.C. Arsenault, “Nanochemistry, A Chemical Approach to Nanomaterials”,RSC Publishing,2009.
8.	S. S. Dara, A textbook of Engineering Chemistry, 10th edition, S Chand & Co., Ltd. NewDelhi, 2014.
9.	Vogel's textbook of quantitative inorganic analysis, revised by J.Bassett, R.C. Denny, G.H. Jeffery, 4thEd.
10.	Laboratory manual in Engineering Chemistry Sudharani, Dhanpatrai Publishing Company,

E Books / MOOCs/ NPTEL

1.	http://bcs.whfreeman.com/vollhardtschore5e/default.asp.
2.	https://www.youtube.com/watch?v=FnJ0V7B7nKo
3.	https://www.youtube.com/watch?v=6_mBFpyruNQ4.
4.	http://nptel.ac.in/courses/113108051/module1/lecture1.pdf

PROBLEM SOLVING THROUGH PROGRAMMING

Course Code:	**CS1001-1**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Computer Science & Engineering

Course Objectives:

1.	Make students learn basics of Computer System, Principles of Problem solving, and the basics of C programming language including the basic structure, data types and keywords used to design & develop programming skills.
2.	Outline the usage of Input Output statements, Operators and Evaluating expressions in C.
3.	Apply the concepts of decision making and looping in problem solving to demonstrate its usage using simple programs.
4.	Apply the concepts of Arrays, User-defined functions and code reusability in problem solving along with parameter passing and returning with the help of user defined functions.
5.	Demonstrate the usage of Strings, Structures, Pointers and File handling that are essential for understanding the concepts with simple examples.

UNIT-I

15 Hours

INTRODUCTION TO COMPUTER SYSTEM:
Introduction to Computer generations and types, CPU, Primary Memory, Secondary Memory, Ports and Connections.
Problem solving, Program Development steps, Introduction to Algorithms and Flowcharts.

INTRODUCTION TO C PROGRAMMING LANGUAGE:
Evolution & Characteristics of C Language, Structure of a C Program, C Compilation Model. Characters set, C tokens, Keywords and identifiers, Constants, Data Types and Variables.
OPERATORS AND EXPRESSIONS:
Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment and Decrement operators, conditional operator, Bitwise operators, Special Operators.
Arithmetic expressions, Operator precedence and associativity, Type conversions in expressions, Evaluation of expressions.

MANAGING INPUT AND OUTPUT OPERATIONS:
Formatted Input and Output functions, Unformatted Input and Output functions.

UNIT-II

15 Hours

DECISION MAKING AND BRANCHING:
Decision making with if statement, Simple *if* Statement, the *if…else* statement, *Nesting of if…else* statements, The *else…if* ladder, The *switch* statement, The *goto* statement, break and continue statements.
DECISION MAKING AND LOOPING:
The *while* statement, the *do…while* statement, the *for* statement, Jumps in Loops.
ARRAYS:
Arrays (1-D, 2-D) Initialization and Declaration.
USER-DEFINED FUNCTIONS:
Need for the User-defined Functions, Element of User-defined Functions, Argument Passing – call by value, call by reference, Category of Functions.

Examples: Linear Search, Binary Search, Bubble sort, Selection Sort, Trace and Transpose, Matrix Multiplication.

UNIT-III

10 Hours

STRINGS:
Declaring and Initializing strings, String manipulation functions.
STRUCTURES:
Defining a Structure, Declaration and Accessing the Structured Variable.
POINTERS AND FILE HANDLING:
Introduction, Declaration, accessing of variables using Pointers, Basic file operations: Open, Close, Read, Write.

Suggested List of Experiments

	Part A
1.	Write a C program to find the roots of a quadratic equation ax2+bx+c=0.
2.	Write a C program to find the sum of all the digits and occurrence of a digit in the number.
3.	Write a C program to find the GCD and LCM of given two numbers using Euclid's method.
4.	Write a C program to print the prime numbers in a given range.
5.	Write a C program to find if a given string is a palindrome or not.
6.	Write a C program to input N real numbers in 1-D array. Compute mean, variance and Standard Deviation. [Mean= sum/N, Variance = Σ(Xi-mean) 2 /N, STD Deviation= √variance.]
7.	Write a C program to read N integers into an array A and find the sum of elements using pointers.
8.	Write a C program to copy contents of one file to another file.
	Part B
9.	Write a C program to perform a binary search for a given key integer in a single dimensional array of numbers in ascending order and report success or failure in the form of a suitable message.
10.	Write a C program to input N integer numbers into a single dimension array, sort them in to ascending order using selection sort technique, and then to print both the given array and the sorted array with suitable headings.
11.	Write a C program to transpose a matrix of order M x N and find the trace of the resultant matrix.
12.	Write a C program using functions to read two matrices A (M x N) and B (P x Q) and to compute the product of A and B if the matrices are compatible for multiplication.
13.	Write a C program using functions readmat ( ), rowsum ( ), colsum ( ), totsum ( ) and printmat( ) to read the values into a two dimensional array A, find the sum of all the elements of a row, sum of all the elements of a column, find the total sum of all the elements of the two dimensional array A and print the results.
14.	Write a C program to perform a linear search for a given key integer in a single dimensional array of numbers and report success or failure in the form of a suitable message using functions.
15.	Write a C program to enter the information like name, register number, marks in 6subjects of N students into an array of structures, and find the average & display grade based on average for each student Average — Grade 80-100 — Distinction 60-79 — First Class 40-59 — Second Class

	<40 Fail
16.	Write a C program, to implement a bubble sort technique using a function to sort given N integers in ascending/ descending order as per user's preference.

Course Outcomes: At the end of the course student will be able to

1.	**Describe** the basics of computer system, basics of C and the process of problem-solving aspects using algorithmic solution for a given problem.
2.	**Apply** the knowledge of expression solving to evaluate simple expressions and input/output statements to **develop** a C program.
3.	**Develop** the C program using control statements such as branching and looping constructs for a given problem.
4.	**Apply** the knowledge of code re-usability, parameter passing and returning values to **develop** a maintainable C program using these concepts including arrays and functions.
5.	**Identify and describe** the use of strings, structures, pointers and file handing mechanisms in a C program.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CS1001-1.1	3													2	
CS1001-1.2	2	3												3	
CS1001-1.3	2	3												3	
CS1001-1.4	2	2	3											3	
CS1001-1.5	2	3												3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	E. Balaguruswamy, Programming in ANSI C, Tata McGraw Hill, 3rd Edition,2004.
2.	Jacqueline A. Jones & Keith Harrow, C Programming with Problem Solving, Pearson, Pap/Dskt edition, 1996

REFERENCE BOOKS:

1.	Kernighan & Ritchie, The C Programming (ANSI C), Prentice Hall; 2ndEdition, 1998.
2.	Rajiv Khanna, Computer Concepts and C Programming, New Age International Pvt Ltd Publishers, 1st Edition, 2006.
3.	Yashwant Kanetkar, Let Us C, 5th Edition, BPB Publications, New Delhi, 2004.

E Books / MOOCs/ NPTEL

1.	http://www.lysator.liu.se/c/bwk-tutor.html#introduction
2.	http://www.acm.uiuc.edu/webmonkeys/book/c_guide/
3.	C programming Tutorial by Mark Burgers http://markburgess.org/CTutorial/C-Tut-02.pdf
4.	http://nptel.ac.in/courses/106105085/4
5	https://www.lynda.com/C-training-tutorials/1249-0.html

Basic Electrical Engineering

Course Code:	**EE1001-1**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T: P:S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1.	To familiarize the student with the DC circuit analyses.
2.	To analyze single and three-phase AC circuits.
3.	To understand the working principle of electrical machines.
4.	To introduce the concept of electrical wiring protective devices and safety measures

UNIT-I

Circuit Fundamentals	**07 Hours**

Basic nodal and mesh analysis excited by independent DC voltage sources, Power and Energy. Generation of sinusoidal voltage, frequency of generated voltage, definition and numerical values of average value, root mean square value, form factor and peak factor of sinusoidally varying voltage and current, phasor representation of alternating quantities.

A.C. Circuits	**09 Hours**

Analysis of R, L, C, R-L, R-C and R-L-C series and parallel circuits. Phasor Diagrams. Real power, reactive power, apparent power and power factor. Three-phase balanced circuits, voltage and current relations in star and delta connections. Measurement of three phase power using two wattmeters

UNIT-II

Single-Phase Transformers	**06 Hours**

Faradays Laws, self and mutually induced emfs. Necessity of transformer, Principle of operation. Types of Transformers, Emf equation, losses, efficiency, problems on emf equation and efficiency, Autotransformer, Applications.

DC Machines	**05 Hours**

Constructional details, Principle of operation of generator and motor, Expression for back emf, Types of dc motors, Characteristic of dc motors (shunt and series motors only) and Applications.

Three Phase Synchronous Machines	**04 Hours**

Basic parts, Principle of operation, Synchronous speed, Frequency of generated voltage, Emf equation. Concept of winding factor (excluding the derivation of distribution and pitch factors). Principle of operation of Synchronous Motor. Applications

UNIT-III

Induction Motors	**05 Hours**

Concept of rotating magnetic field, Construction and working of a three-phase Induction Motor, Slip and its significance, Torque slip characteristics (qualitative). Necessity of a starter, Principle of operation Single Phase Induction Motor. Applications

Domestic Wiring	**04 Hours**

Brief discussion on Service mains, Meter board, Distribution board, conduit wiring. Two-way and Three-way control. Elementary discussion on Circuit protective devices: Fuse and Miniature Circuit Breaker (MCB's). Electric shock, precautions against shock. Earthing: Pipe and Plate earthing.

Suggested List of Experiments

1.	Verification of KVL and KCL for DC circuits.
2.	Measurement of current, power and power factor of incandescent lamp, fluorescent lamp, CFL and LED lamp.

3.	Sinusoidal steady state response of R-L, and R-C circuits- impedance calculation and verification.
4.	Load test on a single-phase Transformer.
5.	Voltage and Current relationships of three phase star/delta circuits.
6.	Measurement of three-phase power using two wattmeter method.
7.	Speed load characteristic of a 3-phase Induction Motor.
8.	Two-way and Three-way Control of lamp and formation of truth table
	Demonstration Experiments
1.	Demonstration of fuse, MCB by creating a fault.
2.	Demonstration of cut out sections of electrical machines (DC machines, Induction machines and Synchronous machines).

Course Outcomes: At the end of the course student will be able to

1.	Analyze the DC Circuits using mesh & node methods and describe AC fundamentals.
2.	Analyze voltage & current phasor relationships in single phase & three phase AC circuits and compute complex power.
3.	Summarize the fundamentals of electromagnetism and apply principle of single-phase transformer to compute transformer efficiency.
4.	Describe the construction, operating principle of DC & synchronous machines and analyze their performance characteristics.
5.	Describe the working principle, starting process, performance characteristics & applications of Induction motor and domestic wiring & protective schemes.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
EE1001-1.1	2	3												
EE1001-1.2	2	3												
EE1001-1.3	2	3												
EE1001-1.4	2	3											1	
EE1001-1.5	2	3											1	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Electrical Technology, Hughes, Edward, Pearson Education Publications, 10th Edition, 2010.
2.	Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, 3rd Edition 2009.
3.	Lecture Notes on Basic Electrical Engineering, Department of E&E, NMAMIT, Nitte

REFERENCE BOOKS:

1.	Electrical Engineering Fundamentals, Vincent Del Toro, 2nd Edition, Pearson, 2015
2.	Electrical Technology, H. Cotton, CBS; 7th Edition, 2005.
3.	Basic Electrical Engineering by A. Mittle and V. N. Mittle, Tata McGraw Hill, 2005
4.	Basic Electrical Engineering, Dr. Debashisha Jena, Wiley India Private Limited, 2012

E Books / MOOCs/ NPTEL

1.	http://nptel.ac.in/courses/108105053/
2.	Basic Electrical Technology Lectures by Dr. L Umanand Department of Power Electronics Group, CEDT IISC Bangalore available at http://www.nptelvideos.in/2012/11/basic-electrical-technology.html

Elements of Mechanical Engineering

Course Code:	**ME1003-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

Students belonging to all branches of Engineering are made to learn certain fundamental topics related to mechanical engineering so that they will have a minimum understanding of mechanical systems, equipment and processes.

1.	Understand the principles of energy sources, formation of steam and boilers.
2.	Know the working principles of pumps, compressors, and turbines.
3.	Understand basic principles of I. C. Engines, Refrigeration and Air-conditioning.
4.	Understand the basic principles of power transmission and metal joining processes.
5.	Understand the different machining operations, automation, and robotics.

UNIT-I

09 Hours

Sources of energy: Introduction to Fossil fuels, Classification of different sources of energy. (Conventional & Non-conventional) with examples.

Properties of Steam: Formation of steam, States of Steam and Steam properties, Numerical Problems.

Boilers: Definition and Functions of boilers, Classification of boilers, Details of Cochran boiler, Babcock & Wilcox boiler. Boiler mountings and accessories – Meaning and Functions.

06 Hours

Pumps and compressors: Introduction, Working principles of Centrifugal Pump and Single Stage Reciprocating Compressor.

Turbines: Working principles of Impulse and Reaction steam turbines (De Laval and Parson's turbines), Water turbines (Pelton wheel, Kaplan, and Francis turbines), Gas turbines (Open and Closed cycles).

UNIT-II

09 Hours

Internal Combustion Engines: I. C. Engines parts, Working of 2-Stroke and 4-stroke Petrol and diesel engines. Numerical Problems on Indicated Power, Brake power, mechanical and thermal efficiencies.

Refrigeration and Air conditioning: Properties of refrigerants, Refrigeration – Meaning, Uses and Definitions (COP, Tons of Refrigeration, Refrigerating Effect). Construction and working Principle of Vapor Compression, Vapor Absorption refrigeration system, and Air-conditioners (Window A.C.)

06 Hours

Power Transmission: Belt drives - Applications, Open and Crossed belt drives, Length of belt and Velocity ratio, Ratio of belt tensions - Formulae and Numerical problems (No derivations). Gear drives - Introduction of Spur, Helical, Bevel gears, Worm & Worm wheel, and Rack & Pinion. Simple and compound spur gear trains, Gear ratios, Formulae and Numerical problems (No derivations)

Welding and Soldering: Basic principles of Arc welding, Gas welding, Soldering, and Brazing.

UNIT-III

10 Hours

Machine Tools: Introduction, Types of machine tools and Applications.
Lathe operations - Turning, facing, Taper Turning using swiveling compound rest and Thread cutting.

Drilling operations - Drilling and Tapping
Milling operations - Plane milling (Up and Down milling), End milling.
Grinding operations - Surface grinding, Cylindrical grinding and Centerless grinding.
Mechatronics and Automation: Meaning, Need for automation, Types - Fixed, Programmable & Flexible automation. Elements of automated systems, Open and Closed loop control systems.
Robotics: Introduction, Robot Anatomy, Classification based on Robot Configuration, Applications of Robots.

Course Outcomes: At the end of the course student will be able to

1.	Explain the principles of energy sources, formation of steam and boilers.
2.	Discuss the working principles of pumps, compressors, and turbines.
3.	Explain basic principles of I. C. Engines, Refrigeration and Airconditioning.
4.	Discuss the basic principles of power transmission and metal joining processes.
5.	Explain the different machining operations, automation, and robotics.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
ME1001-1.1	3	1	-	-	-	1	-	1	-	1	-	-	-	-	-
ME1001-1.2	3	1	-	-	-	-	-	-	-	1	-	-	-	-	-
ME1001-1.3	3	2	-	-	-	-	-	-	-	1	-	-	-	-	-
ME1001-1.4	3	2	-	-	-	-	-	-	1	1	-	-	-	-	-
ME1001-1.5	3	2	-	-	-	-	-	1	1	1	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. K. R. Gopalkrishna, **"A text Book of Elements of Mechanical Engineering"** Subhash Publishers, Bangalore. 2010
2. Mikell P. Groover, **"Automation, Production Systems & CIM"**, 3rd Edition, PHI, 2012
3. V. K. Manglik, **"Elements of Mechanical Engineering"**, PHI Publications, 2013.

REFERENCE BOOKS:

1. S. Trymbaka Murthy, **"A Text Book of Elements of Mechanical Engineering"**, 4th Edition 2006, Universities Press (India) Pvt. Ltd, Hyderabad.
2. K.P. Roy, S.K. Hajra Choudhury, Nirjhar Roy, **"Elements of Mechanical Engineering"**, Media Promoters & Publishers Pvt Ltd, Mumbai,7thEdition,2012.
3. Pravin Kumar, **"Basic Mechanical Engineering"**, 2013 Edition, Pearson.

E Books / MOOCs/ NPTEL

1. https://nidm.gov.in/iec.asp (Study material of National Institute of Disaster management)

BIOLOGY FOR ENGINEERS

Course Code:	**BT1001-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**1:0:0:0**	**Credits**	**01**
Total Teaching Hours	**15**	**CIE + SEE Marks**	**50+50**

Teaching Department: Biotechnology Engineering

Course Objectives:

1.	To learn the types of cells, biomolecules and life processes
2.	To know the applications inspired by nature in various streams
3.	To be updated application of biology in real life scenarios.

UNIT-I

INTRODUCTION FOR BIOLOGY FOR ENGINEERS — **05 Hours**

Why Biology for Engineers? Cell Types & Properties: Prokaryotes - Bacteria, Viruses and Fungi, Eukaryotes - Plant and Animal Cells, Biomolecules, Life Processes at Cellular Level.

UNIT-II

APPLICATIONS INSPIRED BY NATURE — **06 Hours**

Composites in Construction, Termite Mound architecture, Counter current heat exchangers, Design of aeroplane, helicopter and submarine, Information Theory and Biology, SONAR, Medical Devices.

UNIT-III

REAL LIFE SCENARIOS — **04 Hours**

Recent scenarios in Environment, Agriculture and Medical Technology.

Course Outcomes: At the end of the course student will be able to

1.	Ascertain the importance of Biology to be applied in various engineering streams
2.	Interpret the basics of cell and life processes
3.	Draw inspiration nature in design of machinery and construction
4.	Analyse the significance of mimicry of nature in design of electrical, electronic and medical devices
5.	Judge knowledge on recent advances in application of biology to Environment, Agriculture and Medical Technology

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
BT1001-1.1	3								1			1			
BT1001-1.2	3								1			1			
BT1001-1.3	3	3					2		1			1			
BT1001-1.4	3	3					2		1			1			
BT1001-1.5	3	3					2		1			1			

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Suraishkumar , G.K. *Biology for Engineers*, Oxford University Press India, 2019.
2. Chakraborty, T, Akthar, N *Biology for Engineers*, PHI learning Print Book ISBN : 9789391818142 eBook ISBN : 9789391818197

REFERENCE BOOKS:

1. Rao C.V., *Biology for Engineers*, 2021
2. Raven, P. H. and Johnson, G. B. *Biology*. 4th Ed. WCB publishers, 2010.
3. Ethier, R. S. and Simmons, C. A. *Introductory biomechanics*- From cells to organisms. Cambridge University Press, 2012

IT SKILLS

Course Code:	**IS1001-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**1:0:2:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**

Teaching Department: Information Science Engineering

Course Objectives:

1.	Demonstrate the basics of Android Programming.
2.	Design and develop web pages that include static and dynamic content.
3.	Describe the basic concepts of Cloud.
4.	Discuss the basic concepts of IOT.
5.	Recognize the best practices of Cyber Safety and security.

UNIT-I

Introduction to Application development — **07 Hours**

Simple android application development (No knowledge of programming language is required).
Note:

1. The purpose of application development is to ignite and promote programming skills.
2. Application development should be done using any App builder platforms such as
3. MITApp Inventor: https://appinventor.mit.edu/
4. Thunkable: https://thunkable.com/
5. ibuildapp: https://ibuildapp.com/
6. The student should be introduced to the android application development environment for further research and learning https://developer.android.com/

Activity: Create a simple Android application (Unique for each student) and publish on the learning management system.

Design and develop web pages — **06 Hours**

Basic web technologies

- Browser
- Web –Server
- Client-Server Model
- URL
- SEO techniques
- Domain names and domain name system.

Creating Web-pages with HTML5 - Static web pages

- Introduction, Editors
- Tags, Attributes, Elements, Headings
- Links, Images, List, Tables, Forms
- Formatting, Layout, Iframes.

Formatting web pages with style sheets (CSS3)

- Introduction to CSS
- Inline CSS, Internal CSS, Classes and IDs
- div, Color, Floating, Positioning
- Margins, Padding, Borders
- Fonts, Aligning Text, Styling Links

Creating a web page dynamic using JavaScript

- Dynamic web page and Introduction to JS
- Basic syntax
- Functions
- Events

Creating dashboards in websites

Activity: Personal website design and launch with a free platform or Create a Blogging website.

UNIT-II

Introduction To Cloud, IoT Concepts and Cyber Security	**04 Hours**

Fundamentals of cloud
Cloud service models

- IaaS(Infrastructure-as-a-Service)
- PaaS (Platform-as-a-Service)
- SaaS (Software-as-a-Service)

Cloud deployment types

- Public
- Private
- Hybrid

Community Cloud services:

- Google Drive - file storage and synchronisation service developed by Google;
- Google docs, sheets and slides - bring your documents to life with smart editing and styling tools to help you easily format text and paragraphs;
- Google Co-lab (Usage of Jupyter Notebook): Colab notebooks allow you to combine executable code and rich text in a single document, along with images, HTML, LaTeX, and more.

Working of IOT and IOT components (Only brief introduction and demonstration through videos)
Explain concept of Internet of Things with examples

- Smart home
- Smart city
- Smart Farming

Activity: Create your cloud service account and demonstrate using cloud services. Identify cloud service providers with respect to service models and deployment types. Identify areas where the Internet of Things could bring positive changes.

Introduction to Cyber security and cyber safety

- Brief awareness on cyber safety measures
- Identification of basic security issues in mobile phones and personal computers
- Installation of Antivirus software
- Firewall concepts
- Browser settings
- Importance of privacy and Password policy (Best practices).

Programs	**08 Hours**

1. Design and create simple game using MIT-scratch/Code.org
2. Design and create simple android application
3. Design and create web page for displaying your article (Title, header, paragraph, formatting tags)
4. Design and create a webpage for your wish list (What you want to do). Also list challenges and opportunities along with images to present your dreams (List ordered and unordered, Image, table)
5. Design and create webpage using HTML and CSS about an awesome animal (Use necessary CSS tags)
6. Design and create web page for a travel book /recipe book with more than 3 pages, table to list places /recipes (iframe, hyperlink)
7. Design and create web page with JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient
8. Design and create a personal webpage with dashboard
9. Design and create web page about advantages of business process automation with respect to your branch of engineering
10. Create user account and demonstrate use of Google drive, Google docs, Google Colab (Usage of Jupyter Notebook)
11. Demonstrate Internet of Things using examples a. Smart home b. Smart city c. Smart farming
12. Installation of Antivirus software
13. Demonstration and hands on browser settings
14. Demonstration and hands on privacy settings and password policy
15. Demonstration of common security threats (using videos) a. Phishing b. DoS attack c. Man in the middle attack d. Spamming e. Virus

Course Outcomes: At the end of the course student will be able to

1.	Understand the basics of Android Programming.
2.	Develop web pages that include static and dynamic content.
3.	Analyze the basic concepts of Cloud.
4.	Comprehend the basic concepts of IOT.
5.	Illustrate the best practices of Cyber Safety and security

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
IS1001-1.1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	
IS1001-1.2	3	1	-	-	-	-	-	-	-	-	-	-	-	3	
IS1001-1.3	3	2	-	-	-	-	-	-	-	-	-	-	-	3	
IS1001-1.4	2	-	-	-	-	-	-	-	-	-	-	-	-	3	
IS1001-1.5	3	-	-	-	-	-	-	-	-	-	-	-	-	3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Digital Fluency, Suman M, Chinmaya Dash, R Sreenivas Rao, Himalaya Publishing House Pvt. Ltd., 2021.
2.	2. Digital Fluency, Melwyn Amrithraj, Prem Sagar, Pradeep, Himalaya Publishing House Pvt. Ltd., 2021.

3.	3. Digital Fluency, R G Saha, Dr. Kantesha S, Niha Asif, Himalaya Publishing House Pvt. Ltd., 2021.
E Books / MOOCs/ NPTEL	
1.	Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India. (ISBN:978 9332575 271)
2.	https://www.sas.com/en_in/insights/analytics/machine-learning.html
3.	https://www.aig.com/IoT
4.	14 Types of Phishing Attacks That IT Administrators Should Watch For (syscloud.com)
5.	Common Phishing Attacks and How to Protect Against Them (tripwire.com)
6.	Important Applications of Cloud Computing (jigsawacademy.com)
7.	Phishing Attack Prevention: How to Identify & Avoid Phishing Scams in 2021 | Digital GuardianIT Security FAQ (udel.edu)

ENVIRONMENTAL STUDIES

Course Code:	**CV1002-1**	**Course Type**	**MNC**
Teaching Hours/Week (L: T: P: S)	**1:0:0:0**	**Credits**	**00**
Total Teaching Hours	**13**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	To raise consciousness about environmental conditions and to imbibe environmentally appropriate behaviour.
2.	To equip the engineering undergraduates to identify the significance of environmental practice in their daily life and in the engineering practices.
3.	To make them conscious of understanding the environment where we live and act up on.

UNIT-I

03 Hours

Environment

Definition, significance of environmental studies- current scenario, local, regional, national and global problems

Components of environment: atmosphere, hydrosphere, lithosphere and biosphere. Layers of atmosphere and its role.

Parts of Earth- lithosphere and its role; hydrological cycle

Eco system

Definition, ecology and environment, ecosystem components: biotic and abiotic components; ecological balance; elements of ecosystem: biotic, abiotic; producers, consumers and decomposers. Habitat, range of life, Biome, balanced eco- system, food chain, food web and ecological pyramids

Human activities

The Anthropogenic System- human activities like growing food, building shelter and other activities for economy and social security. Soil erosion, water logging -definition. Organic farming- definition.

Natural resources — **03 Hours**

Resources - Natural resources, water, minerals, Fossil fuels and energy

Water resources - Global water resources: distribution, uses of water for irrigation, domestic and industrial purposes in India.

Quality aspects - Water quality parameters, drinking water standards for turbidity, pH value, total hardness, iron, fluoride, lead, arsenic, nitrate

Mineral resources- Metallic minerals, non-metallic minerals Fossil fuels - Coal and petroleum

Forest Wealth - Components of the forest, key benefits of forests. Deforestation-environmental effects of deforestation and remedies Sustainable development- definition, objectives

Material cycles Carbon, nitrogen and sulphur cycles.

UNIT-II

Environmental pollution: Definition, harmful effects related to public health — **03 Hours**

Water pollution:

Definition, types and sources – agriculture (pesticides and fertilizers), industry, domestic and mining, harmful effects, water borne and water induced diseases- definition, common diseases and their causatives, Fluoride problem in drinking water

Land pollution:

ources_ agriculture, housing, industry, mining, transportation. Types of municipal Solid waste Disposal (Sanitary landfills, composting, incineration (in brief) and effects

Air Pollution:

Definition, types and sources: industry, mining, agriculture, transportation and effects

Noise pollution:

Definition, sources, mining, industries, rail-roads, aviation, effects and control measures	
Energy	**02 Hours**
Different types of energy- Nonrenewable energy; fossil fuels- coal, oil and natural gas- brief description only. Nuclear energy- nuclear power plants, Renewable energy: solar energy- Photovoltaic systems for street and domestic lighting, solar water heating-brief description only Wind energy- definition, merits and demerits, Hydro power- definition, merits and demerits. Biomass energy- definition, sources of bioenergy, biogas, biofuels, India's position in renewable energy Hydrogen as an alternative future source of energy- brief scope, fuel cells.	
UNIT-III	
Current environmental issues of importance	**02 Hours**
Population growth- Definition, growth rate, effects, remedies Urbanization- Definition, environmental impacts and remedies Global warming and climate change- Concept of greenhouse effect, sources of greenhouse gases, effects and remedial measures of greenhouse gases Acid rain: Definition, causes and effects, control measures. Ozone Depletion: Definition, causes, effects and control measures. Environmental Impact Assessment- EIA definition, objectives and benefits of EIA.	

TEXTBOOKS:	
1.	Benny Joseph (2005), "Environmental Studies", Tata McGraw Hill Publ. Co., New Delhi
2.	Rajagopalan, R. (2005), "Environmental Studies: From Crisis to Cure", Oxford University Press, London
REFERENCE BOOKS:	
1.	Balasubramanya, N and Chatwal, Gurdeep R. (2007), "Environmental Studies", Himalaya Publishing House, Mumbai
2.	Barucha, E. (2004), "Environmental Studies", University Grants Commission, New Delhi
3.	Bhatia, S. C. (2005), "Environmental Chemistry", CBS Publishers, New Delhi
4.	De, A.K. and De, A. K. (2006), "Environmental Studies"
	Keller, Edward A., (1985), "Environmental Geology", CBS Publishers and Distributors, Delhi.

B. Tech. (CV): Scheme of Teaching and Examinations 2022-26

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2022 - 23)

GROUP – 2

II SEMESTER														
Sl. No.	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week				Examination					
					Theory Lecture	Tutorial	Practical/ Drawing	PBL	Duration in hr	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P						
10.	BSC	MA1003-1	Differential Equations and Laplace Transforms	MA	3	0	0	0	3	50	50	100	3
11.	BSC	PH1001-1	Engineering Physics	PH	3	0	2	0	3	50	50	100	4
12.	ESC	CV1001-1	Elements of Civil Engineering	CV	3	0	0	0	3	50	50	100	3
13.	ESC	EC1001-1	Basic Electronics	EC	3	0	0	0	3	50	50	100	3
14.	ESC	EC1002-1	Applied Digital Logic Design	EC	2	0	2	0	3	50	50	100	3
15.	HSMC	HU1001-1	Technical English	HU	1	0	2	0	3	50	50	100	2
16.	HSMC	HU1002-1	Constitution of India	HU	1	0	0	0	1	50	50	100	1
17.	MNC	ME1003-1	Engineering Visualization	ME	1	0	0	0	0	50	0	50	0
18.	MNC	UM1002-1	Skill Development Lab-II	Any	0	0	2	0	0	50	0	50	0
				TOTAL	17	0	8	0	19	450	350	800	19

Mandatory Internship-I*								
1.	INT	UC1001-1	Internship – I	Mandatory Intra Institutional Internship of duration (80 - 90 Hours) to be completed during I & II Semesters. *The grades will be included in the IV semester grade card (Refer 11.5.2 for details)	100	--	100	2

Differential Equations and Laplace Transforms
(common to BT\CV\EC\EE\ME\RI)

Course Code:	**MA1003-1**	**Course Type**	**BSC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mathematics

Course Objectives:

1.	This course will enable the students to master the basic tools of Laplace transforms, differential equations, partial differential equations and become skilled for solving problems in science and engineering.

UNIT-I

15 Hours

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS

Exact, linear and Bernoulli's differential equations, orthogonal trajectories of cartesian and polar curves. Applications to simple engineering problems. Non linear differential equations (first order and higher degree) equations solvable for p, equations solvable for y and equations solvable for x, general and singular solutions of Clairaut's equations.

ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER

Second and higher order linear differential equation with constant coefficients, solution by inverse differential operator, method of variation of parameters, linear differential equation with variable coefficients- Cauchy's linear differential equation. Applications to engineering problems.

UNIT-II

LAPLACE TRANSFORMS — **15 Hours**

Definitions, transforms of elementary functions, transforms of derivatives and integrals- properties. Periodic functions, unit step functions and unit impulse functions.

Inverse Transforms and properties, convolution theorem, initial & final value theorems. Applications to engineering problems.

UNIT-III

PARTIAL DIFFERENTIAL EQUATIONS — **10 Hours**

First and higher order partial differential equations. Formation of partial differential equations by elimination of arbitrary constants/arbitrary functions. Derivation of one dimensional heat and wave equations, Solution of PDE's by direct integration method, by the method of separation of variables, by Lagrange's Method. Solution of partial differential equations of derivatives involving only one independent variable.

Course Outcomes: At the end of the course student will be able to

1.	Solve first order ordinary differential equations.
2.	Solve linear ordinary differential equations of higher order.
3.	Understand the concept of Laplace Transform and apply it to solve engineering problems.
4.	Make use of Laplace transform method to solve linear ordinary differential equations with constant coefficients
5.	Understand the derivation of one dimensional heat and wave equations and solve partial differential equations.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3

MA1003-1.1	3	2													
MA1003-1.2	3	2													
MA1003-1.3	2	2													
MA1003-1.4	2	2													
MA1003-1.5	3	2													

1: Low 2: Medium 3: High

TEXTBOOKS:

1. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publications, 43rd Edition, 2015.

2. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley and Sons, 10th Edition (Reprint), 2016.

REFERENCE BOOKS:

1. T. Veerarajan, “Engineering Mathematics”, McGraw-Hill, New Delhi, 2008.

2. B. V. Ramana, “Higher Engineering Mathematics”, Tata Mc Graw –Hill, New Delhi,2010.

3. N.P. Bali and M.Goyal, “A text book of Engineering Mathematics”, Laxmi Publications, 2010.

4. W.E. Boyce and R.C. DiPrima, “Elementary Differential Equations and Boundary Value Problems”, Wiley India, 2009.

5. E.A. Coddington, “An Introduction to Ordinary Differential Equations”, Prentice Hall India, 1995.

6. G.F. Simmons and S.G. Krantz, “Differential Equations”, McGraw Hill, 2007.

E Books / MOOCs/ NPTEL

1. ***http://nptel.ac.in/courses/111106100***

2. ***http://nptel.ac.in/courses/111106139***

3. ***http://nptel.ac.in/courses/111107111***

ENGINEERING PHYSICS

Course Code:	**PH1001-1**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Physics

Course Objectives:

1.	To introduce the concepts of wave mechanics to study the properties of sub-atomic particles.
2.	To study the concepts of crystalline solids and X-rays.
3.	To explain the concepts of semiconductors, semiconductor devices and superconductors.
4.	To explain the principle, working and applications of lasers & optical fibers.

UNIT-I

Wave mechanics, Crystallography & X-rays — **15 Hours**

Wave mechanics: Introduction to wave mechanics. Matter waves – de Broglie's relation, characteristics of matter waves. Wave function, properties and physical significance of a wave function, probability density and normalisation of wave function, Schrödinger wave equation (time dependent & independent). Application of Schrödinger wave equation –particle in a potential well of infinite depth, Eigen functions, probability densities and energy Eigen values for a particle in an infinite potential well. Numerical examples.

Crystallography: Introduction to crystallography - space lattice, unit cell, primitive cell, lattice parameters. Crystal systems and Bravais lattice. Direction and planes in a crystal, Miller indices – method of finding the Miller indices. Interplanar spacing – derivation. Co-ordination number, number of atoms per unit cell and atomic packing factor - simple cubic, body centered cubic and face centered cubic lattices.

X rays: X-rays – generation and properties. Continuous and characteristic X-rays. Bragg's law and Bragg's spectrometer, Applications. Numerical examples

UNIT-II

Semiconductors and Superconductors — **15 Hours**

Semiconductors: Band structure - classification of solids. Semiconductors - intrinsic and extrinsic semiconductors, carrier generation. Direct and indirect band gap semiconductors. Fermi - Dirac Statistics, Fermi factor, Fermi energy level in intrinsic and extrinsic semiconductors and effect of temperature on Fermi level, intrinsic effect - maximum device temperature. Conductivity of intrinsic and extrinsic semiconductors - derivation. Effect of temperature on conductivity of intrinsic and extrinsic semiconductor. Hall effect - derivation of Hall coefficient, carrier concentration and mobility. Applications of Hall effect. Numerical examples.

Semiconductor devices: light emitting diode, photodiode, and solar cell.

Superconductors: Introduction to superconductors, characteristic properties. Type-I and Type-II superconductors. BCS theory (qualitative). Applications of superconductors. Numerical examples.

UNIT-III

Lasers and optical fibers — **10 Hours**

Lasers: Introduction to lasers. Absorption and emission of radiation, Einstein's coefficients. Condition for laser action, population inversion and metastable states. Requisites of a laser system – active medium, pumping mechanism and optical resonant cavity. Three level and four level lasers. Principle, construction and working of Nd:YAG laser, He-Ne laser and semiconductor laser. Applications.

Optical fibers: Introduction to optical fibers. Propagation mechanism in optical fibers - angle of acceptance, acceptance cone and numerical aperture – derivation. Fractional index change and V-number. Types of optical fibers and modes of propagation. Attenuation. Applications. Numerical examples.

Suggested List of Experiments

1.	Energy band gap of a semiconductor by four-probe technique.
2.	Hall effect – Determination of the carrier concentration in a semiconductor.
3.	Transistor characteristics – Common emitter mode.
4.	Semiconductor laser - Determination of wavelength by diffraction.
5.	Zener diode characteristics – study of current-voltage characteristics
6.	Solar cell – study of its characteristics.
7.	Photo electric effect – Determination of the work function of the material of the emitter of a photocell.
8.	Charging and discharging of a capacitor – Determination of capacitance value, half time and time constant.
9.	Velocity of ultrasonic waves using ultrasonic interferometer
10.	Series and parallel resonance circuits.
11.	LED characteristics.

Note: Any ten experiments are to be performed

Course Outcomes: At the end of the course student will be able to

1.	Comprehend various properties of sub-atomic particles on the basis of wave mechanics.
2.	Understand the concepts of crystalline solids, and X-rays.
3.	Understand the concepts of semiconductors and working of semiconductor devices.
4.	Understand the characteristics of superconductors and its applications.
5.	Understand the principle, working and applications of lasers & optical fibers.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
PH1002-1.1	3	3													
PH1002-1.2	3	3													
PH1002-1.3	3	3													
PH1002-1.4	3	3													
PH1002-1.5	3	3													

1: Low 2: Medium 3: High

TEXTBOOKS:

1. **G. K. Shivakumar**, Engineering Physics, Prism Engineering Education Series, Prism books Pvt Ltd., Bangalore, 2010-11 edition (Reprint 2013-14).
2. **S. P. Basavaraju**, Engineering Physics, Subhas Stores, Bangalore, latest editions.
3. **Arthur Beiser et.al.** Concepts of Modern Physics, Tata McGraaw Hill Education Private Limited, Special Indian Edition, 2009.

REFERENCE BOOKS:

1. **V. Rajendran**, Engineering Physics, Tata McGraw Hill Pub., 2011.
2. **M. R. Srinivasan**, Physics for Engineers, New Age International Publishers, Bangalore, 2nd Edition, 2009.
3. **Kenneth Krane,** Modern Physics, Wiley International, 3rd Edition, 2012.
4. **S. O. Pillai**, Solid State Physics, New Age International, 7thEdition, 2015
5. **A.Ghatak**, Optics, Tata McGraw Hill Pub.,5th edition, 2012
6. **A. J. Dekker**, Electrical Engineering Materials, Prentice Hall India Pub.,New Delhi, Reprint 2011.

7.	**B. G. Streetmann,** Solid State Electronic devices, 6th edition, Prentice Hall India Learning Private Limited.
8.	***.Sathyaseelan*****:** Laboratory Manual in Applied Physics, New Age International, *3rd Edition, 2009.*
9.	2. ***B. Basavaraju and P. Sadashiva*****:** A Laboratory Manual in Engineering Physics, Omkar Publications.
E Books / MOOCs/ NPTEL	
1.	http://nptel.ac.in/courses/122101002/23
2.	http://nptel.ac.in/courses/113106039/1
3.	http://nptel.ac.in/courses/115106061/

Elements of Civil Engineering

Course Code:	**CV1001-1**	**Course Type**	**ESC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	**Understand** the importance of Civil Engineering and **develop** the analytical skills to solve coplanar concurrent force system
2.	**Solve** non – concurrent force system and **analyze** cylinders and strings using equilibrium conditions.
3.	**Identify** different types of supports, loadings and **analyze** determinate beams
4.	**Understand** static friction and **analyze** block friction and ladder friction
5.	**Understand** centroid and moment of inertia of typical sections

UNIT-I

06 Hours

Scope and importance of different fields of Civil Engineering-Surveying, Building Materials, Construction Technology, Geotechnical Engineering, Structural Engineering, Hydraulics, Water Resources and Irrigation Engineering, Transportation Engineering, Environmental Engineering, RS & GIS.

Introduction to Engineering Mechanics: Basic idealizations -; Definition of force, Characteristics of a force, Force systems and classification; Principle of transmissibility. Resolution of forces, Composition of forces - Definition of Resultant; Resultant of coplanar concurrent force system.

09 Hours

Moment of a force, couple, characteristics of couple, Equivalent force - couple system; Varignon's theorem, Resultant of coplanar - non-concurrent force system.

Equilibrium of forces - *Definition of Equilibrant; Conditions of static equilibrium for different force systems. Particle equilibrium in 2-D & 3-D, Concept of free body diagram, Equilibrium of coplanar concurrent force system.

UNIT-II

08 Hours

Support Reactions –Types of beams, types of loads and supports, statically determinate beams, numerical problems on support reactions for statically determinate beams with point load (normal and inclined), uniformly distributed load, uniformly varying loads and moments

07 Hours

Friction – Theory of friction, types of friction, Coulumb’s laws of friction, limiting friction, angle of friction, block friction and ladder friction

UNIT-III

CENTROID **05 Hours**

Centroid of plane figures, locating the centroid of rectangular, triangular and sector of a circular areas using method of integration, Centroid of simple composite area (consisting of three components).

Moment of Inertia **05 Hours**

Moment of inertia of an area, polar moment of inertia, Radius of gyration, Perpendicular axis theorem and Parallel axis theorem; Moment of Inertia of rectangular, triangular, semi-circular, quarter of a circular area and sector of a circular areas from the method of integration; Moment of inertia of composite areas (consisting of three components).

Course Outcomes: At the end of the course student will be able to

1.	**List** and **explain** the scope of Civil Engineering and **solve** resultant of coplanar concurrent force system.
2.	**Determine** the resultant of coplanar non-concurrent force system by **applying** Varignon's Theorem and **solve** for unknown forces in the cylinders and strings using equilibrium conditions.
3.	**Explain** the types of beams, supports, loadings and **find** the support reactions for determinate beams.
4.	**Find** the static frictional force in blocks and ladder
5.	**Determine** the centroid and moment of inertia of composite area about the reference axes.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV1001-1.1	**3**	**2**											**1**	**1**	
CV1001-1.2	**3**	**2**											**1**	**1**	
CV1001-1.3	**3**	**2**											**1**	**1**	
CV1001-1.4	**3**	**2**											**1**	**1**	
CV1001-1.5	**3**	**2**											**1**	**1**	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Ferdinand L. Singer "*Engineering Mechanics*" Harper and Row Publishers, New York, 3rd edition,2015.
2.	Bhavikatti, S.S, *"Engineering Mechanics*", Vikas Publishing House Pvt. Ltd., New Delhi. 17th edition,2018

REFERENCE BOOKS:

1.	Ferdinand P. Beer and E. Russel Johnson, "*Mechanics for Engineers: Statics and dynamics*" McGraw-Hill Book Company, New York.4th edition, 1987.
2.	Timoshenko,Young,J.V Rao and S.Patil inS.I Units "*Engineering Mechanics"* McGraw-Hill Book Company, New Delhi.5th edition,2013
3.	Merium J.L, Kraige L.G, *Engineering Mechanics* Vol.I & II Wiley Publishers.1993
4.	McLEAN and Nelson,"*Engineering Mechanics"* (Schaum's outline Series), McGraw-Hill Book Company, New Delhi, 5th edition, 1997

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/112/106/112106286/
2.	http://nptel.vtu.ac.in/econtent/courses/BS/CIV1323/index.php
3.	https://lecturenotes.in/notes/15363-note-for-element-of-civil-engineering-and-mechanics-ecem-by-vtu-rangers

Basic Electronics

Course Code:	**EC1001-1**	**Course Type**	**ESC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	Understand the working of Semiconductor Diodes, Zener Diodes and its applications
2.	Understand the working of Transistors and Oscillators
3.	Understand the construction, characteristics and working of FETs and SCR
4.	Understand the working of OPAMPs and their applications
5.	Understand basics of Communication systems and Embedded systems

UNIT-I

Semiconductor Diodes and Applications	**15 Hours**

p-n junction diode, Equivalent circuit of a diode, DC load line analysis, Zener diode, Zener diode as a voltage regulator, Rectification- Half wave rectifier, Full wave rectifier, Bridge rectifier, capacitor and choke filter circuit (only qualitative approach) Photodiode, LED, Photo coupler, 78XX based Fixed IC voltage regulator.

BJT and Applications: BJT construction, Common Base and Common Emitter characteristics (overview), BJT as an amplifier, DC load line analysis for CE amplifier, RC coupled amplifier (frequency response excluded),BJT as a switch, Transistor switch circuit to switch ON/OFF an LED.

Feedback amplifiers – Principle and advantages of negative feedback, Voltage series feedback amplifier. Concept of positive feedback, Oscillator and its applications – RC phase shift oscillator, Hartley and Colpitt's Oscillator.

UNIT-II

	15 Hours

FET and other components: Field Effect Transistor (FET)–n-channel JFET – Construction, Operation and drain characteristics, n-channel Enhancement type Metal oxide Semiconductor (E-MOSFET), Complementary Metal oxide Semiconductor (CMOS). Silicon Controlled Rectifier (SCR) – Two transistor model, Switching action, characteristics.

Operational Amplifiers and Applications: Introduction to Op-Amps, Ideal Op-Amp Characteristics, Op-Amp parameters – Differential gain, common mode gain, CMRR, Slew Rate, Input offset voltage, Bias Current, Virtual gain concept, saturable property of Op- Amp, Pin Configuration of 741 Op-Amp. Applications - Inverting/Non-inverting amplifier, Inverting/Non-inverting summer, Voltage follower, Integrator, Differentiator, Comparator. Oscillator using IC 555(Astable operation only).

UNIT-III

Fundamentals of Communication System and Embedded Systems:	**10 Hours**

communication system scheme (Block scheme), information source, input transducers, transmitter, channels, receivers, noise, modulation, need for modulation, Fundamentals of Cellular / Communication

Embedded System Definition, Embedded System V/S General Computing Systems, Classification of Embedded Systems, Elements of Embedded Systems, Core of Embedded Systems, Microprocessor v/s Microcontroller, RISC v/s CISC, Hardware v/s Von Neumann Architecture, Sensors and Actuators with examples.

Course Outcomes: At the end of the course student will be able to

1.	Describe the characteristics of p-n junction/ Zener diode, Explain the operation of half/full wave rectifier without and with capacitor/choke filter, 78XX based Fixed IC voltage regulator, photodiode/ LED/ photocoupler Design Zener diode based voltage regulator.
2.	Describe the construction, input/output characteristics of BJT in CB/CE configurations, operation of BJT CE-RC coupled amplifier, BJT switch, the principle of feedback amplifiers, Barkhausen's criterion for sustained oscillations, operation of RC-phase shift/Hartley/Colpitts oscillator, Explain the impact of negative feedback on gain.
3.	Describe the drain characteristics of n-channel FET/ n-channel E-MOSFET/SCR, Explain CMOS inverter.
4.	List ideal Op-Amp parameters, Design Op-Amp circuits Inverting/Non inverting amplifier, Inverting/Non inverting summer/Differentiator/Integrator, Describe Op-Amp comparator /Voltage follower/IC 555 timer based oscillator.
5.	Explain the block diagram of communication system, transmitter, receiver and different modulation techniques. Define embedded systems, explain elements and classification of embedded systems, explain difference between various architectures.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
EC1002-1.1													3		
EC1002-1.2													3		
EC1002-1.3													3		
EC1002-1.4													3		
EC1002-1.5													3		

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Robert L Boylestad Louis Nashelsky, "Electronic Devices and circuit theory", 11th Edition, PHI, 2016.
2.	George Kennedy, Bernard Davis, "Electronic Communication Systems", Mc. Graw Hill, 4th Edition, 1999.
3.	Shibu K V, "Introduction to Embedded Systems", TATA Mc Graw Hill Edu., 2nd Edition,2016.

Engineering Skill Development Practices

Course Code:	**ME1001-1**	**Course Type**	**ESC**
Teaching Hours/Week (L: T: P: S)	**0:0:2:0**	**Credits**	**01**
Total Teaching Hours	**26**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

Students belonging to all branches of Engineering are made to learn certain fundamental topics related to mechanical engineering so that they will have a minimum understanding of mechanical systems, equipment and process.

1.	Prepare fitting models by using required tools and fitting operations according to the given dimensions using different hand tools.
2.	Prepare sheet metal models using the required tools and soldering process. Prepare carpentry joints using important carpentry tools.
3.	Calculate velocity ratio in a V belt drive. Assemble and disassemble simple machine parts such as machine vice and linear actuator.

UNIT-I

Fitting Shop — **09 Hours**

Study and use of engineering steel rule, height gauge, caliper, micrometer, files, chisels, hacksaw, hammers, drill bit, taps etc.

Models: Preparation of fitting models by making use of filing, sawing and chipping.

UNIT-II

Carpentry, Sheet metal Work and Soldering — **09 Hours**

Study the use of carpentry sheet metal work and soldering tools. Study the development of surfaces of simple solids like prism, cylinder and cone.

Models: Preparation of a carpentry and two sheet metal models (square/ rectangular prism and cylinder.

UNIT-III

Active learning — **08 Hours**

1. Calculation of speed/ velocity ration of a V belt of a drilling machine
2. Assembly/ Disassembly of a machine part such as machine vice and tailstock of a lathe.
3. Fabrication/ Assembly of Automatic Linear actuator (Fabrication of holes using Power tools such as magnetic drill/ power tool kit)

Course Outcomes: At the end of the course student will be able to

1.	Prepare fitting models by using required tools and fitting operations according to the given dimensions.
2.	Draw the development and prepare sheet metal models of prisms, cylinder and frustum of a cone using the required tools and soldering process. Prepare carpentry joints using carpentry tools. Calculate the percentage error between the theoretical and actual velocity ratios in a V belt drive. Assemble and disassemble simple machine parts such as machine vice and linear actuator performing necessary machining operations.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
ME1001-1.1	3	1	-	-	-	-	-	2	3	2	-	-	-	-	-
ME1001-1.2	3	1	-	-	-	-	-	2	3	2	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	K. R. Gopalkrishna, **“A text Book of Elements of Mechanical Engineering”** Subhash Publishers, Bangalore. 2010
2.	2. Mikell P. Groover, **“Automation, Production Systems & CIM”**, 3rd Edition, PHI, 2012
3.	V.K. Manglik, “Elements of Mechanical Engineering”, PHI Publications,
REFERENCE BOOKS:	
1.	S. Trymbaka Murthy, “A Text Book of Elements of Mechanical Engineering”, 4th Edition 2006, Universities Press (India) Pvt. Ltd, Hyder abad.
2.	K.P. Roy, S.K. Hajra Choudhury, Nirjhar Roy, “Elements of Mechanical Engineering”, Media Promoters & Publishers Pvt Ltd, Mumbai,7 th Edition,2012.
3.	Pravin Kumar, “Basic Mechanical Engineering”, 2013 Edition,
E Books / MOOCs/ NPTEL	
1.	https://nidm.gov.in/iec.asp (Study material of National Institute of Disaster

Computer Aided Engineering Graphics

Course Code:	**ME1002-1**	**Course Type**	**ESC**
Teaching Hours/Week (L: T: P: S)	**1:0:2:0**	**Credits**	**02**
Total Teaching Hours	**60**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	To impart and inculcate understanding of the theory of projection and concepts like dimensioning, conventions and projection of points and lines in different quadrants of projection system.
2.	To know and understand the projection of different plane surfaces.
3.	To impart the knowledge on understanding and drawing of different solid objects in different positions.
4.	To develop the lateral surfaces of solid objects and its use in sheet metal development

UNIT-I

Orthographic Projection	**10 Hours**

Orthographic Projection: Planes of Projection, First angle projection, reference line. Conventions employed for drawing, Projection of points located in first, second, third and fourth quadrants, Projection of Lines (First angle projection only), True and apparent lengths, true and apparent inclinations.

UNIT-II

Projection of Plane surfaces	**12 Hours**

Projection of plane surface: Triangle, Square, Rectangle, Pentagon, Hexagon and Circle in different positions.

UNIT-III

Projection of Solids	**16 Hours**

Projection of right regular solids: Prisms, Pyramids, Cones and Cylinders in different positions.

UNIT-IV

Development of Lateral surfaces of solids	**12 Hours**

Development of lateral surfaces of: Right regular Prisms, Pyramids, Cylinders and cones and their frustums.

Isometric projection and Isometric view	**10 Hours**

Isometric scale, Difference between Isometric projection and isometric view: To draw Isometric views of simple solids and machine components using their orthographic projections.

Course Outcomes: At the end of the course student will be able to

1.	Identify a coordinate system in which a point element exists. Draw the orthographic projections of a point and a line.
2.	Draw the orthographic projections of a plane surface (Triangular, square, rectangular, pentagonal, hexagonal and circular) for a given position using conventional drafting method and Solid Edge software.
3.	Draw the orthographic projections of a solid object (Pyramid, Prism, Cubic, Conical, cylindrical) for a given position using conventional drafting method and Solid Edge software.
4.	Draw the development of lateral surfaces of standard solid objects. Draw isometric projection of solid objects individually or in combination using conventional drafting and Solid Edge software.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3

ME1002-1.1	3	1	0	0	0	0	0	0	1	1	0	2	2	1	2
ME1002-1.2	3	1	0	0	3	0	0	0	1	1	0	2	2	1	2
ME1002-1.3	3	1	0	0	3	0	0	0	1	1	0	2	2	1	2
ME1002-1.4	3	1	0	0	3	0	0	0	1	1	0	2	2	1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Engineering Drawing by N. D. Bhat & V. M. Panchal, Pramod R. Ingle, 53 Ed. 2014, Charotar Publishing House, Gujarat.
2.	Engineering Drawing by K R Gopalakrishna, Subhas publishers, Bangalore , 32nd edition, 2012.

REFERENCE BOOKS:

1.	A Text book of Engineering Graphics And Drafting by P. S. GILL, 11th Ed.2009, S. K. Kataria & sons, ISBN- 8185749612, 9788185749617, New Delhi.
2.	A Text book of Engineering Drawing by K. L. Narayanan & Kannaiah P, Radiant Publishing House, 9th Edition, 2012.
3.	A Primer on computer aided Engineering Drawing, Published by VTU, Belgaum, 8thedition, 2011.
4.	Engineering Drawing and Computer Graphics, Shah, Pearson, 2010.
5.	Textbook on Engineering Drawing, Narayana, Scitech Publishers, 1 December 2011
6.	Engineering Graphics, Agarwal & Agarwal, TMH, Second edition, 2013
7.	Publications of Bureau of Indian Standards a) IS 10711 – 2001: Technical products documentation – Size and lay out of drawing sheets. b) IS 9609 (Parts 0 & 1) – 2001: Technical products documentation – Lettering. c) IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings. d) IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings. e) IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

SCHEME OF EXAMINATION

1. Question paper consists of 4 units with two questions in each unit.
2. Students are expected to answer four full questions choosing at least ONE question from each unit.

Technical English

Course Code:	**HU1001-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L: T: P: S)	**1:0:2:0**	**Credits**	**01**
Total Teaching Hours	**39**	**CIE + SEE Marks**	**50+50**

Teaching Department: Humanities

Course Objectives:

1.	Identify the nuances of Phonetics, Intonation and enhance pronunciation skills
2.	Understand Technical Communication along with the barriers and application of effective Interpersonal Communication Skills
3.	Enhance basic English grammar and essentials of language skills
4.	Improve sentence structure with the help of cohesive devices
5.	Develop spoken and writing skills

UNIT-I

16 Hours

Phonetics & Pronunciation

Introduction to Phonetics; Word Stress, Rhythm and Intonation; Weak Forms and Strong Forms, Role of IPA in past tense and plural forms of words, Awareness of Different Accents

Communication Skills

Introduction to Communication, Greeting and Introducing, Making Requests, asking for and Giving Permission, Offering Help

Understanding Telephone Communication, Handling Calls, Asking for and Giving Information, Telephone Etiquette

UNIT-II

Language Skills — **15 Hours**

Basic English Grammar, Ability to identify, Analyse, Interpret and Describe the critical ideas, values, and themes through literary works

UNIT-III

Writing Skills — **08 Hours**

Paragraph writing, Refutations, Linkers, Types of Letters

Course Outcomes: At the end of the course student will be able to

1.	Identify the nuances of phonetics, intonation and pronunciation to appreciate and incorporate Received Pronunciation
2.	Interpret and assess nuances of oral communication skills and the non-verbal communication for professional usage
3.	Identify, interpret and describe the critical ideas, values, and themes to appreciate literary pieces for its language and social interpretations
4.	Implement English vocabulary at command and language proficiency in personal and professional life
5.	Develop effective writing skills for incorporating them in different forms of writing

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
HU1001-1.1	1	1						2		2		3			
HU1001-1.2	2					2				3		3			
HU1001-1.3		2					3	2		3		3			

HU1001-1.4		2				2			2	2		2			
HU1001-1.5		2				2		2	1	2		2			

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Subhashini, A Textbook of English Language & Communication Skills, R Victor et al.

REFERENCE BOOKS:

1.	English Pronunciation Dictionary, Daniel Jones A Remedial English Grammar for Foreign Students, Woods
2.	Communication Skills, Sanjay Kumar, Oxford University Press.
3.	Exercises in Spoken English Part I - CIEFL, Hyderabad, Oxford University Press.
4.	Exercises in Spoken English Part II - CIEFL, Hyderabad, Oxford University Press.
5.	Exercises in Spoken English Part III - CIEFL, Hyderabad, Oxford University Press.
6.	On Writing Well, William Zinsser
7.	Practical English Usage, Swan, Oxford University Press.
8.	Study Writing, Liz-Hamp Lyons, Cambridge University Press.

Constitution of India

Course Code:	**HU1002-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L: T: P: S)	**1:0:0:0**	**Credits**	**01**
Total Teaching Hours	**13**	**CIE + SEE Marks**	**50+50**

Teaching Department: Humanities

Course Objectives:

1.	Inculcate Social and Political consciousness of the Indian Polity.
2.	Understand their Obligations, Responsibilities, Privileges and Rights, Duties and the Role that they have to play in deciding the Administrative Machinery of the country.
3.	Develop National and Patriotic Spirit.
4.	Understand the nature and character of relations between union and state governments.
5.	Divulge the students about the statutory institutions and policies.

UNIT-I

Evolution of the Indian Constitution — **06 Hours**

1909 Act, 1919 Act, 1935 Govt of India Act, Constituent Assembly: Composition and Functions, Basic structure of Indian Constitution, Fundamental features of the Indian Constitution, Salient Features of Indian Constitution

UNIT-II

Structure of Government — **05 Hours**

Union Government: Legislature; Executive-President, Prime Minister, Council of Ministers; Judiciary, Judicial Review and activism
State Government: Executive: Governor, Chief Minister, Council of Ministers
Local Government: Panchayat Raj Institutions, Urban Governance

UNIT-III

Statutory Institutions — **02 Hours**

Elections - Election Commission of India, National Human Rights Commission, National Commission for Women.

Course Outcomes: At the end of the course student will be able to

1.	Analyze the legalities and related issues of drafting, adoption and enforcement of the Indian Constitution as a fundamental law of the nation and the provisions and privileges of Indian Citizenship
2.	Understand and judiciously use the fundamental rights, fundamental duties and privileges envisaged in the constitution propagating social harmony and equality and respecting the rights and liberties of other people.
3.	Contribute in protecting and preserving the sovereignty and integrity of India and have a compassion to all living creatures, uphold sense of brotherhood ness among all citizens of the nation and promote peace and harmony
4.	Respect the Constitutional Institutions and all noble ideals cherished during Indian struggle for freedom
5.	Develop a Spirit of belongingness to the country.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
HU1002-1.1								3			1	1			
HU1002-1.2								2			1	1			
HU1002-1.3			2				1	2			1	1			

HU1002-1.4								1							
HU1002-1.5			1					3			1	1			

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Introduction to the Constitution of India; Dr. Durga Das Basu; Twentieth Edition, Reprint 2011; LexisNexis Butterworths Wadhwa, Nagpur, Haryana, India.
2.	Introduction to Constitution of India; M.V. Pylee; Fourth Revised Edition, 2005; Vikas Publishing House Pvt. Ltd., New Delhi.
3.	Introduction to Constitution of India; Brij Kishore Sharma; Second Edition, 2004; Prentice Hall of India Pvt. Ltd., New Delhi.
4.	An Introduction to Constitution of India and Professional Ethics; Prof. B R Venkatesh and Merunandan K B; Merugu Publications, Bangalore; Second Edition, 2007.

E Books / MOOCs/ NPTEL

1.	http://nptel.ac.in/courses/109104032/
2.	https://pothi.com/pothi/book/ebook-ministry-law-and-justice-constitution-india
3.	*iasplanner.blogspot.com/2010/11/free-ebook-download-constitution-of.html*
4.	www.iasabhiyan.com
5.	Samvidhaan, Documentary by Prasaar Bharathi

HOLISTIC COMPONENTS

HUMANITIES

Holistic education is not only about teaching the basic subjects, but it is more about redefining the way a student should be taught. The purpose of holistic language teaching is the development of the learners' ability to handle both their language oral skills as well as maximizing their life skills. The department contributes to educational life and work spaces that are creative and meaningful. Multidisciplinary and holistic learning is an ancient method used in Indian education system as well as the other parts of the world. This is the reason that such type of education system was advocated by scholars like Kautilya, Banabhatta, Plato, and Aristotle among many others. Holistic approach is essentially a student centered strategy rather than a teacher centered one.

Holistic education through courses allied to Humanities is created within the inclusive connections of social and human experience. A curriculum built around such stages is considered holistic if they involve the practices that integrates language acquisition and fills multiple cognitive demands in interlocking activities that spiral learning. Through the applied learning style of a person--mind, body and spirit student will learn more effectively the nuances of language, responsibilities towards social fabrics and ethics.

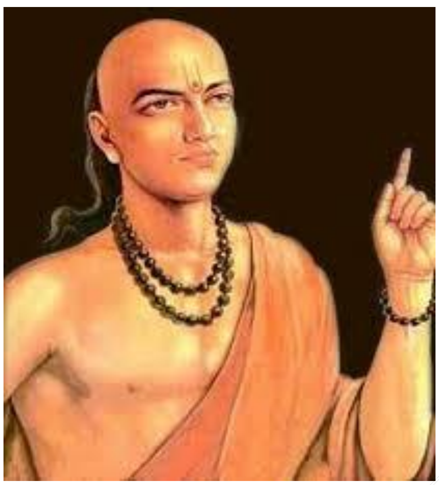
The approach strives to make a learner construct his own understanding of the text he/she interacts with and converses with others according his understanding. Intensive experiential and group sessions, a co-created learning ambience and hands-on engagement through real-life cases, field trips and internships to make learning exciting, rigorous and transformative. As a part of the holistic approach and its philosophy, a student is educated beyond core academics providing him/her virtuous and holistic education. This helps the students to discover their individuality and comprehend the significance of life purposefully, creatively, and morally in a complex world. Krishnamurti writes If the unity of life and the oneness of its purpose could be clearly taught to the young, how much brighter would be our hopes for the future! (Krishnamurti, J. 1974).

INDIAN MATHEMATICIANS

It is essential to know about the ancient, medieval and modern time Indian mathematicians and their contribution to Science and Mathematics. Ancient Indian mathematicians have contributed immensely to the field of mathematics. The invention of zero is attributed to Indians and this contribution outweighs all other made by any other nation since it is the basis of the decimal number system, without which no advancement in mathematics would have been possible. The number system used today was invented by Indians and it is still called Indo-Arabic numerals because Indians invented them and the Arab merchants took them to the western world.

Here we are introducing some of the important Indian mathematicians from ancient times.

Aryabhata: (500 A. D.) - Studied at the University of Nalanda, which was considered as a great centre of learning. Aryabhata was a great Indian mathematician. He gave the value of "π" as 3.1416, claiming for the 1st time, that it was approximation. Aryabhata also dealt with other aspects of mathematics and Astronomical calculations, namely Geometry, Mensuration, Square root, Cube root, Progression and Celestial sphere. He presented a method to solve an intermediate equation of certain type that are important in astronomy and computer science.



Bhaskara: (1100 A. D.) - was a great Mathematician and Astrologer. He was the first Mathematician to declare confidently that any term divided by ZERO is infinity and the sum of any term and infinity is infinity. His concept of "Tatkalikagati", which means instantaneous motion, used by astronomers to determine the motion of the planet accurately brought credit to him. He explained the solutions of quadratic and cubic equations. He stated the Rolle's theorems in analysis, the mean value theorem.

Srinivas Ramanujan was an Indian Mathematician who made significant contributions to mathematical analysis, Number theory and continued fractions. He made many important contributions in the field of mathematics with his wonderful and unique knowledge. That's why his birthday is celebrated as Mathematics Day.

PHYSICS

The ancient world had considered Physical Sciences, Chemical Sciences, Earth Sciences, Biological Sciences, Mathematical Sciences etc. as study of nature, which were all studied under the banner of Philosophy. Even today, the philosophers are studying Metaphysics which connects physical attributes to mind. Physics is a branch of science which deals with the study of matter and energy. The Physical Science was a matter of interest for all the civilizations including Vedic era of India dating back to over 3000 years. The physical science in ancient India was majorly restricted to Astronomy and Astrology. It was **Kaṇāda** (600 B.C.) who presented holistic approach of physics, by blending science, philosophy and religion through 'Vaisesika Sutra'. Their essence is the atomic theory of matter. He gave the name 'Paramanu' (Atom), to be the indivisible entity of matter. The idea of chemical change was also put forward by Kanada. Bharadwaja is credited with teaching missile technology. Aryabhata (500 A.D.) was a great astronomer. He was the first to state that the earth is round and it rotates on its own axis, creating day and night. He declared that the moon is dark and shines only because of sunlight. Aryabhatta contributed greatly to the field of science particularly astronomy. Varaha mihira (500 A.D.) studied astrology and astronomy and declared that the earth was spherical. He also proposed that the moon and planets are lustrous not because of their own light but due to sunlight. Bhaskra (1100 A. D.) was a great scientist his concept of "Tatkalikagati", which means instantaneous motion, used by astronomers to determine the motion of the planet accurately brought credit to him. Brahmagupta (598 A.D.) calculated the instantaneous motion of a planet, gave correct equations for parallax, and some information related to the computation of eclipses and is widely regarded as one of the most accomplished of the ancient Indian astronomers.

"If you wish to make an apple pie from scratch, you must first invent the universe."So said astronomer Carl Sagan in an episode of his landmark television series, Cosmos. Embedded in Sagan's memorable quip is a certain holistic understanding of the universe — a notion that the existence of any one thing is intimately tied to the existence of everything else. There are no apple pies without apples; there are no apples without the proper climate for growing apple trees; there is no proper climate for growing apple trees without a planet on which the apple trees can grow — and so on, all the way back to the Big Bang.Pythagoras and his followers held mathematics in an almost holy regard, and they saw numbers as a basic form of matter. According to their view, all things had numbers, and the objects of the universe — including human societies — were arranged in harmonious mathematical relationships with one another.

All sciences were originated from philosophy. Physics was called natural philosophy until the 19th century, but once it was proven to be correct it was no longer philosophy and became a science. Physics is the science of the natural world, more specifically dealing with the matter, energy, space-time, and fundamental forces that govern the physical world. In physics we study a wide range of physical phenomena from subatomic particles to large galaxies of the material universe, and use empirical data and mathematics to find results and conclusions. Physics is also deeply concerned with arriving at knowledge about the ultimate nature of reality. Since we cannot know whether we have discovered everything which would affect our theories of the universe, all such theories are perpetually subject to modification or change. Mathematics is a language and a tool that we use in physics to explain the universe. Quantum physics is a mathematical description that rules the tiny world of atoms and subatomic particles in our universe. Without quantum physics, much of the information technology that we rely on, from microcircuits to lasers, would not exist. Today many scientists argue that metaphysics plays an important role in quantum mechanics at a deeper level; the nature of reality is all mathematical. This could be an example of how metaphysical assumptions can get in the way of our understanding the paradoxical nature of quantum mechanics. But even when quantum mechanics appears a mystical science of metaphysics, it is not metaphysics but productive science.

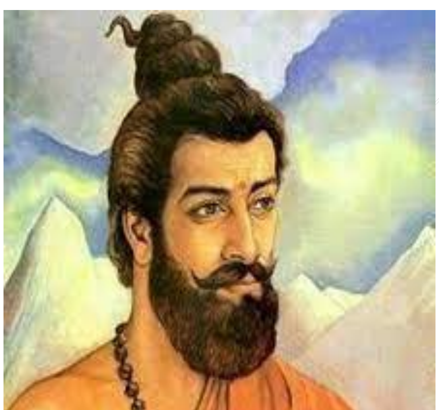
Thus, the Physics though has many branches and uses many other branches of science and philosophy, in the past and the present, its aim is to understand the whole universe which is nothing but matter and energy which is seen or unseen.

CHEMISTRY

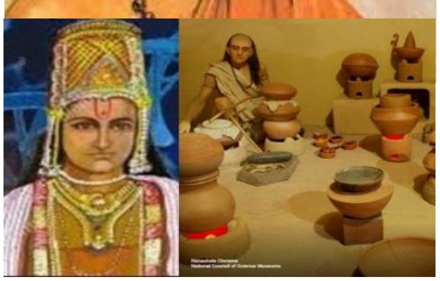
ANCIENT SEERS OF INDIA – CHEMISTRY

In ancient India, chemistry was called **Rasayan Shastra, Rasa-Vidya, Rasatantra and Rasakriya** all of which roughly mean '***Science of Liquids***'. There also existed chemical laboratories which were called **Rasakriya-nagaram**/**Rasakriya-shala**, which literally mean '***School where liquids are activated***'. Rigveda (earlier than 1500 BCE) mentions many fermented drinks and methods of fermentation, apart from various metals. Soma juice from the stems of the soma plant was considered a divine drink. The Vedic Indians were acquainted with the art of dyeing with certain natural vegetable colouring matters. A type of pottery, now known as 'Painted Grey Ware', is also associated with the Vedic period.

Ancient chemistry in India grew out of the early efforts to develop an elixir; to turn base metals into gold and on metallurgy. Chemical techniques in India can be traced back all the way to the Indus valley or Harappan civilisation (3rd millennium BCE). Pre-Harappan Indians were acquainted with the art of making baked or burnt clay pottery as well as painting the same with two or more colours (by addition of iron oxide, manganese oxide, etc.). Kautilya's Arthashaastra (3rd or 4th century BCE) has a lot of information on prevailing chemical practices. Apart from mines and minerals, it discusses the details of precious stones (pearl, ruby, beryl, etc.); preparation of fermented juices (sugarcane, jaggery, honey, jambu, jackfruit, mango, etc.) and oil extraction.



It is said that **Maharshi Kanada** was the first to propound that the *Parmanu* (atom) was an indestructible particle of matter and that Universe is made up of *Kana*. When matter is divided and sudivided, we reach a stage beyond which no division is possible, the undivisible element of matter is *Parmanu*. Kanada explained that this indivisible, indestructible y cannot be sensed through any human organ.



Nagarjuna (931 A.D.) from Somnath in Gujarat was a chemist/alchemist, who concentrated his efforts in transforming the base metals into gold. His reputation was such that people believed Nagarjuna to be in communion with gods and goddesses who had blessed him with the power of changing base metals into gold and extracting the 'elixir of life'.

Prafulla Chandra Ray (1861-1944), an Indian chemist, is often referred to as the Father of Chemistry in India. He received his BS in 1882 and his PhD in 1887 from University of Edinburgh. In 1896, he announced a major discovery of a new compound, mercurous nitrite.

Today's Science and Technology has been greatly inspired by the contributions of these wise seers. Indians have continued to show their global impact in the Field of Science. In the 21st century, biochemist **Har Gobind Khorana** won the Nobel Prize (1968) for demonstrating how the nucleotides in nucleic acids control the synthesis of proteins.

Thus, the seers of ancient India have contributed significantly in the development of Modern Chemistry.

BIOTECHNOLOGY

Biology for Engineers

Science deals with matter. It is based on starting from scratch with what a human can observe, test, and rationalize. Ancient sages have worked hard to be seen as the only reliable providers of knowledge to the world. In 1875, the Vymaanika Shaastra, a 4th Century BC text written by Sage Bharadwaj was discovered in a temple in India. It contains 3000 shlokas in 8 chapters which was physically delivered by the ancient Hindu Sage Bharadwaj. The book greatly deals with the operation of ancient vimanas and included information on steering, precautions for long flights, protection of the airships from storms and lightning and how to switch the drive of solar energy or some other form of energy. One of the chapter will reveal the secrets of constructing aeroplanes that cannot be broken or cut, that is indestructible, that is fire resistant. It also deals with the secret of making planes motionless and invisible. It also describes how to defeat the enemy planes etc. as per the Sage Bharadwaj the vimanas were classifies as per the Yugas. During the period of Krita Yuga, Dharma was establishes firmly. The pushpak Vimana which was used by Ravan was an Aerial vehicle. He used this vehicle to kidnap Sita from jungle and took him to his Kingdom Srilanka. Ramayana was during the Treta Yug in which the Vimanas were highly discovered. During this period "Laghima" gave them the power to lighten their vehicle do they can travel freely in the air.

COMPUTER AND INFORMATION SCIENCE ENGINEERING

The Indians (**Aryabhata**, 476 BC - 550 BC) contributed **Zero (0)** to the number system**.** So that numeric system and computing world found an ease in solving numerical problems using computer programs.

Acharya **Pingala** was an ancient Indian mathematician who lived around 300 BCE. He wrote the Chandaḥśāstra, where he analysed **Sanskrit poetry mathematically**. It also contained the first known explanations of **digit zero**, **binary numbers, Fibonacci numbers and Pascal's triangle**.

Baudhayana (8th century BCE) composed the Baudhayana Sulba Sutra, which contains examples of Pythagorean triples, such as: (3,4,5), (5,12,13), (8,15,17), (7,24,25) and (12,35,37) as well as a statement of the Pythagorean theorem for the sides of a square: "The rope which is stretched across the diagonal of a square produces an area double the size of the original square."

In Indian astronomy, the study of **trigonometric functions** flourished in the Gupta period, especially due to **Aryabhata (sixth century CE),** who discovered the **sine function**.

Quadratic equation of the form $\mathbf{ax^2 + bx + c = 0,\ a \neq 0}$ and is given by $x = (-b \pm \sqrt{(b^2 - 4ac)}) / 2a$. was discovered by **Sridharacharya** in the 11th century.

The largest numbers the Greeks and Romans used were 106. In 5000 BC **Indians used numbers as big as** $\mathbf{10^{53}}$ (10 to the power 53) with specific names. The largest used number today is **Tera** $\mathbf{10^{12}}$.

Kaṭapayadi numerical notation is an ancient Indian system to depict letters to numbers for easy remembrance of numbers as **words or verses**.

For example: क(Ka)=1 ख(Ka)=2 ग(Ga)=3 घ(Ga)=4 ज़(Gnya)=5 च(Cha)=6 छ(Cha)=7 ज(Ja)=8 झ(Ja)=9 अ(Nya)=0. The modern **Hasing technique in computing system** which is resembling was then being used in the **Indian Katapayadi system**. For example, the hashing number based on Katapayadi system would be as follows for '**Gurudev**'

Gu=Ga(is the consonant)=3, Ru=Ra(is the consonant)=2, De=Da(is the consonant)=8 Va=Va(is the consonant)=4, So Gurudeva = 4823.

In the recent decades, following are the few of the major contributors to the computing world:

1. In 1996 the USB port invented by the **Ajay Bhatt,** an Indian at Intel Oregon which involved low level **programs delt with embedded C Language** to perform flexible IO transfer and opened up an area to use plug-and-play devices efficiently.
2. The Pentium chip invented by **Vinod Dham,** that **made C compiler to speed up the program execution** and do well with **GUI applications (both System and User Level) that are wiritten in C language.**

3. **Amit Singhal** is an Indian who rewrote (search engine in 2001) the **google algorithm** (C language coding embedded with Assembly Language service routins in Windows and Unix/Linux). Then on the Google processes over 40,000 search queries every second on average which translates to over **3.5 billion searches per day** and **1.2 trillion searches per year** worldwide.

Few of the contribution as Auther of CP and Educators of C language:

1. **Yashavant Kanetkar** is an Indian computer science author, known for his varieties of C Programming books.
2. **E. Balagurusamy : An Computer scientist** known for **Programming in ANSI C**

ELECTRONICS AND COMMUNICATION ENGINEERING

The idea of a holistic approach to engineering design and education has been envisioned to meet the perceived and emerging needs for innovation in the 21st century. Many engineering educators, practicing engineers and engineering students have already recognized the gaps and areas of potential improvements in the knowledge acquisition process implemented in current engineering degree programs when compared to current societal and technological issues and developments.

Society and humanity have progressed drastically over the past few generations. Engineers as a network of professional problem solvers have been heavily involved in these global communities and the engineering profession is evolving from one that focuses on targeted, isolated issues, to one that embraces challenges that incorporate physical, economic, environmental, and humanitarian aspects.

Currently, engineering students are required to take classes on ethics, liberal studies and technology and society courses, however engineering students are not prefaced with the importance of rounding out their education with these topics, and while social issues are discussed, they are not related to engineering specifically. That being said, explicitly linking the technical aspects of engineering to society is paramount in training effective problem solvers for the 21st century. With some exposure to multi-disciplinary, inter-disciplinary and trans-disciplinary approaches to engineering and design, students will be better prepared for their future careers in industry or research fields.

The functional requirements for the perceived solution were determined by the expected outcomes and what students should take away after experiencing the new educational product. Some of them are:

• students will be inspired and driven to seek opportunities in engineering for environmental, social, medical, and human development/poverty issues.students will be able to identify the issues that are emerging from new technology, how to mitigate the negative aspects and reduce the amount of impact, while leveraging the positive outcomes.

• students will have respect and knowledge of the importance of ethics and policy matters in the field of engineering and be able to determine between unethical and an ethical situation in a proactive manner.

The courses should overcome the challenges of the current engineering educational system. Approaching the degree from a holistic perspective. The integrated system that fosters collaboration among faculty and students. A new organizational and pedagogical model, which emphasizes knowledge integration and interweaves thematic content threads throughout the curriculum should be proposed.

- Foundations thread (math and science) Key mathematical concepts lay the foundation for understanding the anchoring concepts in courses throughout the ECE curriculum. The foundations thread unpacks mathematics and physics concepts to help students learn fundamentals in ECE topics like circuits, signals and systems, and electromagnetics. The foundations thread champion spearheads the collaboration between the math and ECE departments to introduce and promote the value and utility of mathematics in ECE courses, as well as the importance of mathematical thinking.
- Creativity thread (research, design, and optimization tools) The creativity thread is intended to integrate research and design throughout the undergraduate experience. By showing the impact of research, students will see the practical applications and potential breakthroughs of fundamental ECE concepts. Likewise, exposing students to design at every level of the undergraduate experience allows them to experience the excitement of engineering by applying their foundational knowledge to a tangible product.
- Professional formation thread (communications, cultural adaptability, ethics, leadership, and teamwork) Partnering with faculty and industry leaders to ensure students develop professional skills meaningfully and effectively to enhance student-industry interactions.

ELECTRICAL AND ELECTRONICS ENGINEERING

Agastya Samshita available at Prince's Library of Ujjain in India, dates back to the first millennium BC, contains a detailed description construction of an electric battery/cell along with way to utilize the battery to 'split' water into its constituent gasses. The method of generating electricity using modern battery cell resembles Agastya's method. The materials used by Sage Agastya for generating electricity were an earthen pot, copper plate, copper sulphate, wet saw dust, zinc amalgam. As quoted in Agastya Samhita the open circuit voltage and short circuit current of the prepared cell are 1.138 volts and 23 mA respectively. He articulates 100 earthen pots on water, has the power to change the form of water to oxygen and hydrogen. If hydrogen is contained in an air tight cloth, it can be used in aerodynamics, i.e. it will fly in air. In an iron vessel and in a strong acidic medium, gold or silver nitrate covers copper with a layer of gold or silver. The copper that is covered by gold is called Shatakumbha or artificial gold.

Rao Saheb Krishnaji Vajhe, an engineer from Pune while reading books related to science found the pages of Agastya Samhita with Damodar Tryambak Joshi of Ujjain. Dr. M. C. Sahastrabuddhe, the Head of the Sanskrit Department in Nagpur, when reading Agastya Samhita found the similarity of it with of Daniel Cell. He requested P.P. Hole, the Professor of Engineering at Nagpur to investigate on the same.

On the basis of the descriptions in Agastya Samhita Mr. Hole and his friend started preparing the apparatus for the experiment. While preparing the set up they could not understand the meaning of shikhigreeva and while checking the Sanskrit dictionary, they understood that it meant the neck of a peacock. They went to Maharaja Park and asked the chief when a peacock would die. The chief was very angry and asked them to give in an application. After few days during a conversation with an Ayurveda expert he confirmed that shikhigreeva is copper sulphate, which solved their problem. Thus, a cell was formed and it had an open circuit voltage of 1.38 volts and short circuit current of 23 milli amperes. The results of the experimentation were communicated to Dr. M.C. Sahastryabuddhe. It was exhibited fourth general meeting at the Swadeshi Vigyan Sanshodhan Sanstha, Nagpur on August 7, 1990 to the scholars. It was concluded that the description was of an electric cell

On the basis on Agastya Samhita and other scriptures, Rao Saheb Vajhe, who spent his life in rummaging the Indian scientific scriptures, gave different names to electricity. The six ancient terminologies for electricity are:

- Tadit—produced by friction from leather or silk,
- Saudamini—produced by friction from gems or glass,
- Vidyut— from clouds or steam,
- Shatakoti alias Shatakumbhi—produced from a battery of hundreds of cells,
- Hradini—obtained from storage cells,
- Ashani—the one emanating from a magnetic rod.

MECHANICAL ENGINEERING

Mechanical engineering is one of the oldest disciplines of engineering, which requires the knowledge of mathematics, materials, physics and other engineering technologies. It is concerned with materials, processes and machines and requires the concepts of forces, moments, energy, entropy, work etc. The developments that are visible in all spheres of life have connection to mechanical engineering. Engineering has made a significant contribution in the development of civilizations and contribution of mechanical engineering in areas like construction of large scale structures including for irrigation, architecture, military etc. is significant. Difficult problems of the society have been solved using simple concepts of mechanical engineering, say for eg. use of lever principle to move heavy objects. In fact, mechanical engineering made a significant contribution to the first cycle of industrial revolution, i.e., industrial revolution 1.0 during the 18th century. James Watt is often called the 'Father of Mechanical Engineering', as his invention of steam engine led to significant developments during the industrial revolution and beyond. The earliest computers were mechanical devices with electronics.

Significant contributions have been made during the Vedic ages and the first ever mechanical device that was invented was wheel and potter. Surmyam Suiramiva identified metals like Fe, Cu, Ag, Au etc., during the Vedic times. People knew about materials and material processing during those times and identified terminologies for the same in Sanskrit and produced gold and silver coins.

Seers like Tritala, Jalayan, Karaa, Vayurathaa and Vidyutrathaa discovered about aerodynamics during Rig Veda period, much before Wright Brothers discovered about aero planes. Computational Fluid Dynamics (CFD) analysis, which we are talking about today for different analysis, was there in the Vimana Shastra slokas.

Mechanical and manufacturing technology of ancient India ensured processing of natural products and their transformation into goods of trade, commerce and export.

Many scientists have made significant contributions to this domain. Leonardo da Vinci (16th century) studied and designed many mechanical systems that were related to transportation and warfare. In 17th century, Isaac Newton contributed the Laws of Motion used in several applications. Rudolf Diesel (18th century) was a German inventor, who created the first successful diesel engine and today diesel engines play a very important role in the transport and power sector in the world. Carl Frederich Benz (18th century) was a German automotive engineer, who developed the first practical automobile.

Mechanical engineering has evolved over the years and today the advent of computer and IT tools has facilitated better mechanical engineering in terms of design, analysis, and manufacturing. A mechanical engineer needs to work in multiple domains and needs to possess multiple skills like design, redesign, analyze, test, manufacture etc. It has been one of the founding disciplines of engineering and has contributed and will keep contributing to the growth and developments in this physical world.

CIVIL ENGINEERING

Indian civilization was the oldest civilization in the world and has a strong tradition of science and technology. It was the land of sages, seers, scholars, and scientists. Hinduism is a knowledge-based civilization, the Vedic texts should not be ignored dismissed as mythologies or as the work of imagination or just containing some moral stories. The Veda means knowledge and they contain relevant knowledge otherwise these texts would not have survived the millennia years of the historic storm. Let us know some of the great work done in ancient times.

Ancient India not only practised scientific methods of design and construction but also documented them for future generations. Here are some tips given by ancient sages on selection of site and construction

(1) Vishwakarma Vastu Shastra- Vishwakarma explains the first point of construction in the ancient book Vastu Shastra – 'पूर्व भूमिं परिक्ष्येत पश्चात् वास्तु प्रकल्पयेत्', This means that before construction one should test the land. Vishwakarma further says that construction should not be done on the land which is very mountainous or on land with large cracks.

Vastu shastra literally "science of architecture" are texts on the traditional Indian system of architecture. These texts describe principles of design, layout, measurements, ground preparation, space arrangement, and spatial geometry. The designs aim to integrate architecture with nature, the relative functions of various parts of the structure, and ancient beliefs utilising geometric patterns (yantra), symmetry, and directional alignments.

(2) Kashyap Shilpa (Craft) – In this ancient book, Kashyap Rishi has said that the foundation should be dug until water is seen because this way you would ensure that you have reached the rock level and the foundation would be strong.

(3) Bhrigu Samhita – In this scripture saint Bhrigu says that before buying land, one should test it for form, colour, juice, smell and touch. Rishi Bhrigu also explains its methods in his book.

Ancient cities of India found on the basis of archaeological discoveries:

- Rama was the world's first king to build a bridge across the sea. But he did not do it on his own. He sought the help of a great engineer called Nala according to Valmiki Ramayana. Any wise man will seek local knowledge when he ventures into new places. Nala knew the shallow areas across the sea in and around Tamilnadu. American space agency NASA also confirmed that there was a bridge through the satellite pictures. Any wise engineer will use such naturally elevated areas instead of deep waters to build a bridge.

- Bageeratha changed the course of the mighty river Ganges. The vast forest areas of modern Bihar, Uttar Pradesh, and West Bengal were made into fertile lands by his marvelous engineering feat. In those days very few people lived in those jungles. Puranas say that Bageeratha did penance for several thousand years to do this that too 'standing in one foot'. This is a phrase Indians use very often. Even the great Tamil poet Tiruvalluvar uses the simile of Stork that stands in one foot to catch a fish. This is the hidden language to say that he tried for a very long time with focused attention.
- Vedic Saint Agasthya discovered the land route to South India via Vindhyas. The Puranas say that he "subdued the arrogance of the hills", this is hidden language. Till Agastya's this great discovery kings and travellers used only sea routes. Since they knew the secret of monsoon winds they can travel to West Bengal or Maharashtra from Sri Lanka in a few months' time.
- Uparichara Vasu, an ancient king made mountain passes for the benefit of land travellers. He was a Vasu king ruling over the Chedi kingdom. Mahabharata says that he kicked the Kolahal Mountain which was blocking the flow of the Shaktimati River. This is a hidden language to say that he diverted the river for irrigation by cutting the hills.
- In short Bageerathan, Agastya, and Uparichara Vasu are the earliest engineers who built dams across the rivers. But unlike modern engineers, they did not use cement or mortar but they used the hills themselves. To avoid the force they made checks and balances. They use a hidden language saying that Shiva bore the force when Ganga came down from heaven.
- Parasuraman retrieved a lot of lands and gave it to Indians. A Pandya king called Nilam Tharu Vil Nediyon built sea walls to prevent the sea from invading the land.
- Balraman always travelled with an axe to clear the forests and make them cultivable. He was a great agriculturist. When Krishna spent most of his time in politics, his brother Balarama did constructive work.
- The Mohanjodaro, created 3000 years ago, is considered as a wonderful piece of civil engineering. Found in archaeological excavations even the ruins prove that this town was well settled and its buildings and roads – all were made using symmetry and geometrical measurements. The roads found in this city were straight and were made from east to west and north to south and surprisingly they were at an angle of 90 degrees from each other. Buildings were also constructed in proportion. The intersection of the corners, the heights of the walls was equal. The city had public buildings, gardens, a restaurant, a large public bath as well as residential buildings. There was a provision for bathroom, living room etc in the residential buildings. The public buildings were 11.82m long, 7.01m wide and 2.44m high, and there were two streams of water. The building material and bricks

of the walls were coated with a substance on which there was no effect of water. Archaeological research shows that people living here were well-versed in the construction techniques.

- Indus Valley Cities such as Harappa, Mohanjadaro, Lothal, Dholavira, Kalibangan need no new interpretations. The well-laid cities with uniform brick structures, Great Bath, most hygienic drainage systems, grain storage barns, and wells are all already well known to the world.
- Dwarka, also known as Lord Krishna's city, also narrates a similar story. Dr S R Rao discovered Dwarka in the archaeological excavation and found that the ancient city (Dwarka Nagar) was well built and settled. There was a wall around the city. The stones used for the construction of buildings did not erode despite the fact that the city was very close to the sea. Two-storey buildings, roads and water system are also found in the city. Copper, bronze and some alloys with zinc mixed up to 34 percent have also been found during the excavation. The size of columns, windows, etc reveals that they were designed with a complete mathematical precision.
- South Indian Tamil saint Appar always travelled with a pickaxe to clear the bushes from the temple towers. He simply followed Balarama. Great Chola king Karikalan built a dam across river Cauvery in Kal Anai. The Grand Anicut was an engineering wonder of ancient Tamils. It was built around the 1st century AD. Big temples of India, the number of which runs into thousands, stand as monumental proof for the engineering skills of Indians. Mamallapuram and other Pallavacave temples are well-known milestones in Indian architecture.
- The Group of Monuments at Hampi are also recognized as a UNESCO World Heritage Site. The Vittala temple—the stone chariot – is the most iconic symbol of Hampi. The Virupaksha Temple at Hampi was built in the seventh century by the Chalukya rulers.


Virupaksha and Vithala Temple in Hampi

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NMAM INSTITUTE OF TECHNOLOGY

Scheme & Syllabus for B. Tech. (Civil Engineering)

HIGHER SEMESTER COURSES

DEPARTMENT OF CIVIL ENGINEERING
2022-23

B.Tech. (CV): Scheme of Teaching and Examinations 2022-26

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2022 - 23)

2nd Year Scheme

III Semester

Sl. No	Course Type	Course Code	Course Title	Teaching Department	Teaching Hours /Week: Lecture L	Tutorial T	Practical/ Drawing P	PBL J	Examination: Duration in hours	CIE Marks	SEE Marks	Total	Credits
1	BSC	MA2003-1	Vector Calculus and Complex Functions	MA	3	0	0	0	3	50	50	100	3
2	IPCC	CV2001-1	Building Materials and Construction	CV	2	2	2	0	3	50	50	100	4
3	IPCC	CV 2002-1	Fluid Mechanics and Hydraulics	CV	2	2	2	0	3	50	50	100	4
4	PCC	CV 2105-1	Concrete Technology	CV	2	2	0	0	3	50	50	100	3
5	PCC	CV 2102-1	Strength of Materials	CV	3	0	0	0	3	50	50	100	3
6	PCC	CV 2602-1	Computer Aided Civil Engineering Drawing	CV	0	0	2	0	3	50	50	100	1
7	HSMC	HU1004-1	Universal Human Values	HU	1	0	0	0	1	50	50	100	1
8	AEC	ME1654-1	Innovations and Design Thinking	ME	1	0	0	0	1	50	50	100	1
9	MNC	HU1003-1	Kannada (Balake /Samskrathika)	HU	1	0	0	0	-	50	0	50	0
				Total	**15**	**6**	**6**	**-**	**20**	**450**	**400**	**850**	**20**
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs													
10	MNC	MA1011-1	Bridge Course – Calculus and Laplace Transforms	MA	3	0	0	0	-	100	0	100	0

IV Semester													
Sl. No	Course Type	Course Code	Course Title	Teaching Departme	Teaching Hours /Week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	PBL	Duration in hou	CIE Marks	SEE Marks	Total	
					L	T	P	J					
1	BSC	MA2009-1	Probability Theory and Computational Mathematics	MA	3	0	0	0	3	50	50	100	3
2	IPCC	CV 2003-1	Public Health Engineering	CV	3	0	2	0	3	50	50	100	4
3	IPCC	CV 2004-1	Geodetic Engineering	CV	2	2	2	0	3	50	50	100	4
4	PCC	CV 2103-1	Structural Analysis - I	CV	3	0	0	0	3	50	50	100	3
5	PCC	CV 2107-1	Remote Sensing Image Acquisition, Analysis and Applications	CV	3	0	0	0	3	50	50	100	3
6	PCC	CV 2601-1	Basic Materials Testing Lab	CV	0	0	2	0	3	50	50	100	1
7	HSMC	HU2001-1	Enhancing Self-Competence	HU	2	0	0	0	3	50	50	100	2
8	HEC	HU1005-1	Essence of Indian Culture	HU	1	0	0	0	-	50	0	50	0
9	VEC	CV1551-1	Department specific Vocational Education Course – (Construction Practice)	CV	0	0	2	0	3	50	50	100	1
10	UCC	UC1001-1	Internship – I (Activity based Internship)	CV	Mandatory Intra Institutional Activity based Internship of 2 weeks duration (80 - 90 h) to be completed during the vacations o I & II Semesters. Lateral entry students have to complete the Internship - I during the vacation of III semester				-	100	0	100	2
				Tot	17	2	8	0	24	550	400	950	23
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs													
11	MNC	MA1013-1	Bridge Course – Probability and Differential Equations	MA	3	0	0	0	-	100	0	100	0

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3rd Year Scheme

V Semester													
Sl. No	Course Type	Course Code	Course Title	Teaching Department	Teaching Hours /Week				Examination				Credits
					Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	PBL (J)	Duration in hours	CIE Marks	SEE Marks	Total	
1	IPCC	CV 2005-1	Design of RC Structural Elements	CV	3	0	2	0	3	50	50	100	4
2	IPCC	CV 2006-1	Geo Technical Engineering	CV	3	0	2	0	3	50	50	100	4
3	PCC	CV 2106-1	Transportation Engineering	CV	3	0	0	0	3	50	50	100	3
4	PCC	CV 2603-1	Extensive Survey Project and software lab	CV	0	0	2	0	3	50	50	100	1
5	PEC	CV XXXX-1	Professional Elective-I [Group-1]	CV	3	0	0	0	3	50	50	100	3
6	HSMC	HU1006-1	Introduction to IPR	Any Dept.	1	0	0	0	1	50	50	100	1
7	AEC	XXx6xx-1	Program Specific Ability Enhancement Course	CV	1	0	2	0	3	50	50	100	2
		ME1659-1	Research Methodology	Any Dept.	2	0	0	0					
8	AEC	HU1007-1	Social Connect & Responsibility	HU	1	0	0	0	1	50	50	100	1
9	AEC	UM1003-1	Employability Skill Development	CV	1	0	0	0	-	50	-	50	1
				Total	**16/17**	**0**	**8/6**	**-**	**20**	**450**	**400**	**850**	**20**

VI Semester

Sl. No	Course Type	Course Code	Course Title	Teaching Department	Teaching Hours /Week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	PBL	Duration in hours	CIE Marks	SEE Marks	Total	
					L	T	P	J					
1	IPCC	CV 2007-1	Design of Steel Structural Elements	CV	2	0	2	0	3	50	50	100	4
2	PCC	CV 2104-1	Structural Analysis - II	CV	3	0	0	0	3	50	50	100	3
3	PCC	CV 2604-1	Geomatics Lab with project-based learning	CV	0	0	2	0	3	50	50	100	1
4	PEC	CV XXXX-1	Professional Elective - II [Group-1]	CV	3	0	0	0	3	50	50	100	3
5	PEC	CV XXXX-1	Professional Elective -III [Group-2]	CV	3	0	0	0	3	50	50	100	3
6	OEC	XXX5XX-1	Open Elective –I	CV	3	0	0	0	3	50	50	100	3
7	HSMC	MG1001-1	Engineering Project Management	CV	3	0	0	0	3	50	50	100	3
8	AEC	HU1008-1	Life skills for Engineers	Any Dept.	1	0	0	0	1	50	50	100	1
				Total	**18**	**0**	**4**	**-**	**22**	**400**	**400**	**800**	**21**

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4th Year Scheme

VII Semester														
Sl. No	Course Type	Course Code	Course Title	Teaching Department	Teaching Hours /Week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	PBL	Duration in hours	CIE Marks	SEE Marks	Total	
					L	T	P	J					
1	IPCC	CV 2008-1	Quantity Surveying and Estimation	CV	3	0	2	0	3	50	50	100	4
2	PCC	CV 2605-1	Concrete and Highway Materials Testing Lab	CV	0	0	2	0	3	50	50	100	1
3	PEC	CV XXXX-1	Professional Elective – IV [Group-1]	CV	3	0	0	0	3	50	50	100	3
4	PEC	CV XXXX-1	Professional Elective – V [Group-2]	CV	3	0	0	0	3	50	50	100	3
5	OEC	XXX5XX-1	Open Elective –II	CV	3	0	0	0	3	50	50	100	3
6	HSMC	MG1003-1	Management & Entrepreneurship	CV	3	0	0	0	3	50	50	100	3
7	HEC	HU1009-1	Indian Knowledge Systems	Any Dept.	1	0	0	0	-	50	0	50	1
8	UCC	UC3001-1	Major Project Phase I	CV	-	-	4	-	-	100	0	100	2
				Total	16	0	8	0	18	450	300	750	20

VIII Semester													
Sl. No	Course Type	Course Code	Course Title	Teaching Department	Teaching Hours /Week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	PBL	Duration in hours	CIE Marks	SEE Marks	Total	
					L	T	P	J					
1	UCC	UC2001-1	Internship- II (Societal internship and Research/Industry Internship)	Mandatory Societal internship for 2 weeks (80 – 90 h) and Research Internship / Industry Internship of 6 weeks (240 – 270 h) or Research Internship / Industry internship for a total of 8 weeks (320 – 360 h)to be completed in one/two stretches during the vacation periods between IV to VII semesters.					3	50	50	100	8
2	UCC	UC3002-1	Major Project Phase II	Student should carry out project in research institute/industry/intra institute Canter of Excellences. Two contact hours /week for interaction between the project guide and students.					3	100	100	200	8
				Total	-	-	-	-	-	150	150	300	16

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Program Specific Ability Enhancement Course (AEC)	
Course Code	**Course Title**
CV 2651-1	Applications of AI in Civil Engineering
CV 2652-1	Fire Safety in Buildings
CV 2653-1	Green Buildings
CV 2654-1	Instrumentation and Sensor Technologies of Civil Engineering Applications
CV 2655-1	Software Applications in Civil Engineering
CV 2656-1	Technical Writing Skills
CV 2657-1	Visual Basic Application for Excel
CV2658-1	Entrepreneurship Development and Small Business Management
ME1654-1	Innovations and Design Thinking
ME1659-1	Research Methodology

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

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List of Professional Elective Courses [PEC]			
Group-1		**Group-2**	
Structural Engineering Stream			
Code	**Elective Course Title**	**Code**	**Elective Course Title**
CV2201-1	Design of Masonry Structures	CV2301-1	Advanced RCC Design
CV2202-1	Matrix Methods of Structural Analysis	CV2302-1	Design of Bridges
CV2203-1	Structural Dynamics	CV2303-1	Earthquake Resistant Structures
CV2204-1	Theory of Elasticity	CV2304-1	Finite Element Method of Structural Analysis
CV2205-1	Design of Prestressed Concrete Structures	CV2305-1	Numerical Methods in Civil Engg
Geotechnical and Transportation Engineering Stream			
Code	**Elective Course Title**	**Code**	**Elective Course Title**
CV2211-1	Earth Retaining Structures	CV2311-1	Deep Foundations
CV2212-1	Ground Improvement Techniques	CV2312-1	Environmental Geotechniques
CV2213-1	Highway Geometric Design	CV2313-1	Pavement Design
CV2214-1	Road Safety and Management	CV2314-1	Pavement Materials and Construction
CV2215-1	Traffic Engineering	CV2315-1	Reinforced Earth Structures
CV2216-1	Soil Exploration & Ground Improvement Techniques (Industry Supported Course – Geosmart International Pte Ltd, Singapore)		
Construction Technology and Management Stream			
Code	**Elective Course Title**	**Code**	**Elective Course Title**
CV2221-1	Advanced Concrete Technology	CV2321-1	Business Management
CV2222-1	Alternative Building Materials and Technologies	CV2322-1	Construction economics and finance
CV2223-1	Building Services	CV2323-1	Construction Safety Management
CV2224-1	Construction Methods and Equipments	CV2324-1	Design of Special Concretes
CV2225-1	Construction Planning & Control	CV2325-1	Disaster Management and Mitigation
CV2226-1	Construction Quality Management	CV2326-1	Sustainable Construction Materials and Methods
		CV2327-1	Valuation of Real Properties
Water Resources Engg, Environmental Engg & Geology Stream			
Code	**Elective Course Title**	**Code**	**Elective Course Title**
CV2231-1	Advanced Hydraulics	CV2331-1	Advanced Applied Engineering Geology
CV2232-1	Environmental Impact Assessment for Civil Engineering	CV2332-1	Geo-informatics in Environmental Engineering
CV2233-1	Ground Water Hydrology &Exploration	CV2333-1	Groundwater Recharge and conservation
CV2234-1	R S & GIS application in Water Resource Engg.	CV2334-1	Introduction to Geo-informatics
CV2235-1	Rural Water Supply & Sanitation	CV2335-1	Solid Waste Management
CV2236-1	Engineering Geology	CV2336-1	Hydrology and Irrigation Engineering
Software Oriented Courses in Civil Engineering Stream			
Code	**Elective Course Title**	**Code**	**Elective Course Title**
CV2241-1	3D BIM - AUTODESK REVIT	CV2341-1	Application of RS & GIS for Water resources management
CV2242-1	CAD IN CIVIL ENGINEERING	CV2342-1	JAVA PROGRAMMING
CV2243-1	FUNDAMENTALS OF MACHINE LEARNING	CV2343-1	Project Planning using Software's
CV2244-1	GIS with Quantum GIS	CV2344-1	Software Advances in Pavement Design
CV2245-1	Python Programming	CV2345-1	IOT in Civil Engineering
Industry Offered Courses in Civil Engineering Stream Supported by L & T EduTech			
Code	**Elective Course Title**	**Code**	**Elective Course Title**
CV2251-1	Airports & Seaports Engineering	CV2351-1	Bridge Engineering Practices
CV2252-1	Design & Execution of Pile Foundations	CV2352-1	Project Management for Engineers
CV2253-1	Metro Rail Systems and Construction		

BASIC SCIENCE COURSES

VECTOR CALCULUS & COMPLEX FUNCTIONS

Course Code:	**MA2003-1**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**MA1005-1**		

Teaching Department: Mathematics

Course Objectives:

1.	To apply operators like gradient, divergence and curl to both scalar as well as vector functions.
2.	To evaluate surface and volume integrals in terms of line integrals using various integral theorems.
3.	Determine analyticity of a function and find the derivative of a function. Evaluate an integral using Cauchy's integral formula.
4.	Compute the residue of a function and use the residue theory to evaluate a contour integral or an integral over the real line.
5.	Find Fourier series of a function, obtain the half range series and harmonics. Find the Fourier transform and inverse Fourier transform of a function.

UNIT-I

Vector Calculus — **15 Hours**

Vector algebra (review), vector differentiation-gradient, directional derivatives, divergence, curl, Laplacian, solenoidal and irrotational vectors. Curvilinear, spherical and cylindrical co-ordinates.
Vector integration: Line, surface & volume integrals. Green’s theorem, Gauss divergence theorem, Stoke’s theorem and applications.

UNIT-II

Theory of Complex Variables — **15 Hours**

Functions of complex variables, Cauchy Riemann equations, properties of analytic functions, conformal mapping, bilinear transformations.
Line integrals in complex plane, Cauchy’s theorem, Cauchy’s integral formula. Power series-Taylor’s and Laurent’s series. Residues, Cauchy’s residue theorem. Evaluation of standard real integrals using contour integration.

UNIT-III

Fourier Series and Fourier Transforms — **10 Hours**

Periodic functions, Euler’s formulae, Fourier series of odd and even functions, functions with arbitrary period, half range series, harmonic analysis. Fourier integral theorem, Fourier transforms, inverse Fourier transform, convolution theorem and Parseval’s identity. Fourier sine and Fourier cosine transforms, inverse Fourier sine and inverse Fourier cosine transforms.

Course Outcomes: At the end of the course student will be able to

1.	Solve the vector functions and their derivatives for engineering applications.
2.	Demonstrate the applications of Gauss divergence and Stoke’s theorem.
3.	Recognize analytic functions, differentiate and integrate complex functions.
4.	Compute the residue of a function and use the residue theorem to evaluate a contour integral over the real line.

5.	Understand and appreciate the concepts of Fourier series. Find the Fourier transform and the inverse Fourier transform of a function and will be able to apply these concepts in his technical subjects.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
MA2003-1.1	2	3	-	-	-	-	-	-	-	-	-	-	-	-
MA2003-1.2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
MA2003-1.3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
MA2003-1.4	2	3	-	-	-	-	-	-	-	-	-	-	-	-
MA2003-1.5	2	3	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", 43rd edition.

2. Kreysizg, "Advanced Engineering Mathematics", John Wiley and Sons, 6th Edition.

REFERENCE BOOKS:

1. Wylie Ray, "Advanced Engineering Mathematics", 6th edition, McGraw Hill.Inc.

2. Murray R. Spiegal, "Vector Analysis", Schuam Publishing Co.

PROBABILITY THEORY AND COMPUTATIONAL MATHEMATICS

Course Code:	**MA2009-1**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**50+50**
Prerequisites	**MA1001-1**		

Teaching Department: Mathematics

Course Objectives:

1.	Understand the concept of probabilistic models for situation involving chance effect.
2.	Study different types of probability distributions.
3.	Apply interpolation technique in real life problems
4.	Apply numerical differentiation and integration methods, where the function is a
5.	Complicated expression or given in terms of tabular values or not possible to evaluate

UNIT-I

Probability Theory — **15 Hours**

Finite sample space, probability and conditional probability and independence, Bayes' theorem. One dimensional random variable: discrete and continuous random variable, probability functions, cumulative distribution function, expectation and variance. Two Distributions: Binomial, Poisson, Normal and exponential distributions

UNIT-II

Finite Differences and Interpolation — **15 Hours**

Finite differences: forward, backward and central difference operators, Newton-Gregory forward and backward interpolation formulae, Lagrange's interpolation formula, Lagrange's Inverse interpolation formula. Newton's divided difference interpolation formula.
Numerical Differentiation: Numerical differentiation using Newton's forward & backward formulae.
Numerical integration: General quadrature formula, Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule.

UNIT-III

Numerical Methods — **10 Hours**

Solution of algebraic and transcendental equations: Regula falsi Method and Newton Raphson Method.
Numerical solution of ordinary differential equations: Taylor's series method, modified Euler's method and 4th order Runge –Kutta method, Predictor-Corrector methods
Numerical solution of partial differential equations: Solution of Laplace and Poisson equations by standard five point formulae, solution of heat and wave equations.

Course Outcomes: At the end of the course student will be able to

1.	Demonstrate and appreciate probabilistic models for situations involving chance effect.
2.	Illustrate the applications different types of distributions for engineering problems.
3.	Using finite differences and interpolation technique in solving real life problems
4.	Understand the numerical differentiation and integration methods and be able to apply these methods to solve engineering problems
5.	Apply numerical methods to solve partial differential equations.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 2
MA2009-1.1	2	3	-	-	-	-	-	-	-	-	-	-	-	-
MA2009-1.2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
MA2009-1.3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
MA2009-1.4	2	3	-	-	-	-	-	-	-	-	-	-	-	-
MA2009-1.5	2	3	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna publishers, 2012.

2. P. L. Meyer, "Introduction of probability and Statistical applications", Second Edition, American Publishing Co., 1975.

REFERENCE BOOKS:

1. Kreysizg, "Advanced Engineering Mathematics", John Wiley and Sons, 6th Edition.

2. S. S. Sastry, "Introductory methods of Numerical Analysis", 2nd Edition, Prentice Hall, 1990.

3. Wylie Ray, "Advanced Engineering Mathematics", 6th Edition, McGraw Hill.Inc

BRIDGE COURSES FOR LATERAL ENTRY STUDENTS

BRIDGE COURSE - CALCULUS AND LAPLACE TRANSFORMS

Course Code:	**MA1011-1**	**Course Type:**	**MNC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**00**
Total Teaching Hours:	**40+0+0+0**	**CIE + SEE Marks:**	**100+0**

Teaching Department: Mathematics

This course is prescribed to the lateral entry Diploma holders admitted to III semester of BE/B. Tech., programs, they shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student must fulfill the requirements during subsequent semester/s to appear for CIE.
MNC Courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree

Course Objectives:

1.	This course will enable the students to master the basic tools of differential calculus, partial differentiation, Laplace Transforms and Integration and become skilled for solving problems in science and engineering.

UNIT-I

Differential Calculus	**15 Hours**
Limit, continuity, differentiation rules-product rule, quotient rule and chain rule. Taylor's series, Maclaurin's series of simple functions in single variable.	
Partial Differentiation	
Definition, simple problems to find partial differentials, total differentiation, differentiation of composite functions, illustrative examples, and problems. Taylor's and Maclaurin's series for a function of 2 variables	

UNIT-II

Laplace Transforms	**15 Hours**
Definitions, transforms of elementary functions, transforms of derivatives and integrals- properties.	
Inverse Laplace Transform	
Inverse Laplace transforms and properties. Solutions of ordinary differential equations. Applications to engineering problems.	

UNIT-III

Integral Calculus	**10 Hours**
Introduction, rules of integration, solution of integrals using the methods-substitution and partial fraction, integrals of standard functions, definite integral, simple problems. Double integrals, change of order of integration, change in to polar coordinates. Triple integrals, simple Problems and applications.	

Course Outcomes: At the end of the course student will be able to

1.	Learn the concept of limit, continuity, differentiability, and Taylor's theorem.
2.	Learn the concept of partial differentiation of a function with two or more independent variables.
3.	Apply the concept of Laplace transform in engineering applications.
4.	Find the inverse Laplace transform and hence to solve differential equations
5.	Apply the notion of multiple integrals to find areas and volumes.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
MA1005-1.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
MA1005-1.2	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
MA1005-1.3	3	1	-	-	-	-	-	-	-	-	-	-	2	-	-
MA1005-1.4	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
MA1005-1.5	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-

1: Low 2: Medium 3: High

Assessment Details (CIE)

The weightage of Continuous Internal Evaluation (CIE) is 100% (No Semester End Exam (SEE)). T student must obtain minimum of 40% in CIE to pass.

Continuous Internal Evaluation:

1.	Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2.	The class teacher must decide the topic for closed book test and Written Quiz. The methods of CIE the subject must be announced at the beginning of the course.

TEXTBOOKS:	
1.	B.S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, 2015.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons, 2016.
REFERENCE BOOKS:	
1.	G.B. Thomas and R. L. Finney, "Calculus and Analytic geometry", Pearson, 2002.
2.	T. Veerarajan, "Engineering Mathematics", McGraw-Hill, New Delhi, 2008.
3.	B. V. Ramana, "Higher Engineering Mathematics", Tata Mc Graw –Hill, New Delhi, 2010

BRIDGE COURSE - PROBABILITY AND DIFFERENTIAL EQUATIONS

Course Code:	**MA1013-1**	**Course Type:**	**MNC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**00**
Total Teaching Hours:	**40+0+0+0**	**CIE + SEE Marks:**	**100+0**

Teaching Department: Mathematics

This course is prescribed to the lateral entry Diploma holders admitted to III semester of BE/B.Tech., programs, they shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE.
MNC Courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree

Course Objectives:

1.	This course will enable the students to master the basic tools of matrix theory, probability, differential equations, partial differential equations and become skilled for solving problems in science and engineering.

UNIT-I

Matrices	**08 Hours**

Elementary operations of a matrix, echelon form of a matrix, Rank of a matrix (both definitions). Consistency and solution of system of linear equations - Gauss elimination method. Eigen values and eigen vectors of matrices.

Probability	**07 Hours**

Finite sample space, event, mutually exclusive event, equally likely event, probability, addition theorem, conditional probability and independence conditions, multiplication theorem. Bayes' theorem.

UNIT-II

Differential Equations	**08 Hours**

Introduction, order and degree of differential equations, examples. Solution of first order and first-degree differential equations–variable separable method, Linear, Bernoulli's and exact differential equations (without I. F).

Second And Higher Order LDE	**07 Hours**

Second order linear differential equation with constant coefficients, solution by inverse differential operator and method of variation of parameters.

UNIT-III

First and Higher Order Partial Differential Equations	**10 Hours**

First and higher order partial differential equations. Formation of partial differential equations by elimination of arbitrary constants/ arbitrary functions. Solution of PDE's by direct integration method.

Course Outcomes: At the end of the course student will be able to

1.	Reduce the matrix to echelon form and find its rank
2.	Understand the concept of probability and apply Bayes theorem to real life problems
3.	Solve the differential equations
4.	Solve higher order linear differential equations
5.	Form partial differential equations by eliminating the arbitrary constants and functions

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
MA1007-1.1	3	2	-	-	-	-	-	-	-	-	-	-
MA1007-1.2	3	2	-	-	-	-	-	-	-	-	-	-
MA1007-1.3	2	2	-	-	-	-	-	-	-	-	-	-
MA1007-1.4	2	2	-	-	-	-	-	-	-	-	-	-
MA1007-1.5	3	2	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

Assessment Details (CIE)

The weightage of Continuous Internal Evaluation (CIE) is 100% (No semester end exam). The studer must obtain minimum of 40% marks individually in CIE to pass.

Continuous Internal Evaluation:

1. Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2. The class teacher must decide the topics for closed book test and Written Quiz The methods of CI for the subject must be announced at the beginning of the course.

TEXTBOOKS:

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, 10^{th} Edition (Reprint), John Wiley and Sons, 2016.

2. B. S. Grewal, “Higher Engineering Mathematics”, 43^{rd} Edition, Khanna Publications, 2015.

3. P. L. Meyer, “Introduction of Probability and Statistical Applications”, 2nd Edition, American Publishing, 1975.

REFERENCE BOOKS:

1. T. Veerarajan, “Engineering Mathematics”, McGraw-Hill, New Delhi, 2008.

2. B. V. Ramana, “Higher Engineering Mathematics”, Tata Mc Graw –Hill, New Delhi, 2010

3. N. P. Bali and M. Goyal, “A textbook of Engineering Mathematics”, Laxmi Publications, 2010.

INTEGRATED PROFESSIONAL CORE COURSES

BUILDING MATERIALS AND CONSTRUCTION

Course Code:	**CV2001-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L:T:P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: CIVIL ENGINEERING

Course Objectives:

1.	**Know** the types, uses, manufacturing process and properties of building materials like stone, brick and tiles.
2.	**Understand** the properties, types, uses of timber, cement and Other building material.
3.	**Discuss** the purpose of site investigation and types of foundation.
4.	**Identify** different types of masonry and building components.
5.	**Understand** the various materials used in different structural components.

UNIT-I

BUILDING STONE: Common building stones and their uses, quarrying, dressing of stones, deterioration and preservation. **BRICKS**: Manufacture, properties, testing, classification, uses and qualities as per BIS. **TILES**: Types and uses of tiles, testing and classification of Mangalore Tiles.	**07 Hours**
TIMBER: Varieties and uses, defects, seasoning, preservation and test for good timber its uses. **ENGINEERED TIMBER PRODUCTS**: Types, properties and uses. **Cement:** Types, Properties and applications. **MODERN BUILDING MATERIALS**: Properties and uses of Aluminum, Mild steel, Brass and Cast iron.	**07 Hours**

UNIT-II

SITE INVESTIGATION: Necessity, Importance, Bearing Capacity-definition and determination (method of dropping weight and plate load test). **FOUNDATIONS:** Introduction, classification, types- spread, combined, strap, raft and pile foundation (friction and load bearing piles).	**06 Hours**
STONE MASONRY: Classification – Rubble and Ashlar, masonry joints. **BRICK MASONRY:** Terminologies, Bonds – Rules, Types-English and Flemish bond (1 and 1.5 brick thick) **COMPOSITE MASONRY**: Reinforced brick and Glass block.	**05 Hours**
LINTELS: Classification and method of construction. **ARCHES**: Technical Terms, stability and classification. ***CHEJJA, CANOPY AND BALCONY**: method of construction*	**05 Hours**

UNIT-III

FLOORS: Requirements, Types and method of laying: mosaic, ceramic, marble, granite, vitrified tile and industrial flooring (granololitic) and floor coverings. **ROOFS AND ROOF COVERINGS: Roof-**Requirements and types. **Roof Coverings-**Mangalore tiles, Asbestos Cement Sheets and Galvanised Iron sheets, weather proofing for RCC roof slab. **STAIRS:** Technical terms, requirements and classification.	**05 Hours**

DOORS: Technical terms, location and types- paneled, glazed, flush**,** collapsible and rolling shutters. **WINDOWS:** Types -paneled, glazed, bay, dormer and corner window. **PLASTERING:** Types **-** lime and cement mortar. Special type of plastering: asbestos marble, acoustic, granite silicon, gypsum, stucco and lath plastering. ***PAINTING**: Purpose, types of paint- Varnishes, distemper, enamels and emulsion, application of paints on new and old surfaces.*	**05 Hours**

Suggested List of Experiments

MATERIAL TESTING LABORATORY

	Determination of Specific gravity of aggregates.
2.	Determination of grain size using sieve analysis of aggregates.
3.	Determination of Water absorption of aggregates.
4.	Determination of Bulk density of Aggregates.
5.	Determination of Bulking of Fine aggregate.
6.	Determination of compressive strength of Bricks and Tiles.
7.	Efflorescence and Hardness test on Brick.
8.	Determination of Normal Consistency of Cement.
9.	Determination of Setting time of cement.
10	Determination of Specific gravity of cement.
11	Determination of compressive strength of cement.

Course Outcomes: At the end of the course student will be able to

1.	**Describe** the properties, types and applications of common building materials like stone, brick and tiles.
2.	**Explain** the properties, types and uses of Timber, cement and modern building materials.
3.	**Explain** the field tests to determine the bearing capacity of soil and discuss the types of foundation.
4.	**Explain** the types of masonry and summarize the importance of building components.
5.	**Outline** the importance of floors, roof and roof coverings, stairs, doors, windows, plastering and painting.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													01	02	03
CV2001-1.1	1	2			1	1				1	1	2	1		
CV2001-1.2	2				2				1	1	3	1	1	2	2
CV2001-1.3	3	1					1						2	1	
CV2001-1.4	2	1					1						2	1	
CV2001-1.5	2	1					1						2	1	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. 1. Rangwala S.G., (2014), “Engineering Materials”, Charter Publishing House, Anand, India.

2. Rangwala S.G., (2017), “Building Construction”, Charter Publishing House, Anand, India.

3. Sushil Kumar, (2017), “Building Construction”, Standard Publication and Distributors, New Delhi.

REFERENCE BOOKS:

1. 1. P.C. Varghese (2015). “Building Materials”, PHI Learning Pvt. Ltd. Publication.

2. B.C. Punmia, Ashok Kr. Jain, Arun Kr. Jain (2016). “Building Construction”, Laxmi Publications Pvt. Limited.

3. Mohan Rai and Jai Singh, (2010). “Advanced Building Materials and Construction”, CBRI Publications, Roorkee.

E Books / MOOCs/ NPTEL

1. **NPTL ONLINE SOURCE:** http://nptel.ac.in/courses/105102088/

FLUID MECHANICS AND HYDRAULICS

Course Code:	**CV2002-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	Explain the basic properties of fluids, types of fluids and measurement of pressure
2.	Classify the flows and Apply continuity equation and Bernoulli's energy equation for fluid flow problems
3.	Analyse flow through pipes and measuring devices
4.	Explain uniform flow, determine most economical channel sections applying Chezy's and Manning's formulae
5.	Determine force of impact of jet on vanes.

UNIT-I

INTRODUCTION, FLUID PROPERTIES AND CLASSIFICATION OF FLUIDS	**07 Hours**
Scope and Importance, Definition of fluid, Distinction between solids and fluids, liquid and gas, fluid continuum, Definitions: Mass density, Specific Volume, Specific Weight, Relative density, Viscosity, Newton's law of viscosity, Newtonian and Non-Newtonian Fluids, Ideal and Real fluids, Compressibility, Vapour pressure, Surface tension and Capillarity.	
FLUID PRESSURE, FLUID STATICS AND FLUID KINEMATICS	**08 Hours**
Definition of pressure, Pressure at a point, Pascal's law and Hydrostatic pressure law (no derivation), Absolute and Gauge pressure, Measurement of pressure - Simple and Differential manometers, Bourdon's pressure gauges. Introduction to total pressure and center of pressure on immersed plane surfaces (no derivations). Classification of flow, lines of flow, continuity equation (for one dimensional flow only) and its applications.	

UNIT-II

FLUID DYNAMICS	**04Hours**
Euler's equation and Bernoulli's energy equation with assumptions and limitations (No derivation), Applications of Bernoulli's energy equation - Pitot tube and Venturimeter.	
FLOW THROUGH PIPES	**04 Hours**
Major and minor losses in pipe flow, Equation for head loss due to friction (Darcy-Weisbach equation-no derivation), Minor losses (types), Pipes in series, Parallel and equivalent pipe. Water hammer in pipes -Definition, causes, effects and control, Surge tanks- Functions and types.	
FLOW MEASUREMENTS	**07 Hours**
Flow through Orifices - Classification, Hydraulic co-efficients of an Orifice and relationship between them, Flow through mouth pieces- Classification. Classification of notches and weirs, Equation for discharge over rectangular, trapezoidal, V-notch and Cippoletti notch.	

UNIT-III

FLOW IN OPEN CHANNELS	**05 Hours**
Definition, classification, comparison between pipe flow and open channel flow, types of flow, Geometric properties, Uniform flow –Chezy's and Manning's formulae, most economical sections. Derivation of conditions for most economical rectangular and trapezoidal channel sections.	
IMPACT OF JET ON VANES	**05 Hours**

Introduction, Impulse–momentum equation and its applications, Force exerted by a jet on fixed and moving vanes, on a series of flat vanes and curved vanes (no derivations) work done and efficiency.

Course Outcomes: At the end of the course student will be able to

1.	Illustrate properties of fluids.
2.	Explain measurement of pressure, classify the flows and apply continuity equation on fluid flow problems.
3.	Explain Bernoulli's energy equation for fluid flow and make use of this equation on venturimeter, Pitot tube, flow through pipes and analyse water hammer in pipes
4.	Determine flow through orifices, mouthpieces, notches and weirs
5.	Determine most economical channel sections applying Chezy's and Manning's formulae and analyse force exerted by a jet striking on vanes applying impulse-momentum principle

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes															
1	2	2											2	2	
2	2	2	2										2	2	
3	2	3	3										2	3	2
4	2	3	2										2	3	2
5	2	3	3										2	3	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Modi, P.N. and Seth, S.M., Hydraulics and Fluid Mechanics, Standard Book House, 22nd ed., 2019.
2.	R.K Bansal, A Textbook of Fluid Mechanics and Hydraulic Machines, 9th ed., 2015.

REFERENCE BOOKS:

1.	A.K. Jain., "Fluid Mechanics", Khanna Publishers, New Delhi. 8th edition, 1995.
2.	S. Ramamrutham., "Hydraulics, Fluid Mechanics and Fluid Machines". DhanpatRai Publishing Company (P) Limited, 9th edition,2009.
3.	H. M. Raghunath., "Fluid Mechanics & Machinery in SI Units", CBS Publishers.1999
4.	K. Subramanya "Fluid Mechanics and Hydraulic Machines" Mc Graw Hill India, 2nd edition 2018.

E Books / MOOCs/ NPTEL

1.	http://nptel.ac.in/courses/105103095/
2.	http://nptel.ac.in/courses/112105218/

Public Health Engineering

Course Code:	**CV2003-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L: T: P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CV1002-1**		

Teaching Department: Civil Engineering

Course Objectives: This Course will enable students to

1.	Discuss various methods of population forecasting and explain the characteristics of water.
2.	Depict the information about water treatment units
3.	Determine the objectives of wastewater collection and analyzing the characteristics of wastewater
4.	Depict the information about wastewater treatment units.
5.	Discuss the various methods of the water distribution system and explain the laying, testing of sewers and sewer appurtenances.

UNIT-I

QUANTITY and QUALITY OF WATER	**08 Hours**
Human activities and environmental pollution, Types of water demands, Per capita consumption, Factors affecting per capita demand, Population forecasting methods, Fire demand, design periods & factors governing the design period. Physical, chemical and biological examinations using analytical and instrumental techniques.	
TREATMENT OF WATER	**08 Hours**
Flow diagram of municipal water treatment plant. Preliminary treatment. Primary treatment: sedimentation tanks – theory and operation, types, Sedimentation aided with coagulants like copperas and alum. Filtration: Mechanism, theory of filtration, slow sand, rapid sand and pressure filters. Disinfection- methods of disinfection, Softening: lime soda process and zeolite process, fluoridation and de-fluoridation.	

UNIT-II

QUANTITY AND ANALYSIS OF SEWAGE	**08 Hours**
Introduction: Necessity for sanitation, methods of domestic waste water disposal, types of sewerage systems and their suitability. Quantity of sewage: Dry weather flow, factors affecting dry weather flow, estimation of storm flow, rational method and empirical formulae for design of storm water drain, time of concentration. Self-cleansing and non-scouring velocities. Physical, chemical and biological characteristics, BOD and COD. Disposal of effluents – natural methods.	
TREATMENT OF WASTEWATER	**08 Hours**
Flow diagram of municipal water and wastewater treatment plant, Preliminary treatment- Screening, grit chambers, skimming tanks, Primary treatment, Secondary treatment: Attached growth process-trickling filter, suspended growth process – Activated sludge process.	

UNIT-III

CONVEYANCE AND DISTRIBUTION OF WATER	**04 Hours**
Collection and conveyance of water from surface and subsurface sources, intake structures. Methods of distribution systems- System of supply and Methods of layout distribution.	
LAYING, TESTING OF SEWERS AND SEWER APPERTENUNCES	**04 Hours**
Laying, testing, ventilation of sewers. Sewer appurtenances: manholes, oil and grease traps, drainage traps.	

Suggested List of Experiments

	Determination of solids in sewage: Total solids, suspended solids, dissolved solids, volatile Solids, fixed Solids and settable solids.
2.	Determination of Electrical conductivity.
3.	Determination of Turbidity
4.	Determination of Chlorides.
5.	Determination of Alkalinity, Acidity and pH.
6.	Determination of Calcium, Magnesium and Total Hardness
7.	Determination of Dissolved Oxygen.
8.	Determination of BOD
9.	Determination of COD.
10.	Determination of Available Chlorine in bleaching powder
11.	Determination of Chlorine Demand and Residual Chlorine
12.	Determination of Optimum dosage of Alum by Jar test.
13.	Determination of Iron.
14.	Determination of Sulphate.
15.	Determination of Nitrates.

Course Outcomes: At the end of the course student will be able to

1.	Identify the sources and characteristics of water.
2.	Estimate the quantity of drinking water and design the various treatment units.
3.	Identify the source and estimate quantity of wastewater generated.
4.	Analyze characteristics of wastewater, explain the importance of disposal of sewage and design the various treatment units.
5.	Understand the process of conveyance and distribution of water and laying and testing of sewers.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2007-1.1	2	1	-	-	-	2	2	1	-	-	-	-	2	3	-
CV2007-1.2	2	2	3	-	-	2	2	1	-	-	-	-	2	3	-
CV2007-1.3	1	2	1	-	-	2	3	2	-	-	-	-	1	3	-
CV2007-1.4	1	1	-	-	-	2	3	1	-	-	-	-	1	3	-
CV2007-1.5	1	2	3	-	-	2	3	2	-	-	-	-	1	3	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	S.K. Garg, “Water Supply Engineering”, Khanna Publishers, 2016
2.	B.C. Punmia and Ashok Jain, “Environmental Engineering - I”, Lakshmi Publications, 2017
3.	S. K. Garg, “Wastewater treatment”, Khanna Publishers.2016
4.	B.C. Punmia and Ashok Jain, “Environmental Engineering II”, Lakshmi Publications, 2017.

REFERENCE BOOKS:

1.	Hammer and Hammer, ―Water Technology‖, Tata McGraw Hill, 2016
2.	Howard S. Peavey, Donald R. Rowe, George Tchobanoglous, ―Environmental Engineering‖, McGraw Hill International Edition, 2013.
3.	Metcalf & Eddy Inc., George Tchobanoglous, H. David Stensel, RyujiroTsuchihashi, Franklin L. Burton, Wastewater Engineering: Treatment and Resource Recovery, New York, USA: McGraw-Hill Education, 2014.

4.	Mark J. Hammer and Mark. J. Hammer, Jr., ―Water and Wastewater Technology, Eastern Economy Editions, 2016.
5.	Howard Peavey, Donald Rowe, George Tchobanoglous, Environmental Engineering (I Edition), New York, USA: McGraw Hill Education, 2017.
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/105/105/105105201/
2.	https://nptel.ac.in/courses/105/105/105105048/
3.	https:/nptel.ac.in/noc/courses/noc18/SEM2/noc18-ce26/
4.	http://www.nptelvideos.in/2012/11/water-wastewater-engineering.html

GEODETIC ENGINEERING

Course Code:	**CV2004-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L: T: P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Civil Engineering

Course Objectives: This Course will enable students to

1.	**Summarize** the surveying; **explain** the basic principles, **measure** distances and angles.
2.	**Summarize** the methods of leveling, traversing and **compute** the levels and closing error.
3.	**Summarize** the use of contours and **compute** the area and volume measurements.
4.	**Study the** digital surveying instruments, such as Total station, GNSS and Global Positioning Systems
5.	**Study** the basics of photogrammetry, Remote sensing, GIS and its Applications.

UNIT-I

Introduction; Measurement of Horizontal Distances, Angles and Directions	**07 Hours**

Definition, objectives and importance, primary divisions, classification, instruments for setting out right angles. Surveying measurements and errors, types of errors, precision and accuracy.

Horizontal distances - using tapes, taping on level ground and sloping ground, systematic errors in linear measurement by tape, ranging of lines – types. Direction of a line, types of bearings, azimuth, conversion of bearing and azimuth.

Computation of levels; Traversing	**08 Hours**

Computation of levels - Basic terms and definitions, curvature and refraction, Principle of leveling, Types – Differential, Profile, Reciprocal leveling. Level Computation - Height of Instrument Method, Rise and Fall Method.

Traversing - Types, Latitudes and departures, Closed traverse computations and adjustments – Transit rule, Bowditch (compass) rule, omitted measurements.

UNIT-II

Contours; Measurement of area and volumes	**07 Hours**

Contours - Basic definitions, Characteristics of contours, uses of contours, Interpolation of contours.
Measurement of area – by dividing into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpson's one third rule, area from co-ordinates, planimeter – principle and measurement.
Measurement of Volumes - Trapezoidal and prismoidal formula, reservoir capacity.

Digital land surveying instruments: Total Station, Global Positioning Systems & GNSS	**08 Hours**

Electronic Distance Measurement (Total Station) - Basic Concept, Classification of Electromagnetic Radiation, Principle of EDM, Errors, Accuracy, Effect of Atmospheric conditions on wave velocity, computing distance from the phase differences, Instrumental errors, Triangulation and Trilateration, Working principle of Global Positioning Systems & GNSS and its applications.

UNIT-III

Maps; Photogrammetry	**05 Hours**

Photogrammetry: Stereo images, Scale in Aerial photographs, Parallax, Advantages, Geometry of Aerial Photographs - Scale of Vertical Photographs, Relief Displacement, Flight planning, Applications.

Geospatial Techniques	**05 Hours**

Introduction to remote sensing and Geographical Information System: Applications in Civil Engineering (transportation, town planning).

Suggested List of Experiments

Minor Exercise

1.	Determination of Reduced levels of given points.
2.	Introduction to Total Station, Components, Temporary Adjustments
3.	Measurement of Horizontal and Sloping Distance / Horizontal and Vertical angle measurement using Total Station
4.	Orientation of Total Station using compass and Measurement of Magnetic Bearings and co-ordinates (N, E, Z) of various points from one instrument position.
5.	Determination of Height of Buildings / Towers / Power line (remote elevation measurement), Determination of Distance between two points (missing line measurement).
6.	Detailed survey of an area including creation of job file, selecting appropriate point codes, measurement of coordinates, downloading of data and preparation of contour map.

Major Exercise

7.	Traversing using Total Station (Orientation at the first station by compass and at subsequent stations by back sighting) and Area measurement.
8.	Setting out positions of column centres of a Multi-storey Building

Demonstration Experiments

1.	Demonstration of L/S, C/S using SW_DTM and Auto CAD
2.	Contouring plotting using SW_DTM and Auto CAD

Course Outcomes: At the end of the course student will be able to

1.	**Classify** the surveying, **explain** the principles, **measure** distances and angles
2.	**Explain** the methods of leveling, traversing and **compute** the levels and closing error.
3.	**Explain** the use of contours and **compute** the area and volume measurements.
4.	**Summarize** the principles and applications of Total Station GPS, GNSS, and Global Positioning systems.
5.	**Explain** the concepts and applications of Photogrammetry, Remote Sensing, GIS and its applications.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
21CV402.1	2	-	-	-	-	-	-	-	-	-	-	-	1		-
21CV402.2	2	-	-	-	-	-	-	-	-	2	-	-	1	1	-
21CV402.3	2	3	-	-	-	-	-	-	-	2	-	-	1	1	-
21CV402.4	2	3	-	-	-	-	-	-	-	2	-	-	1	1	-
21CV402.5	2	3	-	-	-	-	-	-	-	-	-	-	1	1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. B.C. Punmia, “Surveying Vol I & Vol II”, Laxmi Publications pvt. Ltd., New Delhi. – 2016.

2.	R Subramanian, “Surveying and Leveling”. Oxford University Press (2016)
3.	C. Venkataramiah, “Text Book of Surveying”, Universities Press.(2009 Reprint)
REFERENCE BOOKS:	
1.	K.R. Arora, “Surveying (Vol. 1, 2, 3)” Standard Book House, New Delhi. – 2016.
2.	P. R. Wolf, “Elements of Photogrammetry”, McGraw Hill Publications - 2019
3.	T.M Lillesand, R.W Kiefer, and J.W Chipman, Remote sensing and Image interpretation , 5th edition, John Wiley and Sons India.
4.	Kang-tsung Chang, Introduction to geographic information systems, McGraw Hill Higher Education.
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/105/107/105107122/
2.	http://www.nptelvideos.in/2012/11/surveying.html

DESIGN OF RCC STRUCTURAL ELEMENTS

Course Code:	**CV2005-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L: T: P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CV2107-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	To summarize the basic knowledge of construction materials, codal requirements, limit state method and working stress method.
2.	To analyze the singly reinforced section and doubly reinforced section subjected to flexure and shear.
3.	To know the design and detailing concepts of RC beams by limit state method as per IS 456: 2000.
4.	To know the design and detailing concepts of RC columns by limit state method as per IS 456: 2000.
5.	To know the design and detailing of RC one way slabs and two way slabs for different boundary conditions as per IS 456: 2000.

UNIT-I

16 Hours

Introduction to RCC

Materials, advantage and general features of Reinforced Concrete (RC), design requirements of IS 456:2000, design philosophy – Working stress and Limit State Methods.

Principles of Limit State Method of design and Ultimate Strength of RC sections

Introduction, characteristic and design loads, principles of LSM of design, characteristic and design strength, general aspects of ultimate strength, stress block parameters for limit state of collapse, analysis of RC sections - ultimate flexural strength of singly reinforced and doubly reinforced sections, ultimate shear strength of RC sections, Concepts of development length and anchorage

UNIT-II

14 Hours

Serviceability Limit States

General aspects, deflection limits as per IS 456:2000, calculation of deflection (theoretical method), cracking in structural concrete members, crack width computation.

Design of Beams

Practical requirements, critical section design procedures for moments and shears, check for anchorages and development length, design of rectangular sections (simply supported and cantilever beams).

Design of Columns - General aspects, effective length, loads, slenderness ratio, minimum eccentricity, design of short axially loaded columns, design of columns subjected to combined axial load, uniaxial and biaxial bending using IS 456:2000 and SP 16.

UNIT-III

10 Hours

Design of Slabs

Practical requirements, design of simply supported one way and two way slabs for selected boundary conditions and design of cantilever slabs as per IS456:2000.

Suggested List of Experiments (Detailing)

	Detailing of RC structures using Auto Cad – Beams (Singly reinforced and doubly reinforced beam).
2.	Detailing of RC structures using Auto Cad – Cantilever beam.
3.	Detailing of RC structures using Auto Cad – Slabs (One way slab and two way slab).
4.	Detailing of RC structures using Auto Cad – Continuous slabs.
5.	Detailing of RC structures using Auto Cad – Cantilever slab.
6.	Detailing of RC structures using Auto Cad – Continuous Beams.
7.	Detailing of RC structures using Auto Cad – Columns.
8.	Detailing of RC structures using Auto Cad – footings (Isolated square and rectangular footing).
9.	Detailing of RC structures using Auto Cad – Combined footing.
10.	Detailing of RC structures using Auto Cad – Mat foundation
11.	Detailing of RC structures using Auto Cad – Dog-legged stair case.
12.	Detailing of RC structures using Auto Cad – Spiral stair case.

Course Outcomes: At the end of the course student will be able to

1.	Explain the working stress and limit state methods as per IS 456:2000.
2.	Estimate the moment carrying capacity and shear resistance of singly reinforced section and doubly reinforced section using limit state method.
3.	Analyze, design and sketch the structural detailing of rectangular RC beams.
4.	Analyze, design and sketch the structural detailing of RC columns.
5.	Analyze, design and sketch the structural detailing of one way, two way and cantilever RC slabs.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2002-1.1	1	-	-	-	-	-	-	1	-	-	-	1	1	2	-
CV2002-1.2	2	2	-	-	-	-	-	1	-	-	-	1	2	2	-
CV2002-1.3	2	1	3	-	-	-	-	1	-	-	-	1	2	3	2
CV2002-1.4	2	1	3	-	-	-	-	1	-	-	-	1	2	3	2
CV2002-1.5	2	1	3	-	-	-	-	1	-	-	-	1	2	3	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. N. Krishnaraju and R.N.Pranesh, Reinforced Concrete Design (IS456:2000)-Principles and Practice, New Age International Publishers, New Delhi, 2006.
2. Dr. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Limit State Design of Reinforced Concrete, Laxmi Publications (P) Limited, New Delhi, 2007.

REFERENCE BOOKS:

1. Dr. Ramchandra and Virendra Gehlot, Limit State Design of Concrete Structures (As per IS: 456-2000), Scientific Publishers (India), Jodhpur, 2010.
2. S. N. Sinha, Reinforced Concrete Design, Tata- McGraw Hill Publishing Company Limited, New Delhi, 2014.
3. Dr. P.C. Varghese, Limit State Design of Reinforced concrete, 2nd Edition, Prentice Hall of India Private Limited, 2004.
4. IS: 456-2000 (to be supplied in the examination), SP16.

E Books / MOOCs/ NPTEL

1. https://nptel.ac.in/courses/101/104/105105105/

GEOTECHNICAL ENGINEERING

Course Code:	**CV2006-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L: T: P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CV1001-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	To acquire knowledge of Soil as a three phase system and explain index properties.
2.	To understand the need for soil classification based on IS classification systems and to know the concept of Soil Structure also to Describe the various types and methods involved in the study of stresses under various types of loadings.
3.	To understand the concept of Permeability and Capillarity on soils and study the effect of Compaction Characteristics on soil.
4.	To understand the Consolidation characteristic of soil and its use in the field of foundation engineering.
5.	To understand the Shear Strength of soil and its determination-using laboratory experiments, and Assess the bearing capacity of various types of shallow foundations and estimate the probable settlements.

UNIT-I

INDEX PROPERTIES OF SOILS AND THEIR DETERMINATION:	**07 Hours**

Phase Diagram, Definitions- void ratio, porosity, degree of saturation, percentage air voids, air content, specific gravity, water content, soil densities, functional relationships, field identification of soils.
Index Properties: Grain size distribution, Atterberg‘s Limits and Indices, Insitu density, density index Laboratory determination: specific gravity, grain size distribution-sieve analysis and sedimentation analysis (Hydrometer Method), Liquid Limit (Casagrande Method), plastic limit and shrinkage limit.

SOIL CLASSIFICATION and STRUCTURE	**04 Hours**

Classification of soils: Need for classification, Plasticity Chart and its importance, IS Soil Classification System.
Soil structure Soil structure –Single grained, honey combed, flocculent and dispersed structures.

STRESS DISTRIBUTION IN SOILS:	**05 Hours**

Boussinesq's theory – point load, line load, strip load, uniformly loaded circular area, Vertical stress distribution diagrams, Newmark’s influence chart, Westergard’s equation, Comparison.

UNIT-II

SOIL HYDRAULICS:	**05Hours**

Darcy's law - assumptions and validity; coefficient of permeability, Seepage velocity, superficial velocity and coefficient of percolation. Laboratory determination (constant head and variable head tests), field determination (pumping out test). Factors affecting permeability.

SOIL COMPACTION:	**04 Hours**

SOIL COMPACTION: Moisture–density relationship, Zero-air voids line, laboratory tests (light and heavy compaction), factors affecting compaction. Field compaction methods, compaction specifications and field control.

COMPRESSIBILITY OF SOIL AND CONSOLIDATION:	**05Hours**

Compressibility of soil and consolidation: Compressibility of soil and volume change- compression index, coefficient of compressibility, coefficient of volume change. The consolidation process- spring analogy, normally consolidated and over consolidated soils, pre-consolidation pressure and its determination (Casagrande method). Terzaghi's theory of one-dimensional consolidation – assumptions, coefficient of consolidation and its determination by square root of time and logarithm of time fitting methods, computation of consolidation settlement.

UNIT-III

SHEAR STRENGTH OF SOILS:	**05 Hours**

Shear strength of soils: Stress – strain curve, Mohr - Coulomb failure criterion, peak and residual strength theory. Total and effective shear strength parameters, laboratory measurement of shear strength parameters by direct shear test, tri-axial compression test (different drainage condition), unconfined compression test and vane shear test. Factors affecting shear strength of soils, sensitivity and thixotropy.

BEARING CAPACITY AND SETTLEMENT OF SHALLOW FOUNDATIONS	**05 Hours**

bearing capacity of shallow foundations: Basic definitions, types of shear failure in foundation soil, Terzaghi‘s and IS code methods, effect of ground water table and eccentricity.
SETTLEMENT: Types and modes of settlement -Allowable limits of settlement (IS 1904- 1986) allowable bearing pressure.

Suggested List of Experiments

1.	Specific gravity of coarse and fine grained soils, moisture content (oven drying and pycnometer).
2.	Grain size analysis (sieve analysis) and classification.
3.	In situ density by core cutter and sand replacement methods
4.	Atterberg‘s limits and indices.
5.	Standard Compaction Test (IS light compaction test).
6.	Coefficient of permeability (constant head and variable head methods).
7.	Consolidation Test.
8.	Direct shear test
9.	Tri-axial Compression Test (undrained)
10.	Unconfined compression strength test
11.	Laboratory Vane shear test
12.	California Bearing Ratio test.

Course Outcomes: At the end of the course student will be able to

1.	Assess the index properties of soil and to analyze the index properties of soil using laboratory tests .
2.	Explain the need for classification, classify the soil based on ISSCS, illustrate thesoil structure, and Describe the various types and methods involved in the study of stresses under various types of loadings.
3.	Assess the permeability and compaction characteristics of soils.
4.	Make use of principle of consolidation and to estimate the coefficient of consolidation using odometer test.
5.	Evaluate the shear strength parameters of soil and measure its shear strength, Determine the bearing capacity of shallow foundations applying Terzaghi‘s, IS code methods and estimate the settlement of foundation.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2005-1.1	2	2	1	-	-	-	-	-	-	-	-	-	2	2	-
CV2005-1.2	1	3	1	-	-	-	-	-	-	-	-	-	1	3	-
CV2005-1.3	2	3	1	-	-	-	-	-	-	-	-	-	2	2	-

CV2005-1.4	2	3	2	-	-	-	-	-	-	-	-	-	2	2	-
CV2005-1.5	2	3	3	-	-	-	-	-	-	-	-	-	1	3	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Punmia B.C. (2017) “Soil Mechanics and Foundations” Laxmi Publishing Co.
2.	Gopal Ranjan and Rao A.S.R., “Basic and Applied Soil Mechanics”, New Age International Pvt Ltd, Publishers (2016)

REFERENCE BOOKS:

1.	Purushothama Raj. P., (2005) “Geotechnical Engineering”, Tata McGraw Hill Publishing Company Ltd, New Delhi.
2.	Murthy V.N.S., (2018) “Principles of Soil Mechanics and Foundation Engineering”, UBS Publishers Distributors Pvt. Ltd.
3.	B. M. Das, and Nagaratnam (2019)”Principles of Foundation Engineering, Ninth Edition, SI Edition.
4.	Venkatramaiah C (2006) “Geotechnical Engineering”, Universities Press (India) Ltd.
5	Terzaghi K. and Peck R.B., (1996) “Soil Mechanics in Engineering Practice” John Wiley & Sons, Inc.
6	Muni Budhu, Soil Mechanics and Foundations, Third Edition, John Wiley And Sons, Inc, 2010.
7.	Indian Standard code of practice for design and construction of foundations in soils: general requirements, is: 1904 –1986.

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/105/105/105105176/ https://nptel.ac.in/courses/105/101/105101083/ https://nptel.ac.in/courses/105/107/105107120/
2.	https://nptel.ac.in/courses/105/101/105101201/ https://nptel.ac.in/courses/105/105/105105185/ https://nptel.ac.in/courses/105/101/105101160/

DESIGN OF STEEL STRUCTURAL ELEMENTS

Course Code:	**CV2007-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L: T: P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CV2107-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the behavior of different types of steel structures
2.	Identify different types of sections used in steel construction
3.	Assess the strength and stability of components of steel structures
4.	Analyse the strength of various types of members as per the codal provisions
5.	Study the concepts of Design the structural components, viz., tension members, compression members, flexural members, column bases, bolted and welded connections using IS800:2007, steel tables and they are to Understand the importance of steel structures and their connections.

UNIT-I

16 Hours

INTRODUCTION: Advantages and disadvantages of steel structures, failure criteria for steel, IS codal provisions, section classification.
BOLTED CONNECTIONS: Advantages and disadvantages, Design strength of HSFG bolts, design of simple bolted connections (lap and butt), bracket connections.
WELDED CONNECTIONS: Advantages and disadvantages, strength of welds, design of simple welded connections.
Limit State Method of design, Types of welds, defects in welds

UNIT-II

14 Hours

DESIGN OF TENSION MEMBERS: Modes of failure, design of axially loaded tension members and their connections.
DESIGN OF COMPRESSION MEMBERS: Modes of failure, Design of single angle struts, compression members, Design of built up compression members.
COLUMN BASES: Design of simple slab base, gusseted base.

UNIT-III

10 Hours

DESIGN OF FLEXURAL MEMBERS: Types of beams, Modes of failure, Design strength of laterally supported and unsupported beams in bending and shear, Maximum deflection, Design of laterally supported and unsupported beams.
TYPES OF CONNECTIONS: Bracket connections - bolted and welded.

Suggested List of Experiments

	Detailing of Steel Structure using Auto Cad – Simple Seated Connection and Cleated Connection
	Detailing of Steel Structure using Auto Cad – Beam to Beam connection
	Detailing of Steel Structure using Auto Cad – Beam to Column Connection
	Detailing of Steel Structure using Auto Cad – Slab Base
	Detailing of Steel Structure using Auto Cad – Gusseted Base
	Detailing of Steel Structure using Auto Cad – Simple Truss end connection

Course Outcomes: At the end of the course student will be able to

1.	Explain the basic design philosophy to analyze and design the bolted and welded connections, as per IS 800:2007 guidelines.
2.	Analyze and design the tension and compression members with connections for the failure mechanisms.

3.	Analyze and design the compression, built-up compression members with slab base and gusseted base connection.
4.	Design laterally restrained and unrestrained beams and check the adequacy.
5.	Analyze and design bolted and welded bracket connections,

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2003-1.1	1	2	3	-	-	-	-	1	1	-	-	-	3	2	2
CV2003-1.2	1	2	3	-	-	-	-	1	1	-	-	-	3	2	2
CV2003-1.3	-	2	3	-	-	-	-	1	1	-	-	-	3	2	2
CV2003-1.4	1	2	3	-	-	-	-	1	1	-	-	-	3	2	2
CV2003-1.5	-	2	3	-	-	-	-	1	1	-	-	-	3	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	N. Subramanian, “Design of Steel Structures”, Oxford University Press, 2014.
2.	S. K. Duggal, “Limit State Design of steel structures”, Tata McGraw Hill, 2013.

REFERENCE BOOKS:

1.	S. S. Bhavikatti, “Design of Steel Structures by Limit State Method as per IS 800: 2007”, I.K. International Publishing House Pvt. Ltd., 2013.
2.	IS – 800: 2007, Steel tables (to be supplied in examination).
3.	V. L. Shah and Veena Gore, “Limit State Design of Steel Structures (IS 800: 2007)”, Structures Publications, Pune, 2010.
4.	Ram Chandra and Virendra Gehlot, “Limit State Design of Steel Structures”, Scientific Publishers (India), 2013.

E Books / MOOCs/ NPTEL

1.	http://nptel.ac.in/courses/105103094/
2.	http://nptel.ac.in/courses/105106112/

QUANTITY SURVEYING AND CONTRACT MANAGEMENT

Course Code:	**CV2008-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L: T: P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CV2001-1, CV2002-1, CV2003-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Estimate the quantities of different items of work by using Centre line method to know the approximate construction cost of buildings.
2.	Estimate the quantities of various items of work using the long wall-short wall method to determine the approximate cost of building construction.
3.	Explain the specifications of Civil construction works.
4.	Find the quantities and able to calculate the rates of items.
5.	Outline the contract systems from the point of contractor's interest to avoid conflicts between client and contractors.

UNIT-I	
ESTIMATES:	**08 Hours**
Types, units of measurements, abstract, cost of materials and labour.	
BUILDING ESTIMATE:	**08 Hours**
Methods of quantity extraction, cost of materials from Schedule of Rate (SR), preparation of detailed estimate for the load bearing structures using center line method and long wall-short wall method, preparation of detailed estimate of R.C.C structures.	
UNIT-II	
SPECIFICATION:	**08 Hours**
Objectives, essentials, general and detailed specification of common building items.	
RATE ANALYSIS:	**08 Hours**
Working out quantities and rates for earth work in different types of soils, P.C.C and R.C.C for different mixes, bricks and stone masonry, centering and form work for different RCC structural components flooring, plastering and painting.	
UNIT-III	
CONTRACT MANAGEMENT (Pre award):	**04 Hours**
Tendering Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Letter of intent, Award of contract, letter of acceptance and notice to proceed.	
CONTRACT MANAGEMENT (Post award):	**04 Hours**
Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, breach of contract, Liquidated damages and bonus, measurement and payment.	

Suggested List of Experiments

1	Preparation of detailed estimate for the load bearing structures by center line method using AutoCAD and MS Excel

PROFESSIONAL CORE COURSES (THEORY)

Problem Solving Using Python

Course Code:	**CV2101-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CS1001-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand fundamental programming concepts using functions.
2.	Write and execute basic python programs using functions.
3.	Work on visualization using the built-in matplotlib functions.
4.	Create graphs using built-in matplotlib functions.
5.	Construct simple Graphical User Interface (GUI)

UNIT-I

15 Hours

Functions: Scope, parameter passing, mutable/immutable properties of data objects, passing strings, lists, tuples, dictionaries to functions, default parameters, positional parameters, return values, functions using libraries, mathematical and string functions.

UNIT-II

15 Hours

Visualization with Matplotlib - General Matplotlib Tips, Simple Line Plots, Simple Scatter Plots, Visualizing Errors, Density and Contour Plots, Histograms.

UNIT-III

10 Hours

Graphical user interfaces; event-driven programming paradigm; creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames.

Course Outcomes: At the end of the course student will be able to

1.	Explain the basic program constructs and file operations in Python and express it.
2.	Design the Python programs using the concepts like strings, conversion of strings to numbers, lists, tuples and dictionaries.
3.	Implement the functions and object oriented programming concepts in python.
4.	Create a Graphical User Interface, multiple threads and Client/Server programs in python.
5.	Implement a database connection and CGI programs in python.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2105-1.1	3	3	-	-	3	-	-	-	1	-	-	3	2	2	-
CV2105-1.2	3	3	-	-	3	-	-	-	1	-	-	3	2	2	-
CV2105-1.3	3	3	-	-	3	-	-	-	2	-	-	3	2	2	2
CV2105-1.4	3	3	-	-	3	-	-	-	3	-	-	3	2	2	-

CV2105-1.5	3	3	-	-	3	-	-	-	2	-	-	3	2	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning,
2.	Magnus Lie Hetland, Beginning Python from Novice to Professional, Second Edition.
3.	Mark Summerfield, Programming in Python 3 - A Complete Introduction to the Python Language, Second Edition.
4.	Y. Daniel Liang, “Introduction to Programming Using Python”, Pearson, ISBN: 978-0-13-274718-9, 2013.
REFERENCE BOOKS:	
1.	Chun, J Wesley, Core Python Programming, 2nd Edition, Pearson, 2007 Reprint 2010.
2.	Python Cookbook, Third Edition, David Beazley and Brian K. Jones, Shroff Publishers & Distributors Pvt. Ltd., ISBN : 978-93-5110-140-6
3.	Learning Python, Fifth Edition, Mark Lutz.
4.	Programming Python (English) 4th Edition Mark Lutz.
5	Testing Python, David Sale, Wiley India (P) Ltd., ISBN: 978-81-265-5277-1.
E Books / MOOCs/ NPTEL	

Strength of Materials

Course Code:	**CV2102-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand and determine the stresses, strains in bars, volumetric strain, elastic constants and thermal stresses
2.	Understand and determine normal and shear stresses on a given plane, principal stresses and their planes for a general 2-D stress system
3.	Understand the variation of bending and shear stress across various beam sections and find slope and deflection in determinate beams applying Mecaulay's method
4	Analyze thin and thick cylinders subjected fluid pressure
5.	Understand the behavior of different types of columns subjected to axial load and compute buckling load of long columns and to design a shaft subjected to torque

UNIT-I

Simple Stresses and Strain: Introduction, Total Elongation of bars of constant and varying sections. Elongation due to self-weight, statically indeterminate members. volumetric strain, elastic constants, and their relationship. Thermal stresses (excluding thermal stresses in compound bars).	**8 Hours**
Compound stresses: Introduction, stress components on inclined planes, general two-dimensional stress system, principal planes and principal stresses, Mohr's circle of stresses.	**7 Hours**

UNIT-II

Bending stresses and shear stresses in beams: Introduction, simple bending theory, bending equations (no derivation), modulus of rupture, section modulus, flexural rigidity, expression for horizontal shear stress in beam, shear stress diagram for rectangular, I and T section (fletched beams not included).	**07 Hours**
Deflection of beams: Introduction, slope and deflection, differential equation of elastic curve, slope and deflection for statistically determinate beams using first principles and Macaulay's method subjected to point loads, UDL and couple.	**06 Hours**

UNIT-III

Thin and Thick Cylinders: Thin cylinders subjected to internal pressure, change in length, diameter and volume, thick cylinders - Lame's equations (excluding compound cylinders).	**06 Hours**
Columns and Struts: Introduction, short and long columns, Euler's theory for columns with both ends hinged, effective length, slenderness ratio, radius of gyration, Euler's buckling load and Rankine's load for different end conditions and limitations of Euler's theory.	**06 Hours**

Course Outcomes: At the end of the course student will be able to

1.	**Determine** the stresses, strains in bars, volumetric strain, elastic constants, and thermal stresses.
2.	**Determine** normal and shear stresses on a given plane, principal stresses and their planes for a general 2-D stress system.
4.	**Determine** bending stresses, shear stresses for statically determinate beams and **compute** slope and deflection applying Mecaulay's method.
	Determine stresses developed in thin and thick cylinders subjected fluid pressure
5.	**Determine** buckling load for axially loaded columns using Euler's and Rankine's theory

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
21CV303.1	2	2											2		
21CV303.2	2	3	1										2		
21CV303.3	2	3											2		
21CV303.4	2	3											2		
21CV303.5	2	2	1										2		

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Andrew Pytel, Ferdinand L. Singer," Strength of Materials" Harper & Row, 4th Edition 1987
2. Rajput.R.K., "Strength of Materials, (Mechanics of Solids)", S. Chand and Company Ltd., New Delhi, 2014.

REFERENCE BOOKS:

1. Ferdinand P. Beer, E. Russell Johnston Jr., John T. DeWolf, "Mechanics of Materials", McGraw-Hill, 7th Edition 2014.
2. S. P. Timoshenko, D. H. Young, "Elements of Strength of Materials", East West Press 5th Edition.
3. Punmia B.C., Ashok Kumar Jain, Arun Kumar Jain, "Mechanics of Materials", Laxmi Publications (P) Ltd., 2016.
4. S S Bhavikatti, 'Strength of materials', Vikas Publication, 4th edition 2013

E Books / MOOCs/ NPTEL

1. http://nptel.ac.in/syllabus/112107147/
2. https://ocw.mit.edu/courses/mechanical-engineering/2-001-mechanics-materials-i-fall-2006/lecture-notes/

Structural Analysis-I

Course Code:	**CV2103-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2106-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Determine member forces of the truss by method of joints.
2.	Determine slope and deflection of determinate beams by conjugate beam method.
3.	Develop strain energy expression and calculate the displacement of beams and cantilever frames by strain energy method and unit load method.
4.	Analyze indeterminate beams using Clapeyron's theorem of three moments.
5.	Analyze three hinged parabolic arches, circular arches and cables under loading cases.

UNIT-I

Structural Systems	**08 Hours**

Forms of structures, conditions of equilibrium, degree of freedom, linear and nonlinear structures; one, two- and three-dimensional structural systems, determinate and indeterminate structures, degree of static indeterminacy and kinematic indeterminacy.

Plane Truss

Types, Assumptions, Analysis by method of joints.

Displacement of Beams	**08 Hours**

Slope and deflection: definition, sign conventions.

Conjugate beam method: Concept and application to find slope and deflection of determinate beams (uniform and varying cross section).

UNIT-II

Strain Energy	**08 Hours**

Concept, Strain energy due to axial load, bending and shear, Castigliano's theorems, Displacement of beams and cantilever frames by strain energy method and unit load method.

Analysis of Beams	**08 Hours**

Clapeyron's theorem of three moments for continuous and fixed beams.

UNIT-III

Analysis of Arches and Cables	**08 Hours**

Three hinged parabolic and circular arches with supports at same level. Determination of normal thrust, radial shear and bending moment.

Analysis of cables under point loads, UDL and determination of cable length with supports at same level.

Course Outcomes: At the end of the course student will be able to

1.	Explain the concept of determinacy of the structure and find the forces in the members of the truss using method of joints.
2.	Determine the slope and deflection at given points on a determinate beam using conjugate beam method.
3.	Develop strain energy expression and determine displacement of determinate beams, cantilever frames using strain energy method and unit load method.
4.	Analyze indeterminate beams applying Clapeyron's theorem of three moments.
5.	Analyze arches and cables with supports at same level.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2	3
CV2107-1.1	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
CV2107-1.2	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
CV2107-1.3	2	3	2	-	-	-	-	-	-	-	-	-	2	3	-
CV2107-1.4	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
CV2107-1.5	2	3	2	-	-	-	-	-	-	-	-	-	2	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Punmia B. C., Ashok Kumar Jain, Arun Kumar Jain, "Strength of Materials and Theory of Structures", Volume I & Volume II, Laxmi Publications (P) Ltd., 2019.
2.	Ramamrutham S., "Theory of Structures", Dhanpat Rai & Sons, New Delhi, 2018.
3.	Shah H. J. and Junnarkar S. B., "Mechanics of Structures", Volume I & II, Charotar Publications, New Delhi, 2016.

REFERENCE BOOKS:

1.	Reddy S. C., "Basic Structural Analysis", Tata McGraw Hill Education, New Delhi, 2017.
2.	Vaidyanathan R. and Perumal P., "Structural Analysis", Volume I& II, Laxmi Publications (P) Ltd., 2017.
3.	Vazirani V. N. and M. M. Ratwani, "Analysis of Structures", Khanna Publications, New Delhi, 2015.
4.	Thandava Moorthy T. S., "Structural Analysis", Oxford University Press, 2011.

E Books / MOOCs/ NPTEL

1.	https://swayam.gov.in/nd1_noc20_ce35/preview
2.	https://nptel.ac.in/courses/105/101/105101085/
3.	https://nptel.ac.in/courses/105/105/105105166/

CONCRETE TECHNOLOGY

Course Code:	**CV 2105-1**	**Course Type:**	**PCC**
Teaching Hours/Week (L:T:P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Civil Engineering

Course Objectives: This Course will enable students to:

1.	Study the chemical composition, types and tests on cement.
2.	Learn different types of aggregates and admixtures.
3.	Comprehend the properties of fresh concrete, & manufacturing process of concrete
4.	Understand the properties, testing and study the durability of hardened concrete
5.	Understand the concept of mix design of concrete and know various types of special concretes & their applications.

UNIT-I

INGREDIENTS:

CEMENT: Portland cement-chemical composition, properties, hydration and manufacture process. Fineness, compressive strength, setting time and soundness tests as per BIS.
AGGREGATES: Properties of coarse and fine aggregates and their influence on concrete.
WATER: quality and permissible impurity limits as per BIS

ADMIXTURES: Chemical: accelerators, retarders, air entraining agents, plasticizer and super-plasticizer, tests on admixture, chemistry and compatibility with concrete.
Mineral: fly ash, silica fumes, rice husk ash and blast furnace slag.

15 Hours

UNIT-II

FRESH CONCRETE: Introduction to workability-factors affecting, measurement (slump, compaction factor, flow and Vee Bee consistometer), segregation and bleeding, process of manufacture-batching, mixing, transporting, placing, compaction, finishing and curing.

HARDENED CONCRETE: Factors affecting strength: w/c ratio, gel/space ratio and maturity concept, testing of hardened concrete: destructive methods-compressive strength, split tensile strength and flexural strength, non-destructive methods-rebound hammer and pulse velocity.

DURABILITY: Definition and significance, Shrinkage, chemical attack-sulphate attack, chloride attack, carbonation, freezing and thawing.

15 Hours

UNIT-III

CONCRETE MIX DESIGN: Objectives, factors affecting and BIS method.

INTRODUCTION TO SPECIAL CONCRETES*:* High volume fly ash concrete, light weight concrete, high density concrete and self-compacting concrete: materials, properties and applications

10 Hours

Course Outcomes: At the end of the course student will be able to

1.	Explain the types, hydration mechanism and tests on cement as per BIS.
2.	Describe the properties, their influence on concrete as per BIS and analyze the effect of chemical and mineral admixtures.
3.	Explain the manufacturing process and determine the fresh concrete behavior.
4.	Explain the properties, testing procedure and assess the durability of hardened concrete.
5.	Design standard grade conventional concrete mix proportions as per BIS and identify the suitability of special concretes based on their application.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
21CV62-1.1	2	2	1									1	2	1	
21CV62-1.2	2	2	2									1	2	1	
21CV62-1.3	2	2	2									1	2	1	
21CV62-1.4	2	2	2									1	2	1	
21CV62-1.5	3	2	3			1		2				2	3	2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	MS Shetty, (2014). "Concrete Technology- Theory and Practice", S Chand and Company, New Delhi.
2.	Gambhir ML (2013). Concrete Technology: Theory and Practice, Dhanpat Rai and Sons, New Delhi.

REFERENCE BOOKS:

1.	Adam M. Neville and J. J. Brooks (2018). "Concrete Technology", Prentice Hall
2.	R Santha kumar (2012). "Concrete Technology", Oxford University Press India
3.	Relevant IS codes.

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/105/102/105102012/
2.	https://nptel.ac.in/courses/105/104/105104030/

Structural Analysis-II

Course Code:	**CV2104-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2106-1, CV2107-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Explain strain energy concept and analyze statically indeterminate trusses using minimum strain energy method.
2.	Develop slope deflection equations and analyze indeterminate beams and frames.
3.	Analyze indeterminate beams and frames using moment distribution method.
4.	Demonstrate Kani's Rotation Contribution method to analyze indeterminate beams and frames.
5.	Analyze indeterminate beams using matrix method.

UNIT-I

Indeterminate (Redundant) Trusses — **08 Hours**

Introduction, analysis of statically indeterminate trusses using minimum strain energy method (redundant up to second degree).

Slope Deflection Method — **08 Hours**

Introduction, sign convention, development of slope-deflection equations, analysis of continuous beams and symmetrical frames (indeterminacy up to two)

UNIT-II

Moment Distribution Method — **08 Hours**

Introduction, distribution factor, development of distribution table in analysis of continuous beams and symmetrical frames (indeterminacy up to two)

Kani's Rotation Contribution Method — **08 Hours**

Introduction, rotation factor, analysis of continuous beams and symmetrical frames.

UNIT-III

Fundamentals of Matrix Method — **08 Hours**

Introduction, axes and coordinates, flexibility and stiffness matrix method, relationship between flexibility and stiffness matrices, system approach of flexibility and stiffness matrix method for analysis of propped cantilever and continuous beams (up to two span).

Course Outcomes: At the end of the course student will be able to

1.	Analyze the indeterminate trusses using minimum strain energy method.
2.	Develop slope deflection equations and analyze continuous beams and symmetrical frames.
3.	Analyze the indeterminate beams and symmetrical frames using moment distribution method.
4.	Carryout analysis of continuous beams and symmetrical frames by Kani's rotation contribution method.
5.	Explain the concept of flexibility and stiffness, develop relationship between flexibility and stiffness matrices and analyze the indeterminate beams by matrix method.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2108-1.1	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
CV2108-1.2	2	3	1	-	-	-	-	-	-	-	-	-	2	3	-

CV2108-1.3	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
CV2108-1.4	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
CV2108-1.5	2	3	1	-	-	-	-	-	-	-	-	-	2	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Punmia B. C., Ashok Kumar Jain, Arun Kumar Jain, “Strength of Materials and Theory of Structures”, Volume I & Volume II, Laxmi Publications (P) Ltd., 2019.
2. Ramamrutham S., “Theory of Structures”, Dhanpat Rai & Sons, New Delhi, 2018.
3. Shah H. J. and Junnarkar S. B., “Mechanics of Structures”, Volume I & II, Charotar Publications, New Delhi, 2016.

REFERENCE BOOKS:

1. Reddy S. C., “Basic Structural Analysis”, Tata McGraw Hill Education, New Delhi, 2017.
2. Vaidyanathan R. and Perumal P., “Structural Analysis”, Volume I & II, Laxmi Publications (P) Ltd., 2017.
3. Vazirani V. N. and M. M. Ratwani, “Analysis of Structures”, Khanna Publications, New Delhi, 2015.
4. Pandith G. S., Gupta S. P., “Structural Analysis - A Matrix Approach”, Tata McGraw Hill, New Delhi, 2015.
5. Prakash Rao D. S., “Structural Analysis-A unified Approach”, University Press, 2012.
6. Wang C. K., “Indeterminate Structural Analysis”, Tata McGraw Hill Publications, 2010.

E Books / MOOCs/ NPTEL

1. https://nptel.ac.in/courses/105/101/105101086/
2. https://nptel.ac.in/courses/105/105/105105109/

TRANSPORTATION ENGINEERING

Course Code:	**CV2106-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L:T:P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CV2101-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	To understand the recent development in highways, and understanding the planning and alignment of a highway network.
2.	To acquire the knowledge of design principles and standards for highway geometrics.
3.	To comprehend the properties and requirements of basic pavement materials and to understand the basic principles of pavement design.
4.	To acquire the fundamental knowledge on railway engineering and tunneling.
5.	To gain the basic knowledge of airport engineering and harbors.

UNIT-I

Transportation	**04 Hours**
Importance, modes– comparison, road transport-characteristics, Jayakar committee recommendations and implementation, 3rd road development plan and Problems, NHDP, PMGSY, RDP-vision 2021, RRDP-vision 2025.	
Highway Planning and alignment	**02 Hours**
Planning surveys – master plan and saturation system, road alignment: ideal alignment, factors	
Geometric design	**10 Hours**
Importance, factors affecting, cross sectional elements, design speed, sight distances- stopping and overtaking, design of horizontal alignment- speed, radius, super elevation, extra widening at curves, transition curves, design of vertical alignment- gradient, grade compensation, summit curve and valley curves.	

UNIT-II

Pavement materials and design	**06 Hours**
Desirable properties of road aggregates, bituminous binders (Bitumen, Tar, Emulsion, Cutback) and subgrade soil, CBR and Plate load tests on soil. Pavement Types, Design of flexible pavement by IRC 37-2001 method (design steps and problems only).	
Elements of Railway Engineering	**05 Hours**
Permanent way and its requirements, gauges. Functions and requirements of following elements of permanent way: Rails, Sleepers, Ballast, Track fitting and fasteners. Calculation of quantity of materials required for laying a railway track.	
TUNNELS	**04 Hours**
Introduction-Advantages and limitations, Size and shape of tunnels, Tunnel lining, Tunnel ventilation and drainage.	

UNIT-III

Elements of Airport Engineering	**05 Hours**
Typical Layouts, site selection, airport classification, regional Planning. Geometric design elements of runway, basic runway length - Corrections.	
HARBORS	**04 Hours**
Classifications, site selection, typical layout, function of various elements of harbor.	

Course Outcomes: At the end of the course student will be able to

1.	**Illustrate** the road development in India and **describe** planning stages in highway network.
2.	**Make use of** the design standards for highway geometrics as per IRC guidelines.

3.	**Explain** the requirements of basic construction materials and **design** the flexible pavement structure as per IRC.
4.	**Demonstrate** the various elements of the tunneling and permanent way and to **calculate** the required quantities of materials for railways.
5.	**Explain** the components of airport and to **compute** the corrected length of a runway. Also, to **narrate** the functions of components in harbor

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2106-1.1	3	1	1	-	-	-	-	-	-	-	-	-	2	2	1
CV2106-1.2	2	3	2	-	-	-	-	-	-	-	-	-	2	2	2
CV2106-1.3	3	1	2	-	-	-	-	-	-	-	-	-	1	3	2
CV2106-1.4	3	2	1	-	-	-	-	-	-	-	-	-	2	2	1
CV2106-1.5	3	1	1	-	-	-	-	-	-	-	-	-	1	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Khanna. S. K, Justo. C.E.G, Veeraragavan. A, "Highway Engineering", Revised 10th edition, Nem Chand and Bros, 2014.
2.	Saxena. S.S., Arora S.P., "A Text Book of Railway Engineering", DhanpathRai and Sons, New Delhi, 2nd Revised edition 2013.
3.	Khanna S.K., Arora M.G., Jain S.S., "Airport Planning and design", Nem Chand and Bros, Roorkee, 6th Revised edition, 2009.
4	R. Srinivasan, "Harbour, Dock and Tunnel Engineering", Charotar Publishing House Pvt. Ltd., Anand (Gujarat), 27th Revised edition, 2015.

REFERENCE BOOKS:

1.	Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 3rd Revised Edition. (2015).
2.	Kadiyali L. R., Lal. N.B, "Principles and Practices in Highway Engineering", Khanna Publishers, New Delhi. 7th Revised Edition. (2013).
3.	Relevant IRC codes published by Bureau of Indian Standards, New Delhi.
4.	Handbook for Roads and bridges – MORTH, New Delhi (2009).
5.	Rangwala, "Airport Engineering" Charotar Publishing House Pvt. Ltd., Anand (Gujarat), 16th Revised edition, 2016.
6.	Satish Chandra., Agarwal. M.M., "Railway Engineering", Oxford University Press, New Delhi, 2nd Revised edition 2013.
7.	C Venkatramaiah, " Transportation Engineering", Volume II: Railways, Airports, Docks and Harbours, Bridges and Tunnels, Oxford University Press, New Delhi, 1st edition 2016.

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/105/105/105105107/
2.	NPTEL Source for Transportation Engineering II http://nptel.ac.in/courses/105107123/
3.	Railway Engineering eBook: http://dl4a.org/uploads/pdf/Ebook%20-%20Railway%20Engineering%20.pdf

Remote Sensing Image Acquisition, Analysis and Applications

Course Code:	**CV2107-1**	**Course Type:**	**PCC**
Teaching Hours/Week (L:T:P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CV2004-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Learn about the optical, thermal and microwaves based Remote Sensing.
2.	Sensors and their characteristics.
3.	The students will be able to disseminate basic concepts and applications of Electromagnetic Spectrum in Remote Sensing.
4.	Energy Balance and Data acquisition platforms.
5.	Remote Sensing applications for solving real life problems.

UNIT-I

Introduction to Remote Sensing, Satellites and Sensors	**15 Hours**

Definition of remote sensing, remote sensing process, ideal remote sensing system. Physics of remote sensing, electromagnetic energy, electromagnetic spectrum, black body radiation, laws governing electromagnetic radiation, atmospheric effects, scattering and absorption, atmospheric windows, Interaction with earth surface materials, spectral reflectance curves.

Remote sensing platforms, satellites and orbits, geostationary and sun synchronous satellites, Earth resource satellites – IRS mission, LANDSAT, other satellite missions. Sensors – active and passive sensors, sensor resolutions (spectral, spatial, radiometric and temporal).

UNIT-II

Visual Image Interpretation and Digital Image Processing	**15 Hours**

Introduction, elements of visual image interpretation, image interpretation strategies and keys.

Basics of digital image processing (Brief introduction only): image display and band combinations, true and false color composites. Image pre-processing, radiometric and geometric corrections, image enhancements, image histogram, contrast manipulation, image filtering, low pass and high pass filters, edge detection, spectral rationing, image fusion.

Image classification (Brief introduction only): - methods, supervised and unsupervised, accuracy assessment of image classification.

UNIT-III

Remote Sensing Image Acquisition, Analysis and Applications	**10 Hours**

Introduction to Bhuvan, digitizing, satellite data download from Bhuvan, USGS websites, Raster functions, terrain analysis, DEM, slope, aspect, hillshade map preparation, interpolation, clipping using extent and layer. Satellite data import, pre-processing, conversion from vector to raster, map calculator, color enhancement, FCC creation.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the basic concepts of Remote Sensing and Digital Image Processing and its application
2.	**Understand** different type of sensors and their characteristics
3.	**Explain** the principles of thermal and microwave satellites, sensors and their nature of the data
4.	**Understand** the appropriate use of satellite data for different applications
5.	**Apply** remote sensing in different thematic studies

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2107-1.1	2	1	2	1	-	-	-	-	-	-	-	1	1	2	1
CV2107-1.2	2	1	2	1	-	-	-	-	-	-	-	1	1	2	1
CV2107-1.3	2	1	2	1	-	-	-	-	-	-	-	1	1	2	1
CV2107-1.4	2	1	2	1	-	-	-	-	-	-	-	1	1	2	1
CV2107-1.5	2	1	2	1	2	-	-	-	-	-	-	1	1	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Lillesand, T.M. and Kiefer, R.W., 1987. Remote sensing and Image Interpretation, John Wiley.
2.	Jensen, J. R. 2005 Introductory digital image processing a remote sensing perspective, Prentice Hall series in geographic information science.
3.	Schowengerdt, R. A., 2007. Remote Sensing: Models and Methods for Image Processing, Academic Press.
4.	Campbell, J.B., 1996. Introduction to Remote Sensing, Taylor & Francis, London.
5.	Jensen, J.R., 2003. Remote Sensing of the Environment an Earth Resource Perspective, Pearson Education, Delhi.

REFERENCE BOOKS:

1.	Cracknell, P. and Hayes, L. 2007 Introduction to remote sensing
2.	Jensen J.R., "Introductory digital image processing: A remote sensing perspective", 2nd Edition, Prentice Hall – 1996.
3.	T.M Lillesand,. R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation , 5th edition, John Wiley and Sons India. 2004
4.	Richards J A., X. Jia, "Remote sensing digital image analysis: an introduction", 3 rd Edition, Springer - 1999.
5	Joseph, G., 2003. Fundamentals of Remote Sensing, University press
6	Mather P.M., "Computer processing of remotely sensed images: an introduction", Wiley. – 1988.

E Books / MOOCs/ NPTEL

1.	https://onlinecourses.nptel.ac.in/noc23_ce64/preview
2.	https://onlinecourses.swayam2.ac.in/aic22_ge16/preview

Professional Core Courses (Lab)

BASIC MATERIALS TESTING LAB

Course Code:	**CV2601-1**	**Course Type:**	**PCC Lab**
Teaching Hours/Week (L:T:P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: CIVIL ENGINEERNG

Course Objectives:

1.	Analyze the various mechanical tests and evaluate the mechanical properties of various building materials.
2.	Develop the understanding of mechanical properties of different building materials and their characteristics.

List of Experiments

	Minor Experiments
1.	Shear Test on Mild steel (single shear & double shear)
2.	Impact test.
3.	Brinell Hardness Test.
4.	Vickers Hardness Test
5.	Rockwell Hardness Test.
6.	Specific gravity Test on Bitumen.
	Major Experiments
7.	Tension test on mild steel specimen.
8.	Compression test on mild steel specimens.
9.	Compression test on cast iron.
10.	Compression test on wood.
11.	Bending Test on Wood specimens under two-point loading.
12.	Torsion test on mild steel.

Course Outcomes: At the end of the course student will be able to

1.	Conduct shear and impact on metal specimen to assess the mechanical properties.
2.	Conduct the tension, compression, torsion tests on metal specimen and bending test on wooden specimen to determine mechanical properties and explain their significance.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2601-1.1	2			2		2			2	2			3	2	
CV2601-1.2	2			2		2		3	2				3	2	

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Davis, Troxell and Hawk, "Testing of Engineering Materials", International Student Edition – Mc Graw Hill Book Co. New Delhi-1982.
2.	Fenner, George, "Mechanical Testing of Materials", published by Philosopical library - 1965.
3.	Holes K A, "Experimental Strength of Materials", English Universities Press Ltd. London-1962.

4.	Suryanarayana A V K, “Testing of Metallic Materials”,, Prentice Hall of India Pvt. Ltd. New Delhi -1979.
5.	Kukreja C B- Kishore K, “Material Testing Laboratory Manual”, Ravi Chawla Standard Publishers & Distributors -1996.
6.	Relevant IS codes

COMPUTER AIDED CIVIL ENGINEERING DRAWING

Course Code:	**CV2602-1**	**Course Type:**	**PCC Lab**
Teaching Hours/Week (L: T: P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CV2001-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Develop understanding functional aspects involved in drafting of plan, cross section and elevation of buildings using grid sheet.
2.	Develop understanding commands in AutoCAD.
3.	Plan and develop residential building drawing for the client's requirement using AutoCAD.
4.	Create the connectivity drawing of public buildings using AutoCAD.

List of Experiments

13.	**Introduction to civil engineering drawing** Functional design of buildings (Residential, Industrial and Public), positioning of various components of buildings, orientation of buildings, building standards and bye laws, set back distances.
14.	**Basics of AutoCAD** Drawing tools: Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline and Ellipse. **Modification tools**: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet. **Usage of Text**: Single line text, Multiline text, Spelling, Edit text. **Special Features**: View tools, Layers concept, Dimension tools, Hatching, Customizing tool bars, working with multiple drawings.
15.	**Use of AutoCAD in Civil Engineering Drawings:** ii) Development of plan, elevation, section and prepare a schedule of openings from the given line diagram of residential building (two bed room).
16.	Connectivity (Bubble) Diagram for the given data of public buildings: i) Primary Health Center ii) School Building iii) Canteen Building.

Course Outcomes: At the end of the course student will be able to

1.	Develop the Plan, Elevation, Cross Section and prepare a schedule of openings for the given line diagram of residential building using AutoCAD and state its Significance
2.	Develop and draw the connectivity diagram of public buildings using AutoCAD and state its Significance.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2602-1.1	2	2	2	-	3	1	-	-	-	2	-	1	2	2	3
CV2602-1.2	2	2	2	-	3	1	-	-	-	2	-	1	2	2	3

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. Shah M.H. and Kale C.M. "Building Drawing" Tata Mc Graw Hill Publishing Co. Ltd, New Delhi, 4th edition 2011.

2.	Balagopal T S Prabhu, Building Drawing and Detailing, Spades Publishers, 2007.
3.	Dr. B.P.Verma, Civil Engineering Drawing & Housing, Khanna Publishers, Delhi, 11 edition, 2014.
4.	Dr M.N. Shesha Prakash and Dr.G.S. Suresh, “Reference Book on Computer Aided Design Laboratory”, Lakshmi Publications, New Delhi, 2006.
5.	M.A. Jayaram and D.S. Rajendra Prasad, “Reference Book on CAD Laborator”, Sapna Publications,2010
6.	National Building Code of India 2016 (NBC 2016).
7.	IS 5533: 1969, Recommendation for Dimensions of Spaces for Human Activities. B.I.S.
E Resources	
1.	https://nptel.ac.in/courses/105/102/105102088/

EXTENSIVE SURVEY PROJECT AND SOFTWARE LAB

Course Code:	**CV2603-1**	**Course Type:**	**PCC Lab**
Teaching Hours/Week (L: T: P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CV2004-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	To study the data processing, preparation of contour drawings using software.
2.	To study the collection and processing data, representing l/s, c/s, design drawings and earthwork calculation.

List of Experiments

1.	Software Application Lab M.S. Excel, Softwel_DTM, Auto CAD
2.	Extensive Survey Project (Project Based Learning) 1. A group consisting of 10 students shall be carrying one project. The project will be distributed equally among students' groups. 2. The students shall submit a report on one project consisting of Survey data, earthwork estimation, plan and relevant design drawings.
3.	1. Highway Project (1 km distance) Preliminary and detailed investigations to align a new or upgrade existence road between two obligatory points. The report should consist of a Topographic survey with contour drawings. b Key plan with initial alignment. c Geometric design (curve design, culvert, drainage) d Longitudinal section (at an interval of every 10m) and cross-section (at an interval of every 20m). e Earth work calculation.
4.	2. Tank Project Preliminary and detailed investigations to align a new or upgrade existence tank between two obligatory points. The report should consist of a. Topographic survey with contour drawings. b. Key plan with initial alignment. c. Rainfall data in the catchment area / drainage basin. d. Capacity contour in the proposed reservoir site. e. Bed and bank levels of the streams and canal alignment (L/s and C/s). f. Earthwork Calculation.
5.	3. Stake out using Total Station Preliminary and detailed investigations consist of topographic surveying for a strip of land. The report should consist of Topographic survey with contour drawings. Preparation of building plan. Longitudinal and typical cross-section of building. Front elevation of building. Preparation of stake out report and centre line for column footing. Earthwork calculation.

Scheme of Examinations: (CIE)
The student has to choose one project out of three
1. Evaluation of reports on contouring and modeling : 20 marks

2. Evaluation of reports on Earthwork calculation, drawings: 20 marks
2. Viva voice : 10 marks

Course Outcomes: At the end of the course student will be able to

1.	Model the project and represent the contours.
2.	Estimate the earthwork, develop drawings and reporting.
3.	State the significance of the projects carried.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2603-1.1	3	3	2	2	3	-	-	2	2	3	-	3	3	2	3
CV2603-1.2	3	3	2	2	3	-	-	2	2	3	-	3	3	3	3
CV2603-1.3	3	-	-	-	-	-	-	-	-	3	-	3	3	3	3

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. Manual of SW_DTM: Digital Terrain Modeling / Contouring, softwel (P) Ltd.
2. Manual of Irrigation Canal Longitudinal & Cross Section Drawing and Quantity Offtake Package, softwel (P), Ltd.
3. Surfer 13 full user’s guide, powerful contouring, gridding & surface mapping system, golden software.
4. B. C. Punmia, “Surveying Vol.1 & 2”, Laxmi Publications Pvt. Ltd., New Delhi. - 2016
5. B.C. Punmia, Ashok K. Jain, Arun K. Jain, “Higher Surveying”, Laxmi Publications Pvt. Ltd. New Delhi. – 2016

Geomatics Lab with Project Based Learning

Course Code:	**CV2604-1**	**Course Type:**	**PCC Lab**
Teaching Hours/Week (L: T: P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CV2004-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	**Inspect** Aerial photographs, **identify** the features and **measure** them
2.	**Survey**, **examine** and **select** SOI Topo sheets, Remote Sensing data sets and Meta data from the server or agencies through web browsing and **make use of** them for **composing** the maps
3.	**Adapt** GPS instrument and **make use of** GNSS App to **survey, determine** and **mark** the position or location of point, line or polygon features.
4.	**Utilize** an image processing/GIS software for pre-processing, digitizing, mosaicking, sub setting and visualizing a satellite data, and **modify, combine** and **compile** various maps and **interpret** them
5	**Identify** and **mark** the land use/land cover pattern, **combine** and **compose** various thematic and overlaid maps and **analyze** the geospatial distribution

List of Experiments

1.	Stereo Test and Determination of Scale in Aerial photographs
2.	Visual Image interpretation: Identification of features on Aerial Photograph and satellite imageries
3.	Browsing and downloading Topo sheets (SOI Nakshe), Satellite imageries (Google Earth/BHUVAN/NRSC/Earth Explorer USGS, etc.) and metadata
4.	GPS & GNSS App demo and data collection-(point, line, and polygon) features
5.	Familiarization with DIP software, Image Display: Visualization of Image data and Layer Stacking
6.	Image Rectification and Registration: Georeferencing of Topo sheets & Satellite image
7.	Digitization and Interpretation of Land use/Land cover features from the Multispectral Satellite Images
8.	Mosaicking and Sub setting of the imagery
9.	Digitization of features (location, roads, drainage, buildings, land boundaries) and preparation of thematic maps,
10.	Thematic maps over lay and Map composition (five components)
11.	Project work
12.	Project work

Course Outcomes: At the end of the course student will be able to

1.	**Inspect** Aerial photographs, **identify** and **measure** the features.
2.	**Survey**, **examine** and **select** SOI Toposheets, Remote Sensing data sets and Meta data from the server or agencies through web browsing and **make use of** them for **composing** the maps.
3.	**Adapt** GPS instrument and **make use of** GNSS App to **survey, determine** and **mark** the position or location of point, line or polygon features.

4.	**Utilize** an image processing/GIS software for preprocessing, digitizing, mosaicking, sub setting and visualizing a satellite data, and **modify, combine** and **compile** various maps and **interpret** them
5.	**Identify** and **mark** the land use/land cover pattern, **combine** and **compose** various thematic and overlaid maps and **analyze** the geospatial distribution

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2604-1.1	2	2	-	1	3	2	2	-	-	-	-	-	2	1	1
CV2604-1.2	2	2	-	-	2	2	-	-	2	-	2	2	2	1	1
CV2604-1.3	2	2	-	-	2	2	-	-	1	-	-	-	2	2	1
CV2604-1.4	2	2	1	1	3	2	2	-	2	2	2	2	2	1	2
CV2604-1.5	2	2	1	1	3	3	2	-	2	2	2	2	3	2	2

1: Low 2: Medium 3: High

TEXT BOOKS:

1.	Anji Reddy, M. (2012) ***Text Book of Remote Sensing and Geographical Information Systems***, Fourth Edition, BS Publication, Hyderabad
2.	Lillesand, T.M., Kiefer, R.W and Chipman, J.W. (2015) ***Remote sensing and Image Interpretations***, *7th* edition, John Wiley and sons, New Delhi
3.	Punmia, B.C., Jain Ashok K. and Jain, Arun K. (2014) *"**Higher Surveying**"*, Laxmi Publications Pvt. Ltd. New Delhi. – (All chapters except Chapter 4)

REFERENCE BOOKS:

1.	Anji Reddy, M. and Hari Shankar, Y. (2006) ***Digital Image Processing***, BS Pub., Hyd.
2.	Arora, Manoj K. and Badjatia, R.C. (2011) ***"Geomatics Engineering***" Nem Chand and Bros. Roorkee
3.	Bernhardsen, Tor (2002) Geographic ***Information Systems-3rd*** Ed., Wiley India, Delhi
4.	Canada Centre for Remote Sensing (2011) Fundamentals of Remote sensing-Tutorial
5.	Chang, Kang-tsung (2008) ***Introduction to Geographic Information Systems*** 4th Ed.,Tata McGraw Hill Publishing Company Limited, New Delhi
6.	Gopi, Satheesh (2005) "***Global Positioning System - Principles and Applications***", Tata McGraw Hill Publishing Co. Ltd. New Delhi.
7.	Kennedy, Michael. (2003). ***The global positioning system and GIS***. CRC Press,
8.	Kerle, Norman, Lucas LF Janssen, and Gerrit C. Huurneman. (2004) "***Principles of remote sensing.***" *ITC, Educational textbook series* 2 (): 46-64.
9.	Korte, George B. (2001), ***The GIS Book***, Onword Press, Thomson Learning Inc., USA
10.	Kumar, S. (2008) ***Basics of Remote sensing and GIS***Laxmi Publications (P) Ltd., Delhi Longler, Paul A., Goodchild, Michael F., Maguire, David J., Rhind. David W., (2004) ***Geographic Information Systems and Science*** John Wiley & Sons Ltd., ESRI Press
11.	Arora, Manoj K.and R.C. Badjatia, 2011 ***"Geomatics Engineering***" Nem Chand and Bros. Roorkee
12.	Sabins, F.L. (1997) ***Remote Sensing: Principles and Interpretation***3rd edn.WH Freeman and Company, New York, 494p
13.	Wolf, P. R. (2009) *"**Elements of Photogrammetry**"*, McGraw Hill Publications

E Resources

1.	http://nptel.ac.in/courses/105104100/
2.	http://nptel.ac.in/courses/105107157/
3.	http://nptel.ac.in/courses/105107158/

CONCRETE AND HIGHWAY MATERIALS TESTING LAB

Course Code:	**CV2605-1**	**Course Type:**	**PCC Lab**
Teaching Hours/Week (L:T:P: S):	**0:0:2**	**Credits:**	**01**
Total Teaching Hours:	**26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: CIVIL ENGINEERNG

Course Objectives:

1.	Determine the physical properties of aggregates, bitumen and hardened Concrete, explain their significance.
2.	Determine the properties of aggregate and fresh concrete, explain their importance.

List of Experiments

	Minor Experiments
1.	Aggregate Impact value test.
2.	Aggregate Crushing value test
3.	Compressive strength of concrete.
4.	Split tensile test of concrete and Flexural strength of concrete.
5.	Penetration Test on Bitumen.
6.	Ductility Test on Bitumen.
7.	Flash and Fire point Test on Bitumen.
8.	Softening point Test on Bitumen.
	Major Experiments
9.	Shape Test on aggregates (Flakiness and Elongation index Test).
10.	Los Angeles Abrasion test on aggregates.
11.	Slump test on concrete.
12.	Compaction factor test on concrete.

Course Outcomes: At the end of the course student will be able to

1.	**Conduct** experiments to **determine** the physical properties of aggregates and bitumen, properties of hardened concrete and **explain** their significance.
2.	**Conduct** experiments to **determine** the physical properties of aggregates, properties of fresh concrete and **discuss** their importance.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2605-1.1	3		2	2		2		3	2	2		1	2	2	1
CV2605-1.2	3		2	2		2		3	3	2		1	2	2	1

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Khanna. S. K, Justo. C.E.G, Veeraragavan. A, "Highway material testing laboratory manual", Revised 3rd edition, Nem Chand and Bros, 2015
2.	**Gambhir.M.L., "Concrete manual", Dhanpat Rai & Sons, New Delhi**
3.	Relevant IS codes

Construction Practice (Department Specific Vocational Course)

Course Code:	**CV2606-1**	**Course Type:**	**PCC Lab**
Teaching Hours/Week (L:T:P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	To give idea of basic of setting out operations and construction of masonry units.
2.	To estimate the quantity of steel reinforcement required for different elements of work.
3.	To realize the importance of Plumb bob, mercury level and tape in the construction activities.
4.	To create the awareness about various construction activities related in the construction of a building.
5.	To create the awareness about various tests and repair methods used in buildings.

List of Experiments

1.	Study of construction tools, plumbing tools and sanitary fixtures.
2.	Demonstration of Safety kits and accessories used at construction site- Personal Protective Equipment (PPE).
3.	Setting out of center line for a small building.
4.	Construct one thick brick wall in English bond for a height of Two layer.
5.	Construct one thick brick wall in Flemish bond for a height of Two layer.
6.	Prepare Bar Bending Schedule & Fabrication of reinforcements for a doubly reinforced beam.
7.	Prepare Bar Bending Schedule & Fabrication of reinforcements for a lintel with chejja.
8.	Prepare Bar Bending Schedule & Fabrication of reinforcements for a column with footing Mat.
9.	Plastering for a new masonry wall surface(1 square meter area) with CM (1:6)
10.	Prepare a plan and fabricate for PVC pipe layout using valves, fixtures, adhesive solvents and fittings from over head tank to wash basin/tap and excute it.
11.	Identification of retention of pressure in Plumbing system.
12.	

Course Outcomes: At the end of the course student will be able to

1.	Give basic idea of setting out operations, bar bending schedule and use of construction tools.
2.	Study the plumbing accessories and its applications in Civil Engineering buildings.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2606-1.1	2			2		2			2	2			3	2	
CV2606-1.2	2			2		2		3	2				3	2	

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Davis, Troxell and Hawk, “Testing of Engineering Materials”, International Student Edition – Mc Graw Hill Book Co. New Delhi-1982.
2.	Fenner, George, “Mechanical Testing of Materials”, published by Philosopical library - 1965.
3.	Holes K A, “Experimental Strength of Materials”, English Universities Press Ltd. London-1962.
4.	Suryanarayana A V K, “Testing of Metallic Materials”,, Prentice Hall of India Pvt. Ltd. New Delhi -1979.
5.	Kukreja C B- Kishore K, “Material Testing Laboratory Manual”, Ravi Chawla Standard Publishers & Distributors -1996.
6.	Relevant IS codes

PROFESSIONAL ELECTIVE COURSES (STRUCTURAL ENGINEERING STREAM)

DESIGN OF MASONRY STRUCTURES

Course Code:	**CV2201-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2001-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Know about ‘Masonry’, its use, advantages and disadvantages
2.	Have clear knowledge of different types of ‘Masonry units’, types and grades of ‘Mortar’ as per IS Code, properties of masonry units and mortar.
3.	Know the strength of masonry unit and masonry prism, computation of permissible strength of masonry for different types of masonry structures considering factors like ‘Effective height’,’ Effective length’, ‘Slenderness ratio’ and ‘Eccentricity ratio’.
4.	Design different types of masonry structures selecting suitable masonry units and mortar using IS 1905 (revised in 2002) and SP 20.
5.	Know about the use of (i) Reinforced Masonry, (ii) Composite Masonry (iii) Confined Masonry and (iv) ‘In filled frames’, their advantages and disadvantages.

UNIT-I

MASONRY UNITS, MATERIALS, TYPES & MASONRY CONSTRUCTION	**15 Hours**

Brick, stone and block masonry units – strength, modulus of elasticity, water absorption and uses.
Mortar: classification and properties, selection.
Defects and errors in masonry construction cracks in masonry, types, reasons for cracking, methods of avoiding cracks.
Strength and Stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship, strength formulae and mechanism of failure for masonry subjected to direct compression.

UNIT-II

Permissible Stresses and Design Considerations	**15 Hours**

Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses.
Load considerations for masonry: walls carrying axial load, eccentric load with different eccentric ratios—walls with openings and free-standing wall.
Design considerations: Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action and lintels.

UNIT-III

	10 Hours

Design of load bearing masonry walls for building up to 3storeys using IS 1905 and SP20 procedure.
Reinforced masonry and its application, flexural and compression elements of reinforced masonry, shear walls.
Composite masonry walls, composite wall beam elements, infilled frames.

Course Outcomes: At the end of the course student will be able to

1.	Know about the masonry units and mortar, properties of different masonry units, mortar and Defects, errors in masonry construction. (**Explain** the types, properties, uses, defects, crack and its remedial measures in masonry structures)

2.	**Analyze**the emerging permissible compressive, tensile and shear stress and factors influencing them for masonry elements.
3.	**Explain** permissible stresses and design criteria as per IS: 1905 and SP-20.
4.	**Determine** the effective height of walls, columns, effective length, effective thickness of wall and factors affecting them.
5.	**Analyze and design** load bearing masonry walls for buildings up to three stories using IS: 1905 and SP-20 and **understand** the concept of reinforced masonry.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓** 1	2	3
CV2201-1.1	1	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CV2201-1.2	1	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CV2201-1.3	1	2	3	-	-	-	-	-	-	-	-	-	1	2	-
CV2201-1.4	1	2	3	-	-	-	-	-	-	-	-	-	1	2	-
CV2201-1.5	1	2	3	-	-	-	-	-	-	-	-	-	1	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Henry, A. W (1990), "Structural masonry", Macmillan Education Ltd.
2. Dayarathnam. P (1987), "Brick and reinforced brick structures", Oxford & IBH Publication.
3. M. L. Gambhir, Building and Construction Materials (2017) , Mc Graw Hill education Pvt. Ltd.

REFERENCE BOOKS:

1. Sinha, B.P and Davies, S.R (1997), "Design of Masonry Structures", E & FN Spon.
2. IS 1905-1987 (3rd revision), "Code of practice for structural use of unreinforced masonry", BIS, New Delhi.
3. SP 20 (S& T) 1991, "Hand book on Masonry Design and Construction (1st revision)", BIS, New Delhi.
4. R E Klingner 2010 Masonry structural design, McGraw Hill Companies, Inc. New York, pp 588.
5. National Building Code of India 2016 Vol.1, Part 6 Section 4 Structural Design – Masonry.

E Books / MOOCs/ NPTEL

1. https://nptel.ac.in/courses/105/106/105106197/

MATRIX METHODS OF STRUCTURAL ANALYSIS

Course Code:	**CV2202-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2103-1 CV2104-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	To **define** the flexibility and **development** of flexible matrix for defined coordinates for structural system.
2.	To **analyze** the trusses, continuous beams and rigid plane frames by flexibility matrix method.
3.	To **define** the stiffness and **development** of stiffness matrix for the defined coordinates for structural system.
4.	To **analyze** the trusses, continuous beams and rigid plane frames by stiffness matrix method.
5.	To **summarize** the direct stiffness method, local and global coordinates and **analyze** the trusses, continuous beams and rigid frames.

UNIT-I

Flexibility Matrix Method:	**16 Hours**

Introduction to flexibility method, Element flexibility matrix, Principle of contragradience, and Force Transformation Matrix, Member Flexibility matrix, Construction of structure flexibility matrix. Matrix determination of the displacement vector, Determination of member forces. *Analysis of trusses by flexibility method using force transformation matrix.*
Analysis of axially rigid continuous beams and *rigid plane frames with axially rigid members by flexibility method using Force transformation Matrix*.

UNIT-II

Stiffness Matrix Method:	**15 Hours**

Fundamentals of the stiffness method, equivalent joint loads, Displacement Transformation matrix. Member stiffness matrix, Total or System stiffness matrix, *Truss analysis by stiffness method using Displacement Transformation Matrix.* Continuous Beam and *rigid frame analysis with axially rigid members by stiffness method using displacement transformation matrix.*

UNIT-III

Direct Stiffness Method:	**09 Hours**

Introduction to direct stiffness method, local and global co-ordinate system, transformation of variables, transformation of the member displacement matrix, force matrix, stiffness matrix, transformation of the stiffness matrix of the member of a truss, transformation of the stiffness matrix of the member of the rigid frame, overall stiffness matrix, boundary conditions, computation of internal forces.
Analysis of pin jointed truss, rigid plane frames and continuous beams by direct stiffness method.

Course Outcomes: At the end of the course student will be able to

1.	**Define** flexibility matrix and **develop** flexibility matrix for assigned coordinates.
2.	**Determine** the member forces in trusses, **analyze** continuous beams and rigid plane frames by flexibility matrix method.
3.	**Define** stiffness matrix and **develop** stiffness matrix for assigned coordinates.
4.	**Determine** the member forces in trusses, **analyze** continuous beams and rigid plane frames by stiffness matrix method
5.	**Analyze** the trusses, continuous beams and rigid plane frames by direct stiffness method.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2202-1.1	1	2	-	-	-	-	-	-	-	-	-	1	2	3	-
CV2202-1.2	2	3	-	-	-	-	-	-	-	-	-	1	3	1	2
CV2202-1.3	1	2	-	-	-	-	-	-	-	-	-	1	2	3	-
CV2202-1.4	2	3	-	-	-	-	-	-	-	-	-	1	3	1	2
CV2202-1.5	2	3	-	-	-	-	-	-	-	-	-	1	3	1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. W. Weaver J.M. Gere, (1986), "Matrix Analysis of framed structures", CBS publishers and Distributors.

2. S Rajshekharan. G Sankara Subramanian, (2010), "Computational Structural Mechanics", PHI.

REFERENCE BOOKS:

1. L. S. Negi and R S Jangid, (1997), "Structural Analysis", Tata Mc Graw-Hill.

2. H C Martin, (1996), "Introduction to Matrix Methods of Structural Analysis", International Text Book Company.

3. R. Vaidyanathan, P. Perumal, (2007), "Comprehensive Structural Analysis– Volume I", Laxmi Publications (P) Limited.

4. S. S. Bhavikatti, (2013), "Matrix Methods of Structural Analysis", I.K. International Publishing House Pvt. Ltd.

STRUCTURAL DYNAMICS

Course Code:	**CV2203-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**-**		

Teaching Department: Civil Engineering

Course Objectives:

1.	**Comprehend** principles of vibration and elementary components of a vibratory system.
2.	**Comprehend** the behaviour of engineering structures subjected to dynamic forces.
3.	**Analyze** undamped and damped free vibration of a single degree of freedom system
4.	**Analyze** undamped and damped forced vibration of a single degree of freedom system
5.	**Analyze** MDOF systems.

UNIT-I

15 Hours

Introduction to Structural Dynamics: Laws of motion, D'Alembert's Principle, Stiffness of springs in series and parallel, Mass moment of inertia, Simple harmonic motion, Vibration – Types, Parts of a vibrating system, Degrees of freedom, Fundamentals of free vibration.
Free vibration: Undamped and damped (single degree of freedom system), Logarithmic decrement.

UNIT-II

15 Hours

Forced Vibration: Undamped and damped (single degree of freedom system) – Steady state response, Dynamic magnification factor, response to harmonic loading, Rotational and reciprocating unbalance, Force transmissibility, Force transferred to foundation, Forced vibration and its effect on machine foundation

UNIT-III

10 Hours

Multi Degree of Freedom (MDOF) Systems: Response to Free and forced vibration – natural frequencies, determination of Eigen values and Eigen vectors – Orthogonality principle, Shear buildings modelled as MDOF systems. Forced undamped and damped vibration of shear buildings – Modal superposition method.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the principles of vibration and elementary components of a vibratory system.
2.	**Discuss** the behavior of engineering structures subjected to dynamic forces.
3.	**Analyze** undamped and damped free vibration of a single degree of freedom system.
4.	**Analyze** undamped and damped forced vibration of a single degree of freedom system.
5.	**Analyze** the given MDOF system.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2203-1.1	3	2	-	1	-	-	-	-	-	-	-	-	2	2	-
CV2203-1.2	2	2	-	1	-	-	-	-	-	-	-	-	2	2	-
CV2203-1.3	3	2	-	2	-	-	-	-	-	-	-	-	2	1	-
CV2203-1.4	3	2	-	2	-	-	-	-	-	-	-	-	2	1	-

CV2203-1.5	3	3	-	3	-	-	-	-	-	-	-	-	2	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Mukhopadhya M. "Vibrations, Dynamics and Structural Systems" Oxford IBH Publications, 2000
2.	Mario Paz. "Structural Dynamics" CBS Publishers, 2004

REFERENCE BOOKS:

1.	Clough & Penzien. "Dynamics of Structures" McGraw Hill Publishers 2004.
2.	Anil K Chopra. "Dynamics of Structures" PHI Publishers 2006
3.	S. R. Damodarasamy and S. Kavitha, Basics of Structural Dynamics and Aseismic Design, PHI Learning Private Limited, New Delhi, latest print 2015.

THEORY OF ELASTICITY

Course Code:	**CV2204-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2102-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the concept of plane stress and plane strain problems.
2.	Develop compatibility equations for strains and strain measurements.
3.	Formulate and solve two dimensional problems in case of bending and develop Airy’s stress function equations
4.	Derive compatibility equations in polar coordinates.
5.	Analyze the stress distribution in axisymmetric problems and the effect of circular hole on the stress distribution.

UNIT-I

15 Hours

Introduction to elasticity : S*tress and strain relations*, mathematical theory continuum, stress and strain at a point, constitutive laws, generalized Hooke’s law, strain-displacement relations, stress tensor, stress transformation, stress invariants, strain tensor, strain invariants, plane stress and plane strain, principal stresses and strains.
Analysis of strain: F*ormation and solutions to differential equations*, measurement of surface strains – strain rosettes, compatibility concept – need and physical significance, compatibility equation in terms of strains

UNIT-II

15 Hours

Two dimensional problems in Cartesian coordinates: compatibility equations for plane stress and plane strain cases, Airy’s stress function – Polynomial stress functions. *Bending theory of beams-assumptions, bending stresses.* Bending of a cantilever beam subjected to end load and UDL, Simply supported beam subjected to UDL, Displacements in Cantilever and simply supported Beams.
Two dimensional problems in polar coordinates: Strain-displacement relations – Equations of equilibrium, Compatibility equation, Stress function.

UNIT-III

10 Hours

Axisymmetric Stress Distribution stress - strain relations for thin and thick cylinders, radial and circumferential stress distribution, Thick discs and cylinders, Rotating discs
Circular Hole in a plate- Effect on Stress Distribution subjected to Tension, compression and shear, Stress concentration factor

Course Outcomes: At the end of the course student will be able to

1.	**Illustrate** mathematical representation of stresses, strains in continuum and **analyze** the beams for plane stress, plane strain conditions
2.	**Formulate** compatibility equation in terms of strains and **measure** the strains in strain rosettes.
3.	**Develop** the differential equations and **Solve** two dimensional problems in rectangular coordinates
4.	**Develop** the differential equations and **Solve** two dimensional problems in polar coordinates.

5.	**Determine** the stress distribution under axisymmetric loading in cylinders, rotating discs and **analyze** the effect of circular hole in a plate

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2204-1.1	3	2	-	1	-	-	2	-	-	-	-	-	2	2	-
CV2204-1.2	2	2	2	1	-	-	2	-	-	-	-	-	2	2	-
CV2204-1.3	3	2	3	2	-	-	2	-	-	-	-	-	2	1	-
CV2204-1.4	3		2	2	-	-	2	-	-	-	-	-	2	1	-
CV2204-1.5	2	2	2	2	-	-	-	-	-	-	-	-	2	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Timoshenko S.P. and Goodier J.N. "Theory of Elasticity", International Student's Edition, Mc Graw Hill Book Co., Inc., New Delhi,2005.
2.	Wang P.C., "Applied Elasticity", 2005.

REFERENCE BOOKS:

1.	Valliappan C., (1981), "Continuum Mechanics – Fundamentals", Oxford & IBH Publishing Co. Ltd, New Delhi.
2.	Srinath L. S., (2009), "Advanced Mechanics of Solids", Tata Mc Graw Hill Publications Co. Ltd., New Delhi.
3.	Venkataraman & Patel, "Structural Mechanics with introduction to Elasticity and Plasticity", Mc Graw Hill Book Inc., New York, 2009.
4.	Sadhu Singh, 'Theory of Elasticity", Khanna Publishers, Delhi, 2009.
5.	T. G. Seetharam & L. Govindaraju, "Applied Elasticity", Interline publishing.

DESIGN OF PRESTRESSED CONCRETE STRUCTURES

Course Code:	**CV2205-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2005-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	**Summarize** the concept of prestress, materials and types of pre-stressing.
2.	**Analyse** the section for flexure and losses of pre-stress in concrete under different loading condition.
3.	**Explain** deflection and analyse pre-stressed concrete members.
4.	**Analyse** the section for flexure, shear in reference with IS code recommendations
5.	**Solve for** the permissible stress, Pre-stressing force and Eccentricity in a pre-tensioned and post-tensioned sections.

UNIT-I

16 Hours

MATERIALS: High strength concrete and steel, stress-Strain characteristics and properties, Pre-tensioning and Post-tensioning systems, Tensioning methods and End Anchorages.
BASIC PRINCIPLES OF PRESTRESSING: Fundamentals, Load Balancing, Stress Concepts, Pressure Line Concept.
ANALYSIS OF SECTIONS FOR FLEXURE: Stresses in concrete due to pre-stress and loads, Cable Profiles.
LOSSES OF PRE-STRESS: Pre-tensioning and post tensioning, determination of jacking force.

UNIT-II

14 Hours

DEFLECTIONS: Short term and long-term, Methods of reducing deflection, Deflection limits as per IS: 1343- 2012, elastic deflections under transfer loads and due to different cable profiles, effect of creep, load verses deflection curve.
LIMIT STATE OF COLLAPSE: Flexural and Shear strength of sections, IS Code recommendations, shear resistance of sections, shear reinforcement, limit state of serviceability – control of deflections and cracking.

UNIT-III

10 Hours

DESIGN OF BEAMS: pre-tensioned and post-tensioned symmetrical and asymmetrical sections. *Permissible stress, prestressing force and eccentricity*.

Course Outcomes: At the end of the course student will be able to

1.	**Summarize** the concept, basic materials and types of pre-stressing systems.
2.	**Solve for** the stresses and losses in the pre-stressed members.
3.	**Explain** Short-term and Long-term deflections and **Evaluate** the deflection under given loading condition
4.	**Analyse** the section for flexure, shear under limit state of collapse and serviceability for pre-stressed concrete members.
5.	**Evaluate** pre-tensioned and post tensioned beam components for permissible stress, Pre-stressing force and Eccentricity.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2103-1.1	1	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CV2103-1.2	2	-	2	-	-	-	-	-	-	-	-	-	2	-	-
CV2103-1.3	-	3	2	-	-	-	-	2	-	-	-	-	2	2	-
CV2103-1.4	-	3	-	-	-	-	-	2	-	-	-	-	2	2	-

CV2103-1.5	-	2	2	-	-	-	-	2	-	-	-	-	2	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	N. Krishna Raju, “Pre-stressed Concrete”, 6th edition, Tata McGraw Hill Education (India) Pvt. Ltd, Chennai 2018.
2.	Praveen Nagarajan, “Pre-stressed Concrete Design”, Pearson Education, 2013
REFERENCE BOOKS:	
1.	T.Y. Lin and Ned H. Burns, “Design of pre-stressed concrete structures”, 3rd edition, John Wiley & Sons, New York, 2015.
2.	N.C. Sinha & S.K. Roy, “Fundamental of pre-stressed concrete”, 2011, S. Chand Limited.
3.	IS: 1343: 2012 “Pre-Stressed Concrete - Code of practice (To be provided in the examination)
4.	P. Dayarathnam, “Pre-stressed Concrete”, 6th edition, Oxford and IBH Publishing Co, 2018.
5.	N. Rajgopalan, “Pre-stressed Concrete”, Alpha Science International, 2005.
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/105/106/105106117/ http://www.nptelvideos.in/2012/11/prestressed-concrete structures.html

ADVANCED RCC DESIGN

Course Code:	**CV2301-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2005-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Analyze of slabs by yield line approach and Design flat slab.
2.	Analyze and design of grid slabs by approximate method.
3.	Design the continuous beams with moment redistribution
4.	Analyze and design Silos and Bunkers
5.	Understand the behavior of shells and folded plates.

UNIT-I

16 Hours

Analysis of Slabs: Boundary conditions and yield line pattern at failure, Yield line analysis of slabs with equilibrium method and virtual work method.
Design of flat slabs by Direct Design Method (with drops)

UNIT-II

14 Hours

Design of grid floors
Design of continuous beams with redistribution of moments

UNIT-III

10 Hours

Silos and Bunkers: Components, design using Janssen's Theory and IS: 456-2000 Method
Shells and folded plate roofs – Types, forms and structural behavior.

Course Outcomes: At the end of the course student will be able to

1.	Analyze slabs by yield line approach.
2.	Design flat slab by direct method.
3.	Analyze and design grid slabs by approximate methods.
4.	Design the continuous beams with moment redistribution.
5.	Analyze and design silos and bunkers and explain the behavior of shells and folded plates.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2301-1.1	2	2	3	1	-	-	-	-	-	-	-	-	2	2	-
CV2301-1.2	2	2	3	1	-	-	-	-	-	-	-	-	2	2	2
CV2301-1.3	2	2	3	2	-	-	-	-	-	-	-	-	2	1	2
CV2301-1.4	2	2	3	2	-	-	-	-	-	-	-	-	2	1	2
CV2301-1.5	2	2		2	-	-	-	-	-	-	1	-	2	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Raju N K "Advanced Reinforced Concrete Design", CBS Publisher
2.	Dr.B.C.Punmia et.al, "Reinforced Concrete Design",Vol – II, Lakshmi Publications
REFERENCE BOOKS:	
1.	Jai Krishna and Jain "Plain and Reinforced Concrete Vol.II" Nem Chand Bros. Roorkee
2.	Varghese P.C "Advanced Reinforced Concrete Design" Prentice Hall of India – 2007
3.	Devadas Menon and Unnikrishnan.P "Reinforced Concrete Structures"
4.	Varghese.P.C. "Limit State Design of Reinforced Concrete Vol.II" Prentice Hall of India (P) ltd, New Delhi

DESIGN OF BRIDGES

Course Code:	**CV2302-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2005-1, CV2205-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Learn the components and classification of bridges.
2.	Understand the IRC codal provisions for bridge design.
3.	Learn the concepts in analyzing & designing the pipe and slab culverts.
4.	Understand the analysis & design of slab and girder of T-beam bridges.
5.	Understand the importance of bearings and joints in bridges.

UNIT-I

16 Hours

INTRODUCTION TO BRIDGES: History, components, classification, selection of site, linear waterway, scour, afflux.
Foundation: types of foundation (Pile, Raft, Well and Caisson – Brief Description only) cofferdam.
Substructure: types of abutment, piers, wing walls– forces acting on them and empirical designs – bank connection and protection works
BRIDGE LOADING STANDARDS: Loads to be considered while designing road bridges as per IRC (Indian Road Congress), impact factors, Indian railway bridge loading standards.

UNIT-II

15 Hours

CULVERTS: Computation of water discharge, design of pipe culverts and slab culverts for IRC class AA and class-A loading.
T-BEAM BRIDGES: Pigeaud's method for computation of interior slab moments, design of interior slab panel of T-beam bridge for IRC class AA tracked vehicles, courbon's method for computation of moments in girders.

UNIT-III

09 Hours

BEARINGS, JOINTS AND APPURTENANCES
Importance of bearings, bearings for slab bridges, bearings for girder bridges, expansion bearings, fixed bearings, elastomeric bearings, bearings for skew bridges, joints and appurtenances.

Course Outcomes: At the end of the course student will be able to

1.	Explain the components of bridges and classify them.
2.	Explain the IRC codal provisions for road and railway bridge design.
3.	Estimate the water discharge, analyse and design the pipe and slab culverts as per IRC 6 : 2016 part II, IS 458 : 2003, IS 456 : 2000 and IRC 21 : 2000.
4.	Analyse and Design the interior slab panels and girders of T Beam bridges as per pigeaud's method and courbon's method respectively using IS 456 : 2000 and IRC 6 : 2016 part II.
5.	Explain the importance and types of bearings and joints in bridges.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2302-1.1	1	-	-	-	-	-	-	-	-	-	-	1		1	-

CV2302-1.2	2	-	-	-	-	-	-	-	-	-	-	1	1	2	-
CV2302-1.3	1	2	3	-	-	-	-	1	-	-	-	1	3	2	1
CV2302-1.4	1	2	3	-	-	-	-	1	-	-	-	1	3	2	1
CV2302-1.5	1		-	-	-	-	-		-	-	-	1	1	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Johnson Victor, "Essentials of bridge Engineering", Sixth edition, Oxford and IBH publications, 2007.
2.	Krishna Raju, "Design of Bridges", Fourth edition, Oxford and IBH publications, 2009.

REFERENCE BOOKS:

1.	Jagadish T.R. & Jayaram M.A., "Design Of Bridge Structures", Second Edition, Prentice Hal Of India Private Limited, 2004
2.	Ponnuswamy. S.' 'Bridge Engineering', Tata Mcgraw-Hill Publishing Co.' New Delhi, 2008
3.	M.G.Aswani, V.N Vazirani & M.M. Ratwani, 'Design of Concrete Bridges' Second Edition Khanna Publishers,2013
4.	S.P.Bindra, 'Principles and Practice of Bridge Engineering', Ninth Edition, Dhanpat Ra publications,2016

E Books / MOOCs/ NPTEL

1.	Nptel.ac.in/courses/105105165.

EARTHQUAKE RESISTANT STRUCTURES

Course Code:	**CV2303-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2203-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	To provide the basic knowledge of Earthquake and seismic zoning of India.
2.	To study the performance of buildings due to irregularity during Earthquake
3.	To apply the knowledge of mathematics, science and engineering to analyze linear structural systems subjected to earthquake forces.
4.	To study the detailing of Earthquake resistant RCC buildings and to gain basic knowledge on geotechnical earthquake engineering.
5.	To study the code provisions for Earthquake resistant masonry and earthen buildings. And also to apply the knowledge of mathematics, science and engineering to analyze linear structural systems of masonry buildings.

UNIT-I

16 Hours

Introduction:
Engineering Seismology – Internal structure of earth, Geology of Earth, Definitions, Classification of Earthquakes, Causes of Earthquakes, Seismic waves, Theory of plate tectonics, Elastic rebound theory, Intensity and Magnitude of earthquake, Seismic measuring equipment's.

Seismic Response of Buildings:
Effect of Structural Irregularities on seismic performance of RC buildings. Vertical irregularity and plan configuration problems, Seismo resistant building architecture –lateral load resistant systems, Building characteristics.

UNIT-II

14 Hours

Earthquake Resistant Design Concepts:
Seismic zones of India, Design Philosophy and principle of Earthquakes Resistant Design, Guidelines for Earthquakes Resistant Design. Equivalent static force method-Assumptions, evaluation of Earthquake forces as per IS: 1893-2016. Dynamics analysis procedure- Response spectrum Method. Liquefaction–Causes and remedial measures.

UNIT-III

10 Hours

Seismic Analysis of Masonry Buildings –*Lessons learnt from past earthquakes on the performance of masonry and earthen buildings*. Elastic properties of structural masonry, Failure of masonry building- Causes, failure modes. Steps for improving seismic performance of masonry buildings- Design considerations, provisions of IS: 4326-1993 for design of masonry buildings.

Course Outcomes: At the end of the course student will be able to

1.	**Acquire** knowledge on basic concepts of earthquake engineering and seismic zones of India.
2.	**Explain** the suitability of building plan and configuration for an earthquake prone area.

3.	**Determine** earthquake forces in a building as per IS 1893:2016 provisions and **analyze** the failure of RC buildings.
4.	**Analyze** the structure using dynamic analysis procedure and **acquire** knowledge of geotechnical earthquake engineering.
5.	**Analyze** and **design** the masonry buildings subjected to seismic forces.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2303-1.1	1	1	2	-	-	1	1	-	-	-	-	-	1	2	-
CV2303-1.2	1	2	3	-	-	1	1	-	-	-	-	-	1	2	-
CV2303-1.3	1	2	3	-	-	1	1	-	-	-	-	-	1	2	-
CV2303-1.4	1	2	3	-	-	1	1	-	-	-	-	-	1	2	-
CV2303-1.5	1	2	3	-	-	1	1	-	-	-	-	-	1	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Jaikrishna et al., Elements of Earthquake Engineering, South Asia Publishers, New Delhi. 1st edition December 2000, reprinted 2014.
2.	Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, PHI, India.2nd edition 2015.
3.	Chopra, A.K., Dynamics of Structures, Prentice-Hall of India Pvt. Ltd. New Delhi. 1st edition 2011.
4.	S K Duggal, Earthquake Resistant Design of Structures, Oxford University press, 2007.

REFERENCE BOOKS:

1.	Clough, R.W. and Penzien J, Dynamics of Structures, McGraw Hill Book Co. New York 3rd edition 2003.
2.	S. R. Damodarasamy and S. Kavitha, , Basics of Structural Dynamics and Aseismic Design, PHI Learning Private Limited,New Delhi, latest print 2015.
3.	Biggs, M., An Introduction to Structural Dynamics, McGraw Hill Book Co. New York, January 1964.
4.	PAZ M., Structural Dynamics, CBS Publishers, New Delhi. July 1997.

FINITE ELEMENT METHOD OF STRUCTURAL ANALYSIS

Course Code:	**CV2304-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2202-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Get an idea how strain energy concept can be used for FEA method
2.	Analyse the components by 2D formulation and element discretization.
3.	Demonstrate numerical evaluation of stiffness to find stresses
4.	Study the concepts of Isometric and jacobian matrix.
5.	Finding solutions by numerical Integration.

UNIT-I

16 Hours

Finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions
Theory of elasticity concepts, Energy principles

UNIT-II

15 Hours

2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses,
Finding solutions for Static Condensation of nodes

UNIT-III

09 Hours

Isoparametric concepts: isoparametric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isoparametric Elements, Finding solutions to Numerical integration by Gaussian quadrature rule for one, two- and three-dimensional problems

Course Outcomes: At the end of the course student will be able to

1.	Explain the basic concept of energy principles and steps involved in FEA method and Analyze2D formulation for 4 and 8 noded quadrilateral elements.
2.	Determine static condensation of nodes.
3.	Analyze and Evaluate element stiffness and stresses by numerical approach.
4.	Explain Isoparametric concepts applying Jacobian transformation matrix and Stiffness Matrix.
5.	Analyze and Find solutions for one, two and three dimensional elements by Numerical integration.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2304-1.1	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
CV2304-1.2	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
CV2304-1.3	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
CV2304-1.4	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
CV2304-1.5	2	3	-	-	-	-	-	-	-	-	-	-	2	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Krishnamoorthy C.S., “Finite Element analysis” -Tata McGraw Hill, 2015
2.	Desai C &Abel J F.," Introduction to Finite element Method" , East West Press Pvt. Ltd.,2014
3.	Cook R D et.al., “Concepts and applications of Finite Element analysis ”, John Wiley.2013
REFERENCE BOOKS:	
1.	Daryl L Logan,“ A first course on Finite element Method ” , Cengage Learning 2011
2.	Bathe K J - “Finite Element Procedures in Engineering analysis ”- Prentice Hall .2016
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/112/104/112104193/
2.	https://nptel.ac.in/courses/112/104/112104116/

NUMERICAL METHODS IN CIVIL ENGINEERING

Course Code:	**CV2305-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**-**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand different numerical techniques to solve civil engineering problems
2.	Understand different methods solving simultaneous and transcendental equations
3.	Understand various numerical integration techniques for computing slope and deflections of determinate beams
4.	Explain numerical methods for solving ordinary differential equations
5.	Explain finite difference techniques

UNIT-I

16 Hours

INTRODUCTION, SCOPE AND IMPORTANCE OF THE SUBJECT:
Solution of linear simultaneous equations by the following methods:
(i) Gaussian elimination, (ii) Gauss-Jordan matrix inversion, (iii) Gauss-Siedel, (iv) Factorization. Application of the above methods in solving problems by slope-deflection method applied to beams and frames, problems in construction planning.
Finding the roots of nonlinear algebraic and transcendental equations by (i) Bisection method, (ii) Newton-Raphson method. Application of the above methods to solve problems in structural engineering, hydraulics, geotechnical engineering and environmental engineering.

UNIT-II

15 Hours

NUMERICAL INTEGRATION TECHNIQUES: (i) Trapezoidal rule, (ii) Simpson's one third rule. Application of the above methods for computing the area of BMD for statically determinate beams. Computation of slope and deflection in statically determinate beams by New Marks method.
Solution of ordinary differential equations by (i) Euler's method, (ii) 4th order Runge-Kutta method. Application of the above methods to solve civil engineering problems.

UNIT-III

09 Hours

Finite difference techniques to solve problems in structural mechanics. Analysis of statically determinate and indeterminate beams,

Course Outcomes: At the end of the course student will be able to

1.	Develop the linear equations in solving problems related to Civil Engineering and solve them by different techniques
2.	Determine the Eigen values and Eigen roots for the given data.
3.	Find the area of bending moment diagram for different problems on statically determinate structures and computing slope and deflection of statically determinate structures by adopting numerical integration techniques
4.	Formulate and solve differential equations for Computation of slope and deflection
5.	Analyze the determinate and indeterminate beams using finite difference method

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**

↓ Course Outcomes													1	2	3
CV2305-1.1	3	2	-	1	-	-	-	-	-	-	-	-	1	1	-
CV2305-1.2	3	2	-	1	-	-	-	-	-	-	-	-	1	1	-
CV2305-1.3	3	2	-	1	-	-	-	-	-	-	-	-	1	1	-
CV2305-1.4	3	2	-	1	-	-	-	-	-	-	-	-	1	1	-
CV2305-1.5	3	2	-	1	-	-	-	-	-	-	-	-	1	1	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Chapra S.C. &R.P.Canale, "Numerical Methods for Engineers", McGraw Hill, 2014.

2. N.Krishna Raju &K.U.Muthu, "Numerical Methods in Engineering Problems", MacMillan India Limited, 2005.

REFERENCE BOOKS:

1. Iqbal H.Khan&Q.Hassan, "Numerical Methods for Engineers and Scientists", Galgotia, New Delhi, 2010.

2. Pallab Ghosh, "Numerical Methods using Computer Programs in C", Prentice Hall of India Private Limited, New Delhi, 2006.

3. Schilling, "Numerical methods for Engineers using MATLAB and C", I Edition, Thomson Publications, 2009.

4. S. Rajasekaran, "Numerical Methods in Science and Engineering- A Practical Approach", S. Chand and Company Limited, New Delhi, 2013.

PROFESSIONAL ELECTIVE COURSES (GEOTECHNICAL AND TRANSPORTATION ENGINEERING

EARTH RETAINING STRUCTURES

Course Code:	**CV2211-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2006-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Know about types of retaining wall, forces acting on them and possible modes of failure of each type.
2.	Understand how to analyze stability of different types of retaining wall, and to study different types of sheet pile walls and how to design them under different soil conditions.
3.	Differentiate between cantilever sheet pile wall and anchored sheet pile wall with reference to the design and construction for given field conditions.
4.	Study and understand lateral earth pressure distribution on sheeting of braced system in different soil types.
5.	Study different components of braced systems, their selection and design them for given soil and depth of excavation. Also, to study the different types of coffer dams and the usefulness under the different situations.

UNIT-I

16 Hours

RETAINING WALLS: Types of retaining wall and forces on each type of wall. Modes of failure of retaining walls - sliding, overturning and bearing. Stability analysis and principles of the design of retaining walls – Gravity retaining walls, *Cantilever retaining walls, counter fort retaining walls (no structural design). Drainage from the backfill.*

BULK HEADS: Cantilever sheet pile walls *Types of sheet pile walls.* Cantilever sheet pile wall in cohesion-less soils. Cantilever sheet pile wall in clay. Design problem in each case.

UNIT-II

15 Hours

BULK HEADS: Anchored Sheet Pile Walls:

Anchored sheet pile with free earth support in cohesion-less and cohesive soil. Bulkheads with fixed earth support method – *Types, locations and design of anchors*.

BRACED CUTS: Introduction. Lateral earth pressure on sheeting, Different types of sheeting and bracing systems. *Design of various components of bracings*.

UNIT-III

09 Hours

COFFER DAMS & CELLULAR COFFER DAMS: Introduction. Introduction – *types of cofferdams* - Design of cellular cofferdams on rock by Tennesse Valley Authority (TVA) method – safety against sliding, slipping, overturning, vertical shear and stability against bursting

Design of cellular coffer dam on soil -safety against sliding, slipping, overturning, vertical shear and stability against bursting.

Course Outcomes: At the end of the course student will be able to

1.	Explain and analyze retaining wall, the force acting on earth type wall and possible mode of failure of each type.
2.	Explain and design cantilever type sheet pile wall.
3.	Explain anchored sheet pile walls, its advantage over cantilever sheet pile wall.

4.	Analyze and identify lateral earth pressure distribution on sheeting of braced system for earth trench in different soil types.
5.	Analyze and design coffer dams and cellular cofferdams.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2211-1.1	2	3	2	-	-	-	-	-	-	-	-	-	2	3	1
CV2211-1.2	2	2	3	-	-	-	-	-	-	-	-	-	2	3	1
CV2211-1.3	1	2	3	-	-	-	-	-	-	-	-	-	2	3	1
CV2211-1.4	1	2	3	-	-	-	-	-	-	-	-	-	2	3	1
CV2211-1.5	2	2	3	-	-	-	-	-	-	-	-	-	2	3	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Clayton, C.R.I., Woods, R.I., Bond, A.J., Milititsky, J. – Earth Pressure and Earth-retaining structures, CRC Press, Taylor and Francis group, 20132.
2.	Budhu, M. – Foundations and Earth retaining structures, John Wiley & Sons, Inc., 2008

REFERENCE BOOKS:

1.	Bowles, J.E. – Foundation Analysis and Design, 5th Edition, BBS Publisher, 2009.
2.	Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012.
3.	Soil Mechanics and Foundation Engineering: Dr. K.R. Arora, (Sixth edition) (2003), Pub: Standard Publishers & Distributors.
4.	Soil Mechanics and Foundation Engineering, S.K. Garg, (Fifth edition)(2004), Pub :Khanna Publishers.
5.	Soil Mechanics and Foundation Engineering,: Dr. B.C. Punmia (2005),Pub : Laxmi Publications Ltd.,
6.	Numericals in Geotechnical Engineering: A.V. Narasimha Rao & Dr. C. Venkataramaiah, Pub: University Press.
7.	Soil Mechanics and Foundation Engineering, Dr. V.N.S. Murthy (2011), Pub: C B S Publishers and Distributers, Bengaluru.
8.	Geotechnical Engineering, Dr. C. Venkataramaiah (2006): Pub: New Age publications.

E Books / MOOCs/ NPTEL

1.	http://nptel.ac.in/courses/105106052/9
2.	http://nptel.ac.in/downloads/105101083/

Ground Improvement Techniques

Course Code:	**CV2212-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2006-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Know the objectives of soil improvement, classification of ground improvement techniques and to select the best method or technique for the existing condition.
2.	Know ‗Hydraulic modification', its aim, principle and techniques such as gravity drain, lowering of water table, multistage well point, vacuum dewatering etc.
3.	Define chemical modification, its aim, special effects, different methods or techniques.
4.	Have a clear knowledge regarding ―Grouting‖, effects of grouting, Chemicals and materials used, and types of grouting. Grouting procedure and applications of grouting.
5	Know the concepts and use of recent methods in Soil reinforcement.

UNIT-I

GROUND IMPROVEMENT	**06 Hours**
Definition, Objectives of soil improvement. Classification of ground improvement techniques. Factors to be considered in the selection of the best soil improvement technique.	
MECHANICAL MODIFICATION	**10 Hours**
Type of mechanical modification, compaction, Principle of modification for various types of soils. Effect of grain size distribution on compaction for various soil types like BC soil, lateritic soil, coarse-grained soil, micaceous soil. Effect of compaction on engineering behaviour like Compressibility, Swelling and Shrinkage, Permeability, relative density, liquefaction potential. Field compaction - static, dynamic, impact and vibratory type. Specification of compaction. Tolerance of compaction.	

UNIT-II

HYDRAULIC MODIFICATION	**07 Hours**
Definition, aim, principle, techniques, gravity drain, lowering of water table, multistage well point, vacuum dewatering, and design of dewatering system including pipe line effects of dewatering. Drainage of slopes, preloading, vertical drains, numerical problems on design of vertical drains, sand drains, Prefabricated vertical drains sand drains, Electro osmotictic dewatering.	
CHEMICAL MODIFICATION	**07Hours**
Definition, aim, special effects, and methods, Techniques -sandwich technique, admixtures, cement stabilization. Hydration - effect of cement stabilization on permeability, Swelling and shrinkage. Criteria for Lime stabilization, cement stabilization. - Suitability, process, special effects, criteria. Other chemicals, chlorides, hydroxides, lignin, hydrofluoric acid. Fly ash in cement stabilization, Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.	

UNIT-III

GROUTING	**04 Hours**
Introduction, Effects of grouting, Chemicals and materials used, Types of grouting, Grouting procedure and Applications of grouting.	
MISCELLANEOUS METHODS (only Concepts)	**06 Hours**
Introduction, Soil reinforcement. Thermal methods, Ground improvement by confinement - Crib walls, Gabions & Mattresses, Anchors, Rock bolts and soil nailing Geo-synthetics in soil modification, Micro piles. Case studies.	

Course Outcomes: At the end of the course student will be able to

1.	Understand the objectives, necessity and scope of ground improvement techniques
2.	Identify and Implement the various methods of mechanical modifications in the soil improving techniques.
3.	Explain the methods involved in ground modification by hydraulic methods.
4.	Identify and apply the chemical modifications techniques in field conditions.
5.	Explain techniques related to grouting and other miscellaneous soil reinforcement techniques.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2212-1.1	1	1	-	-	1	-		-	-	-	-	1	2	2	-
CV2212-1.2	1	2	-	-	1	-	1	-	-	-	-	1	2	2	-
CV2212-1.3	1	2	-	-	2	1	1	-	-	-	-	1	2	2	-
CV2212-1.4	1	2	-	-	2	1	1	-	-	-	-	1	2	2	-
CV2212-1.5	1	2	-	-	2	1	1	-	-	-	-	1	2	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Koerner. R.M. ―Construction and Geotechnical Methods in Foundation Engineering‖, Prentice Hall, New Jersy, 3rd Edn. 2002.
2.	Purushoptham Raj., P. ―Ground Improvement Techniques‖ Tata McGraw Hill, New Delhi, 2005.

REFERENCE BOOKS:

1.	Manfred Hausmann., ―Engineering Principles of Ground modification‖. McGraw-Hill Ryerson, Limited, 1990
2.	Colin, J.F.P. (1988) ―Earth Reinforcement and Soil Structures‖.
3.	Ingles, C.G. and Metcalf, J.B. (1956), Soil Stabilization- Principle and Practice.
4.	Jewell, R.A., Soil Reinforcement with Geotextile, CIRIA, London, 1996.

E Books / MOOCs/ NPTEL

1.	http://www.cdeep.iitb.ac.in/webpage_data/nptel/civil%20engineering/foundation_engineering/course_home36.1.html
2.	https://nptel.ac.in/courses/105/108/105108075/

HIGHWAY GEOMETRIC DESIGN

Course Code:	**CV2213-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2108-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the different road design elements factors as per IRC Standards.
2.	Acquire the knowledge in different cross-sectional elements of highway.
3.	Understand and calculate the different sight distances, set back distance.
4.	Understand the elements and calculate the length of horizontal and vertical alignment.
5.	Identify different intersection, road markings and design the drainage systems.

UNIT-I

16 Hours

INTRODUCTION: *Objectives, requirements*, design control factors: topography, design speed, design vehicle, traffic capacity, volume, environment and other factors - IRC specifications, PCU concept for design.

CROSS SECTION ELEMENTS: Pavement surface characteristics –friction, skid resistance, pavement unevenness, light reflecting characteristics, camber: *objectives*, types, methods, pavement width carriageway, kerb, medians, shoulders, foot paths, parking lanes, service roads, cycle tracks, driveways, *guard rails*, *width of formation*, *right of way*, design of road humps as per IRC Specification.

UNIT-II

15 Hours

SIGHT DISTANCES: Factors and problems: stopping and overtaking, at intersections, set back distances at curves.

HORIZONTAL AND VERTICAL ALIGNMENT: Horizontal alignment: *objectives*, *requirements*, design elements, super elevation, extra widening of pavements at curves, transition curve: types, evaluating length; vertical alignment*: gradient*, design criteria, types, design of summit and valley curves, design standards for hill roads.

UNIT-III

09 Hours

INTERSECTIONS: *Types*, elements, design considerations of at-grade intersection, grade separations and interchanges.

ROAD MARKINGS: Objects, materials, classifications.

HIGHWAY DRAINAGE: *Importance*, *Requirements of surface and subsurface drainage*, design of cross sections and filter material.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the road design control factors as per IRC guidelines.
2.	**Explain** the road surface characteristics, road side amenities and **illustrate** the design aspects of road hump as per IRC guidelines.
3.	**Determine** the sight distances and set back distance at highway curves.
4.	**Design the** horizontal, vertical alignment elements in highway and hill roads.
5.	**Illustrate** the types of intersection, types of road markings, highway drainages and **design** the highway drainage cross section and filter material.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 2	PSO↓ 3
CV2213-1.1	2	2	2	-	-	-	-	-	-	-	-	-	1	1	1
CV2213-1.2	2	2	2	-	-	-	-	-	-	-	-	-	1	2	1
CV2213-1.3	3	2	3	-	-	-	-	-	-	-	-	-	2	3	2
CV2213-1.4	3	2	2	-	-	-	-	-	-	-	-	-	1	2	2
CV2213-1.5	3	3	3	-	-	-	-	-	-	-	-	-	2	3	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Khanna S.K, C.E.G Justo & Veeraraghavan A. "Highway Engineering", Nemchand& Bros , Roorkee.(2014) (10th Revised Edition)
2. Kadiyali L. R., Lal. N.B, "Principles and Practices in Highway Engineering", Khanna Publishers, New Delhi. 7th Revised Edition. (2013).

REFERENCE BOOKS:

1. Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 3rd Revised Edition. (2015).
2. Kadiyali, L. R., "Traffic Engineering and Transportation Planning", 7th Ed., Khanna publishers, India (2011).
3. AASHO, A policy on Geometric Design of Rural Highway.
4. MORTH, "Type Design for Intersections on National Highways", (1992), IRC, New Delhi.

E Books / MOOCs/ NPTEL

1. https://nptel.ac.in/courses/105/105/105105107/

ROAD SAFETY AND MANAGEMENT

Course Code:	**CV2214-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2108-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Get awareness about the global, national and regional road crash scenario and their impacts
2.	Identify the risk factors associated with crash involvement and its severity
3.	Demonstrate the traffic management measures to minimize road crash
4.	Understand the methods of collection and analysis of crash data
5.	Gain the knowledge of the procedure for performing road safety audit.

UNIT-I

INTRODUCTION TO ROAD SAFETY ENGINEERING — **07 Hours**

Over view of road safety - Global road safety scenario and pattern - global trends and projections - national and state road safety level - problems in road safety in developing countries magnitude, socioeconomic and health effects.

TRAFFIC ELEMENTS — **09 Hours**

Characteristics of Road user, Motor vehicle, Roadway- relationship between elements- human factors governing road user behavior- risk factors for traffic accidents- exposure to risk- crash involvement-crash severity- post crash injury outcomes

UNIT-II

ANALYSIS AND PREVENTION OF ACCIDENTS — **10 Hours**

Collection of accident data- Statistical methods for analysis of accident data- Speed in relation of safety- Weather and its effects on accidents- Vulnerable road users safety- parking influence on accidents.

TRAFFIC MANAGEMENT MEASURES FOR ACCIDENT PREVENTION — **06 Hours**

Legislation, Enforcement, Education and Propaganda, Formulating and implementing road safety policy

UNIT-III

ROAD SAFETY IMPROVEMENT PROGRAM — **08 Hours**

Road safety audit (RSA) - Procedure in road safety audit- design standards- audit tasks- stages of road safety audit- key legal aspects. Road design issues in RSA‘s – structuring and preparation of audit report.

Course Outcomes: At the end of the course student will be able to

1.	**Identify** the factors contributing to accidents
2.	**Collect** the necessary data pertaining to road crashes and **prepare** comprehensive accident crash database.
3.	**Perform** the statistical analysis of accident crash data.
4.	**Describe** the traffic management measures for accident prevention
5.	**Explain** the road safety audit and **prepare** a detailed audit report.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3

CV2214-1.1	3	-	-	-	-	-	-	-	-	-	-	-	1	3	-
CV2214-1.2	2	3	1	-	-	-	-	-	-	-	-	-	2	1	-
CV2214-1.3	3	2	-	-	-	-	-	-	-	-	-	-	1	2	1
CV2214-1.4	2	3	1	-	-	-	-	-	-	-	-	-	2	1	-
CV2214-1.5	3	2	-	-	-	-	-	-	-	-	-	-	1	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Kadiyali, L. R., "Traffic Engineering and Transportation Planning", 7th Ed., Khanna publishers, India (2011).
2.	David L. Geotsc. Occupational Safety and Health for Technologists, Engineers and Managers. 5th Edition, 2004.

REFERENCE BOOKS:

1.	Khanna. S. K, Justo. C.E.G, Veeraragavan. A, “Highway Engineering”, Revised 10th edition, Nem Chand and Bros, 2014.
2.	World Health Organization, Road Traffic Injury Prevention Training Manual, 2006
3.	Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 2006.
4	Fuller, R., Santos, J.A. Human Factors for Highway Engineers, Pergamon, 2002.
5	Following IRC codal guidelines: IRC: 103-1988, IRC: SP: 32-1988, IRC: SP: 44-1996, IRC: SP: 88-2010.

TRAFFIC ENGINEERING

Course Code:	**CV2215-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2108-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the fundamentals of traffic engineering, scope and its uses in the actual field condition.
2.	Understand the significance of various traffic studies as per IRC guidelines.
3.	Understand the flow theories and its probabilistic approach in connection with traffic engineering.
4.	Acquire the knowledge of traffic signals design and other traffic regulatory methods as per IRC.
5.	Impart the basic knowledge on traffic rotary, street lighting, arboriculture and intelligent transport system.

UNIT-I

16 Hours

Introduction to Traffic Engineering: *Scope*, road user and vehicle characteristics- static and dynamic, *reaction time of driver*.

Traffic parameter Studies and Analysis: *Objectives*, method of study- definition, data collection and analysis (traffic volume, spot speed, origin and destination, speed and delay), parking- on street and off-street parking, accidents- *causes*, analysis and *measures.*

UNIT-II

15 Hours

Traffic Flow Theories: Green shield theory, Goodness of fit-correlation and regression analysis (linear only), Queuing theory, car following theory, Traffic forecast- simulation technique.

Traffic Regulation and Control: *Controls-Driver, Vehicle and Road*, Traffic Regulations- One Way Streets, *Traffic Signs*, *Road Markings*, Traffic signals- types, design principles (Webster's and IRC Method).

UNIT-III

09 Hours

ROAD INTERSECTIONS AND MANAGEMENT: Road intersection-Importance, classification, Rotary design, *Highway lighting, Road side Arboriculture*, Intelligent Transport system.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the Scope and characteristics of traffic engineering.
2.	**Illustrate** the importance and methods in Traffic studies.
3.	**Summarize** the Traffic flow theories and **explain** the importance.
4.	**Apply** the design principles of traffic signals and **outline** the traffic regulation measures.
5.	**Design** the rotary intersection and **explain** the importance of highway lighting, arboriculture and ITS.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2215-1.1	2	1	-	-	-	1	1	-	-	-	-	-	2	1	-
CV2215-1.2	2	3	2	-	-	1	1	-	-	-	-	-	3	2	-
CV2215-1.3	3	2	-	-	-	1	1	-	-	-	-	-	2	1	-
CV2215-1.4	2	2	3	-	-	1	1	-	-	-	-	-	2	2	1
CV2215-1.5	3	2	3	-	-	1	1	-	-	-	-	-	2	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Khanna S.K, C.E.G Justo &Veeraraghavan A. "Highway Engineering", Nemchand&Bros, Roorkee.(2014) (10th Revised Edition)
2.	Kadiyali, L. R., "Traffic Engineering and Transportation Planning", 7th Ed., Khanna publishers, India (2012).
REFERENCE BOOKS:	
1.	Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 3rd Revised Edition. (2015).
2.	Kadiyali L. R., Lal. N.B, "Principles and Practices in Highway Engineering", Khanna Publishers, New Delhi. 7th Revised Edition. (2013).
3.	Matson, T.M. Smith, W.S. and Hurd, F.W.,'Traffic Engineering, Connecticut, USA.
4.	Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt Ltd, New Delhi. (2011)
5.	Wells, G.R., 'Traffic Engineering-An Introduction', Griffin, London.
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/105/105/105105107/
2.	http://nptel.ac.in/downloads/105101087/

SOIL EXPLORATION & GROUND IMPROVEMENT TECHNIQUES

(Industry Supported Course – Geosmart International Pte Ltd, Singapore)

Course Code:	**CV2216-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the underlying concepts of type of soil and its suitability for construction work.
2.	Understand various field tests and their suitability to field conditions.
3.	Develop ability to analyze weak and compressible soil and provide proper treatment to improve its characteristics.
4.	Understand the underlying principle in dynamic consolidation. Select proper method for anchors, grouting and vacuum consolidation.

UNIT-I

Introduction — **06 Hours**

Principles of exploration: Geophysical and sounding methods, Modern methods of boring and sampling; Preservation and transportation of samples; Sampling records, Soil profiles.

Soil Exploration Methods — **10 Hours**

Various types of field tests; Instrumentation; Investigation below sea/river bed; offshore investigation; investigation; interpretation of exploration data and report preparation; economics of field testing & lab testing.

UNIT-II

Soil Stabilization 01 — **10 Hours**

Engineering properties of soft & weak and compressible deposits; principles of treatment; Methods of soil improvement-lime stabilization and injection; thermal, electrical and chemical methods.

Soil Stabilization 02 — **06 Hours**

Dynamic consolidation; vibroflotation; compaction by blasting; pre-consolidation with vertical drains; Granular piles; soil nailing.

UNIT-III

Soil Stabilization 03 — **06 Hours**

Anchors; Grouting; Electro-osmosis; Soil freezing; Vacuum consolidation; Case histories Soil confinement

Course Outcomes: At the end of the course student will be able to

1.	Plan the method of soil exploration for a given site and structure.
2.	Analyzing soil strata below river/sea bed by planning proper field tests.
3.	Propose proper treatment method for soft, weak and compressible soil strata.
4.	Planning and design of suitable method of dynamic consolidation for a site.
5.	Planning and design of suitable techniques of grouting, anchors and vacuum consolidation.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2216-1.1	2	1	-	-	-	1	1	-	-	-	-	-	2	1	-
CV2216-1.2	2	3	2	-	-	1	1	-	-	-	-	-	3	2	-
CV2216-1.3	3	2	-	-	-	1	1	-	-	-	-	-	2	1	-

CV2216-1.4	2	2	3	-	-	1	1	-	-	-	-	-	2	2	1
CV2216-1.5	3	2	3	-	-	1	1	-	-	-	-	-	2	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Joseph Bowles, "Foundation Analysis and Design", McGraw-Hill Book Company.
2.	Hvorslev MJ, “Subsurface Exploration and Sampling of Soils for Civil Engg. Purposes” Elsevier Pub. Co
REFERENCE BOOKS:	
1.	Manfredd RH, “Engineering Principles of Ground Modification”, Mc Graw Hill
2.	Braja M. Das, "Principles of Foundation Engineering", PWS Publishing Company.
3.	Literature on Advanced foundations Bureau of Indian Standard codes on foundations.
4	Purushotham Raj, “Ground Improvement Techniques”.

Deep Foundations

Course Code:	**CV2311-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2006-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	To learn more about the introductory aspects of piles, selection of deep foundation systems and associated equipment.
2.	Design of axial and lateral geotechnical capacity of driven piles in both individually and as group and Learn the usage of wave equation analysis applied to the design and installation of driven piles including driving problem.
3.	To carry out the design of pile and to estimate the efficiency of a Pile Group.
4.	To understand the structural mechanic aspects of the design in a laterally loaded pile and
5.	Study the different types of well foundations and carry out the analysis and design.

UNIT-I

PILE CLASSIFICATION FUNCTION	**09 Hours**
Classification of piles – Factors governing choice of pile foundation – Load transfer principles – piling equipment and methods – changes in soil condition during installation of piles –Load transfer mechanism, Soil properties for static pile capacity, Ultimate static pile point capacity, Skin resistance, Static load capacity using load transfer, Tension piles, Piles for resisting uplift, Laterally loaded piles, Numerical problems. Pile load test and Penetration tests.	
SINGLE PILE –DYNAMIC ANALYSIS AND LOAD TESTS	**07 Hours**
Dynamic analysis, Pile driving, Rational pile formulae, other dynamic pile driving formulae and general considerations, Reliability of dynamic pile driving formulae	

UNIT-II

PILE GROUPS – EFFICIENCY OF PILE GROUPS	**09 Hours**
Pile groups – Efficiency of pile groups- Group capacity in clays– Minimum spacing of piles in a group – Negative skin friction of single piles and pile groups	
SETTLEMENT OF PILE GROUPS IN CLAYS	**05 Hours**
Equivalent raft approach – Settlement of pile groups in sands, under reamed piles.	

UNIT-III

WELL FOUNDATIONS	**05 Hours**
Components of a well foundation–Procedure for construction and sinking of wells–Thickness of well steining for sinking under self-weight - Grip length- Problems encountered in well sinking–Tilts and Shifts– Causes – Permissible tilts and shifts - Methods to rectify tilts and shifts – Forces acting on a well foundation –Allowable bearing pressure – Lateral stability of well foundations - Terzaghi‘s analysis.	
DRILLED PIERS & CAISSONS	**05 Hours**
Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic and floating caissons. Advantages and disadvantages of floating caissons.	

Course Outcomes: At the end of the course student will be able to

1.	Understand about the introductory aspects of piles and Selection of deep foundation systems and associated equipment.
2.	Analyze and design individually loaded piles using static and dynamic formulas.
3.	Analyze and design pile group and estimate the efficiency of a Pile Group.
4.	Understand and Estimate the settlement of pile group under loading.

5.	Analyze and Design the types of well foundations.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2	3
CV2311-1.1	1	1	-	-	-	-	-	-	-	-	-	-	1	3	-
CV2311-1.2	1	2	3	-	-	-	-	-	-	-	-	-	2	3	-
CV2311-1.3	1	2	3	-	-	-	-	-	-	-	-	-	2	3	-
CV2311-1.4	1	2	3	-	-	-	-	-	-	-	-	-	2	3	-
CV2311-1.5	1	2	3	-	-	-	-	-	-	-	-	-	2	3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Poulos, H.G., Davis, E.H., Pile foundation analysis and design, John Wiley and Sons, New York, 1980.
2.	Swami Saran‖ Analysis and Design of Substructures Limit state design‖, Oxford and IBH Pub. Co.pvt, Ltd. New Delhi 1996.
3.	Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
4	Tomlinson, M.J. Foundation engineering, ELBS, Longman Group, U.K. Ltd.,England 1995.

REFERENCE BOOKS:

1.	Cernica, J.N. Geotechnical Engineering Foundation Design, John Wiley and Sons, Inc. 1995.
2.	Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1996.
3.	Donald, P., Coduto, Foundation Design Principles and Practices, Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1996.
4.	Winterkorn, H.F. and Fang, H.Y, Foundation Engineering Handbook, Von Nostrand Reinhold, 1994.
5	Grigorian, Pile Foundation for Buildings and Structures in collapsible Soil, Oxford & IBH Publishing Co, Pvt. Ltd., New Delhi, 1999.
6	Varghese P.C.,‖ Foundation Engineering‖, PHI Learning Private Limited, New Delhi, 2005.
7	Code of practice for design and construction of pile foundation-IS: 2911 (Part I to IV).
8	Shamsher Prakash and Hari D. Sharma ―Pile foundations in engineering practice, wiley (2012).

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/105/108/105108069/
2.	https://nptel.ac.in/courses/105/105/105105039/
3.	https://nptel.ac.in/courses/105/106/105106144/

ENVIRONMENTAL GEOTECHNIQUES

Course Code:	**CV2312-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2003-1, CV2006-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	To acquire knowledge about various branches of environmental geotechniques
2.	To familiarize with design of landfill impoundments
3.	To study different waste disposal systems suiting for hazardous and non-hazardous wastes
4.	To familiarize with non-destructive techniques of site characterization.
5.	To study the remediation methods for contaminated soil.

UNIT-I

Soil-water-environment interaction — **08 Hours**

Introduction to geo environmental Engineering, Soil-water-environment interaction relating to geotechnical problems, Waste:-source, classification and management of waste, Physical, chemical and geotechnical characterization of municipal solid waste, Impact of waste dump and its remediation.

Waste Disposal and Introduction to Landfills — **08 Hours**

Origin, nature and distribution of soil - Description of individual particle - Soil fabric and Geotechnical application of waste and disposal: Geotechnical use of different types such as Thermal power plant waste, MSW, mine waste, industrial waste. Waste disposal facilities, Parameters controlling the selection of site for sanitary and industrial landfill. Site characterization. MoEF guidelines.

UNIT-II

Contaminant transport — **08 Hours**

Sources, types and composition of different wastes - Characteristics and classification of hazardous wastes - Generation rates - Potential problems in soils due to contaminants. Ground water flow - Sources of ground water contamination - Contaminant transport - Pollution of aquifers by mining and liquid wastes - Ground water pollution downstream of landfills - Transport mechanisms.

Waste management — **08 Hours**

CPCB rules and regulations on waste handling and management - Criteria for selection of sites for waste disposal - Disposal techniques -Disposal systems for typical wastes. Ground modification and waste modification techniques in waste management - Ground modification - Mechanical modification, hydraulic modification, chemical modification.

UNIT-III

Engineered Landfills and soil remediation — **08Hours**

Liners and covers for waste disposal - rigid and flexible liners - Leachate and gas collection system - Engineered landfills (including basal liner and cover liner systems) – components design criteria. Hydrological design for ground water pollution control.
Soil contamination and remediation technology for both ground and aquifers.

Course Outcomes: At the end of the course student will be able to

1.	Understand the fundamentals, and engineering aspects on soil-water environment interaction.
2.	Explain the Origin, distribution, and applications of solid waste management.
3.	Classify and characterize the hazardous waste and ground water flow of contaminant in soil.
4.	Understand CPCB rules and regulations on waste and Examine ground modification techniques in waste management.

5.	Explain the importance of liners, covers, hydrological designs and remediation's for soil contaminations

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2	3
CV2312-1.1	1	2	1	1	-	2	2	1	-	-	-	2	1	2	-
CV2312-1.2	1	2	1	1	-	2	2	1	-	-	-	2	1	2	-
CV2312-1.3	1	2	1	1	-	2	2	1	-	-	-	2	1	2	-
CV2312-1.4	1	2	1	1	-	2	2	1	-	-	-	2	1	2	-
CV2312-1.5	1	2	1	1	-	2	2	1	-	-	-	2	1	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Koerner, R.M. (2005). Designing with Geosynthetics. Fifth Edition. Prentice Hall, New Jersey, 2005.
2. Daniel, D.E. (1993). Geotechnical Practice for Waste Disposal. Chapman and Hall, London.
3. K. R. Reddyand H D Sharma, ―Geo environmental Engineering: Site Remediation, waste containment, and emerging waste management technologies‖, John Willey, 2004

REFERENCE BOOKS:

1. David. E. Daniel, Geotechnical practice for waste disposal – Chapman and Hall – London, 1993.
2. Masashi Kamon, editor – Balkema, Environmental Geotechnics, - Rotterdan 1996
3. Hsai- Yang Fang, 3. 3. Introduction to Environmental Geotechnology,- CRC Press, New York, 2009.
4. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989.
5. Mitchell J. ―Fundamentals of soil behaviour‖, John Wiley and Sons. Third Edition, 2005.
6. Robert M. Koerner, Construction and Geotechnical methods in Foundation Engineering‖, McGraw Hill Book Co., 1996.
7. Abdel M. O. Mohamed and Hogan E. Antia, ―Developments in Geotechnical Engineering‖, Elsevier, 1998.
8. Hari D. Sharma and Krishna R. Reddy, ―Geo environmental Engineering – Site Remediation, Waste Containment, Emerging waste management technologies‖, John Wiley and sons, 2004.
9. Hsai Yang Fang and John Daniel, ―Introduction to Environmental Geo technology‖, CRC press, Taylor and Francis, Second Edition, 2013

E Books / MOOCs/ NPTEL

1. https://nptel.ac.in/courses/105/101/105101196/

PAVEMENT DESIGN

Course Code:	**CV2313-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2108-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Get a preliminary knowledge on flexible and rigid pavement design for highways and airport pavements.
2.	Analyze the stresses and deflections in flexible and rigid pavements.
3.	Understand the various methods in designing the structure of a flexible pavement.
4.	Describe the functions and requirements of various types of joints in CC pavement.
5.	Know to design the various component parts of concrete pavement.

UNIT-I

Introduction to Pavement Design — **06 Hours**

Desirable characteristics and requirements of a well-designed Pavement, Difference between highway and air field pavements, Basic concepts and objects of pavement design. Functions of various components and comparison of flexible and rigid pavements, Factors affecting design and performance of pavements.

STRESSES AND DEFLECTIONS IN FLEXIBLE PAVEMENTS — **10 Hours**

Stresses and deflections, Principle-Assumptions-limitations, applications of Boussinesq's single layered theory and Burmister's two layered theories in pavement design and problems. Various factors in traffic design wheel load-Contact pressure-ESWL concept for dual and tandem wheel load assembly (Boyd and Foster method), repeated loads and EWL concept-Problems.

UNIT-II

FLEXIBLE PAVEMENT DESIGN — **08 Hours**

Methods for highways and airport pavement design, Introduction to CBR method-Advantages and limitations, Flexible pavement design as per IRC: 37-2001- design factors and recommendations- design steps and Problems.
McLeod method, Burmister's method and Kansas (triaxial) method- principle, design steps and problems.

STRESSES IN RIGID PAVEMENTS — **07 Hours**

Factors to be considered in traffic wheel load during the design life of a CC pavement. Basic principle and concepts in analysis of stresses in rigid pavements. Westergaard's analysis- Assumptions, Modified Westergaard's (IRC) equations- Concept of Wheel load stresses-Warping stresses-Frictional stresses-Combined stresses (Using charts /equations)-Problems.
Design of low volume concrete roads by IRC equations method.

UNIT-III

RIGID PAVEMENT DESIGN: — **09 Hours**

Design of joint spacing as per IRC guidelines.
Design of Dowel bars at load transfer joints, Design of Tie bars at longitudinal joints-design steps and problems as per IRC: 58-2002. Design of CC slab as per IRC:58-2002

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the fundamental design factors affecting the performance of flexible and rigid pavements.
2.	**Analyze** the stresses and deflections in flexible pavement.
3.	**Design** the thickness of the highway and airport pavements by different methods.
4.	**Compute** the stresses and deflections in cement concrete pavements.
5.	**Design** various components of the rigid pavement as per IRC guidelines.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3

CV2313-1.1	3	-	-	-	-	-	-	-	-	-	-	-	1	3	-
CV2313-1.2	2	3	1	-	-	-	-	-	-	-	-	-	2	1	-
CV2313-1.3	3	2	-	-	-	-	-	-	-	-	-	-	1	2	1
CV2313-1.4	2	3	1	-	-	-	-	-	-	-	-	-	2	1	-
CV2313-1.5	3	2	-	-	-	-	-	-	-	-	-	-	1	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Khanna. S. K, Justo. C.E.G, Veeraragavan. A, “Highway Engineering”, Revised 10th edition, Nem Chand and Bros, 2014.

2. Kadiyali L. R., Lal. N.B, “Principles and Practices in Highway Engineering”, Khanna Publishers, New Delhi. Revised Edition. 2012.

REFERENCE BOOKS:

1. Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 2006.

2. Yoder E.J. and Witczak, “Principle of pavement design”, 2nd edition, John Wiley and Sons, 1975.

3. Relevant publications of Bureau of Indian Standards, New Delhi.

4. Yang H. Huang, “Pavement Analysis and Design”, Pearson Prentice Hall, 2004

5. Khanna, Justo. C.E.G, “Highway Engineering”, 8th edition, Nem Chand and Bros, 2001.

PAVEMENT MATERIALS AND CONSTRUCTION

Course Code:	**CV2314-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2109-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Know the properties, requirements and uses of soil, aggregates, Bitumen and Tar in the construction of pavement.
2.	Understand the preparation, requirements and uses of Bituminous emulsions and cutbacks.
3.	Choose suitable aggregate mix and design bituminous mix as per specification.
4.	Know the various equipment used in the construction of pavement and their working principle.
5.	Understand the different steps involved in preparing sub-grade and tests used to check its quality.
6.	Know the specifications, construction methods and quality control checks used for different layers of flexible pavement.
7.	Know the specifications, construction methods and quality control checks used for cement concrete pavement.
8.	Describe the necessity and use of different types of joints in cement concrete pavements.

UNIT-I

Introduction — **06 Hours**

Introduction to Pavements, Types, Comparison, Typical cross-sections, functions and requirements.
AGGREGATES: Concepts of size and gradation, design gradation. Maximum aggregate size, aggregate blending to meet the specification using method of trials and Rothfutch's method.

BITUMENOUS BINDERS — **04 Hours**

Origin, preparation, properties and chemical constituents of Bitumen, emulsion, cutback and modified bitumen. Requirements for pavement construction.

BITUMINOUS MIXES — **06 Hours**

Mechanical properties, dense and open textured mixes, flexibility and brittleness (excluding Hveemstabilometer & Hubbar – field tests). Bituminous mix design by Marshall method and specification using different criteria- voids in mineral aggregate, voids in total mix, density, flow, stability and voids filled with bitumen.

UNIT-II

EQUIPMENT IN HIGHWAY CONSTRUCTION — **05 Hours**

Different types of equipment for excavation, grading and compaction, their working principle, advantages and limitations. Equipment for the construction of bituminous and cement concrete pavement and stabilized soil road.

SUB GRADE and CONCRETE PAVEMENTS — **10 Hours**

Earthwork grading, construction of embankments and cuts for roads. Preparation of sub grade, quality control tests.
Specifications of materials and method of construction of cement concrete pavements, Quality control tests. Different types of joints used and their construction method.

UNIT-III

FLEXIBLE PAVEMENTS — **09 Hours**

Introduction, Interface treatment-Prime coat and tack coat, Penetration macadam.
Specifications of materials, construction methods and quality control checks during construction for GSB, WBM, WMM, Dense Bituminous Mixes.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the types of pavements, component layers, their functions, their importance, and the various materials used for the construction and to **describe** the properties, requirements, preparation and uses of aggregates, and Bituminous binders in the construction of pavement.
2.	**Select** suitable aggregate mix and to **design** the bituminous mix as per Marshall Method.

3.	**Select** the suitable equipments for the construction of pavement based on necessity and **describe** their working principle; and **describe** the different steps involved in preparing sub-grade and tests used to check its quality.
4.	**Explain** the specifications, construction methods and quality control checks used for cement concrete pavement and to **construct** the different types of joints in the pavements.
5.	**Recite** the specifications, construction methods and quality control checks used for different layers of flexible pavement.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2314-1.1	3	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CV2314-1.2	2	3	2	-	-	-	-	-	-	-	-	-	2	2	1
CV2314-1.3	3	1	-	-	-	-	-	-	-	-	-	-	3	2	2
CV2314-1.4	3	2	1	-	-	-	-	-	-	-	-	-	2	3	1
CV2314-1.5	3	2	1	-	-	-	-	-	-	-	-	-	2	3	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Kadiyali L. R., Lal. N.B, "Principles and Practices in Highway Engineering", Khanna Publishers, New Delhi. Revised Edition. 2012.
2.	Khanna. S. K, Justo. C.E.G, Veeraragavan. A, "Highway Engineering", Revised 10th edition, Nem Chand and Bros, 2014.

REFERENCE BOOKS:

1.	Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 2006.
2.	F.L.Roberts. Prithvi S. Kandhal., E. Ray Brown, Dah-Yinn Lee, Thomas W. Kennedy, "Hot mix asphalt materials, mixture design, and construction", Second edition, National Asphalt Pavement Association Research and Education Foundation, Lanhman, Maryland, 1996..
3.	Relevant publications of Bureau of Indian Standards, New Delhi.

REINFORCED EARTH STRUCTURES

Course Code:	**CV2315-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2005-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Know the concepts of reinforced earth structures.
2.	Know the types, engineering properties of Geo synthetics
3.	Understand the field requirements of Geo synthetics for using them in Separation, filtration, drainage and containment
4.	Understand the principles and design of earth embankments.
5.	Understand the stability analysis of reinforced earth foundations and to know the concepts of Soil nailing system

UNIT-I

16 Hours

REINFORCED EARTH: Historical background, mechanism of reinforced earth, Effect of reinforcement on soil. Application and advantages of reinforced earth.
GEOSYNTHETICS: Types, properties and testing methods.

UNIT-II

15 Hours

COMPONENTS: Soil- properties; Reinforcement, types- geosynthetics and metallic (bars, strips, mats and grids). Facing elements-types and properties.
FUNCTIONSOF GEOSYNTHETICS: Separation, reinforcement, filtration, drainage and containment. Two examples of application in the field (case histories) for each function are to be explained.
REINFORCED EARTH RETAINING WALL: External and internal stability, Design Methods – Coherent gravity and Tie back wedge, design of typical reinforced earth retaining wall (Tieback wedge method only).

UNIT-III

09 Hours

REINFORCED EARTH EMBANKMENT AND FOUNDATION: Improving the stability of a typical earth embankment slope using geotextiles. Reinforced earth foundation – Modes of failure, improvement of bearing capacity by geotextile inclusion.
SOIL NAILING SYSTEM: concept and principles, driven and grouted nail system, advantages and limitations.

Course Outcomes: At the end of the course student will be able to

1.	**Describe** the mechanism and **list** advantages of reinforced earth.
2.	**Evaluate** physical, mechanical strength, hydraulic, durability and endurance properties for a given geosynthetics.
3.	**Explain** the components of reinforced earth, **outline** the functions of geotextile and **assess** the suitability of geosynthetics in filtration, drainage and containment.
4.	**Design** the reinforced earth retaining wall using Tieback wedge method for external and internal stability.
5.	**Analyze** and **check** the stability of reinforced earth embankments, earth foundations and recommend suitable measure to improve bearing capacity.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**

Course Outcomes↓													1	2	3
CV2315-1.1	2	1	1	-	-	1	-	-	-	-	-	-	3	2	
CV2315-1.2	3	1	1	-	-	1	-	-	-	-	-	-	3	2	
CV2315-1.3	1	1	3	-	-	2	1	1	-	-	-	-	3	2	1
CV2315-1.4	2	1	3	-	-	2	1	1	-	-	-	-	3	2	1
CV2315-1.5	1	2	3	-	-	2	1	1	-	-	-	-	3	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Jones C.J.E.P, (1996), "Earth Reinforcement and Soil Structure", Butterworth's, London.
2. Korner, R.M, (1999), "Design With Geo-synthetics", Prentice -Hall of India, Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1. Ingold, T.S.,(1989), "Reinforced Earth", Thomas, Telford, London
2. Purushothama Raj, P. (2016), "Ground Improvement Techniques", Laxmi Publication(P) Ltd., Bangalore
3. Venkatappa Rao G., and Suryanarayana Raju, G.V, S.,(1990), "Engineering With Geosynthetics", TataMcGraw Hill Publishing Company Limited, New Delhi.
4. Swamy Saran, (2005), "Reinforced Soil and Its Engineering Applications", I. K. International Publishing House Pvt Ltd.

E Books / MOOCs/ NPTEL

1. http://nptel.ac.in/courses/105106052/9
2. http://nptel.ac.in/downloads/105101083/

PROFESSIONAL ELECTIVE COURSES (CONSTRUCTION TECHNOLOGY AND MANAGEMENT STREAM)

ADVANCED CONCRETE TECHNOLOGY

Course Code:	**CV2221-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2103-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the importance of microstructure of cement and concrete, types of admixtures and its properties in fresh and hardened state of concrete.
2.	Know the tests and factors affecting the results of hardened concrete.
3.	Understand durability requirements.
4.	Select a suitable type of concrete based on specific application.
5.	Know the design concepts cement concrete by BIS method.

UNIT-I

16 Hours

INTRODUCTION: Importance of Bogue's compounds, Structure of a Hydrated Cement Paste, Volume of hydrated product, porosity of paste and concrete, Transition Zone, transport through cement microstructure. Rheology of concrete.

TESTS ON HARDENED CONCRETE: Elastic Modulus, factors affecting strength and elasticity of concrete, Effect of end condition of specimen, capping, H/D ratio, rate of loading, moisture condition, determination of hardened concrete original W/C. NDT test concepts - Rebound hammer, Ultrasonic Pulse Velocity (UPV) methods.

UNIT-II

15 Hours

DURABILITY OF CONCRETE: Effect of fire, aggregates, abrasion and cavitation. Autogenious, drying and plastic cracking in concrete.

Corrosion of steel reinforcement, carbonation, chloride ingress, corrosion of prestressing steel. Sulphate attack and delayed ettringite formation, physical salt attack.

SPECIAL CONCRETES :

Concept, materials, properties and applications of Alkali Activated Binders, Graphic concrete pattern for precast concrete surface, Self-healing concrete, Pollution Eating Concrete, Engineered Cementitios Composites, Bio Receptive Concrete to colonize structural concrete, Living 'concrete' to reduce the environmental impact, High quality Graphene concrete, Cement made with CARROT extract.

UNIT-III

09 Hours

MIX DESIGN - Factors affecting mix design, Design of High Strength Concrete mixes with/without mineral admixtures using IS 10262-2019 method.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the microstructure of HCP, mechanism of Water Reducing Agents, Bingham's parameters, elasticity of concrete, **calculate** the effect of chemical composition changes on Bogue's compounds formation and effect of w/c on Volume and porosity.
2.	**Explain** the effect of admixtures on fresh and hardened concrete properties, **compare** the effects of test conditions on concrete strength.
3.	**Explain** the durability of concrete and **identify** the remedial measures for the durability related issues.
4.	**Explain** the concept, materials, properties, applications, manufacturing method and typical mix of special concretes.
5.	**Design** High Strength Concrete mix proportioning with/without mineral admixtures, as per IS 10262-2019.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**

↓ Course Outcomes													1	2	3
CV2223-1.1	2	-	-	-	-	-	-	-	-	-	-	2	2	2	2
CV2223-1.2	2	-	-	-	-	2	-	-	-	-	-	2	1	2	-
CV2223-1.3	2	-	-	-	-	2	-	-	-	-	-	2	1	2	-
CV2223-1.4	2	-	-	-	-	-	-	-	-	-	-	2	2	2	-
CV2223-1.5	2	-	2	-	-	2	-	-	-	-	-	2	1	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Neville, A.M., “**Properties of Concrete”,** ELBS Edition, Longman Ltd., London. 2015.
2. M.S. Shetty, (2015) “**Concrete Technology Theory and Practice” S. chand and company New Delhi.**
3. P.K. Mehta, P J M Monteiro, (2016) “**Concrete microstructure and properties”,** Prentice Hall, New Jersey (Special Student Edition by Indian Concrete Institute, Chennai).

REFERENCE BOOKS:

1. IS 10262-2019 “Concrete mix proportioning guidelines”.
2. N. Krishna Raju, “**Concrete Mix Design”,** Sehgal Publishers, 2016
3. Gambhir M.L, “**Concrete Manual**”, Dhanpat Rai & Sons, New Delhi, 2012

ALTERNATIVE BUILDING MATERIALS AND TECHNOLOGIES

Course Code:	**CV2222-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2001-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	**Learn** the energy consumption in building materials and cost effective technologies in buildings.
2.	**Illustrate** the design concept for green building taking into consideration of local climatic condition and building materials
3.	**Summarize** the alternative building materials in the present context from wastes.
4.	**Summarize** the alternative building technologies which are followed in present construction.
5.	**Outline** alternate roofing systems with respect to local climatic conditions and locally available building material.

UNIT-I

16 Hours

INTRODUCTION Energy in building materials, Environmental issues concerned to building materials, embodied energy calculations. Green design concepts in buildings and its rating, Rainwater harvesting. Environmental friendly and cost effective building technologies, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Comprehensive understanding, criterion, rating procedure of green building through GRIHA assessment.

UNIT-II

14 Hours

ALTERNATIVE BUILDING MATERIALS Fiber reinforced concrete - Matrix materials, metal and synthetic fibers, Properties and applications. Ferrocement components, materials and specifications, properties and construction methods. Masonry blocks using industrial wastes, Raw materials, manufacture, properties, advantages and disadvantages of FaL G blocks and Stabilized mudblock.

Building materials from agro and industrial wastes Types of agro wastes, Types of industrial and mining wastes, properties and applications.

UNIT-III

10 Hours

ALTERNATIVE BUILDING TECHNOLOGIES Use of arches in foundation, alternatives for wall construction, composite masonry, confined masonry, cavity walls, rammed earth, applications, Top down construction.
Alternative roofing systems: concepts of filler slabs, composite beam panel roofs. Waffle slab construction. Bridge construction by balanced cantilever, incremental launching methods.
Mivan Construction Techniques, Precast concrete and modular construction methods

Course Outcomes: At the end of the course student will be able to

1.	**Solve** the problems related to Energy of building materials and **make use** of cost effective building technologies.
2.	**Make use of** the design concept for green building taking into consideration of local climatic condition and building materials.
3.	**Utilize** suitable agro and industrial wastes as a building material.
4.	**Select** suitable type of alternative building technologies used in civil engineering construction.
5.	**Make use of** the alternative economical roofing system by considering local climatic condition.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
↓ Course Outcomes													**1**	**2**	**3**
CV2223-1.1	**2**	-	-	-	-	-	-	-	-	-	-	**2**	**2**	**2**	**2**
CV2223-1.2	**2**	-	-	-	-	**2**	-	-	-	-	-	**2**	**1**	**2**	-

CV2223-1.3	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**2**	**-**
CV2223-1.4	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**-**
CV2223-1.5	**2**	**-**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**2**	**-**

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	K.S Jagadish et al., "Alternative Building Materials and Technologies", New Age International Publishers – 1st edition -2007, Reprint: Aug – 2014
2.	Arnold W Hendry, "Structural Masonry", Macmillan Publishers 3rd Edition December 2013.

REFERENCE BOOKS:

1.	IS: 15912 (first revision 2017) Structural Design Using Bamboo – Code of Practice.
2.	James J Marks, "The Alternative Building Source Book", Chelsea Green Publishers, 1st Edition 1998.
3.	Clarke Snell etal., "Building Green", Large Book Publishers, 1st edition in 2005, reprinted -2014.
4.	Jon Nunan, "The Complete Guide to Alternative Home Building Materials and Methods", Atlantic Publishing Company 30th October – 2009, Re-Print 2010.

BUILDING SERVICES

Course Code:	**CV2223-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV1004-1, CV2001-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	To gain the knowledge of different building services and their types used in buildings.
2.	To understand the functional requirements of ventilation and principles of illumination of buildings.
3.	To outline the classification of air conditioning based on function and season.
4.	To gain knowledge of different thermal properties and insulation materials for buildings.
5.	To explain the fire hazards and general safety requirements for buildings.

UNIT-I

16 Hours

Introduction: requirements and necessity of services for buildings. Types.
Ventilation: Definition, Necessity, Functional Requirements, Types- Natural Ventilation and Artificial Ventilation
Illumination of buildings- definition, laws of illumination, principles, artificial lighting, day lighting, flood lighting, Introduction to various types of lamps.

UNIT-II

15 Hours

Air conditioning of buildings- essentials of air-conditioning systems, classification based on function & season, systems, design- AC load calculations, installation and maintenance cost.
Thermal comfort in buildings- factors affecting, heat transfer through buildings, thermal properties of building materials, insulation materials for buildings.

UNIT-III

09 Hours

Fire protection: necessity, fire hazards, characteristics and types of fire-resistant materials, fire load and its calculation, fire resistant construction – walls and columns, floors and roofs, wall openings, escape elements and strong room construction, fire protection equipment. General fire safety requirements.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the different building services and their types used in buildings.
2.	**Summarize** the functional requirements of ventilation and principles of illumination of buildings.
3.	**Classify** the air conditioning based on function and season.
4.	**Explain** thermal properties and insulation materials for buildings.
5.	**Explain** the fire hazards, **assess** fire load and **summarize** the general safety requirements for buildings.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
↓ Course Outcomes													**1**	**2**	**3**
CV2223-1.1	**2**	-	-	-	-	-	-	-	-	-	-	**2**	**2**	**2**	**2**
CV2223-1.2	**2**	-	-	-	-	**2**	-	-	-	-	-	**2**	**1**	**2**	-
CV2223-1.3	**2**	-	-	-	-	**2**	-	-	-	-	-	**2**	**1**	**2**	-
CV2223-1.4	**2**	-	-	-	-	-	-	-	-	-	-	**2**	**2**	**2**	-
CV2223-1.5	**2**	-	**2**	-	-	**2**	-	-	-	-	-	**2**	**1**	**2**	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Building construction by B.C.Punmia, Laxmi Publications.
2.	A Text Book on Building Construction by P.C.Varghese, Prentice Hall of India publications

3.	Architectural Lighting by Bran David.
REFERENCE BOOKS:	
1.	IS SP41 and SP32-hand book on functional requirements of buildings

CONSTRUCTION METHODS AND EQUIPMENTS

Course Code:	**CV2224-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2001-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Summarize the construction of equipment planning, cost of owning and operating.
2.	Explain the types and specifications of compacting equipment's.
3.	Outline the fundamentals and preliminary earth work operations.
4.	Explain the types, basic parts and operating procedure of earthwork equipment's.
5.	Outline the process of foundation grouting.

UNIT-I

16 Hours

Construction planning, types, importance, lack of planning. Equipment management in projects, classification of equipment's, selection of construction equipment's, *cost of owning and operating, economic life of equipment's, cost control of equipment's, depreciation analysis.*
Equipment for Compaction – Introduction, specification and types of compacting equipment's.

UNIT-II

14 Hours

Equipment for Earthwork - Fundamentals of Earth Work Operations, types of Earth Work, Machines for preliminary work.
Tractors – Basic parts and operation, Scrapers – types, construction, operation and applications, Motor Graders – construction, operation and safety, Dragline – types, basic parts and operation. Clamshells – Classification, Hoe – basic parts, operation and application, Bulldozer – Classification, selection of type of bulldozer and out of bulldozer. Power Shovel – *types, basic parts, operation of shovel, selection of type, size of power shovel and factors affecting the output of power shovel, methods of improving the output of power shovel*.

UNIT-III

10 Hours

Foundation grouting – materials, purpose, exploring the need, *rate of grouting, equipment's of cement grouting and effectiveness.*

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the planning of construction equipment and **solve** for the owning, operating and depreciation cost.
2.	**Summarize** the types and specifications of compacting equipment's.
3.	**Explain** the fundamentals and preliminary earthwork operations.
4.	**Explain** the types, basic parts and operating procedure of earthwork equipment's and **calculate** the output of a power shovel.
5.	**Summarize** the process of foundation grouting.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
↓ Course Outcomes													**1**	**2**	**3**
CV2223-1.1	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**
CV2223-1.2	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**2**	**-**
CV2223-1.3	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**2**	**-**
CV2223-1.4	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**-**
CV2223-1.5	**2**	**-**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**2**	**-**

1: Low 2: Medium 3: High	
TEXTBOOKS:	
1.	B. Satyanarayana and S. C. Saxena., "Construction, Planning and Equipment's", Standard Publishers New Delhi, 8th edition, 2019.
2.	Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction. Planning, Equipment and Methods", 9th Edition, McGraw Hill, Singapore, 2019.
REFERENCE BOOKS:	
1.	Sharma S.C. "Construction Equipment and Management", Khanna Publishers, New Delhi, 2017
2.	Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 1988.
3.	Dr. Mahesh Varma, Construction Equipment and its planning and Application, Metropolitan Book Company, New Delhi, 1983.

CONSTRUCTION PLANNING AND CONTROL

Course Code:	**CV2225-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2001-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Illustrate concepts related to management, economics and project feasibility conditions.
2.	Outline the principles and concepts involved in management.
3.	Illustrate the needs of planning and updating project schedule through project management tools such as CPM, PERT.
4.	Identify suitable database to manage and organize information's in project.
5.	Solve problems using optimization techniques.

UNIT-I

16 Hours

ENGINEERING ECONOMICS- Basic Concepts of economic analysis, Micro and Macro analysis, project feasibility, benefit cost ratio, interest formula, present worth, future worth, Annual equivalent, Basis for comparison of alternatives, break even analysis. Introduction to management, organization and administration. Value engineering, time management, labor and Material management

UNIT-II

14 Hours

CONSTRUCTION PLANNING - Introduction, time estimates, planning methods of projects, Bar and Milestone charts, PERT and CPM network analysis, crashing of networks. Project Information and its accuracy, use of Information, organizing information in databases, Relational and conceptual model of databases, Centralized database management Systems, Programs, Information Transfer and Flow. Computerized Organization and use of Information.

UNIT-III

10 Hours

OPTIMIZATION TECHNIQUES: Linear Programming: standard form of linear programming, formulation, solution to LPP by graphical method.
Transportation Problem: Introduction, mathematical formulation, methods for initial basic feasible solution, North West corner method, Vogels Approximation method.
Transportation Problem: least cost method, Row and Column minima method.

Course Outcomes: At the end of the course student will be able to

1.	**Make use of** concepts related to management and economics for project feasibility.
2.	**Relate** effectively the principles and concepts involved in management of civil works.
3.	**Utilize** project management tools. to develop plan and schedule
4.	**Identify** and **choose** database systems to manage and organize systems.
5.	**Utilize** the linear programming and transportation problems for solutions.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2225-1.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CV2225-1.2	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-
CV2225-1.3	2	-	-	-	-	-	-	-	-	-	2	-	2	-	3
CV2225-1.4	2	1	-	-	-	-	-	-	-	-	1	-	-	-	-
CV2225-1.5	2	-	-	-	-	-	-	-	-	-	2	-	-	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	K. Subramanyam, “Construction Management”, Anuradha Publishers Madras, (2009).
2.	L.S. Srinath, “Pert and CPM”. Affiliated East-West Press Pvt. Ltd. New Delhi. (2014).
3.	B.C Punmia, “Pert and CPM”, Lakshmi publication (2016).
4.	Peurifoy , R.L , “Construction Planning equipments and methods”, 8th edition, Mc Graw Hill Publication (2010).
REFERENCE BOOKS:	
1.	Mahesh Varma, “Construction planning and management”, Metropolitan Book Co, Delhi.
2.	S.D. Sharma, “Operation research”. 4th edition, Pub: KedarnathRamnath, Meerut, Delhi (2015).

CONSTRUCTION QUALITY MANAGEMENT

Course Code:	**CV2226-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2001-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Summarize the history and quality elements in engineering management.
2.	Explain the Integrated quality management as per International Organisations for Standardization.
3.	Utilize the quality control in construction projects.
4.	Summarize the process and steps involved in benchmarking process.
5.	Outline the quality management system in construction projects.

UNIT-I

15 Hours

Quality –History, definition, inspection, control, assurance, engineering, management, Quality guru's, quality function deployment, *six sigma methodology – leadership principles, six sigma team.*
Integrated Quality Management – quality standards, International Organisations for standardization (ISO), ISO 9000 Quality Management system, ISO Certification, ISO 14000 Environmental Management System, *Occupational Health and safety assessment series.*

UNIT-II

15 Hours

QUALITY CONTROL IN CONSTRUCTION PROJECTS QC in concreting, Brick work, stone masonry, Formwork, Foundations, Piling work, Structural work, Woodwork & Timber, Painting, Electrical system, *Waste recovery and maintenance.*
BENCH MARKING: Sources, Process & Step model for Benchmarking, Types of Benchmarking and Code of Conduct. *Internal & External Benchmarking, Advantages of Benchmarking*

UNIT-III

10 Hours

QUALITY MANAGEMENT SYSTEM IN CONSTRUCTION PROJECTS: Concept, Approach to Problems, Quality Assurance, Quality Control, *Quality Inspection, Records and Reports, Training*, Total Quality Control, Manual/Check Lists, Guide Lines.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the history, quality elements and **summarize** the six-sigma methodology.
2.	**Summarize** the Integrated quality management as per International Organisations for Standardization.
3.	**Explain** the quality control carried in the construction projects.
4.	**Explain** the process and steps involved in benchmarking process.
5.	**Explain** the quality management system in construction projects.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2225-1.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CV2225-1.2	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-
CV2225-1.3	2	-	-	-	-	-	-	-	-	-	2	-	2	-	3
CV2225-1.4	2	1	-	-	-	-	-	-	-	-	1	-	-	-	-
CV2225-1.5	2	-	-	-	-	-	-	-	-	-	2	-	-	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Total Quality Management for Engineers by Mohammed Zairi, Aditya Books Pvt. Ltd., New Delhi. 1992.
2.	Project Planning and Control with PERT and CPM by B.C. Punmia and K.K. Khandelwal, Lakshmi Publications Pvt. Ltd., New Delhi.
3.	Total Quality Management by B. Janakiraman and R.K. Gopal, Prentice-Hall of India Private Limited, New Delhi.
REFERENCE BOOKS:	
1.	Quality in the Construction Project by Fox, Arthur J., and Holly A. Cornell, American Society of Civil Engineers, New York, Latest Edition.
2.	Total Quality Management by Mohantry R.P. and Lakhe R.R., Jaico Publishing House, Mumbai, 2000.
3.	Total Quality Management by Break Joseph and Susan Joseph, Excel Books, New Delhi, 1995.
4.	Total Quality in Construction Projects by Hellard R.B.: Achieving profitability with customer satisfaction, Thomas Telford, London, 1993.
5.	Quality Management by Manjula, Satish, Raj Publishing House, Jaipur, 1999.

BUSINESS MANAGEMENT

Course Code:	**CV2321-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2352-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the Nature and Purpose of Business, Financial Markets and Instruments
2.	Apprehend Financial Institutions and Investment Banking
3.	Appreciate the models of micro finance and its operational aspects.
4.	Comprehend components of microfinance, disaster and insurance fundamentals.
5.	Know the basics of role and functions of capital markets

UNIT-I

16 Hours

Nature and Purpose of Business
Economic activities – Types; Business - Characteristics and Objectives of Business, Structure of Business, Classification of Business activities, Classification of Industries, Business Environment.
Financial Markets and Instruments
Money Market - Capital Market – Primary Market and Secondary Market – derivatives. Market – Debt Market – Corporate Debt and Government Securities - New Financial Instruments.
Financial Institutions
Development Financial Institutions – Banking and Non-Banking Institutions – Mutual Fund Organizations – Insurance Companies
Investment Banking
Financial and economic meaning of Investment – Characteristics and objectives of Investment – Types of Investment – Investment alternatives – Choice and Evaluation

UNIT-II

15 Hours

Models of Microfinance
Models of Microfinance across the world, Microfinance delivery methodologies, Legal and Regulatory framework, Financial Inclusion, Impact of Microfinance
Microfinance: Operational Aspects
Financial products and services, financial accounting and reporting, Revenue models of Microfinance, Risk management.
Microfinance and Disaster
Recent developments of Microfinance in India, Microfinance and Disaster, Cases on Women SHGs, Linkage Building and Successful Micro Entrepreneurs
Fundamentals of Insurance*:* Introduction to Insurance, Principles of Insurance, Insurance contract and provisions

UNIT-III

09 Hours

Role and Functions of Capital Markets, SEBI
Overview of Capital Market; Stock Exchange; Commonly used Terms; Types of Capital Issues; Financial Products/ Instruments including ASBA, QIP; SEBI; Registration of Stock Brokers, Sub-brokers, Share Transfer Agents, etc. QIBs.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the *Nature and Purpose of Business and financial Markets and Instruments*.
2.	**Describe** *Financial Institutions and Investment Banking*.
3.	**Describe** *Financial Institutions and Investment Banking*.
4.	**Identify** models of micro finance and its operational aspects

5.	**Explain** role and functions of capital markets

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2321-1.1	-	2	1	-	-	2	-	1	1	-	3	1	2	-	-
CV2321-1.2	-	2	1	-	-	2	-	1	1	-	3	1	2	-	-
CV2321-1.3	-	2	1	-	-	2	-	1	1	-	3	1	2	-	-
CV2321-1.4	-	2	1	-	-	2	-	1	1	-	3	1	2	-	-
CV2321-1.5	-	2	1	-	-	2	-	1	1	-	3	1	2	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Financial Institutions and Markets: Structure, Growth & Innovation , 6th Edition, 2017, by Bhole, McGraw Hill
2.	Financial Institutions and Markets,10 th edition,2014, by Jeff Madura , Cengage Learning
3.	Financial Institutions and Markets,10 th edition,2014, by Jeff Madura , Cengage Learning

REFERENCE BOOKS:

1.	Microfinance in India, 2008, K G Karmakar, SAGE Publications
2.	Capital Markets of IndiaAn Investor's Guide, 2011, By Alan R. Kanuk · Wiley publisher

CONSTRUCTION ECONOMICS AND FINANCE

Course Code:	**CV2322-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2352-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Define the importance of engineering economics
2.	Summarize the scope of engineering economics and elements of cost in economy
3.	Outline the role of civil engineering in construction economics and its effects on workers.
4.	Summarize the capital structure in financial management
5.	Explain the fund flow and cash flow statements to implement in construction accounting.

UNIT-I

16 Hours

INTRODUCTION TO ECONOMICS - Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency
Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis.

UNIT-II

15 Hours

CONSTRUCTION ECONOMICS - Role of Civil Engineering in Industrial Development, Construction development in Housing, transport and other infrastructures, Economics of ecology, environment, energy resources. Construction workers - Urban Problems, Poverty, Unemployment Effects on economics due to migration of construction workers to urban area
Capital Structure - The need for financial management, Types of financing - short term borrowing, long term borrowing, leasing.

UNIT-III

09 Hours

FINANCIAL ANALYSIS - Fund Flow and Cash Flow statements (Simple Problems), Financial Analysis – Meaning and Types, Tools and Techniques, Ratio Analysis, Types of Ratios, Profitability Ratio, Turnover ratio, Financial ratio (Balance sheet ratios) (Simple problems), Liquidity and Profitability.

Course Outcomes: At the end of the course student will be able to

1.	**Outline** the importance of engineering economics.
2.	**Explain** the scope of engineering economics and **outline** the elements of cost**.**
3.	**Explain** the role of civil engineering in construction economics and **identify** its effect on construction workers.
4.	**Explain** the capital structure in financial management.
5.	**Prepare** fund flow and cash flow statements and **utilize** in construction accounting.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2322-1.1	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CV2322-1.2	2	-	-	-	-	-	-	-	-	-	-	-	2	2	-
CV2322-1.3	2	1	-	-	-	2	2	-	-	-	-	2	2	2	-
CV2322-1.4	2	1	-	-	-	-	-	-	-	-	-	2	2	2	-
CV2322-1.5	2	2	-	-	-	-	-	-	-	-	-	2	2	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2012.

2.	Suma Damodaran, "Managerial economics", Oxford university press 2010.
3.	I.M. Pandey, "Financial Management" 11th edition, VikasPublishing house Pvt, Ltd, 2015.
REFERENCE BOOKS:	
1.	Warneer Z Hirsch, "Urban Economics", Macmillan, New York.
2.	Prof. K.S. Nagapathi "Management Accounting", R. Chand & Co., New Delhi.

CONSTRUCTION SAFETY MANAGEMENT

Course Code:	**CV2323-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2352-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Outline the salient feature of safety programs for construction.
2.	Summarize the Indian standards for safety in construction.
3.	Summarize the construction accidents and safety measures.
4.	Explain the behaviour of fuels during fire accidents.
5.	Outline the importance of housekeeping and explain the common hazards.

UNIT-I

16 Hours

Safety Management - Introduction, salient features of safety programs, general safety programs for construction. Safe working environment, Safety clauses in contract documents, Safety programme, Safety policy, Safety department, *safety officers, safety records, safety training*. Safety lacunae in Indian Construction Industry

SAFETY STANDARDS - Indian standards for safety in construction, *BIS standards*, American National Standards**.**

UNIT-II

14 Hours

CONSTRUCTION ACCIDENTS AND SAFETY - Accident- Causes, Effects and Safety measures, Legal requirements, Responsibility of the employers. Reporting occurrence of accidents, Reporting occurrence of hazards, *Action to be taken by the Site-in-charge in case of accidents.*

FIRE PREVENTION AND CONTROL - Understanding fire chemistry, Behaviour of fuels in fire, *Fire causes, Types of extinguishers and use,* Fire prevention planning, Check list for fire prevention. Emergency Escape Means of Escape, Evacuation, Occupant firefighting.

UNIT-III

10 Hours

COMMON HAZARDS - Dust, Impregnated timber, Lead poisoning, Toxic fumes, Noise, *Code of practice for reducing noise, Vibration, Power supply*, Lighting, Maintenance, House-keeping, Materials, Movement, Drowning, Openings, Weight.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the salient features of safety programs in construction.
2.	**Summarize** the Indian standards for safety in construction.
3.	**Outline** the construction accidents and its safety measures.
4.	**Explain** the behaviour of fuels and fire chemistry during fire accidents.
5.	**Outline** the importance of housekeeping **and** explain the common hazards.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2323-1.1	2	-	-	-	-	-	-	2	-	-	-	-	2	-	-
CV2323-1.2	2	-	-	-	-	-	-	3	-	-	-	-	2	2	-
CV2323-1.3	2	-	-	-	-	-	-	-	-	-	-	2	2	2	-
CV2323-1.4	2	-	-	-	-	-	-	-	-	-	-	2	2	2	-
CV2323-1.5	2	-	-	-	-	-	-	-	-	-	-	2	2	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Construction Safety Management, NICMAR Publications, Hyderabad, October 2003.
REFERENCE BOOKS:	
1.	Jimmy W. Hinze, construction safety, Prentice hall Inc 1997
2.	Richard.J.Coble, Jimmoe and TheoeHampt, Construction Safety and Health Management, Prentice Hall Inc 2001.
E Books / MOOCs/ NPTEL	
1.	https://theconstructor.org/practical-guide/safety-management-at-construction-site/1666/
2.	https://theconstructor.org/construction/construction-safety-tools/59815/

DESIGN OF SPECIAL CONCRETES

Course Code:	**CV2324-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2105-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Learn to differentiate and apply the principles of special concretes mix designs.
2.	Understand the materials, properties, applications, factors influencing the manufacturing of special concretes.

UNIT-I

16 Hours

SUSTAINABLE CONCRETE MIX DESIGN
Properties and factors to be considered for the use of industrial wastes, recycled wastes as aggregates in concrete, Design of Standard Grade Concrete with/without recycled and industrial waste aggregates, **Fiber Reinforced Concrete** – Properties, Applications, Factors influencing the mix design, Design of mixes.

UNIT-II

14 Hours

LIGHT AND HEAVY WEIGHT CONCRETE: Material, Properties, Applications, Factors affecting the mix design, Design of Mix Proportioning**,** Manufacturing Methods.

UNIT-III

10 Hours

MASS CONCRETE AND HIGH VOLUME FLYASH (HVFA) CONCRETE: Factors affecting the mix design, Mix proportioning

Course Outcomes: At the end of the course student will be able to

1.	**Identify** the Properties, factors influencing for the use of recycled, industrial waste aggregates in concrete and explain the properties, applications and factors influencing high strength and fiber reinforced concrete mixes.
2.	**Design** Standard, High Strength and Fiber Reinforced Concrete Mixes.
3.	**Identify** material, properties, applications, and explain the factors affecting the mix design, Manufacturing Methods of Light weight and high density concrete mixes.
4.	**Design** Light weight and High Density Concrete mixes.
5.	**Design** Mix Proportioning of Mass Concrete and High Volume Fly Ash Concrete.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2324-1.1	1	1	-	-	-	-	2	-	-	-	-	-	-	2	1
CV2324-1.2	3	2	3	1	-	-	3	2	-	-	-	1	3	2	2
CV2324-1.3	2	1	-	-	-	-	1	-	-	-	-	-	-	2	1
CV2324-1.4	3	2	3	1	-	-	2	-	-	-	-	1	3	2	1
CV2324-1.5	3	2	3	1	-	-	3	-	-	-	-	1	3	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	IS: 10262: 2019 - Concrete Mix Proportioning – Guidelines
2.	IS 456: 2000- reaffirmed in 2016: Plain and Reinforced Concrete - Code of Practice
3.	IS 383 : 2016 'Coarse and fine aggregates for concrete'

REFERENCE BOOKS:

1.	A.R. Santhakumar, "Concrete Technology"-Oxford University Press, New Delhi, 2015.
2.	Short A and Kinniburgh. W, "Light Weight Concrete"- Asia Publishing House, 2000
3.	Neville A.M, "**Properties of Concrete",** Pearson Education, Asis, 2012.
4.	Aitcin P.C. "High performance concrete"-E and FN, Spon London 1998

DISASTER MANAGEMENT AND MITIGATION

Course Code:	**CV2325-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite			

Teaching Department: Civil Engineering

Course Objectives:

1.	Describe the basic types of hazards and their potential consequences to India
2.	Understand the planning and assessment of Hazard, Risk, Vulnerability and disaster
3.	Describe the basic concepts of the emergency management cycle (mitigation, preparedness, response, and recovery)
4.	Critically understand the various disaster management acts and policies and approaches in both national and state level scenario.
5.	To build skills to respond to disasters in an effective, humane and sustainable manner

UNIT-I

16 Hours

Hazard, Risk, Vulnerability, Disaster and Disaster Management. Types of Disasters: Hazard and vulnerability profile of India.
Relevance of Disaster Risk, Vulnerability & Capacity Assessment in Planning, Concepts of Hazard Assessment, Vulnerability Assessment, Risk Assessment and Capacity Assessment, Hazard Identification and analysis.

UNIT-II

15 Hours

Four elements of comprehensive disaster management (Preparedness, Response, Recovery and Mitigation), Concept of Mitigation and its importance (Structural and Non Structural mitigation measures, identification of mitigation measures relating to different types of hazards and implementing strategies). Land use Management tools for disaster risk reduction. (building codes, GDCR, zoning ordinances, land acquisition, transfer of development rights, Recovery and reconstruction plan).
National Disaster Management Act, Various State Disaster Management Acts (Gujarat, Uttar Pradesh, Uttaranchal, Bihar, Karnataka) and State disaster management policies (e.g. Orissa, Gujarat, Uttaranchal, Karnataka, Tamil Nadu, Delhi, Uttar Pradesh). Relevance of Rehabilitation and Resettlement Policy in Recovery and reconstruction phase of disaster management. Coastal zoning regulation for construction and reconstruction phase in the coastal areas.

UNIT-III

09 Hours

Role of Government/Civil Society/International Organizations/Communities and Approaches to Community Based Disaster Risk Management and Planning. (Local coping mechanisms, Importance of Mock Drills and On site volunteer management in Community level disaster preparedness activities).
Projects implemented general description of projects carried out in India following natural disasters. Disaster resistant buildings & measures. Recent developments. Case studies

Course Outcomes: At the end of the course student will be able to

1.	Develop an understanding of the key concepts, definitions a key perspectives of All Hazards, Disasters, Risk and Vulnerability
2.	Develop a deep understanding of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe
3.	Develop a basic under understanding of Prevention, Mitigation, Preparedness, Response and Recovery
4.	Understand the various acts and policies related to Indian disaster management
5.	Explain the role of public and private partnerships

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2325-1.1	1	1	-	-	-	-	2	-	-	-	-	-	-	2	1
CV2325-1.2	3	2	3	1	-	-	3	2	-	-	-	1	3	2	2
CV2325-1.3	2	1	-	-	-	-	1	-	-	-	-	-	-	2	1
CV2325-1.4	3	2	3	1	-	-	2	-	-	-	-	1	3	2	1
CV2325-1.5	3	2	3	1	-	-	3	-	-	-	-	1	3	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Emergency Management: A Reference Handbook by Jeffrey B. BumgarnerABC-Clio, 2008
2.	Lessons of Disaster: Policy Change after Catastrophic Events by Thomas A. BirklandGeorgetown University Press, 2006
3.	The Indian Ocean Tsunami: The Global Response to a Natural Disaster by Pradyumna P. Karan; Shanmugam P. SubbiahUniversity Press of Kentucky, 2011

REFERENCE BOOKS:

1.	Chaos Organization and Disaster Management by Alan KrischenbaumMarcel Dekker, 2004
2.	Emergency Relief Operations by Kevin M. CahillFordham University Press, 2003
3.	A Comprehensive Approach to Emergency Planning By Worsely, Tracy L.; Beckering, DonCollege and University, Vol. 82, No. 4, January 1, 2007.

SUSTAINABLE CONSTRUCTION MATERIALS AND METHODS

Course Code:	**CV2326-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2001-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the 'modern' building materials developed using advanced technologies and testing methods.
2.	Apprehend the application of recycled/reconstructed building materials in the construction of green buildings.
3.	Know the different precast construction methods used at construction site.
4.	Appreciate the cutting edge technologies, methods and strategies of project management for sustainable construction.
5.	Comprehend components of embodied energy in building and understand the Rating Systems, its contribution to sustainability based on GRIHA and LEED Rating systems.

UNIT-I

16 Hours

Modern Building Materials: Properties and applications –Self-healing concrete3D graphene, Self-healing concrete, Aerographite, Laminated timber, Modular bamboo, Transparent aluminium, Translucent wood, Light-generating concrete, Microbial cellulose, Spider silk, Aluminium foam, Nanocrystal, Wool brick, Pollution-absorbing brick, Hydroceramics, Biochar, Bioreactors, Invisible solar cells

Modern Construction Formworks: Aluminium formwork, Precast system, Modular formwork, Tunnel formwork, Fiberglass shuttering.

UNIT-II

15 Hours

Modern Building Construction Techniques: 3D Volumetric Construction, Precast Flat Panel Modules, Pre-cast Foundation Technique, Hybrid Concrete Building Technique, Thin Joint Masonry Technique, Insulating Concrete Formwork (ICF) Technique

Sustainable Construction and Management: Identification of cutting edge sustainable construction materials, technologies. Project management strategies for use in the construction industry and evaluation of their potential to reduce the negative environmental impacts of construction activity.

UNIT-III

09 Hours

Components of Embodied Energy: energy for production, transportation and erection, Estimation methodology, Computation of embodied energy for building.

Green Buildings Rating: Concepts Features of TERI GRIHA rating. LEED rating with respect to building envelope, Economics of sustainability and benefits

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the properties and applications of modern building materials.
2.	**Describe** the choice, properties and various applications of modern construction formworks.
3.	**Describe** advanced construction techniques.
4.	**Identify** the cutting edge technologies, methods, strategies of project management
5.	**Explain, compute the components of embodied energy** and **evaluate** a building based on GRIHA and LEED rating systems

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2326-1.1	1	2	-	-	-	1	2	-	-	-	-	-	1	2	-

CV2326-1.2	1	2	-	-	-	1	2	-	-	-	-	-	1	2	-
CV2326-1.3	1	2	-	-	-	1	2	-	-	-	-	-	1	2	-
CV2326-1.4	1	2	-	-	2	1	2	-	-	-	-	-	1	2	-
CV2326-1.5	1	3	-	-	2	1	3	2	-	-	-	-	1	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Bureau of Indian Standards – relevant codes.
2.	National Building Code of India -2016
3.	Product Manufacturers' manuals/specifications

REFERENCE BOOKS:

1.	CPWD construction manual - 2019
2.	Sustainability of Construction Materials, Woodhead Publishing Series in Civil and Structural Engineering Edited by J. Khatib - 2nd edition-2016.
3.	Green Building Fundamentals by Mike Montoya, Pearson, 2nd edition, 2010
4.	GRIHA MANUAL VOL I "National Rating System for Green Buildings, Green Rating for Integrated Habitat Assessment (GRIHA)", Ministry of New & Renewable Energy Government of India, Teri Press, 2010
5.	GREEN BUILDING GUIDE Design Techniques, Construction Practices & Materials for Affordable Housing, Published by Rural Community Assistance Corporation (RCAC), by Craig Nielson, LEED AP, 2019.
6.	IGBC Green Building Ratings System Version 3.0 – Abridged Reference Guide September – 2014.
7.	Wu Chung, H. Advanced Civil Infrastructure Materials, First Edition, Woodhead Publishing Limited, 2006
8.	Minsitry of Power, Energy Conservation Building Code 2007, Revised Version, Bureau of Energy Efficiency, 2008,
9.	Indian Building Congress, Practical Handbook on Energy Conservation in Buildings, 1st ed. Nabhi Publication, 2008.
10.	TERI-Griha's Green Design practices (www.teriin.org/bcsd/griha/griha.htm)
11.	Leadership in Energy and Environmental Design (www.usgbc.org/LEED)
12.	Venkatarama Reddy, B. V., and. Jagadish, K., S. "Embodied energy of common and
13.	Alternative building materials and technologies". Energy and Buildings., 35, 129-137,2003

VALUATION OF REAL PROPERTIES

Course Code:	**CV2327-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2001-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Classify properties and understand forms of value.
2.	Determine depreciation using suitable methods.
3.	Apply techniques of valuation of land.
4.	Understand forms of rent and determine standard rent.
5.	Adopt suitable techniques of valuation of lands with buildings.

UNIT-I

16 Hours

Cost, Price and Value, Nature and essential characteristics of value. Forms of value. Valuation and its purpose. Classification of property- Freehold and leasehold. Sinking Fund. Amortization. Depreciation and Obsolescence. Methods of depreciation - Straight Line Method, Constant Percentage Method, Sum of years digit method, Sinking Fund Method and Declining Balance Method.

Qualities of a valuer, Principal types of lease- Building lease, Occupation lease, Sublease, Life lease, Perpetual lease.

UNIT-II

14 Hours

Valuation of Land - Valuation methods: Comparative Method, Abstractive Method, Belting Method, Development Method, Flat Rate Technique and Hypothetical Building Scheme (or Land residual Method.) Rent and forms of rent - Outgoings, Gross income and net income, Year's purchase, rate of interest, Standard rent and its computation, Tenancy Laws on rent.

Factors affecting the value of Land, Regular Shaped Plots, Land Locked Land, Recess Land, Strips of Land, Estimating the future life of buildings.

UNIT-III

10 Hours

Valuation of Land with Buildings: Direct Comparison, Land and building method, Rental Method, Profit Method, Development Method, - Valuation for Capital Gains, -, Valuation for Land Acquisition.

The Real Estate (Regulation and Development) Act 2016, Insolvency and Bankruptcy Code.

Course Outcomes: At the end of the course student will be able to

1.	**Identify** forms of value and classify property.
2.	**Determine** depreciation rates for properties.
3.	**Make use of** suitable method to **valuate** a land.
4.	**Determine** standard rent of a property.
5.	**Valuate** a property with land and building and **make use of** RERA to appropriate condition.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2327-1.1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CV2327-1.2	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CV2327-1.3	2	2	-	-	-	-	-	-	-	-	-	-		-	3
CV2327-1.4	1	-	-	-	-	-	-	-	-	-	-	-	2	-	-

CV2327-1.5	2	2	-	-	-	-	-	-	-	-	-	-	-	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Namavati, R., (1991), "Theory and Practice of Valuation", Lakhani Book Depot, Mumbai
2.	S.C. Rangwala, "Valuation of Real Properties" Charotar Publishing House Pvt ltd , Anand. Ninth edition (2013).
3.	Shyamales Dutta , "Valuation of Real Property" Eastern Law House, Kolkata Second edition (2004)

REFERENCE BOOKS:

1.	S.C. Rangwala , "Elements of Estimating and Costing", Charotar Publishing House, Anand. (1984),
2.	Sabapathy, B.K., (1996), "Practical Valuation", Ezhilarasi Prestige Flats, Tiruchirapalli.

E Books / MOOCs/ NPTEL

1.	https://theconstructor.org/construction/valuation-of-building-methods calculation/33091

PROFESSIONAL ELECTIVE COURSES (WATER RESOURCE ENGINEERING, ENVIRONMENTAL ENGINEERING AND GEOLOGY STREAM)

ADVANCED HYDRAULICS

Course Code:	**CV2231-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2002-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	**Illustrate** Chezy's and Manning's formulae and **determine** most economical channel section
2.	**Explain** specific energy and **compute** critical flow in prismatic channels
3.	Derive dynamic equations of gradually varied flow and compute draw down and back water curves
4.	Make use of hydraulic jump as energy dissipator
5.	Explain pipe network analysis and analyse pressure distribution system

UNIT-I

Open Channel Flow: **16 Hours**

Kinds of open channel flow, channel geometry, types and regimes of flow Velocity distribution in open channel, Uniform Flow – features of uniform flow, Manning's and Chezy's formula- rigid and mobile boundary channels, determination of roughness coefficients

Determination of normal depth and velocity, most economical sections, non-erodible channels, Flow in a channel section with composite roughness, flow in close conduit with open channel flow, wide open channel, specific energy, critical flow and its computation in prismatic channels.

UNIT-II

Varied Flow; Hydraulic Jumps **15 Hours**

Dynamic equations of gradually varied flow, assumptions and characteristics of flow profiles, classification of flow profile, draw down and back water curves(M1 and M2 type) profile determination, graphical integration, direct step and standard step method, numerical methods.

Hydraulic Jumps: momentum in open channel flow, specific force, derivation of conjugate depths, types, basic characteristics, length and location, jump as energy dissipation, control of jump, surges.

UNIT-III

PIPE NETWORK: **9 Hours**

Water distribution, network analysis, analysis of pressure distribution system- equivalent pipe and Hardy cross method, software application.

Course Outcomes: At the end of the course student will be able to

1.	**Determine** most economical channel sections for rigid and mobile boundary channels applying Chezy's and Manning's formulae
2.	**Explain** and **compute** specific energy and critical flow prismatic channels
3.	Develop dynamic equations of gradually varied flow, **classify** the flow profiles and **compute** length of draw down and back water curves
4.	**Develop** conjugate depth relationship and **make use of** hydraulic jump as energy dissipator
5.	**Analyse** pressure distribution system in pipe network

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2231-1.1	1	3	-	-	-	-	-	-	-	-	-	-	1	2	-
CV2231-1.2	1	3	-	-	-	-	-	-	-	-	-	-	1	2	-
CV2231-1.3	1	3	-	-	-	-	-	-	-	-	-	-	1	2	-
CV2231-1.4	1	3	1	1	-	-	-	-	-	-	-	-	1	2	-
CV2231-1.5	1	3	2	-	2	-	-	-	-	-	-	-	1	2	-

	1: Low 2: Medium 3: High
TEXTBOOKS:	
1.	Modi, P.N. and Seth, S.M., Hydraulics and Fluid Mechanics, Standard Book House, 22nd edition, 2019.
2.	Rangaraju K G, "Flow through open channel", McGraw Hill Publications, 2nd edition 2001
REFERENCE BOOKS:	
1.	A.K. Jain., "Fluid Mechanics", Khanna Publishers, New Delhi. 8th edition, 1995.
2.	V.T . Chow: "Open-channel hydraulics." McGraw Hill Publications ,2009
3.	K. Subramanya "Flow in open channels" Mc Graw Hill India, 4th edition 2015.
4.	Santhosh Kumar Garg., Water Supply Engineering, Khanna Publishers, New Delhi, 33 Edition,2010
E Books / MOOCs/ NPTEL	
1.	http://nptel.ac.in/courses/105103021
2.	http://nptel.ac.in/courses/105105201

ENVIRONMENTAL IMPACT ASSESSMENT FOR CIVIL ENGINEERING

Course Code:	**CV2232-1**	**Course Type:**	**PEC**
Teaching Hours/Week (L: T: P: S):	**3**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CV2003-1**		

Teaching Department: Civil Engineering

Course Objectives: This Course will enable students to

1.	Identify the need to assess and evaluate the impact of projects on environment
2.	Explain major principles of environmental impact assessment.
3.	Understand the different steps within environmental impact assessment
4.	Appreciate the importance of EIA for sustainable development and a healthy environment.

UNIT-I

16 Hours

Evolution of EIA: Concepts of EIA, EIA methodologies (Adhoc, Network Analysis, Checklists, Map overlays, Matrix method), Screening and scoping, Rapid EIA and Comprehensive EIA, General Framework for Environmental Impact Assessment.

UNIT-II

14 Hours

Baseline data study: Prediction, and assessment of impacts on physical, biological, and socio-economic environment, Legislative and environmental clearance procedures in India, Public participation, Resettlement, and rehabilitation, Fault tree analysis, Consequence Analysis

UNIT-III

10 Hours

Introduction to Environmental Management Systems: Environmental management plan-Post project monitoring, Environmental Audit: Cost Benefit Analysis, Life cycle Assessment. Case studies on project, regional and sectoral EIA

Course Outcomes: At the end of the course student will be able to

1.	Understand phenomena of impacts and know the impact quantification of various projects in the environment
2.	Liaise with and list the importance of stakeholders in the EIA process.
3.	Know the role of public in EIA studies
4.	Overview and assess risks posing threats to the environment.
5.	Assess different case studies/examples of EIA in practice.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
↓ Course Outcomes													**1**	**2**	**3**
CV2232-1.1	**1**	**1**	**-**	**-**	**-**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**3**	**-**
CV2232-1.2	**1**	**1**	**-**	**-**	**-**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**3**	**-**
CV2232-1.3	**1**	**1**	**-**	**-**	**-**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**3**	**-**
CV2232-1.4	**1**	**1**	**-**	**-**	**-**	**2**	**3**	**2**		**3**	**-**	**-**	**2**	**3**	**-**
CV2232-1.5	**1**	**1**	**-**	**3**	**-**	**2**	**3**	**2**	**-**	**-**	**-**	**3**	**2**	**3**	**-**

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Noble, L. 2010. Introduction to environmental impact assessment. A Guide to Principles and Practice. 2nd edition. Oxford University Press, Don Mills, Ontario
2.	Larry W. Canter, Environmental Impact Assessment, McGraw Hill Inc. Singapore, 1996

REFERENCE BOOKS:	
1.	Morris and Therivel, 2009. Methods of Environmental Impact Assessment, 3rd edition. New York, NY: Routledge.
2.	Hanna, K.S. 2009. Environmental impact assessment. Practice and Participation. 2nd edition. Oxford, University Press, Don Mills, Ontario.
E Books / MOOCs/ NPTEL	
1.	http://nptel.ac.in/courses/120108004/
2.	http://nptel.ac.in/courses/120108004/module3/lecture3.pdf

GROUND WATER HYDROLOGY AND EXPLORATION

Course Code:	**CV2233-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2002-1, CV2336-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	**Develop** an understanding on the fundamentals of groundwater hydrology, **appraise** its Significance and **Inspect** the techniques of groundwater exploration, development and management.
2.	**Explain** the occurrence and distribution of subsurface water, **list** and **distinguish** the types of aquifers, wells and their characteristic properties.
3.	**Explain** aquifer parameters, **analyze** pump test and Darcy' Law governing the steady unidirectional groundwater flow
4.	**Explain** Well hydraulics and **estimate** the aquifer parameters in steady and unsteady state radial flow into unconfined and confined aquifers.

UNIT-I

FUNDAMENTALS OF GROUND WATER FLOW AND HYDROLOGY: — **16 Hours**

INTRODUCTION: Vertical distribution of subsurface water and its occurrence. Aquifer and its types, water bearing properties of rocks and their classification.

FUNDAMENTALS OF GROUND WATER FLOW: Aquifer parameters- porosity, permeability, Specific yield, specific retention, hydraulic conductivity, storage coefficient, transmissibility, Pump tests, recuperation tests, interference of wells; Darcy's law, steady unidirectional flow in confined and unconfined aquifers

UNIT-II

WELL HYDRAULLCS: — **16 Hours**

Steady state Radial flow in confined and unconfined aquifer, Thiem's equilibrium formulae; Estimation of Discharge and Transmissivity.

Unsteady state Radial flow: Aquifer parameters, General equation derivation- Theis's method, Cooper-Jacob method, Chow's method, solution of unsteady flow equations.

UNIT-III

GROUNDWATER EXPLORATION, DEVELOPMENT AND MANAGEMENT: — **08 Hours**

Remote sensing and Geophysical methods, Electrical Resistivity methods, types of wells and yield of a well. Methods of construction, tube well design, dug wells, well development, pumps for lifting water - working principles, power requirement. Resource Management, Conjunctive use - necessity, techniques and economics.

Course Outcomes: At the end of the course student will be able to

1.	**Illustrate** the vertical distribution and occurrence of subsurface water, **List** and **distinguish** the water bearing properties of the rocks, the types of aquifers and their characteristic properties
2.	**List** and **Explain** aquifer parameters, **analyze** pump test and Darcy' Law in steady state unidirectional groundwater flow.
3.	**Explain** equilibrium Well hydraulics and **estimate** the aquifer parameters in steady state radial flow in the unconfined and confined aquifers
4.	**Explain** in-equilibrium Well hydraulics and **estimate** the aquifer parameters in unsteady state radial flow in the unconfined and confined aquifers using appropriate methods.
5.	**List and categorize** types of wells, **Inspect** and **explain** advanced techniques of groundwater exploration, development and management using remote sensing, geophysics and GIS.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
↓ Course Outcomes													**1**	**2**	**3**

CV2233-1.1	**2**	**2**	-	-	-	-	-	-	-	-	-	-	**1**	-	-
CV2233-1.2	**3**	**2**	-	-	-	-	-	-	-	-	-	-	**2**	-	-
CV2233-1.3	**2**	**3**	-	-	-	-	-	-	-	-	-	-	**2**	-	-
CV2233-1.4	**2**	**3**	-	-	-	-	-	-	-	-	-	-	**2**	-	-
CV2233-1.5	**3**	**2**	-	-	-	-	-	-	-	-	-	-	**2**	**2**	-

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Todd, D.K. (2006) "**Groundwater Hydrology**", John Wiley and Sons, Singapore
2.	Ramakrishnan, S. (2011) "**Ground Water**", 2^{nd} edition, Scitech publications (India) Pvt. Ltd., Chennai
3.	Garg, S.K. (2010) "**Hydrology and Water Resources Engineering**" Khanna Publishers, New Dehi
REFERENCE BOOKS:	
1.	Karanth, K.R. (1987) "**Groundwater Assessment, development and Management**", Tata McGraw Hill
2.	Raghunath, H.M. (2007) "**Groundwater**", New Age International Publishers, New Delhi
3.	Patel, A.S., and Shah, D.L., (2008), "**Water management**" New Age International Publishers, New Delhi
4.	Bower H. (1978), **Groundwater Hydrology**, **-** McGraw Hill.
5.	Walton W.C. (1970),"**Groundwater Resource Evaluation**", Mc Graw Hill Pubication, New Delhi.
E Books / MOOCs/ NPTEL	
1.	http://nptel.ac.in/courses/105101010/38#
2.	https://nptel.ac.in/courses/105105042/

RS & GIS APPLICATIONS IN WATER RESOURCES ENGINEERING

Course Code:	**CV2234-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2004-1, CV2336-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	**Explain** the basic principles of Geoinformatics comprising Remote sensing, Photogrammetry, GPS, GNSS& GIS
2.	**Explain** the stages and techniques of photogrammetry, aerial photo interpretation, visual & digital image processing, enhancement and interpretation.
3.	**Explain** and **Appraise** GIS - its components, data structures, process and operation, Map and its projections, components, preparation and overlays
4.	**List, Explain** and **appraise** the significance of GEOMATICS in various Water Resource Engineering practices

UNIT-I

16 Hours

Remote sensing and its principles: Physics of Remote sensing, EM spectrum, Blackbody concept, atmospheric windows, spectral response of common earth features.

Platforms & Sensors: Ground based, Air borne and Space borne platforms, Active and Passive Sensors, Photographic sensors, scanners, radiometers, RADAR and thermal infrared, hyper spectral remote sensing, Indian satellites and sensors: capabilities, data products

Photogrammetry: Basic principles of Aerial photography and Photogrammetry, Flight procedures, Aerial Photo Interpretation and Analysis techniques.

Satellite Image Interpretation and Analysis techniques: Visual & Digital Image interpretation, Interpretation elements, False Colour Composites (FCC).

UNIT-II

15 Hours

Digital Image Processing, Analysis and GIS: Digital image formats, pre-processing and processing (DIP), image restoration/enhancement procedures, information extraction, pattern recognition concepts, post processing procedures.

Geographic Information System -concept and spatial models: Fundamentals of GIS, spatial and non-spatial data, Vector and Raster GIS, GIS Hardware and software, GPS & GNSS, georeferencing, digitization, Thematic Maps, Overlay Analysis, Operation of GIS, Co-ordinate systems and map projections, Map scale, data display and cartography.

UNIT-III

09 Hours

RS & GIS Applications in Civil Engineering: Watershed characteristics, Soil moisture analysis, Water quality assessment and monitoring, flood mapping and monitoring, Village resource mapping, Smart City Development, Groundwater inventory, coastal environmental studies

Course Outcomes: At the end of the course student will be able to

1.	**Define** and **Explain** the principles of Remote Sensing, and **list** various types of platforms, sensors & resolutions in RS with a special reference to Indian satellites and data products.
2.	**Explain** Photogrammetry, its basic principles, elements of photo interpretation and Visual& Digital Image interpretation techniques.
3.	**Explain** different stages involved in Digital Image Processing, various image enhancement techniques, **list** and **Classify** the digital image formats and the extracted information for various purposes.
4.	**Explain** and **Appraise** GPS, GNSS & GIS - their components, data structures, process and operation, Map and its projections, components, preparation and Overlays.

5.	**List** the applications and **explain** the significance of geospatial technology or GEOMATICS (Photogrammetry, RS, GPS, GNSS & GIS) in various fields of Water Resource Engineering practices.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2234-1.1	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CV2234-1.2	2	2	-	-	-	2	1	-	-	-	-	-	2	2	-
CV2234-1.3	2	2	-	-	-	2	1	-	-	-	-	-	2	2	-
CV2234-1.4	2	2	-	-	-	2	1	-	-	-	-	-	2	2	-
CV2234-1.5	2	2	-	-	-	2	1	-	-	-	-	-	2	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Anji Reddy, M. (2012) **Text Book of Remote Sensing and Geographical Information Systems**, Fourth Edition, BS Publication, Hyderabad
2.	Bhatta, Basudeva (2011) **Remote Sensing and GIS**, 2nd edition, Oxford University Press, New Delhi
3.	Lillesand, T.M., Kiefer, R.W and Chipman, J.W. (2015) **Remote sensing and Image Interpretations**, 7th edition, John Wiley and sons, New Delhi

REFERENCE BOOKS:

1.	Anji Reddy, M. and Hari Shankar, Y. (2006) ***Digital Image Processing***, BS Pub., Hyd.
2.	Bernhardsen, Tor (2002) ***Geographic Information Systems-3rd*** Ed., Wiley India, Delhi
3.	Canada Centre for Remote Sensing **(2011)** ***Fundamentals of Remote sensing-Tutorial***
4.	Chang, Kang-tsung (2008) ***Introduction to Geographic Information Systems*** 4th Ed.,
5.	Korte, George B. (2001), ***The GIS Book***, Onword Press, Thomson Learning Inc.,USA
6.	Kumar, S. (2008) ***Basics of Remote sensing and GIS***Laxmi Publications (P) Ltd., Delhi
7.	Longler, Paul A., Goodchild, Michael F., Maguire, David J., Rhind. David W., (2004) ***Geographic Information Systems and Science*** John Wiley & Sons Ltd., ESRI Press
8.	Sabins, F.L. (1997) ***Remote Sensing: Principles and Interpretation***3rd edn. WH Freeman and Company, New York, 494p.

E Books / MOOCs/ NPTEL

1.	https://www.youtube.com/user/edusat2004
2.	https://eclass.iirs.gov.in/login

RURAL WATER SUPPLY AND SANITATION

Course Code:	**CV2235-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2003-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand importance of water, drinking water standards, water treatment methods and different types of rural water supply systems.
2.	Learn different rural sanitation methods and its importance, rain water harvesting and its uses
3.	Create awareness on communicable diseases and its control measures.
4.	Understand different methods of Refuse collection methods and its disposal.
5.	Provide the knowledge on Milk sanitation, quality control of milk.

UNIT-I

16 Hours

Rural water supply - Introduction: Need for a protected water supply, investigation and selection of water sources, various techniques for rural water supply, protection of well waters, drinking water quality standards water treatment methods – disinfection, deflouridation, hardness and iron removal, ground water contamination and control

Rural sanitation-Conservancy, public latrine, concept of Eco-sanitation, trenching and composting methods, Two pit latrines, aqua privy, W.C, septic tank, soak pit. Drainage Systems: Storm water and sullage disposal, rain water harvesting and uses.

UNIT-II

16 Hours

Communicable diseases- Terminology, water borne diseases, classifications, methods of communication, general methods of control. Disease vectors: House fly and mosquito – life cycle, diseases, transmission and control measures.

Refuse collection and disposal-Garbage, ash, rubbish, collection methods, transportation, disposal- salvaging, dumping, controlled tipping, incineration, composting, dung disposal-digester, biogas plant

UNIT-III

08 Hours

Milk sanitation- Essentials, test for milk quality, pasteurization, quality control, cattle borne diseases, planning for a cow shed**.**

Course Outcomes: At the end of the course student will be able to

1.	Identify problems in rural water supply and monitor, quality and maintenance of rural water supply, design low cost water treatment system for rural areas.
2.	Explain rural sanitation, management of grey, storm water and recognize types of waste water treatment systems.
3.	Outline the safe disposal methods of solid wastes.
4.	Illustrate types of diseases and preventive measures.
5.	Ensure quality of milk and preventive measures for cattle borne diseases.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2235-1.1	1	2	2	-	-	1	2	1	-	-	-	-	1	2	2
CV2235-1.2	2	2	-	-	-	1	2	1	-	-	-	-	1	2	-
CV2235-1.3	1	2	-	-	-	1	2	1	-	-	-	-	1	2	-

CV2235-1.4	2	2	-	-	-	1	2	1	-	-	-	-	1	2	-
CV2235-1.5	1	2	-	-	-	1	2	1	-	-	-	-	1	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Joseph A. Salvato (1992), "Environmental Engineering and Sanitation" Wiley publications.
2.	E.W Steel (1979),"Water supply & Sanitary Engineering". McGraw-Hill publications
3.	Terence J. McGhee, E.W. Steel (1991), "Water Supply and Sewerage". McGraw-Hill publications.
REFERENCE BOOKS:	
1.	Park and Park (2017) "Preventive & Social Medicine" McGraw-Hill, publications. 24th edition.
2.	B.C Punmia & Ashok Jain. (2009) "Environmental Engineering-II", Lakshmi publications.
3.	Cairncross, S. and Feachem, R. (2000) Environmental Health Engineering in the Tropics, John Wiley & Sons, 306 p.
4.	Dangerfield, B. J. (1983)Water Supply and Sanitation in Developing Countries, The Institution of Water Engineers and Scientists, London, England.
5.	McGhee, T. J. (1991) Water Supply and Sewerage, McGraw-Hill, 602 p.
6.	Morgan, P. (1990) Rural Water Supplies and Sanitation, Macmillan Education Ltd, 358 p.
7.	Qasim S. R., Motley E. M., Zhu G., (2000) Water Works Engineering – Planning, Design and Operation, Prentice-Hall PTR, Upper Saddle River, NJ 07458.
8.	Wright, F.B., Rural Water Supply and Sanitation, E. Robert Krieger Publishing Company, Huntington, New York.
9.	Winbald, U., and Simpson-Hebert, M., Ecological Sanitation, SEI, Stockholm, Sweden.
10.	Kadlec R.H. and Wallace S.D., Treatment Wetlands, CRC Press, Boca Raton
11.	Wastewater Engineering – Treatment and Reuse, Metcalf and Eddy, Tata McGraw Hill
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/105/104/105104102/
2.	http://www.pbdwss.gov.in/dwss/left_menu/major_schemes_projects.html
3.	https://www.classcentral.com/course/water-1364
4.	https://www.classcentral.com/course/sanitation-2230

ENGINEERING GEOLOGY

Course Code:	**CV2236-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite			

Teaching Department: Civil Engineering

Course Objectives:

1.	To equip the students to identify the significance of Geology in Civil Engineering practices
2.	To make them understand the earth, its structure, materials, resources, processes and forces acting on it in order to appreciate the geological problems and its solutions comes under Civil Engineering practices

UNIT-I

15 Hours

Physical Geology: Geology and its importance in Civil Engineering practices; Parts of the Earth- Internal Structure and its Composition; Earthquakes- Causes and effects, Seismographs, concept of plate tectonics, seismic resistant structures and engineering considerations; Rivers- Drainage pattern, drainage basin, concept of water shed, geological work of rivers, major erosional and depositional land forms, engineering significance ; Weathering- agents, types and engineering significance, influence of climate and lithology on weathering; Soil- Soil Profile, Geological classification, soil erosion and its control.

Materials of the Earth: Minerals and Rocks, rock forming minerals and economic minerals; physical properties of Minerals; classification, chemical composition, general characteristics, properties and uses of common rock forming minerals- Quartz group, Feldspars, Pyroxenes, Amphiboles, Micas, Carbonates, Olivine, Asbestose, Garnet, Talc, Gypsum, magnetite and Kaolinite; economic minerals and their uses. Rocks- definition, threefold division of rocks, Rock cycle, distinguishing features of igneous, sedimentary and metamorphic rocks; Characteristics and identification factors of rocks- textures and structures.

UNIT-II

16 Hours

Petrology: Igneous rocks– forms, textures and structures, classification, Tabular classification; varieties- Granite, Gabbro, Dunite, Dolerite, Pegmatite and Basalt, their engineering properties and uses. Sedimentary rocks – classification, textures and structures, varieties- Sandstone, Limestone, Shale, Breccia, Conglomerate and Laterite, their engineering importance and uses. Metamorphic Rocks- Metamorphism, process, agents, types, textures and structures; varieties- Gneiss, Quartzite, Marble, Slate, Phyllite, Schists, their engineering importance and uses. Qualities of good Building stones, Road Metals, Railway Ballasts and Concrete aggregates. Rocks as building materials for foundation, decorative stones, flooring and roofing with examples.

Structural Geology: definition, forces, stress, strain; Attitude of beds, Clinometer compass, outcrops, escarpments, outlier and inlier. Folds, Faults, Joints and Unconformities- definition, causes, parts, classification, recognition and engineering importance.

UNIT-III

09 Hours

Engineering Geology: Ground water- source, occurrence, zones, aquifers- types and properties; Ground water investigation- Selection of Well sites, geological, hydrological and geophysical methods (electrical resistivity method); Engineering Geology in Dams and Reservoirs, silting up of reservoirs and its control; Engineering geology in tunnelling practice. Mass movements- causes, classification and control.

Course Outcomes: At the end of the course student will be able to

1.	Identify the significance of Geology in Civil Engineering practices
2.	Understand the earth, its structure, materials, resources, processes and forces acting on it in order to appreciate the geological problems and its solutions comes under Civil Engineering practices
3.	Identify the building stones used in Civil Engineering practices

4.	Understand the structural geology
5.	Identify and appraise ground water, water quality, tunneling and mass movements.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2236-1.1	1	2	2	-	-	1	2	1	-	-	-	-	1	2	2
CV2236-1.2	2	2	-	-	-	1	2	1	-	-	-	-	1	2	-
CV2236-1.3	1	2	-	-	-	1	2	1	-	-	-	-	1	2	-
CV2236-1.4	2	2	-	-	-	1	2	1	-	-	-	-	1	2	-
CV2236-1.5	1	2	-	-	-	1	2	1	-	-	-	-	1	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Singh, Parbin (1994) "Engineering and General Geology", 6th ed., Katson Publishing House, Ludhiana.
2. Gokhale, K.V.G.K. (2010), "Principles of Engineering Geology", BS Publications, Hyderabad

REFERENCE BOOKS:

1. Mukherjee, P.K. (1994), "Text Book of Geology", World Press Pvt. Ltd., Calcutta
2. Legget, Robert F. & Hatheway, Allen W. (1988), "Geology and Engineering", 3rd ed., Mc. Graw Hill Book company, Singapore
3. Read, H.H. (1984), "Rutley's Elements of Mineralogy", 26th ed., CBS, New Delhi
4. Reddy, D.V. (1995), "Engineering Geology for Civil Engineers", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
5. Maruthesh Reddy (2008), "Text Book of Applied Engineering Geology", New Age International Pvt. Ltd. Publishers, New Delhi

E Books / MOOCs/ NPTEL

1. https://nptel.ac.in/courses/105/104/105104102/
2. http://www.pbdwss.gov.in/dwss/left_menu/major_schemes_projects.html
3. https://www.classcentral.com/course/water-1364
4. https://www.classcentral.com/course/sanitation-2230

ADVANCED APPLIED ENGINEERING GEOLOGY

Course Code:	**CV2331-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2236-1, CV2336-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	**Develop** an understanding and **appraise** the significance of Earth Sciences in Civil Engineering practices.
2.	**Identify** and **differentiate** the suitable Materials of construction **evaluating** its Engineering properties
3.	**Appraise** and **appreciate** the advanced applications of Earth Sciences in the field of resource exploration, natural calamities, health and environmental management.
4.	**Identify, Appreciate, Analyze, Interpret, Evaluate** and **Solve** the geological problems coming under Civil Engineering practices

UNIT-I — **14 Hours**

Geology and Engineering: Earth Science and its disciplines in Engineering practices, Geological Engineering, significance of geology in the Civil Engineering projects, Maps and Map Reading

Earth Resources and Applied Geology: Geology of dams, reservoirs, tunnels, highways and bridge site engineering. Engineering Properties of Rocks: Crushing strength, Transverse strength, porosity, density, abrasive resistance, frost and fire resistance, Qualities of good Building stones, Road Metals, Railway Ballasts & Concrete aggregates. Rocks as M.O.C. – foundation, decorative stones, flooring & roofing with examples.

UNIT-II — **16 Hours**

Geohydrology and Watershed Management: Concept of watershed and its development, rainwater harvesting & artificial recharging, water quality and water pollution.

Environmental Geology & Medical Geology: Earth and Health, Impact of Geology on environmental health hazards, Environmental Geology of landslides, mining, developmental projects, etc., its applications in Engineering disciplines and civil engineering projects viz: tunneling, dams and reservoirs, etc., Impact of Weathering and Erosion in the Civil Engineering projects and structures

UNIT-III — **10 Hours**

Exploration Geology and Geophysics: for foundation and groundwater; geological, geophysical and hydrological investigations, electrical resistivity and seismic methods, Remote Sensing, GIS, GNSS and their application in the field of exploration and civil engineering.

Course Outcomes: At the end of the course student will be able to

1.	**Identify, Explain** and **Appraise** the significance of Earth Sciences in Civil Engineering practices.
2.	**Identify** and **differentiate** the suitable materials of construction **evaluating** its Engineering properties
3.	**Identify** and **appraise** artificial recharging, water quality, watershed development and management.
4.	**Appraise and Appreciate** the advanced applications of Earth Sciences in the field of resource exploration, natural calamities, health and environmental management.
5.	**Identify, Appreciate and Evaluate** the engineering geological problems coming under Civil Engineering practices and **examine** the **solutions** for them

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2331-1.1	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CV2331-1.2	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-

CV2331-1.3	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CV2331-1.4	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CV2331-1.5	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Legget, Robert F & Hatheway, Allen W., (1988) ***Geology and Engineering*** 3rd ed., Mc. Graw Hill Book company, Singapore
2.	Valdiya, K.S. (2005) ***Environmental Geology*** John Wiley & sons, New Delhi
3.	Anji Reddy, M. (2012) ***Textbook of Remote Sensing and Geographical Information Systems***, Fourth Edition, BS Publication, Hyderabad

REFERENCE BOOKS:

1.	Krynine, Dimitri. P & Judd, William. R (1998) ***Principles of Engineering Geology and Geotechnics***, Tata McGraw Hill Publ. Co., New Delhi
2.	Keller, Edward A., (1985) ***Environmental Geology*** 4th Ed., CBS Publishers & Distributors, Delhi
3.	Johnson, Robert. B & De Graff V. Jerome (1989), **"*Principles of Engineering Geology and Geotechnics*",** Mc Graw Hill Book co.. London

E Books / MOOCs/ NPTEL

1.	https://swayam.gov.in./nd1_noc20_ce33/preview
2.	https://nptel.ac.in/courses/105/105/105105106

GEOINFORMATICS IN ENVIRONMENTAL ENGINEERING

Course Code:	**CV2332-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2003-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	**Explain** the fundamentals of **geoinformatics**
2.	**Explain** platforms, visual & digital image processing, enhancement and interpretation.
3.	**Explain** and **Appraise** GIS - its components, data structures, process and operation, Map and its projections, components, and its applications.
4.	**Explain** and **Remote sensing**, data sets, process and operation, and its applications.
5.	**Explain** the RS & GIS applications in environmental engineering

UNIT-I

16 Hours

Fundamentals of Remote Sensing: Definition, Physics of remote Sensing, EM Radiation and its interactions with atmosphere, Spectral reflectance of earth features, Resolution: Spatial, Spectral, Temporal and Radiometric.

Platforms, Sensors and Image Processing: Platforms, Active and Passive sensors, various satellites in orbit and their sensors, Data products, Image Processing- Visual and digital image, Interpretation, Ground truth verification, Image analysis, Image enhancement, Rectification, Classification: types, accuracy assessment.

UNIT-II

15 Hours

Introduction to GIS: GIS Components- Hardware, Software, Dataware, User. Data input, manipulation and outputs, data analysis, overlay analysis, buffer analysis, interpolation and extrapolation.

Application of Remote Sensing and GIS : Applications of remotely sensed data for identifying solid waste disposal, forest fire mapping, EIA studies , Optimal routing of solid waste using GIS –Case study, Environmental siting of industries.

UNIT-III

09 Hours

Re-modeling of water distribution system using GIS.
Environmental degradation assessment using geoinformatics.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the principles of remote sensing, and **list** types of platforms, sensors and resolutions in RS with a special reference to Indian satellite data products.
2.	**Explain** platforms and sensors and **discuss** digital image processing and enhancement techniques.
3.	**Explain** GIS components, data structures, process, operation, output and **discuss** their applications.
4.	**Evaluate** the applications of Geoinformatics in environmental engineering.
5.	**Remodel** the case studies related to water distribution system and **assess** the environmental degradation using Geoinformatics.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2332-1.1	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CV2332-1.2	2	2	-	-	-	-	1	-	-	-	-	-	2	2	-
CV2332-1.3	2	2	-	-	-	-	1	-	-	-	-	-	2	2	-

CV2332-1.4	2	2	-	-	-	-	1	-	-	-	-	-	2	2	-
CV2332-1.5	2	2	-	-	-	-	1	-	-	-	-	-	2	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Anji Reddy, M. (2012) **Text Book of Remote Sensing and Geographical Information Systems**, Fourth Edition, BS Publication, Hyderabad
2.	Bhatta, Basudeva (2011) **Remote Sensing and GIS**, 2nd edition, Oxford University Press, New Delhi
3.	Lillesand, T.M., Kiefer, R.W and Chipman, J.W. (2015) **Remote sensing and Image Interpretations**, 7th edition, John Wiley and sons, New Delhi

REFERENCE BOOKS:

1.	Anji Reddy, M. and Hari Shankar, Y. (2006) ***Digital Image Processing***, BS Pub., Hyd.
2.	Bernhardsen, Tor (2002) ***Geographic Information Systems-3rd*** Ed., Wiley India, Delhi
3.	Canada Centre for Remote Sensing **(2011)** ***Fundamentals of Remote sensing-Tutorial***
4.	Chang, Kang-tsung (2008) ***Introduction to Geographic Information Systems*** 4th Ed.,
5.	Korte, George B. (2001), ***The GIS Book***, Onword Press, Thomson Learning Inc.,USA
6.	Kumar, S. (2008) ***Basics of Remote sensing and GIS***Laxmi Publications (P) Ltd., Delhi
7.	Longler, Paul A., Goodchild, Michael F., Maguire, David J., Rhind. David W., (2004) ***Geographic Information Systems and Science*** John Wiley & Sons Ltd., ESRI Press
8.	***Geographic Information Systems and Science*** John Wiley & Sons Ltd., ESRI Press Sabins, F.L. (1997) ***Remote Sensing: Principles and Interpretation***3rd edn. WH Freeman and Company, New York, 494p.

E Books / MOOCs/ NPTEL

1.	https://www.youtube.com/user/edusat2004
2.	https://eclass.iirs.gov.in/login

GROUNDWATER RECHARGE AND CONSERVATION

Course Code:	**CV2333-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2336-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	**Develop** an understanding of the basics of groundwater geology, the concepts of rainwater harvesting water conservation and groundwater recharging with their significance and help them to **Identify** and **explain** the proper water management techniques
2.	**List, categorize** and **explain** aquifer parameters, types of wells, well inventories, **Inspect** the significance of water quality and geology in groundwater recharging.
3.	**List, appraise** and **explain** various traditional and artificial water harvesting & groundwater recharging techniques**, examine** site specific selection procedures, their benefits and problems,
4.	**Examine** different water conservation & water quality management techniques, **assess** their suitability and cost effectiveness**.**
5.	**Identify, appraise** and **explain** the application of Geoinformatics in water harvesting, conservation, artificial recharging and management of water resources

UNIT-I

15 Hours

INTRODUCTION: Water for life, rainwater harvesting and groundwater recharge: concepts, basics of groundwater geology and water conservation techniques, importance.
WELLS AND WELL INVENTORIES: Definition, types, aquifer parameters, well inventories, ground water quality, groundwater pollution, significance of geology in recharging.

UNIT-II

17 Hours

GROUNDWATER RECHARGING: Objectives, recharge, water balance, traditional, artificial, induced methods, hydro fracturing, roof top harvesting, site selection for groundwater recharging, quality of recharging water, coastal aquifers and recharging, benefits and problems.
WATER CONSERVATION AND MANAGEMENT: Water conservation for commercial and industrial facilities, water quality management, management of freshwater and wastewater, recycling and reuse of water, water conservation, need of ensuring quality and cost-effectiveness of water harvesting**.**

UNIT-III

08 Hours

RS & GIS application in groundwater conservation, harvesting, artificial recharging and management of water resources.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the basics of groundwater geology, concepts of rainwater harvesting, water conservation and groundwater recharging with their significance
2.	**List, categorize** and **explain** aquifer parameters, types of wells, well inventories, **Inspect** the significance of water quality and geology in groundwater recharging.
3.	**List, appraise and explain** various traditional and artificial water harvesting and groundwater recharging techniques, site specific selection procedures, their benefits and problems,
4.	**Examine** different water conservation & water quality management techniques, **assess** their suitability and cost effectiveness
5.	**Identify, appraise** and **explain** the application of Geoinformatics in water harvesting, conservation, artificial recharging and management of water resources

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2	3
CV2333-1.1	2	2	-	-	-	2	2	-	-	-	-	-	2	-	-
CV2333-1.2	2	2	-	-	-	2	2	-	-	-	-	-	2	-	-
CV2333-1.3	2	2	-	-	-	2	2	-	-	-	-	-	2	-	-
CV2333-1.4	2	2	-	-	-	2	2	-	-	-	-	-	2	-	-
CV2333-1.5	2	2	-	-	-	2	2	-	-	-	-	-	2	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Patel, A.S., and Shah, D.L., (2008), "***Water Management***" New Age International Publishers, New Delhi
2.	Karanth, K.R., (1987), "***Groundwater Assessment Development and Management***", Tata McGraw Hill Publishing co. Ltd., New Delhi

REFERENCE BOOKS:

1.	Todd, D.K., (1980), "***Groundwater Hydrology***", 2nd ed. John Wiley and Sons, New York
2.	**Karnataka State Pollution Control Board, (2007). "***Proceedings of International Workshop of Integrated Water Resources management***"**
3.	Sharma, P.B.S. (2008) ***Groundwater Development and Management***
4.	Mohan, Seneviratne (2008). "***A practical Approach to water conservation for commercial and Industrial facilities***", Elsevier Publications.
5.	Lilles and Thomas N., and Kiefer, R.W: (2003). **"*Remote sensing and image interpretations*",** 6th edition, John Wiley and Sons, New Delhi
6.	Bhatta, Basudeva (2011) **Remote Sensing and GIS**, 2nd edition, Oxford University Press, New Delhi

E Books / MOOCs/ NPTEL

1.	https://www.youtube.com/user/edusat2004
2.	https://eclass.iirs.gov.in/login

INTRODUCTION TO GEOINFORMATICS

Course Code:	**CV2334-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2004-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	**Explain** the basic principles of Geoinformatics comprising Remote sensing, Photogrammetry, GPS, GNSS & GIS
2.	**Explain** the stages and techniques of photogrammetry, aerial photo interpretation, visual & digital image processing, enhancement and interpretation
3.	**Explain** and **Appraise** GIS - its components, data structures, process and operation, Map and its projections, components, preparation and overlays
4.	**Explain** the GIS functionality and **Appraise** the significance of GEOINFORMATICS (Photogrammetry, RS, GPS, GNSS & GIS) in real world applications.

UNIT-I | **16 Hours**

Remote sensing and its Principles: Physics of remote sensing, EM spectrum, Blackbody concept, atmospheric windows, spectral response of common earth features.

Platforms & Sensors: Ground based, Air borne and Space borne platforms, Active and Passive Sensors, Photographic sensors, scanners, radiometers, RADAR and thermal infrared, hyper spectral remote sensing, Indian satellites and sensors: capabilities, data products

Photogrammetry: Basic principles of Aerial photography and Photogrammetry, Flight procedures, Aerial Photo Interpretation and Analysis techniques.

Satellite Image Interpretation and Analysis techniques: Visual & Digital Image interpretation, Interpretation elements, False Colour Composites (FCC).

UNIT-II | **16 Hours**

Digital Image Processing and Analysis: Digital image formats, pre-processing and processing (DIP), image restoration/enhancement procedures, information extraction, pattern recognition concepts, post processing procedures.

Geographic Information System -concept and spatial models: Fundamentals of GIS, spatial and non-spatial data, vector and raster GIS, GIS Hardware and software, georeferencing, digitization, thematic maps, Overlay Analysis, Operation of GIS, Co-ordinate systems and map projections, Map scale, data display and cartography.

UNIT-III | **08 Hours**

Geoinformatics and Virtual GIS: Modern Surveying and Geoinformatics, GPS & GNSS.

GIS Functionality: Introduction, data acquisition, preliminary data processing, data storage and retrieval, spatial search and analysis, graphics and interaction, Virtual GIS and Real-world applications.

Course Outcomes: At the end of the course student will be able to

1.	**Define** and **explain** the principles of Remote Sensing and **list** various types of platforms, sensors & resolutions in RS with a special reference to Indian satellites and data products.
2.	**Explain** Photogrammetry, its basic principles, elements of photo interpretation, Visual & Digital Image interpretation techniques
3.	**Explain** different stages involved in Digital Image Processing, various image enhancement techniques, **list** and **classify** the digital image formats and the extracted information for various purposes.
4.	**Explain** and **Appraise** GIS - its components, data structures, process and operation, Map and its projections, components, preparation and Overlays.
5.	**Explain** the GIS functionality and **appraise** the significance of GEOINFORMATICS (Photogrammetry, RS, GPS, GNSS & GIS) and Virtual GIS in real world applications.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2	3
CV2334-1.1	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CV2334-1.2	2	2	-	-	-	-	1	-	-	-	-	-	2	2	-
CV2334-1.3	2	2	-	-	-	-	1	-	-	-	-	-	2	2	-
CV2334-1.4	2	2	-	-	-	-	1	-	-	-	-	-	2	2	-
CV2334-1.5	2	2	-	-	-	-	1	-	-	-	-	-	2	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Anji Reddy, M. (2012) ***Text Book of Remote Sensing and Geographical Information Systems***, Fourth Edition, BS Publication, Hyderabad
2.	Bhatta, Basudeva (2011) ***Remote Sensing and GIS***, 2nd edition, Oxford University Press, N. Delhi
3.	Lillesand, T.M., Kiefer, R.W and Chipman, J.W. (2015) ***Remote sensing and Image Interpretations,*** 7th edition, John Wiley and sons, New Delhi

REFERENCE BOOKS:

1.	Anji Reddy, M. and Hari Shankar, Y. (2006) ***Digital Image Processing***, BS Pub., Hyd.
2.	Bernhardsen, Tor (2002) ***Geographic Information Systems-3rd*** Ed., Wiley India, Delhi
3.	Canada Centre for Remote Sensing **(2011)** ***Fundamentals of Remote sensing-Tutorial***
4.	Chang, Kang-tsung (2008) ***Introduction to Geographic Information Systems*** 4th Ed.,
5.	Korte, George B. (2001), ***The GIS Book***, Onword Press, Thomson Learning Inc.,USA
6.	Kumar, S. (2008) ***Basics of Remote sensing and GIS***Laxmi Publications (P) Ltd., Delhi
7.	Longler, Paul A., Goodchild, Michael F., Maguire, David J., Rhind. David W., (2004) ***Geographic Information Systems and Science*** John Wiley & Sons Ltd., ESRI Press
8.	Sabins, F.L. (1997) ***Remote Sensing: Principles and Interpretation***3rd edn. WH Freeman and Company, New York, 494p.

E Books / MOOCs/ NPTEL

1.	https://www.youtube.com/user/edusat2004
2.	https://eclass.iirs.gov.in/login

SOLID WASTE MANAGEMENT

Course Code:	**CV2335-1**	**Course Type:**	**PEC**
Teaching Hours/Week (L: T: P: S):	**3**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CV2003-1**		

Teaching Department: Civil Engineering

Course Objectives: This Course will enable students to

1.	Impart the knowledge of present methods of solid waste management system and to
2.	analyze the drawbacks.
3.	Understand various waste management statutory rules for the present system.
4.	Analyze different elements of solid waste management and design and develop recycling options for biodegradable waste by composting.
5.	Identify incineration technologies and waste to energy incineration methods

UNIT-I

16 Hours

Introduction: Scope and importance of solid waste management, definition and functional elements of solid waste management,
Sources: Sources and types of solid waste, composition of municipal solid waste, generation rate and conventional solid waste disposal methods.
Collection and transportation of municipal solid waste: services, systems and economics, Municipal Solid waste (Management and Handling) 2016 rules.
Composting: Aerobic and anaerobic process, Vermicomposting.
Sanitary land filling: definition, site selection, methods, stages, leachate movement and control, advantages and disadvantages

UNIT-II

16 Hours

Incineration, Air emission control and Energy Recovery:
Types of incinerators, air pollution control process sources – air pollutants and their effect on health and environment. Air pollution control strategy – particulate and gaseous pollution control devices, types of waste to energy technologies.
Hazardous waste management: Definition, identification, classification of hazardous waste, onsite storage, collection, transfer and transport, processing, disposal, hazardous waste management rules 2016(India).
E-waste management: Definition, categories, impacts on human health and environment**,** recycling and recovery an integrated approach, e-waste generation and management status in india, E-waste management rules 2016(India).

UNIT-III

08 Hours

Biomedical waste management: Classification, collection, transportation, disposal and treatment of biomedical waste, biomedical waste management rules 2016(India).
Plastic waste management: Sources, types, uses, impact of plastics on marine life, effect on wildlife, human health and environment. Practices- use of plastic waste in roads, greener alternatives. Plastic waste management rules 2016(India).
Construction and demolition waste management: origin, components, proper management, recycling, construction and demolition waste management rules.
Government initiatives for solid waste management: Swachh Bharat Mission, Smart City.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the basic engineering principles of solid waste management, **identify** improper practices and **summarize** the environmental implications.
2.	**Outline** the need for economics in collection and transportation of solid waste and **select** the collection
3.	**Explain** the process of incineration, energy recovery and **illustrate** the environmental impacts of incineration.
4.	**Plan** the transportation protocol for hazardous wastes, e-waste and choose the treatment and disposal methods.
5.	**Develop** an idea on conventional handling and treatment options for biomedical, plastic, construction and demolition waste and **discuss** government initiatives for waste management

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2	3
CV2335-1.1	1	2	-	-	-	2	3	2	-	-	-	-	1	3	1
CV2335-1.2	1	1	2	-	-	2	3	2	-	-	-	-	1	3	1
CV2335-1.3	2	1	-	-	-	2	3	2	-	-	-	-	1	3	2
CV2335-1.4	2	1	-	-	-	2	3	2	-	-	-	-	1	3	2
CV2335-1.5	1	1	-	-	-	2	3	2	-	-	-	-	1	3	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	George.C. Tchobanoglous, “Integrated Solid Waste Management” – McGraw hill publication. International edition 1993, ISBN 978-0070632370
2.	Bhide A D and Sunderashan B B, “Solid Waste Management in developing countries”, Indian National Scientific Documentation Centre, 1983

REFERENCE BOOKS:

1.	R.E. Hester, Roy M Harrison, “Electronic waste management”, Cambridge, UK, RSC Publication, 2009, ISBN 9780854041121
2.	Municipal Solid waste (Management & Handling Rules) , Ministry of Environment & Forest Notification, New Delhi, 25th Sept 2000 and amendments on 2013.
3.	The Plastic Manufacture, Sale and usage Rules2009. Ministry of Environment and Forest Notification, New Delhi, amendment on February 4, 2011
4.	Biomedical waste management (Management & Handling Rules) 20th July 1998. Ministry of Environment & Forest Notification, New Delhi, amendment on February 26, 2013.
5.	Ashok K. Rathoure “Zero Waste: Management Practices for Environmental Sustainability “ISBN: 9780367180393, 2019

E Books / MOOCs/ NPTEL

1.	swachhbharaturban.gov.in ; http://swachhbharatmission.gov.in/sbmcms/index.htm
2.	http://smartcities.gov.in/content/
3.	https://nptel.ac.in/courses/120/108/120108005/
4.	https://nptel.ac.in/courses/105/105/105105160/
5.	https://nptel.ac.in/courses/105/106/105106056/

HYDROLOGY AND IRRIGATION ENGINEERING

Course Code:	**CV2336-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	Explain hydrological cycle, water budget equation, **determine** mean rainfall and missing rainfall and its measurements.
2.	Analyze water losses like infiltration, evaporation and components of runoff.
3.	Explain systems and methods of irrigation, reference crop evapotranspiration and irrigation efficiencies.
4.	Distinguish canals, canal regulation works, cross drainage works and design irrigation channels using silt theories
5.	Analyse stability of gravity dams and explain types and failure of earthen dams.

UNIT-I

INTRODUCTION	**06 Hours**

Definition, importance of hydrology, global water availability, practical applications of hydrology, concept of catchment and water budget equation.

Forms and types of precipitation, measurement of rain fall - recording and non-recording type of rain gauges, computation of mean rainfall and missing rainfall, moving average curve, mass curve, rainfall hyetographs.

WATER LOSSES	**06 Hours**

Introduction, infiltration, factors affecting infiltration capacity, measurement (double ring infiltrometer), Horton's infiltration equation, infiltration indices. Evaporation- process, factors affecting evaporation, evapotranspiration, PET, AET, estimation of ET.

RUNOFF	**04 Hours**

Components and factors affecting runoff, rainfall - runoff relationship- regression analysis, peak runoff (flood) estimation - rational method**.**

UNIT-II

IRRIGATION	**08 Hours**

Benefits and ill effects of irrigation, Water logging, Systems and Methods of irrigation, Reference crop evapotranspiration - crop coefficients, crop water requirements, irrigation water requirements, irrigation efficiency, frequency of irrigation.

CANALS	**08Hours**

Types and alignment of canals, design of irrigation channels for alluvial soils using - Lacey's and Kennedy's methods, description of canal drops, canal regulators and cross drainage works.

UNIT-III

RESERVOIRS	**03 Hours**

Types, investigation for reservoir sites, storage zones, determination of storage capacity and yield of a reservoir using mass inflow curve.

DAMS	**05Hours**

GRAVITY DAMS: Forces acting, modes of failure, elementary and practical profile, stability analysis- steps of design by analytical method only.
EARTHEN DAMS: Types and modes of failure.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** catchment, water budget equation and **determine** mean rainfall and missing rainfall.

2.	**Determine** water losses, runoff and **develop** rainfall -runoff relationship applying regression analysis.
3.	**Explain** systems and methods of irrigation, reference crop evapotranspiration, crop and irrigation water requirements.
4.	**Explain** the alignment of canals, **design** irrigation channels applying Lacey's and Kennedy's theories and **discuss** canal drops, canal regulators and cross drainage works
5.	**Find** the storage capacity of reservoirs, **analyze** stability of gravity dams and **explain** the types and failures of earthen dams

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
1	1	3	1				2						2	3	
2	1	3	1	1			2						2	3	
3	1	3	1				2						2	3	1
4	1	2	3				2						2	3	1
5	1	3	3				2						2	3	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	K Subramanya , "Engineering Hydrology", Tata McGraw Hill, New Delhi, 4th Edition, 2017.
2.	Punmia B.C and PandeLal, "Irrigation and Water Power Engineering", Laxmi Publications, New Delhi, 16th edition, 2013

REFERENCE BOOKS:

1.	Garg S.K. "Irrigation Engineering and Hydraulic Structures: Water Resources Engineering, Vol. II" Khanna Publications, New Delhi, 5th edition 2016
2.	Modi P.N. "Irrigation, Water Resources, and Water Power Engineering", Standard Book House, New Delhi, 10th edition 2019
3.	Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi, 2005
4.	Raghunath H. M. "Hydrology Principles, Analysis and Design", 3rd edition, New Age International, 2006.

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/105/104/105104103/
2.	https://nptel.ac.in/courses/126/105/126105010/

PROFESSIONAL ELECTIVE COURSES (SOFTWARE ORIENTED COURSES IN CIVIL ENGINEERING STREAM)

3D BIM - AUTODESK REVIT

Course Code:	**CV2241-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**1:0:2:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV1004-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	To know the interface of the Revit world and create the model, views, structural items.
2.	To add stairs, ramps, railings, floors and roofs in the model
3.	To create the ceilings, interiors, dimensioning, annotating and working with revit edit tools.
4.	To show the detailing of the model, creating specific views, area plans.
5.	To complete the project by using Autodesk Revit tool

UNIT-I

16 Hours

The Autodesk Revit World - The Revit Interface, the Project Browser, File Types and Families.
Creating a model - Placing Walls, Using Reference Planes, Editing Wall Joins, Placing Doors and Windows.
Creating views –Creating levels, creating and modifying building sections, adding wall section, creating detail sections, creating callouts, creating and modifying a camera view, creating an elevation.
Structural items – Adding structural grids, structural columns, structural framing, foundation systems, structural footings.
Stairs, Ramps, and Railings – Creating stairs by using rise/run function, winding staircase, custom railing system, custom stairs, adding ramps.
Floors – Placing floor slab, building a floor by layers, splitting floor materials, pitching a floor to a floor drain, creating shaft openings.
Roofs – Placing roofs by footprint, creating a sloping roof, creating roof by extrusion, adding a roof dormer.

UNIT-II

15 Hours

Ceilings and interiors – creating ceilings, ceiling openings and soffits, interior design, alternate floor materials
Working with the Revit tools – Basic edit, Array, mirror, align, split element.
Dimensioning and Annotating – Selecting and applying dimensioning, placing text and annotation.
Detailing – Working with line weights, drafting on top of the detail, adding notes, creating blank drafting views.
Creating specific views and match lines – Duplicating views, creating dependent views, adding match lines.
Creating sheets and printing, creating rooms and area plans

UNIT-III

9 Hours

Project based learning
Create a building model of dimension 50' x 80'. Should include the following features; Plan, Elevation, Section details, Electrical layout, plumbing layout, landscaping, 3D views.

Course Outcomes: At the end of the course student will be able to

1.	To ***illustrate*** the interface of the Revit world and create the ***model***, views, structural items. (L3)
2.	***Model*** stairs, ramps, railings, floors and roofs. (L3)
3.	***Create*** the ceilings, interiors, dimensioning, annotating and working with revit edit tools. (L3)
4.	***Model,*** show the detailing of the ***plan*** by creating specific views and represent the area plans. (L3)
5.	***Create*** the project by using Autodesk Revit tool (L6)

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2241-1.1	2	2	2	-	2	-	-	-	2	2	-	2	2	2	-

CV2241-1.2	2	2	-	-	2	-	-	-	2	2	-	2	2	2	-
CV2241-1.3	2	2	-	-	2	-	-	-	2	2	-	2	2	2	-
CV2241-1.4	2	2	-	-	2	-	-	2	2	2	-	2	2	2	2
CV2241-1.5	2	2	2	-	2	-	-	2	2	2	-	2	2	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Eric Wing, "Autodesk Revit 2017 for Architecture No experience required", Autodesk authorized publisher.
REFERENCE BOOKS:	
1.	"Autodesk® Revit® 2015 Getting Started Guide", Autodesk authorized publisher.
2.	"Revit shortcuts guide", Autodesk authorized publisher.
E Books / MOOCs/ NPTEL	
1.	https://www.youtube.com/playlist?list=PLe_I-JWckL7HnPkUSHT3FhT4mEEz8OTYe

CAD IN CIVIL ENGINEERING

Course Code:	**CV2242-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2602-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	**Understand** the analysis by software tool
2.	**Identify** different types of methods of analysis using software's
3.	**Assess** the geotechnical problems using industry best software's
4.	**Analyse** the strength of various types of structural members as per the codal provisions
5.	**Design** the various civil Engineering structures using software's

UNIT-I

STRUCTURAL ANALYSIS — **16 Hours**

Structural Analysis of 2D and 3D Trusses, Structural Analysis of Continuous Beams using for different types of loadings and support conditions.
Structural Analysis of 2D and 3D Rigid and Braced Frames for different types of loadings, support conditions, section orientations and stiffness variation between columns and beams.

UNIT-II

GEOTECHNICAL DESIGN — **14 Hours**

Analysis and design of retaining walls using CAD software.

UNIT-III

SPREAD SHEET — **10 Hours**

Creating design sheets using Microsoft Excel.

Course Outcomes: At the end of the course student will be able to

1.	Explain the types analysis, structural analysis methods and procedure (L2)
2.	Create 2D and 3D Models for analysis with various end conditions. (L3)
3.	Plan a column orientation for different types of buildings (L5)
4.	Analyse Retaining wall and 3D frames. (L3)
5.	Design the analysed structures using MS Excel. (L6)

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2242-1.1	2	-	-	-	3	2	-	-	2	2	2	2	2	2	-
CV2242-1.2	2	1	-	-	3	2	-	-	2	2	2	2	2	2	--
CV2242-1.3	2	2	2	-	3	2	-	-	2	2	2	2	2	2	2
CV2242-1.4	2		2	-	3	2	-	-	2	2	2	2	2	2	
CV2242-1.5	2	2	2	-	3	2	-	-	2	2	2	2	2	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Punmia B. C., Ashok Kumar Jain, Arun Kumar Jain, "Strength of Materials and Theory of Structures", Volume I & Volume II, Laxmi Publications (P) Ltd., 2019.
2.	Ramamrutham S., "Theory of Structures", Dhanpat Rai & Sons, New Delhi, 2018.
3.	N. Krishnaraju and R.N.Pranesh, Reinforced Concrete Design (IS456:2000)-Principles and Practice, New Age International Publishers, New Delhi, 2006.

REFERENCE BOOKS:

1.	Dr. Ramchandra and VirendraGehlot, Limit State Design of Concrete Structures (As per IS: 456-2000), Scientific Publishers (India), Jodhpur, 2010.

2.	Punmia B.C.(2017) “Soil Mechanics and Foundations” Laxmi Publishing Co
3.	IS: 456-2000 (to be supplied in the examination), SP16.
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/112102101
2.	https://nptel.ac.in/courses/112104031

FUNDAMENTALS OF MACHINE LEARNING

Course Code:	**CV2243-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite			

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the need and basics of machine learning.
2.	Learn ANN and Decision Tree model.
3.	Explore the various learning algorithms using Supervised Learning.
4.	Understand the important aspects of Analytical Learning and difference between Analytical and Inductive Learning Algorithms.
5.	Analyse the techniques related to reinforcement learning.

UNIT-I

16 Hours

Introduction: Well posed learning problems, designing a Learning system, Perspectives and Issues in Machine Learning.
Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version Space and Candidate Elimination Algorithm, Inductive Bias.
Decision tree: Representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm. Hypothesis Space Search, Inductive Bias, Issues in Decision Tree Learning.
Artificial Neural Networks: Introduction, Neural Network Representations, Appropriate problems, Perceptrons, Back propagation algorithm.

UNIT-II

15 Hours

Instance Based Learning: k-nearest neighbor learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.
Bayesian Learning: Bayes theorem, Bayes theorem and concept Learning, Maximum Likelihood, Minimum Description Length, Bayes Optimal Classifier, Gibbs Algorithm, Naive Bayes Classifier, Bayesian Belief Networks, EM Algorithm.
Analytical Learning: PROLOG-EBG, Explanation Based Learning.
Combining Inductive and Analytical Learning: Inductive–Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Alter the Search Objective, Augment Search Operators.

UNIT-III

09 Hours

Reinforcement Learning:
Learning Task, Q Learning, Non Deterministic Rewards and Actions, Temporal Difference Learning.

Course Outcomes: At the end of the course student will be able to

1.	Acquire the fundamental concept and importance of machine learning.
2.	Demonstrate the application of Decision Tree and ANN and Genetic algorithm for real world problems.
3.	Design and implement algorithms for supervised learning system.
4.	Design and implement algorithms for Analytical and Inductive Learning.
5.	Develop machine learning algorithm and reinforcement techniques for real world problems.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**

↓ Course Outcomes													1	2	3
CV2243-1.1	2	-	-	-	3	2	-	-	2	2	2	2	2	2	-
CV2243-1.2	2	1	-	-	3	2	-	-	2	2	2	2	2	2	-
CV2243-1.3	2	2	2	-	3	2	-	-	2	2	2	2	2	2	2
CV2243-1.4	2		2	-	3	2	-	-	2	2	2	2	2	2	-
CV2243-1.5	2	2	2	-	3	2	-	-	2	2	2	2	2	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	T. M. Mitchell, "Machine Learning", McGraw Hill, 2017.
2.	EthemAlpaydin, "Introduction to Machine Learning", Second Edition, The MIT Press, 2004.
3.	C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
4.	R. O. Duda, P. E. Hart and D. G. Stork, "Pattern Classification", Wiley Publications, 2001.

REFERENCE BOOKS:

1.	T. Hastie, R. Tibshirani, J. Friedman. "The Elements of Statistical Learning", 2nd edition, 2008.
2.	P. Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, 2012.
3.	K. P. Murphy, "Machine Learning: A probabilistic perspective", MIT Press, 2012.
4.	M. Mohri, A. Rostamizadeh, and A. Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.
5.	S. Russel and P. Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Prentice Hall, 2009.

E Books / MOOCs/ NPTEL

1.	https://in.mathworks.com/
2.	https://www.kdnuggets.com/
3.	https://blog.cambridgespark.

GIS WITH QUANTUM GIS

Course Code:	**CV2244-1**	**Course Type:**	**PEC**
Teaching Hours/Week (L: T: P: S):	**3:0:2:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CV2604-1**		

Teaching Department: Civil Engineering

Course Objectives: This Course will enable students to

1.	Explain the basic principles of remote sensing
2.	Summarize the concepts of VIP and DIP
3.	Explain the components and principles of GIS
4.	Study the photogrammetry techniques
5.	Explains the concepts of GPS and applications

UNIT-I

Introduction; Remote Sensing — **08 Hours**

Basics: Fundamentals of Remote Sensing, Electromagnetic Spectrum, Process of remote sensing, Blackbody Radiation, Energy Interactions with earth atmosphere and surface features, spectral reflectance curves-For Vegetation, soil & water.

Sensors: Definition, Types (Typical Sensor used in optical remote sensing, Thermal sensor, Synthetic Aperture Radar) Classification Plat Forms: Definition & Types: Airborne & Space Borne platforms, Plat form characteristics. Indian Remote Sensing Programme: Definition, Objectives, Data Products.

VIP and DIP — **08 Hours**

Visual Image Interpretation: Definition, Objectives, Keys & Elements of Visual Image interpretation. Digital Image Processing (DIP): Definition, Need, Stages of DIP-Image rectification & restoration, Image Enhancement-Contrast Manipulation-Grey Level Thresholding, Classification-Brief discussion of classification procedure for Supervised & Unsupervised Classification Techniques.

UNIT-II

GIS — **07 Hours**

Introduction, basics of GIS- definition of GIS, components of GIS, GIS work flow, representing spatial data, raster and vector data. Coordinate systems and map projections, datums, spatial data input, Non spatial data Brief introduction to measurements in GIS, georeferencing, map overlays, neighborhood functions, spatial interpolation, network analysis, DEMs, surface analysis, GIS data modelling,

Photogrammetry — **08 Hours**

Basics of Photogrammetry : Acquisition of Arial photographs, Aerial Camera, Flight Planning, Photograph processing & feature extraction

UNIT-III

GPS — **05 Hours**

Global Positioning System, The 3 segments of GPS, How GPS Works, Triangulation, Sources of GPS Error, GPS Terminology, Applications

Land use/cover mapping, Agriculture, Urban and regional planning applications, Applications in water resources and management, Environmental applications, — **04 Hours**

Course Outcomes: At the end of the course student will be able to

1.	Explain the concepts of remote sensing
2.	Interpretation of digital images
3.	Explain the components of GIS
4.	Understand the photogrammetric technique
5.	Explain the application of RS and GIS

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2244-1.1	2	1	2	1	-	-	-	-	-	-	-	1	1	2	1
CV2244-1.2	2	1	2	1	-	-	-	-	-	-	-	1	1	2	1
CV2244-1.3	2	1	2	1	-	-	-	-	-	-	-	1	1	2	1
CV2244-1.4	2	1	2	1	-	-	-	-	-	-	-	1	1	2	1
CV2244-1.5	2	1	2	1	2	-	-	-	-	-	-	1	1	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Lillesand T.M., and R.W. Kiefer, "Remote sensing and Image interpretation", 4th edition, John Wiley & Sons – 2012.
2.	Christopher Jones "GIS and Computer Cartography"publication Prentice-Hall(2009)
3.	Lilly Sand, "Remote sensing and Image interpretation, John Willey and Sons, New York 1999.
4.	Manoj K. Arora, R.C. Badjatia, " Geomatics Engineering", Nemichand & Bros. Roorkee –2011.

REFERENCE BOOKS:

1.	Chang, "Geographical Information Systems", McGraw Hill Book Co., 2007.
2.	Jensen J.R., "Introductory digital image processing: A remote sensing perspective", 2nd Edition, Prentice Hall – 1996.
3.	T.M Lillesand,. R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation , 5th edition, John Wiley and Sons India.
4.	Richards J A., X. Jia, "Remote sensing digital image analysis: an introduction", 3 rd Edition, Springer - 1999.
5	Peter A. Burrough & Rachel A. McDonnel "Principles of geographic information systems"- (1998), Oxford University press, Great Britain.
6	Mather P.M., "Computer processing of remotely sensed images: an introduction", Wiley. – 1988.

E Books / MOOCs/ NPTEL

1.	https://onlinecourses.nptel.ac.in/noc20_de04/preview
2.	https://onlinecourses.nptel.ac.in/noc22_ce26/preview

PYTHON PROGRAMMING

Course Code:	**CV2245-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**IS1001-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Explain the elementary programming constructs and file operations and use it in Python programming.
2.	Describe the concepts like strings, conversion of strings to numbers, lists, tuples, and dictionaries and use these in the python programming.
3.	Illustrate the functions, recursive functions and object oriented programming concepts in Python.
4.	Construct a Graphical User Interface (GUI) and write a multi-threaded and a Client/Server program in Python.
5.	Perform the database connection and Common Gateway Interface (CGI) programming in Python.

UNIT-I

15 Hours

Introduction to python, the concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program.
Understanding error messages; Conditions, boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short circuit evaluation.
Strings and text files; manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).
String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers. Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists.
Dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.

UNIT-II

16 Hours

Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design; Recursive functions.
Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects inheritance, polymorphism, operator overloading (_eq_,_str_, etc); abstract classes; exception handling, try block.
Graphical user interfaces; event-driven programming paradigm; creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames.
Multithreading, Networks, and Client/Server Programming.

UNIT-III

09 Hours

Python database application programmer's interface (DB- API), connection and cursor objects, Type objects and constructors, python database adapters.
Creating simple web clients, introduction to CGI, CGI module, building CGI applications, python web application frameworks.

Course Outcomes: At the end of the course student will be able to

1.	Explain the basic program constructs and file operations in Python and express it.
2.	Design the Python programs using the concepts like strings, conversion of strings to numbers, lists, tuples and dictionaries.
3.	Implement the functions and object oriented programming concepts in python.
4.	Create a Graphical User Interface, multiple threads and Client/Server programs in python.

5.	Implement a database connection and CGI programs in python.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2245-1.1	3	3	-	-	3	-	-	-	1	-	-	3	2	2	-
CV2245-1.2	3	3	-	-	3	-	-	-	1	-	-	3	2	2	-
CV2245-1.3	3	3	-	-	3	-	-	-	2	-	-	3	2	2	2
CV2245-1.4	3	3	-	-	3	-	-	-	3	-	-	3	2	2	-
CV2245-1.5	3	3	-	-	3	-	-	-	2	-	-	3	2	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning,
2.	Magnus Lie Hetland, Beginning Python from Novice to Professional, Second Edition.
3.	Mark Summerfield, Programming in Python 3 - A Complete Introduction to the Python Language, Second Edition.
4.	Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, ISBN: 978-0-13-274718-9, 2013.

REFERENCE BOOKS:

1.	Chun, J Wesley, Core Python Programming, 2nd Edition, Pearson, 2007 Reprint 2010.
2.	Python Cookbook, Third Edition, David Beazley and Brian K. Jones, Shroff Publishers & Distributors Pvt. Ltd., ISBN : 978-93-5110-140-6
3.	Learning Python, Fifth Edition, Mark Lutz.
4.	Programming Python (English) 4th Edition Mark Lutz.
5.	Testing Python, David Sale, Wiley India (P) Ltd., ISBN: 978-81-265-5277-1.

E Books / MOOCs/ NPTEL

1.	https://in.mathworks.com/ https://www.kdnuggets.com/ https://blog.cambridgespark.
2.	https://www.udemy.com/topic/ https://www.mooc-list.com/ https://peltarion.com (Build and deploy AI with deep learning platform)

APPLICATION OF RS & GIS FOR WATER RESOURCES MANAGEMENT

Course Code:	**CV2246-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**1:0:4**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the concepts of remote sensing techniques
2.	Understand the concepts of image processing techniques
3.	Analyze components of GIS and map making process
4.	Carry-out the project related to water resources management
5.	Carry-out the preparations of thematic maps and analysis

UNIT-I

INTRODUCTION- Remote Sensing — **08Hours**

Introduction, what is Remote Sensing? Remote vs. *In Situ* Sensing, Passive and Active Remote Sensing, Sensor Types, Platforms, , Remote Sensing, Electromagnetic Spectrum (EMS), Electromagnetic Wave, EMR Energy, Energy Interactions in the Atmosphere, EM/Atmospheric Interactions: Scattering, Absorption, Atmospheric Windows, Spectral Characteristics, Sensor Selection, Spectral Reflectance Curves, specular versus diffuse reflection, Typical Spectral Reflectance curves for Vegetation, Soil and Water, Healthy Vs Stressed Vegetation, Atmospheric Influences on Spectral Response Patterns , Spatial and Temporal Effects, Advantages of Remote Sensing, Remote Sensing Images, Natural Colour Photography, False Colour composite, Remote Sensing Applications.

Aerial photography and Photogrammetry — **07 Hours**

Origin, Types of aerial photograph, Photogrammetry, Parallax, Filters, Orthophotography, Characteristics and its uses, Spatial Resolution, Spectral Resolution, Radiometric Resolution, Temporal Resolution, Hyperspectral Remote Sensing, Signal-to-Noise Ratio (SNR), Storage Formats, Digital Images, Elements of digital image processing system, Comparison of Scanner Systems, Scale of an Image, Satellites & Orbits, examples Hyperspectral Imaging and its importance, DIP, Geometric Corrections, Radiometric Correction, Image Enhancement steps, Effects of Filtering, Information Extraction, Land cover analysis - Vegetation Indices, Image Classification, Objective of Image Classification, Supervised and Unsupervised Image Classification.

UNIT-II

GIS — **08 Hours**

What is a GIS? Spatial and non-spatial data, GIS Process, Raster, Vector Formats, Cartographic instruments, Basic properties of geographic features, Database Implementation, Role of DBMS,

MAPS –Introduction, Features, scale, classification, types, numbering of maps, Map projections, types, coordinate system.

GPS Introduction, How GPS Works? Principle, Segments, Trilateration, Navigation System Worldwide, Types of GPS Survey, Errors in GPS, Differential GPS, IRNSS, Applications of GPS.

Hands on sessions — **08Hours**

1. Introduction to QGIS, Importing vector and raster data, attribute table, metadata, feature selection, data export.
2. QGIS Plugins, downloading and installing, importance, open street map
3. Georeferencing an Image downloading map, importing, plugin, transformation setting
4. Creating Vector Features-point, lines and polygon, feature editing, adding attributes.

5. Vector Functions and querying, dissolve, join tables, split and merge vector, extraction, overlay, buffer and spatial query.
6. Data Acquisition and raster functions, DEM, terrain analysis –slope, aspect, hill shade and contour, raster calculator, interpolation, clipping
7. Map composition styling and labelling in QGIS, map elements, Map composition.
8. Bhuvan geoportal and Google earth, utilities, data preparation, importing data to QGIS
9. Introduction to Web GIS and Geoserver –Data sharing, geospatial web services, advantages, publishing vector file. creating workspace, editing new data source.
10. Geoserver – Raster and SLD Integration publishing raster file creating SLD file, applying styles.

Project work **9 hours**

Project work

Project work

Project work

Project work presentation and report submission.

CIE will be based on the submission of project report and presentation.

Course Outcomes: At the end of the course student will be able to

1.	**Plan** to use suitable remote sensing imagery for the water resources applications
2.	**Develop** and **implement** the concepts of different image processing techniques
3.	**Analyze** components of GIS and to **utilize** it for map making process
4.	**Design** the methodology for water resources management
5.	**Create** thematic maps created

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
1	3	3	3		1		2		2	2	1	1	2	2	1
2	3	3	3		1		2		2	2	1	1	2	2	1
3	3	3	3		1		2		2	2	1	1	2	2	1
4	3	3	3		1		2		2	2	1	1	2	2	1
5	3	3	3		1		2		2	2	1	1	2	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Lillesand T.M., and R.W. Kiefer, "Remote sensing and Image interpretation", 4th edition, John Wiley & Sons – 2012.
2. Gonzal, R.C., Wood, R.E., Digital Image processing, Pearson International Publication,2010.
3. Manoj K. Arora, R.C. Badjatia, "Geomatics Engineering", Nemichand & Bros. Roorkee – 2011.
4. Burrough, P.A., Principles of Geographical Information System for Land Resource Assessment, Oxford University Press, 2010.

REFERENCE BOOKS:

1. Mather P.M., "Computer processing of remotely sensed images: an introduction", Wiley. – 1988.

2.	Jensen J.R., "Introductory digital image processing: A remote sensing perspective", 2nd Edition, Prentice Hall – 1996.
3.	Richards J A., X. Jia, "Remote sensing digital image analysis: an introduction", 3rd Edition, Springer - 1999.
4.	Peter A. Burrough & Rachel A. McDonnel "Principles of geographic information systems"- (1998), Oxford University press, Great Britain.
5.	Chang, "Geographical Information Systems", McGraw Hill Book Co., 2007.
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/105101206
2.	https://nptel.ac.in/courses/105108077

JAVA PROGRAMMING

Course Code:	**CV2342-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2007-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	To write, test, and debug simple Python programs.
2.	Use functions for structuring Python programs.
3.	Represent compound data using Python lists, tuples, and dictionaries.
4.	Read and write data from/to files in Python.

UNIT-I

16 Hours

Introducing Classes – Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, this keyword, Method overloading, Using objects as parameters, Argument passing, Returning objects, Access control, static, final, Using command line arguments, variable length arguments.
Inheritance – Inheritance Basics, Using super, creates a Multilevel Hierarchy, When constructors are called? Method Overriding, Using abstract classes, Using final with Inheritance.
Packages and Interfaces – Packages, Access protection, Importing Packages, Interfaces.
Exception Handling – Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, multiple catch Clauses, Nested try statements, throw, throws, finally.

UNIT-II

15 Hours

Multithreaded Programming – The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Inter-thread Communication.
Event Handling -Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model.
Working with Windows, Graphics and Text - Overview, AWT Classes, Window Fundamentals, Working with Frame Windows, Creating a Frame Window in an Applet, Creating a Windowed Program, Displaying Information within a Window, Working with Graphics, Working with color, Setting the Paint Mode, Working with Fonts, Managing Text Output Using Font Metrics.

UNIT-III

09 Hours

Introducing Swings – component and container, Event handling, Painting. Exploring Swings, Swings UI components.
Input/Output – I/O Basics, Reading Console Input, Writing Console Output, The Print Writer Class.
File Handling - Serial Access Files, File Methods, Redirection, Command Line Parameters, Random Access Files.
Java Database Connectivity (JDBC) - The Vendor Variation Problem, SQL and Versions of JDBC, Creating an ODBC Data Source, Simple Database Access, Modifying the Database Contents, Transactions, Meta Data

Course Outcomes: At the end of the course student will be able to

1.	Write, test, and debug simple Python programs. Implement Python programs with conditionals and loops.
2.	Develop Python programs step-wise by defining functions and calling them.
3.	Use Python lists and tuples for representing compound data.
4.	Use Python dictionaries for representing compound data.
5.	Read and write data from/to files in Python

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3

CV2342-1.1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CV2342-1.2	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CV2342-1.3	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CV2342-1.4	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CV2342-1.5	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. The Complete Reference Java by Herbert Schildt, Seventh Edition, 2007, Tata McGraw-Hill.

2. An Introduction to Network Programming with Java by Jan Graba, 2007, Springer Publications.

3. Programming with World Wide Web by Robert W.Sebesta, Fourth Edition, Pearson Education.

REFERENCE BOOKS:

1. The Complete Reference J2EE by Jim Keogh, 2002, Tata McGraw-Hill.

2. Java – How to Program? by H. M. Deitel, 2004, Prentice Hall.

PROJECT PLANNING USING SOFTWARES

Course Code:	**CV2343-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**1:0:2:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite			

Teaching Department: Civil Engineering

Course Objectives:

1.	To study the types of projects, organization structure and project life cycles
2.	To study the creation of project file and input data using M S Project.
3.	To study the techniques of network analysis, prepare WBS and estimate resources, duration.
4.	To schedule a project, assign resources and track status of project.
5.	To prepare the progress report and perform earned value analysis of the project.

UNIT-I

16 Hours

Project definition, Time bound project, Cost bound project, Performance (quality) bound project, Safety bound project. Project sequence, Organization structure, Bar chart, Mile stone chart, Project life cycles.
Working in MS Project: Creating a Simple Project, Setting Up a Project File, Identifying the activities.

UNIT-II

15 Hours

Network Analysis - Activity and event, Floats; Precedence diagrams, Activity definition, Work break down structures (WBS), Estimation – Resources, duration. Project management plan, Progress reporting, Cost control, Earned value analysis.
Working in MS Project: Building a Schedule, building a Team for Project, Assigning Resources to Tasks, Setting Up a Project Budget, Tracking Status, Managing Change.
Evaluating and Correcting Project Performance, Reporting on Projects, closing a Project, Working on More Than One Project, Exchanging Data Between Programs, Linking and Embedding.

UNIT-III

09 Hours

Working in Primavera: Overview of Primavera, Creating Simple Project, Scheduling, Assigning Resources.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the types of projects, organization structure and project life cycles. (L2
2.	**Create** a project file and input the data using M S Project. (L3)
3.	**Plan** a project using the techniques of network analysis; **Organise** WBS and **Estimate** resources, duration. (L5)
4.	**Develop** the schedule of a project, assign resources and track status of project. (L3)
5.	**Compile** the progress report and **analyse** earned value of the project. (L6)

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2343-1.1	2	-	-	-	3	2	-	-	2	2	2	2	2	2	-
CV2343-1.2	2	1	-	-	3	2	-	-	2	2	2	2	2	2	-
CV2343-1.3	2	2	2	-	3	2	-	-	2	2	2	2	2	2	2
CV2343-1.4	2		2	-	3	2	-	-	2	2	2	2	2	2	-
CV2343-1.5	2	2	2	-	3	2	-	-	2	2	2	2	2	2	2

1: Low 2: Medium 3: High

Scheme of Evaluation: CIE

A project report should include Schedule, WBS, Resource Estimation, Duration Estimation and budget for the following projects

a. Residential project
b. Multi-storeyed project

SEMESTER END EXAMINATION - SEE

- Scheduling a Project in software : 10 Marks
- Preparation of WBS : 10 Marks
- Assigning of resources and cost : 10 Marks
- Reporting on project : 10 Marks
- Viva voce : 10 Marks
- **Total : 50 Marks**

TEXTBOOKS:

1.	Project Planning and Control Fourth Edition (2003) Eur Ing Albert Lester, CEng, FICE, FIMechE, FIStructE, FAPM, Elsevier Butterworth-Heinemann Linacre House, Jordan Hill, Oxford OX2 8DP
2.	Practice standard for work breakdown structures, Project Management Institute, Newtown square, Pennsylvania USA, 2001.
3.	Thomas E Uher, Programming and scheduling techniques, UNSW press book, 2003.

REFERENCE BOOKS:

1.	Paul Eastwood Harris, Planning and Control using Microsoft® PROJECT 2013 and 2016, East wood Harris Pty Ltd, 2016.
2.	Bonnie Biafore, Microsoft Project 2013 The missing manual, O'Reilly Media, Inc., first edition 2013.

SOFTWARE ADVANCES IN PAVEMENT DESIGN

Course Code:	**CV2344-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV2108-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the flexible pavement design technique using IRC: 37-2018 recommendations.
2.	Understand the fundamentals of flexible pavement analysis using KENLAYER application of KENPAVE software.
3.	Comprehend the rigid pavement design technique using IRC: 58-2015 recommendations.
4.	Understand the fundamentals of rigid pavement analysis using KENSLAB application of KENPAVE software.
5.	Carry-out the design of bituminous overlay design using IRC: 81 and IRC:115 guidelines.

UNIT-I

Flexible Pavement Design using IRC 37-2018 guidelines — **10 Hours**

Introduction, Fundamental concepts in flexible pavement design as per IRC 37-2018, Steps in design of pavement, Pavement design examples for (i) Pavement section with bituminous layer(s), granular base and GSB; with bituminous layer(s), granular crack relief layer, CTB, and CTSB; (ii) Pavement Section with bituminous layer(s), SAMI crack relief layer, CTB, and CTSB showing; (iii) Pavement Section with bituminous layer(s), emulsion/foam bitumen stabilised RAP/virgin aggregate layer and CTSB; (iv) Pavement Section with bituminous layer(s), granular crack relief layer, CTB, and GSB; bituminous layer(s), granular base (WMM) and CTSB. Perpetual Pavement designs. Introduction to the use of **IIT Pave software** and design examples.

Application of KENPAVE in Flexible Pavement Design — **05 Hours**

Introduction to KENLAYER package of KENPAVE software, basic concepts, Analysis of pavement using KENLAYER package, design steps and problems.

UNIT-II

Rigid Pavement Design using IRC 58-2015 guidelines — **10 Hours**

Introduction, Fundamental concepts in rigid pavement design as per IRC 58-2015, Salient Features, Typical cross sections, Damage analysis, Steps in design of pavement, Design of various Components of rigid pavements as per IRC, Illustrative examples for rigid pavement design: (i) Concrete Pavement with tied concrete shoulders, (ii) Concrete Pavement with no concrete shoulders, (iii) Concrete Pavement with widened outer lanes, (iii) Concrete Pavement bonded to DLC layer. Introduction to the use of **IRC-58 2015** excel sheet and design examples.

Application of KENPAVE in Rigid Pavement Design — **05 Hours**

Introduction to KENSLAB package of KENPAVE software, basic concepts, Analysis of pavement using KENSLAB package, design steps and problems.

UNIT-III

Overlay Design and applications — **10 Hours**

Bituminous overlay design using IRC 81 - 1997: Introduction to BBD studies, Steps in BBD overlay design, development of excel sheets and solving the problems on overlay design.
Bituminous overlay design using IRC 115-2014: Introduction to FWD test, corrections and back calculations. Steps in FWD overlay design, Use of KGP BACK package and IIT-PAVE package for overlay design using FWD datasets. Example problems. Comparison of BBD and FWD method of overlay design.

Course Outcomes: At the end of the course student will be able to

1.	**Identify** the factors contributing to accidents
2.	**Collect** the necessary data pertaining to road crashes and **prepare** comprehensive accident crash database.
3.	**Perform** the statistical analysis of accident crash data.
4.	**Describe** the traffic management measures for accident prevention
5.	**Explain** the road safety audit and **prepare** a detailed audit report.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 2	PSO↓ 3
CV2344-1.1	3	3	-	-	1	-	-	-	2	2	-	1	2	2	1
CV2344-1.2	3	3	-	-	1	-	-	-	2	2	-	1	2	2	1
CV2344-1.3	3	3	-	-	1	-	-	-	2	2	-	1	2	2	1
CV2344-1.4	3	3	-	-	1	-	-	-	2	2	-	1	2	2	1
CV2344-1.5	3	3	-	-	1	-	-	-	2	2	-	1	2	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Khanna. S. K, Justo. C.E.G, Veeraragavan. A, “Highway Engineering”, Revised 10th edition, Nem Chand and Bros, 2014.

2. Yang H. Huang, “Pavement Analysis and Design”, Pearson Prentice Hall, 2004

REFERENCE BOOKS:

1. IRC: 37-2018: Guidelines for the Design of Flexible Pavements, (4th revision), Indian Roads Congress, New Delhi.

2. IRC: 58-2015: Guidelines for the design of Plane Jointed Rigid Pavements for Highways, (3rd revision), Indian Roads Congress, New Delhi.

3. IRC: 81-1997: Guidelines for Strengthening of Flexible Road Pavements Using Benkelman Beam Deflection Technique, (1st revision), Indian Roads Congress, New Delhi.

4 IRC: 115-2014, Guidelines for Structural Evaluation and Strengthening of Flexible Road Pavements Using Falling Weight Deflectometer (FWD) Technique, Indian Roads Congress, New Delhi.

IOT IN CIVIL ENGINEERING

Course Code:	**CV2345-1**	**Course Type:**	**PEC**
Teaching Hours/Week (L: T: P: S):	**3:0:2:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**
Prerequisite			

Teaching Department: Civil Engineering

Course Objectives: This Course will enable students to

1.	Know basic protocols in sensor networks.
2.	Program and configure Arduino boards for various designs.
3.	Python programming and interfacing for Raspberry Pi.
4.	Data Handling and Analytics.
5.	Design IoT applications in different domains

UNIT-I

INTRODUCTION TO INTERNET OF THINGS — **16 Hours**

Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

UNIT-II

Implementation of IoT — **15 Hours**

Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi.

Implementation of IoT with Raspberry Pi, Introduction to Software defined Network (SDN), SDN for IoT, Data Handling and Analytics.

UNIT-III

IOT APPLICATIONS — **09 Hours**

Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture

Course Outcomes: At the end of the course student will be able to

1.	Explain the concepts of remote sensing
2.	Interpretation of digital images
3.	Explain the components of GIS
4.	Understand the photogrammetric technique
5.	Explain the application of RS and GIS

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CV2244-1.1	2	1	2	1	-	-	-	-	-	-	-	1	1	2	1
CV2244-1.2	2	1	2	1	-	-	-	-	-	-	-	1	1	2	1
CV2244-1.3	2	1	2	1	-	-	-	-	-	-	-	1	1	2	1
CV2244-1.4	2	1	2	1	-	-	-	-	-	-	-	1	1	2	1
CV2244-1.5	2	1	2	1	2	-	-	-	-	-	-	1	1	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	"The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2.	Make sensors: Terokarvinen, kemo, karvinen and villey valtokari, 1st edition, maker media, 2014.
3.	"Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti
REFERENCE BOOKS:	
1.	Vijay Madisetti, Arshdeep Bahga, Internet of Things: A Hands-On Approach
2.	Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
3.	Beginning Sensor networks with Arduino and Raspberry Pi – Charles Bell, Apress, 2013
E Books / MOOCs/ NPTEL	
1.	https://onlinecourses.nptel.ac.in/noc20_de04/preview
2.	https://onlinecourses.nptel.ac.in/noc22_ce26/preview

AIRPORTS & SEAPORTS ENGINEERING

Course Code:	**CV 2251-1**	**Course Type**	**PSC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:2**	**Credits**	**03**
Total Teaching Hours	**45**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the concept of master planning of a modern airport
2.	Plan and design of key airside facilities, terminal building and landside works
3.	Provide inputs on the overview of port infrastructures and the design considerations and functional requirements of typical structures.

UNIT-I

06 Hours

Introduction and Typical Master Planning process of a commercial airport: Introduction- key features of a modern airport, Important Codes and aviation regulation organizations, Infrastructure in the Country, Need for Growth Requirements- Passenger Demand Capacity, New Airport envisaged for the Next 10 years.
Phases: Airport Master Plan Process, ICAO: Outline of Master Planning process, Case studies, Configuration of Runways, Topographical Survey of various airside elements/facilities, Layout plans, Functions of Terminal building, Data, Size, position and number of Arrival and Departure gates, MEP and HVAC Systems

06 Hours

Planning of Landside works and Airside works: Air Traffic Control Tower, Departure/Arrival Forecourt and approach roads, Drainage Planning, Multi- Level/Surface car parking/Waiting areas, arboriculture, Water harvesting cum storage/distribution, Fuel storage and supply, Renewable Energy, Data for Orientation and Design of Runway, Design of Taxiways, Aprons and drainage system, Airport capacity.

UNIT-II

06 Hours

Navigational aids and pre-construction works: Navigational and Meteorological Aids, Ducts and Runway/Approach Lighting Systems, Runway Marking, Air Cargo Facilities, Environmental impacts, Noise mitigation, Sustainability measures, Earthmoving Plants, Dumpers and Compaction Equipment, Tower Cranes and Hoists, Procurement and phase-wise deployment of key resources and setting up of Site Infrastructure.

06 Hours

Construction, Distress evaluation of airport pavements: Design of flexible and rigid pavements, Construction: rigid pavement, Execution & Estimation of Other Layers of Flexible and Rigid Pavements, Airport Layout and Grading Plan, Types of Layers and Gradients etc., Typical Failures of Flexible and Rigid Pavements, Maintenance, Strengthening and Rehabilitation of pavements

UNIT-III

06 Hours

Overview of Ports and Harbours: Introduction and Evolution of Ports and Harbours, Overview of Marine structures, Operation and components of Ports, Navigation Aids, Site Investigation and Survey, Design considerations and Functional requirements of typical structures, Design of breakwaters, Pre-cast planning, Cofferdams, Marine piling, Diaphragm wall, Modular construction, Load Out Jetty

Course Outcomes: At the end of the course student will be able to

1.	Comprehend the development of master plan for a modern commercial airport as per laid down codes and regulations
2.	Plan the various infrastructure elements on landside, Terminal building, Navigational aids to support the operations of airports
3.	Design the runways, taxiways, aprons, ducts; preconstruction works of airports
4.	Adopt the procedures of construction, maintenance and rehabilitation of airport pavements
5.	Interpret the design considerations, operations and components of ports

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV XXXX-1.1	1	2	2			1	1				1				
CV XXXX -1.2	1	2	2												
CV XXXX -1.3	1	2	2	2											
CV XXXX -1.4		2	2				1				1				
CV XXXX -1.5	1	2	2												

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Khanna S.K., Arora M.G., Jain S.S., "Airport Planning & Design", 1st Edition, Nemch and Bros. Roorkee, 2009
2. Robert Horonjeff, Francis McKelvey, William Sproule and SethYoung, "Planning and Design of Airports" 5th Edition, McGraw Hill Book Co 2010.

REFERENCE BOOKS:

1. Planning and Design of Airports by Robert Horonjeff
2. ICAO Annex 14 Aerodromes

E Books / MOOCs/ NPTEL

1. L&T EduTech LMS Content

DESIGN AND EXECUTION OF PILE FOUNDATIONS

Course Code:	**CV 2252-1**	**Course Type**	**PEC II**
Teaching Hours/Week (L: T: P: S)	**2:0:0:2**	**Credits**	**03**
Total Teaching Hours	**45**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	Introduce the concept of Piling works and design requirements for a pile
2.	Elaborate the construction procedures which are involved in different pile foundations
3.	Explain the different load test which need to be conducted on the piles.
4.	Understand the Environmental, Health and Safety standards which need to be in place for the handling of the pile works
5.	Elaborate on the bill of quantities of various Pile foundations

UNIT-I

06 Hours

Introduction to piles, Design and construction of Bored Cast insitu piles and Driven Cast insitu piles:
Overview of Pile foundations, Selection Criteria, Common Design considerations, General Terminologies and Indian standard codes. Materials and Equipment, Construction procedures, workmanship, Vertical and Lateral Capacity calculations, Load tests, Case Studies of Bored cast insitu piles and Driven cast insitu piles

06 Hours

Introduction, design and construction of precast driven and under reamed piles:
Materials and Equipment, Construction procedures, workmanship, Vertical and Lateral Capacity calculations, Load tests, Case Studies of precast driven piles, precast driven piles in pre-bored holes and Under reamed piles

UNIT-II

06 Hours

Grouping and settlement of piles and testing:
Introduction to Grouping and Settlement of piles, Pile Group efficiency and Spacing, Capacity of Pile group, Settlement of Pile group, Case studies Introduction & Types of testing on piles and General requirements for testing, Pile Integrity tests - introduction & Equipment Types of Pile Integrity test, Data Recording & Interpretation of results, Introduction to quality assurance of piles, General requirement

06 Hours

Quality control and Special Types of piles:
Quality Control of BCIS, DCIS piles, Quality records and checklists. Materials, Equipment, manufacturing procedure, Design and installation, suitability and application and failure modes of spun piles and helical piles

UNIT-III

06 Hours

Software and Bill of quantities, Construction challenges:
Introduction to Bill of quantities for Bored cast insitu, Driven Cast insitu, Precast driven and Precast driven piles in pre-bored holes and undreamed piles. Challenges in bored and driven piles, Introduction to types of piling software, Software demonstrations (e.g., **PLAXIS**) and step-by-step design techniques for deep foundations. Modelling in Plaxis 2D.

Course Outcomes: At the end of the course student will be able to

1.	**Comprehend** Basic design concepts, of pile foundations
2.	**Compute** capacity of piles and select suitable type of pile foundation based on soil conditions
3.	**Apply** different construction procedures of pile foundation.
4.	**Design** and execute different load testing on piles
5.	**Compute** bill of quantities for pile foundations

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV XXXX-1.1	2														
CV XXXX -1.2	3	2	2	3	1										
CV XXXX -1.3	3	3	3												
CV XXXX -1.4	3		2												
CV XXXX -1.5	3	3													

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
2.	Varghese P.C.," Foundation Engineering", PHI Learning Private Limited, New Delhi, 2005.

REFERENCE BOOKS:

1.	IS 2911- Indian standard code driven cast insitu, bored cast insitu, Driven precast piles
2.	IS 14593-Indian standard code for bored cast insitu piles founded on rocks -Guidelines

E Books / MOOCs/ NPTEL

1.	L&T EduTech LMS Content

METRO RAIL TRANSPORTATION SYSTEMS AND CONSTRUCTION

Course Code:	**CV 2253-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:2**	**Credits**	**03**
Total Teaching Hours	**45**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	Elaborate on the salient features and types of Transit oriented development and its significance
2.	Explain the planning, design and execution of elevated and underground Metro viaducts, tunnels including monitoring systems and stations
3.	Explain the design Earth retaining structures used in Metro systems
4.	Explain the different pre-excavation and tunnel support systems

UNIT-I

06 Hours

Introduction to Mass Rapid Transit System (MRTS, Planning of Metros and Site Investigation Overview of Metro, Transit Oriented Development, Feasibility Study for MRTS Project, Sustainable and Smart Technologies, Recent Advancements & Future Technologies (High Speed Rail Technology, 'Maglev & Ground Effect Trains etc.). Basic Interfacing Principles – Alignment, Urban level planning, constraints and restrictions, Sub surface investigations, Sampling techniques, Laboratory testing of Rocks and soils using CIVIL 3D

06 Hours

Elevated Metro stations and Viaducts:
Introduction to Contracts, Overview of FIDIC standards, Introduction to Quality Systems, Precasting Yard Development, Types of Precast Super Structure, Precast Mould development, Formwork System Overview, introduction to Precast Erection, Superstructure launching Methods, Obligatory Spans, substructure and foundation Construction Methodology, Challenges in Foundation Construction

Alignment / Span configuration of elevated structures, Soil condition and type of foundations, Substructure system, choosing type of Pier based on alignment profile, Rail / Over Head Equipment mast, Station overall layout, Pier arm - spine wing / cantilever and Platform- precast/cast-in-situ system. Errection methods and case studies
Overview of Elevated station, Analysis and Design, Spine beam method, Design of station components, Loads and introduction to IRC/IRS Codes, 'Analysis and Design of superstructure, Substructure and foundation

UNIT-II

06 Hours

Pre-excavation support systems, Tunnel support systems and Earth Retaining systems
Need for pre-excavation supports, fore poling, face supports, grouting, Rock bolts, Rock anchors, Shotcrete, Rib reinforced shotcrete, Lattice girder and steel arches, Selection of tunnel supports, Applicability of temporary and Permanent retaining systems, Sheet piles, soldier piles, secant piles and contiguous piles and Diaphragm walls, Establishing design situation, design life and geotechnical categorisation, Determination of ground water pressure and surcharges, Modelling of Diaphragm wall in Wallap software

06 Hours

Underground Metro Stations and Tunnels

Underground Stations and its configurations, Shoring Systems, supporting systems, Construction Methodology (Bottom Up method/ Top Down method), Tunnelling methods-NATM, NMT, Drill and Blast, cut and cover Earth retaining structures, Secant pile wall design, Guide walls, Introduction to Loads, Load combinations, Fire resistant criteria and Floatation check, SOD restrictions & Element sizing for UG Stations, Design of all the components of UG station, Overview of Modelling of Stations in STAAD software

UNIT-III

06 Hours

Tunnel instrumentation and Monitoring systems and MEP in Metros:

Purpose of instrumentation and monitoring, Geotechnical monitoring systems for underground structures, Load, stress and water pressure monitoring, Deformation monitoring, trigger limits and instrumentation monitoring plans, MEP systems- HVAC, Tunnel ventilation, Fire protection and fire alarm systems.

Course Outcomes: At the end of the course student will be able to

1.	**Create** the basic layout of elevated and underground metro stations as per laid down codes and regulations
2.	**Interpret** design recommendations and Codes of Practice for Elevated and Underground Metros and select suitable construction practices
3.	**Design** the earth retaining systems for the excavations of underground stations
4.	**Select** suitable pre-excavation and tunnel support systems for different ground conditions
5.	**Comprehend** the tunnel instrumentation and monitoring systems

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV XXXX-1.1	3		3												
CV XXXX -1.2	3			3											
CV XXXX -1.3	3	2		2											
CV XXXX -1.4	2	2		2	1										
CV XXXX -1.5	2														

1: Low 2: Medium 3: High

TEXTBOOKS:

1.

2.

REFERENCE BOOKS:

1. Indian Standard code- IS 456, Guidance on embedded retaining wall design CIRIA- C760

2. David Chapman, Nicole Metje, Alfred Stark ” Introduction to Tunnel Construction “2017 , CRC Press

3. M. Ramachandran ,”Metro Rail Projects in India- A Study in Project Planning “2011, Oxford University Press

E Books / MOOCs/ NPTEL

1. L&T EduTech LMS Content

BRIDGE ENGINEERING PRACTICES

Course Code:	**CV 2351-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:2**	**Credits**	**03**
Total Teaching Hours	**45**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	Determine the optimal solution of Bridge structure depending on various constraints and input parameters
2.	Analysis and Design of all components of bridges and cross drainage work with detailing
3.	Illustrate various Erection methods (Segmental, Balanced cantilever and Cable stayed bridges etc.) with case studies in detail

UNIT-I

06 Hours

Introduction and Conceptual Design of Bridges:

Introduction to bridges – Types of bridges based on Material, Structural form, Usage, span and support, alignment and decks – Auxiliary components of bridges.
Conceptual design based on planning, design and execution – Functional – Aesthetics – Inventory – different types of surveys – Investigations – Geometrical aspects as per IRC code

06 Hours

Analysis and Design of Concrete & Pre-stressed concrete:

Loads due to Permanent loads – Prestressing loads – Live loads for Highway, Railway and Metro – Seismic – Thermal – Water Currents – Wind Forces – Accidental Loads – Creep & Shrinkage
Structural analysis methods – Hand computed methods – Grillage Analysis – Transverse Analysis – FEM Methods
Introduction to IRC Codal provisions – Ultimate and Serviceability Limit State Design – Prestressing systems– Cable profiling – End block design

UNIT-II

06 Hours

Analysis and Design of Composite Super Structure:

Idealization and Grillage Analysis – Load Applications – ULS and SLS design
Composite plate girder bridge – Modelling – Design according to IRC– Introduction to Truss and Bow String Truss Bridges.

06 Hours

Design of Substructure and Foundation:
Types of Substructure – Cantilever Pier – Portal Pier – Pier Cap – Bearings – Pedestals & Seismic restrainers Types of Foundation – Geotechnical capacities – Open foundation - Pile foundation - Well foundation

UNIT-III

06 Hours

Erection Methods and Inspection, Monitoring & Maintenance of Bridges:
Introduction to concept of Execution of Bridges – PSC I girder (Pre-& Post – Tensioned) – Truss Bridge –Balanced Cantilever Bridge – Segmental Bridge – Cable Stayed Bridge
Installation of Sensors for Service Stage – Periodic inspection methods – Periodic Maintenance-Replacement of bearings, expansion joints etc.

Course Outcomes: At the end of the course student will be able to

1.	**Obtain** solution of Bridge structure depending on various constraints and input parameters
2.	**Analyse** and Design of RCC composite Girder
3.	**Design** of Substructure and Auxiliary components
4.	**Design** of different types of foundations for bridges
5.	**Concept** of different types of execution methods of Bridges and Inspection, Monitoring & Maintenance of Bridges

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV XXXX-1.1	2	2				1									
CV XXXX -1.2		2	2	2	1										
CV XXXX -1.3		2	2	2											
CV XXXX -1.4	2	2	2												
CV XXXX -1.5						1	2								

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Johnson Victor, "Essentials of bridge Engineering", Sixth edition, Oxford and IBH publications, 2007.
2. Krishna Raju, "Design of Bridges", Fourth edition, Oxford and IBH publications, 2009.

REFERENCE BOOKS:

1. IRC: 6-2017 and IRC: 112-2020
2. D.J. Victor, Essentials of Bridge Engineering, Oxford & IBH Publishing Co. Pvt. Ltd
3. W.F. Chen, and L. Duan, Bridge Engineering Handbook, CRC Press, Taylor & Francis Group

E Books / MOOCs/ NPTEL

1. L&T EduTech LMS Content

PROJECT MANAGEMENT FOR ENGINEERS

Course Code:	**CV 2352-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:2**	**Credits**	**03**
Total Teaching Hours	**45**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the concepts of project management from planning to execution and how to apply them in projects.
2.	Prepare the resource, schedule, cost planning for an industrial project.
3.	Identify the risk and its management.
4.	Usage of **MS Project** as a tool for project management and monitoring.

UNIT-I

06 Hours

Contract Management and Scope Management:

Introduction to Project Management, Project and Project Lifecycle – Process, Phases, Organization, Project Financial Feasibility Methods, Non-numerical Feasibility Methods.
Basic Concepts of Contract Management, Essential elements, Contract Types, Tendering and Proposal Preparation, Key Commercial Terms and Conditions, Bid Evaluation and Contract Award, Contract Administration, Claim Management. Work Breakdown Structures- Creation & Case Study

06 Hours

Schedule and Resource Management:
Approach to schedule management, Charts, Sequencing and Dependency, Network Diagram, Activity Duration, Critical Path Method, Float, Case study, Relationships, Case Study, Precedence Diagramming Method.
Resource Allocation and Resource Levelling, Case Study on Schedule Compression, PERT to Predict the Probability of Project Completion.

UNIT-II

06 Hours

Project Cost and Quality Management:
Cost Estimation, Budget and Variance Analysis, Monitoring and Control, Cash Flows, Case Study. Occupational Health, Safety and Environment, Barriers, Quality Management System – Chart and tools.

06 Hours

Procurement, Subcontracts and Stakeholder Management:
Supply Chain Management, Logistics and Transportation, Vendor and Inventory Management. Stakeholder Analysis and Engagement, Project Communication, Dealing with Difficult Stakeholders.

UNIT-III

06 Hours

Project Risk Management and Project Monitoring:
Process, Terminology, Identification, Analysis and Response Strategy
Analysis Techniques, Monitor and Control Schedule, Cost, Resources, Quality and risks Creating schedules, Assigning Resources, Cost, Evaluation, Optimization and Tracking

Course Outcomes: At the end of the course student will be able to

1.	**Develop** WBS and estimate the resource requirements
2.	**Prepare** bar charts for work schedule

3.	**Analyse** the cost control monitoring and accounting methods
4.	**Understand** the quality control and safety during construction
5.	**Create** a project monitoring plan

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV XXXX-1.1	1	2	3		2						2	1			
CV XXXX -1.2	1		3		2						2				
CV XXXX -1.3	1	3	2	2	1						1				
CV XXXX -1.4	1	1	3	1		2	1				2	1			
CV XXXX -1.5	1	2	3	1	2	1			1		3	1			

1: Low 2: Medium 3: High

TEXTBOOKS:

1. P C Tripathi and P N Reddy, "Principles of Management", Tata McGraw-Hill Education, 6th edition, 2017.
2. Chitkara, K.K. "Construction Project Management Planning ", Scheduling and Control, Tata. McGraw Hill Publishing Co., New Delhi, 4th edition, 2019.

REFERENCE BOOKS:

1. Project management institute, Guide to the Project Management Body of Knowledge (PMBOK® Guide), seventh edition/2022.

E Books / MOOCs/ NPTEL

1. L&T EduTech LMS Content

ABILITY ENHANCEMENT COURSES

APPLICATIONS OF AI IN CIVIL ENGINEERING

Course Code:	**CV2651-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CS1002-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Define what is Neural Network and model a Neuron and Express both Artificial Intelligence and Neural Network
2.	Applications of ANN to various Civil Engineering Problems
3.	Develop various fuzzy membership functions, understand defuzzification sets and to apply the knowledge to solve some Engineering Problems
4.	Understand working principle of genetic algorithm and able to apply genetic algorithm to solve some real engineering problems

UNIT-I

Introduction to Neural Networks: **10 Hours**

ANN definition, Neural Network, Human Brain, components, input, output and hidden layers, threshold value, weights. Models of Neuron, Biological Neural Network, Different ANN architectures, Training techniques for ANNs, Relationship of ANN with other technologies. Applications of ANN to solve Civil Engineering problems

UNIT-II

Fuzzy logic: **10 Hours**

Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Some applications of Fuzzy logic. Applications of Fuzzy logic for various Civil Engineering problems.

UNIT-III

Genetic Algorithms: **05 Hours**

Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc. Working Principle of Genetic Algorithm, Applications of Genetic algorithm for various Civil Engineering problems.

Course Outcomes: At the end of the course student will be able to

1.	Define what is Neural Network and model a Neuron and Express both Artificial Intelligence and Neural Network
2.	Understand the artificial neural networks and its applications.
3.	Understand the fuzzy logic and different membership functions and applications
4.	Develop the fuzzy logic sets and membership function and defuzzification techniques.
5.	Working principle, operators of Genetic algorithm and applications to solve some civil Engineering problems

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2651-1.1	3	2	-	-	-	-	-	-	-	1	-	1	1	2	-
CV2651-1.2	3	2	-	-	-	-	-	-	-	1	-	1	1	2	-
CV2651-1.3	3	2	-	-	-	-	-	-	-	1	-	1	1	2	-
CV2651-1.4	3	3	-	-	-	-	-	-	-	1	-	1	1	2	-
CV2651-1.5	3	3	-	-	-	-	-	-	-	1	-	1	1	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Stuart Russell, Peter Norvig: "Artificial Intelligence: A Modern Approach",2nd Edition, Pearson Education, 2007
2.	Neural Networks, Fuzzy Logis and Genetic Algorithms: Synthesis, and Applications, S. Rajasekaran, and G. A. Vijayalakshmi Pai, Prentice Hall of India, 2007.
3.	Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.
REFERENCE BOOKS:	
1.	Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, Nikola K. Kasabov, MIT Press, 1998.
2.	An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.
3.	Soft Computing: Fundamentals and Applications by D.K.Pratihar, Narosa Publishing House, New-Delhi, 2014
E Books / MOOCs/ NPTEL	
1.	Introduction to Soft Computing, NPEL Course by IIT Kharagpur
2.	Fuzzy Logic and Neural Networks, NPEL Course by IIT Kharagpur

FIRE SAFETY IN BUILDINGS

Course Code:	**CV2652-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	To understand the concept of high-performance green building and sustainability.
2.	To study and understand the function of materials used for designing green buildings and generate substantial cost savings.
3.	Learn about the selection of mechanical and electrical lighting systems. And learn about green building water supply and waste water supply systems.

UNIT-I

Introduction — **10 Hours**

Fire, change of state and latent heat, thermal expansion of solids, liquids and gases. Transmission of heat, combustion, Fire tetrahedron, and combustible solid, liquids and gases. Classification of Fire and different fire extinguishing methods, portable fire extinguishers, types and operating procedure. Fundamental Principles of Hydraulics, Atmospheres pressure and suction lift, use of Nozzle discharges. Advantages and disadvantages of Centrifugal pumps. Types of pumps and primers. Operation of pumps and primers, Types of ladders and trolleys. Pitching and climbing hints.

UNIT-II

Safety Management — **10 Hours**

Key elements of a safety and Health Management System- Policy & commitment, Planning, Implementation and Operation, Measuring Performance, Auditing and Reviewing performance Initial Safety and health Management System Review, Safety and health Management System model, safety and Health policy- Developing a workplace Safety and Health Policy , Planning – safety and Health objectives and Targets, performance standards, Implementation and Operation – structure and responsibilities- management responsibilities, individual responsibilities, Safety Consultation.

UNIT-III

Risk assessment and Control — **05 Hours**

Risk assessment and control- the legal Basis for risk Assessment, key stages of Risk assessment and control- use trained Risk assessors, preparation and Inventory, Identify the hazards, assess the risk, identify Appropriate Action , Risk assessment records and control . A simple Risk estimation example – Hazards, remedial measures, Motivation of employees, Insurance coverage of Industrial plant & personnel.

Course Outcomes: At the end of the course student will be able to

1.	Realize the methodologies involved in fire formation and Discuss the classification & causes of fire at the workplace
2.	Discuss the importance of various fire control mechanisms
3.	Outline the factors involved in the prevention of fire
4.	Familiarize with workplace Inspection & reporting procedures and Describes various fire safety devices & their working mechanisms
5.	Details the essential requirements of the emergency evacuation plan and Recognize the different types of fire extinguisher & their usage

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2653-1.1	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-
CV2653-1.2	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-
CV2653-1.3	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-
CV2653-1.4	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-

CV2653-1.5	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Fundamentals of Industrial safety & health byK.U. Mistry
2.	Carl Goodson, “Essentials of fire fighting” Fire protection publications; 5th edition
3.	Pann Well, “Fire engineering’s skill drills for Fire Fighter”, Pann Well; 1st & 2nd edition

GREEN BUILDING

Course Code:	**CV2653-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	To understand the concept of high-performance green building and sustainability.
2.	To study and understand the function of materials used for designing green buildings and generate substantial cost savings.
3.	Learn about the selection of mechanical and electrical lighting systems. And learn about green building water supply and waste water supply systems.

UNIT-I

Introduction — **05 Hours**

Introduction. Need for green building- Impact of building industry on energy resources, natural resources and environment. Green building-definition. Principles of green building. Life cycle assessment. Consideration while selecting material and design for longevity

Building Envelope — **05 Hours**

Building envelope- Conventional materials and Use of low energy materials - Base materials for RCC and Steel systems. Alternatives to structural systems, masonry, mortar, plastering, roofing, ceiling, flooring, doors, windows and wood work. Smart materials. Low energy construction- low energy material, locally sourced material and recycled material.

UNIT-II

Sustainable siting of building — **05 Hours**

Sustainable siting of building. Orientation of the building. Use of natural light, solar heat and ventilation. Fenestration and shading. Effective cooling and heating systems-solar passive techniques of heating and cooling in a building design.

Thermal Comfort — **05 Hours**

Thermal Insulation for roof and walls. Glazing and shading systems. Building finishes. Effective electrical systems- photovoltaic systems. Efficient HVAC systems. Efficient lighting system- efficient bulbs, occupancy sensor systems and light sensors. Efficient motors. Energy auditing and Certification systems-GRIHA, LEED BREEAM and IGBC etc

UNIT-III

Water Conservation — **05 Hours**

Conserving water in building- Water efficient fixtures- flow restrictors, sensors, no water fixtures. Alternatives for secondary uses. Rain water harvesting, solar water heaters and solar cooking. Low flush toilets, grey water recycling. Onsite treatment. Eco-friendly toilets. Reducing irrigation water requirements. Vertical farming. Xeriscaping.

Course Outcomes: At the end of the course student will be able to

1.	Apply the concepts of embodied energy and their calculations and design for longevity.
2.	Application of alternative energy efficient materials for various building components.
3.	Orient and plan the building environment to suit to effectively utilize the natural light, solar energy and other sources to ensure effective control on the inside environment of a building.
4.	Understand the implementation of thermal insulation system, energy saving bulbs etc.,
5.	Understand the criteria involved in energy auditing and certification systems-GRIHA, LEED BREEAM and IGBC etc.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2652-1.1	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-
CV2652-1.2	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-

CV2652-1.3	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-
CV2652-1.4	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-
CV2652-1.5	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Prof. Dr. Michael Bauer, Peter Mösle and Dr. Michael Schwarz (2010) “Green Building – Guidebook for Sustainable Architecture” Springer.
2.	Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison (2001) “Green Building Handbook” Volume 1-Spon Press. Editor:
3.	MiliMajumdar, (2002) “Energy-efficient buildings in India” Tata Energy Research Institute.
4.	TERI “Sustainable Building Design Manual- Volume I & II” Tata Energy Research Institute.
5.	Indian Green Building Council: www.igbc.inIGBC Green Homes Abridged Reference Guide
6.	IGBC Green Factory Building Abridged Reference Guide
7.	LEED India NC Reference Guide / LEED India CS Reference Guide
8.	Background material of green building training programme conducted by IGBC

E Books / MOOCs/ NPTEL

1.	Green Rating for Integrated Habitat Assessment: http://grihaindia.org/
2.	United States Green Building Council: http://www.usgbc.org/
3.	The Whole Building Design Guide: http://www.wbdg.org/Technical Manual

INSTRUMENTATION AND SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS

Course Code:	**CV2654-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	To understand the concept of high-performance green building and sustainability.
2.	To study and understand the function of materials used for designing green buildings and generate substantial cost savings.
3.	Learn about the selection of mechanical and electrical lighting systems. And learn about green building water supply and waste water supply systems.

UNIT-I

Sensors & Transducer — **05 Hours**

Definition, Classification & selection of sensors, Measurement of displacement using Potentiometer, LVDT & Optical Encoder, Measurement of force using strain gauge, Measurement of pressure using LVDT based diaphragm & piezoelectric sensor.

05 Hours

Measurement of temperature using Thermistor, Thermocouple & RTD, Concept of thermal imaging, Measurement of position using Hall effect sensors, Proximity sensors: Inductive & Capacitive, Use of proximity sensor as accelerometer and vibration sensor, Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive.

UNIT-II

Virtual Instrumentation — **05 Hours**

Graphical programming techniques, Data types, Advantage of Virtual Instrumentation techniques, Concept of WHILE & FOR loops, Arrays, Clusters & graphs, Structures: Case, Sequence & Formula nodes, Need of software-based instruments for industrial automation.

Data Acquisition Methods — **05 Hours**

Basic block diagram, Analog and Digital IO, Counters, Timers, Types of ADC: successive approximation and sigma-delta, Types of DAC: Weighted Resistor and R-2R Ladder type, Use of Data Sockets for Networked Communication.

UNIT-III

Intelligent Sensors — **05 Hours**

General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control.

Course Outcomes: At the end of the course student will be able to

1.	Apply the concepts of embodied energy and their calculations and design for longevity.
2.	Application of alternative energy efficient materials for various building components.
3.	Orient and plan the building environment to suit to effectively utilize the natural light, solar energy and other sources to ensure effective control on the inside environment of a building.
4.	Understand the implementation of thermal insulation system, energy saving bulbs etc.,
5.	Understand the criteria involved in energy auditing and certification systems-GRIHA, LEED BREEAM and IGBC etc.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2	3
CV2652-1.1	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-
CV2652-1.2	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-
CV2652-1.3	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-
CV2652-1.4	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-
CV2652-1.5	-	3	2	3	2	1	-	-	-	-	-	-	2	3	-

1: Low 2: Medium 3: High

TEXT BOOKS:

1.	DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013
2.	D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.
3.	S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994.
4.	Gary Johnson / Lab VIEW Graphical Programing II Edition /McGraw Hill 1997.

REFERENCE BOOKS:

1.	Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.
2.	A.D. Helfrick and W.D. cooper,Modern Electronic Instrumentation & Measurement Techniques, PHI – 2001
3.	Hermann K.P. Neubert, “Instrument Transducers” 2nd Edition 2012, Oxford University Press.

E Books / MOOCs/ NPTEL

1.	Green Rating for Integrated Habitat Assessment: http://grihaindia.org/
2.	United States Green Building Council: http://www.usgbc.org/
3.	The Whole Building Design Guide: http://www.wbdg.org/Technical Manual

SOFTWARE APPLICATIONS IN CIVIL ENGINEERING

Course Code:	**CV2655-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	**Understand** the analysis by software tool.
2.	**Identify** different types of methods of analysis using software.
3.	**Analyse** the strength of various types of structural members as per the codal provisions.
4.	**Design** the various civil Engineering structures using software.

UNIT-I

Structural Analysis of Trusses and Beams	**05 Hours**
Structural Analysis of 2D and 3D Trusses, Structural Analysis of Continuous Beams using for different types of loadings and support conditions.	
Structural Analysis of Frames	**05 Hours**
Structural Analysis of 2D and 3D Rigid and Braced Frames for different types of loadings, support conditions, section orientations and stiffness variation between columns and beams.	

UNIT-II

Analysis of Buildings	**05 Hours**
Structural Analysis of one BHK Building.	
Analysis of Retaining Wall	**02 Hours**
Structural Analysis of Cantilever Retaining Wall	
Analysis of Bridges	**03 Hours**
Structural Analysis of Simple Slab Bridge	

UNIT-III

Design of Structures using MS Excel	**03 Hours**
Creating Design spreadsheet for Beams, Slabs	
Design of Structures using MS Excel	**02 Hours**
Creating Design spreadsheet for Columns, Footings, and Staircases	

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the types of analysis, structural analysis methods and procedure (L2)
2.	**Create** 2D and 3D Models for analysis with various end conditions. (L3)
3.	**Plan** a column orientation for different types of buildings (L5)
4.	**Analyse** 3D frames, Buildings, Retaining wall, and Bridges. (L5)
5.	**Design** the analysed structures using MS Excel. (L6)

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2656-1.1	2	-	-	-	3	2	-	-	2	2	2	2	2	-	-
CV2656-1.2	2	1	-	-	3	2	-	-	2	2	2	2	2	-	-
CV2656-1.3	2	2	-	-	3	2	-	-	2	2	2	2	2	-	-
CV2656-1.4	2	-	2	-	3	2	-	-	2	2	2	2	2	2	-
CV2656-1.5	2	-	2	-	3	2	-	-	2	2	2	2	2	-	-

1: Low 2: Medium 3: High2

TEXTBOOKS:

1.	Punmia B. C., Ashok Kumar Jain, Arun Kumar Jain, "Strength of Materials and Theory of Structures", Volume I & Volume II, Laxmi Publications (P) Ltd., 2019.
2.	Ramamrutham S., "Theory of Structures", Dhanpat Rai & Sons, New Delhi, 2018.

3.	N. Krishnaraju and R.N.Pranesh, Reinforced Concrete Design (IS456:2000)-Principles and Practice, New Age International Publishers, New Delhi, 2006.
REFERENCE BOOKS:	
1.	IS: 456-2000 (to be supplied in the examination), SP16.
2.	Dr. Ramchandra and VirendraGehlot, Limit State Design of Concrete Structures (As per IS: 456-2000), Scientific Publishers (India), Jodhpur, 2010.
3.	Punmia B.C.(2017) "Soil Mechanics and Foundations" Laxmi Publishing Co
4.	S.Ramamrutham., R Narayana, "Theory of Structures", Dhanpat Rai Publishing company, New Delhi, 2016.
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/105105166
2.	https://nptel.ac.in/courses/105101085
3.	https://nptel.ac.in/courses/105105105

TECHNICAL WRITING SKILLS

Course Code:	**CV2656-1**	**Course Type**	**AEC**
Teaching Hours/Week (L:T:P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the information design and development in technical writings.
2.	Acquire the knowledge of grammar and editing in technical writing.
3.	Comprehend the details of self-development and assessment in technical writing.
4.	Acquire the fundamental knowledge and importance of communication in technical writings.
5.	Gain the basic knowledge on ethics and report writing aspect of technical communication.

UNIT-I

Information Design and Development — **05 Hours**

Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

Technical Writing, Grammar and Editing — **05 Hours**

Technical writing process, forms of discourse, writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

UNIT-II

Self Development and Assessment — **05 Hours**

Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, taking notes; Complex problem solving; Creativity

Communication and Technical Writing — **05 Hours**

Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

UNIT-III

Ethics — **03 Hours**

Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

Interpretation and Report Writing — **02 Hours**

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the information design and development in technical writings.
2.	**Illustrate** the knowledge of grammar and editing in technical writing.
3.	**Comprehend** the details of self-development and assessment in technical writing.
4.	**Elucidate** the fundamental knowledge and importance of communication in technical writings.
5.	**Describe** the ethics and report writing aspect of technical communication.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2657-1.1	-	1	-	-	-	-	-	-	1	3	-	-	2	-	-

CV2657-1.2	-	1	-	-	-	-	-	-	1	3	-	-	2	-	-
CV2657-1.3	-	1	-	-	-	-	-	-	1	3	-	-	2	-	-
CV2657-1.4	-	1	-	-	-	-	-	-	1	3	-	-	2	-	-
CV2657-1.5	-	1	-	-	-	-	-	3	1	3	-	-	2	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2.	Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)

REFERENCE BOOKS:

1.	Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
2.	Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
3.	Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
4.	Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.

VISUAL BASIC APPLICATION FOR EXCEL

Course Code:	**CV2657-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	To study the basics of excel and macros.
2.	To study the operators decisions and loops used in excel vba.
3.	To study about the strings, arrays, user defined functions in excel.
4.	To study the sub procedures, events and excel objects.
5.	To study the text files, programming charts and user forms.

UNIT-I

Overview — **05 Hours**

VBA, Excel Macros, Excel Terms, Macro comments, Message box, Input box, Variables – data types, Constants

Operators; Decisions; Loops — **05 Hours**

Operators - Arithmetic operators, comparison operators, logical operators, concatenation operators
Decision – If Statement; If else statement; If elseif-Else statement; Nested If statement; Switch statements
Loops – For Loop; For each loops; while wend loops; Do while loop; Do until loop; Loop control statements; Exit for; Exit Do.

UNIT-II

Strings; Arrays; User defined functions — **05 Hours**

Strings – Instr; Instring Reverse; LCase; UCase; Left; Right; Mid; Ltrim; Rtrim; Trim; Len; Replace; Space; StrComp; String Function; String Reverse Function.
Arrays – Array declaration, Assigning values to an array, Multi dimensional array, ReDim statement, Array methods, LBound function, Ubound function, split function, join function, filter function, IsArray function, Erase function
User defined functions – Function definition, Calling a function

Sub procedure; Events — **03 Hours**

Calling procedures; Events - Worksheet events; workbook events
Error Handling – Syntax errors; Runtime errors; Logical errors; Err object

Excel Objects — **02 Hours**

Excel Objects – Application objects; workbook objects; worksheets objects; Range objects

UNIT-III

Text files — **05 Hours**

Text files – File system object (FSO); write command
Programing charts
User forms

Course Outcomes: At the end of the course student will be able to

1.	**Summarize** the basics of excel and macros. (L2)
2.	**Make use of** the operators, decisions and loops used in excel vba. (L3)
3.	**Utilize** the strings, arrays, user defined functions in excel. (L3)
4.	**Apply** the sub procedures, events and excel objects. (L3)
5.	**Develop** the text files, programming charts and user forms. (L3)

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2654-1.1	2	-	-	-	2	-	-	-	-	1	-	-	2	-	-
CV2654-1.2	2	2	-	-	2	-	-	-	-	1	-	-	-	2	-

CV2654-1.3	2	2	-	-	2	-	-	-	-	1	-	-	1	-	-
CV2654-1.4	2	2	-	-	2	-	-	-	-	1	-	-	1	-	1
CV2654-1.5	2	2	2	-	2	-	-	-	-	1	-	-	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	David A Williams , “Excel VBA: The Ultimate Beginner’s Guide to Learn VBA Programming Step by Step”
2.	Hein Smith, “Excel VBA and Macros
3.	Richard Mansfield, “ Mastering VBA for Microsoft Office 2016.

REFERENCE BOOKS:

1.	Michael Alexander, Dick Kusleika, “Excel 2016 Power Programming with VBA” Wiley Publications.
2.	Michael Alexander, Dick Kusleika, “Excel 2019 BIBLE, Wiley Publications.

E Books / MOOCs/ NPTEL

1.	Excel/VBA for Creative Problem Solving | Coursera

ENTREPRENEURSHIP DEVELOPMENT AND SMALL BUSINESS MANAGEMENT

Course Code:	**CV2658-1**	**Course Type**	**AEC**
Teaching Hours/Week (L:T:P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand the information design and development in technical writings.
2.	Acquire the knowledge of grammar and editing in technical writing.
3.	Comprehend the details of self-development and assessment in technical writing.
4.	Acquire the fundamental knowledge and importance of communication in technical writings.
5.	Gain the basic knowledge on ethics and report writing aspect of technical communication.

UNIT-I

ENTREPRENEURSHIP — **05 Hours**

Introduction, Meaning and Importance, Evolution of term 'Entrepreneurship', Factors influencing entrepreneurship', Psychological factors, Social factors, Economic factor, Environmental factors, Characteristics of an entrepreneur, Entrepreneur and Entrepreneur.
Types of entrepreneur, According to Type of Business, According to Use of Technology, According to Motivation, According to Growth, According to Stages
New generations of entrepreneurship viz. social entrepreneurship, Entrepreneurship, Health entrepreneurship, Tourism entrepreneurship, Women entrepreneurship etc, Barriers to entrepreneurship

Foundation of Entrepreneurship Development — **05 Hours**

Concept and need of entrepreneurship; Characteristics and Types of Entrepreneurship; Entrepreneurship as a career; Entrepreneurship as a style of Management; The changing role of the entrepreneur; Entrepreneurial traits, factors affecting entrepreneurs.

UNIT-II

Theories of Entrepreneurship — **05 Hours**

Influences on entrepreneurship development; External influences on entrepreneurship development; Socio-cultural, Political, economical, personal entrepreneurial success and failure: reasons and remedies; Women entrepreneurs: Challenges and achievements of women entrepreneurs.

Business Planning Process — **05 Hours**

The business plan as an entrepreneurial tool; Elements of business planning; Objectives; Market analysis; development of Product/idea; Marketing, Finance, Organization and management; Ownership; Critical risk contingencies of The proposal; Scheduling and milestones.

UNIT-III

Project Planning for Entrepreneurs — **03 Hours**

Technical, Financial, Marketing, Personnel, and management feasibility reports; Financial schemes offered by various financial institutions, Like Commercial Banks, IDBI, ICICI, SIDBI, SFCs, Foreign currency Financing; Estimation of Financial requirements.

Entrepreneurship Development and Government — **02 Hours**

Role of Central Government and State Government in promoting entrepreneurship with various incentives, subsidies, grants, programs, schemes and challenges. Government initiatives and inclusive entrepreneurial Growth.

Course Outcomes: At the end of the course student will be able to

1.	**Explain** the information design and development in technical writings.

2.	**Illustrate** the knowledge of grammar and editing in technical writing.
3.	**Comprehend** the details of self-development and assessment in technical writing.
4.	**Elucidate** the fundamental knowledge and importance of communication in technical writings.
5.	**Describe** the ethics and report writing aspect of technical communication.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2657-1.1	-	1	-	-	-	-	-	-	1	3	-	-	2	-	-
CV2657-1.2	-	1	-	-	-	-	-	-	1	3	-	-	2	-	-
CV2657-1.3	-	1	-	-	-	-	-	-	1	3	-	-	2	-	-
CV2657-1.4	-	1	-	-	-	-	-	-	1	3	-	-	2	-	-
CV2657-1.5	-	1	-	-	-	-	-	3	1	3	-	-	2	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Khanna, S. S., Entrepreneurial Development, S. Chand, New Delhi.
2.	Hisrich D. Robert, Michael P. Peters, Dean A. Sheperd, Entrepreneurship, McGraw-Hill,6 ed.
3.	Zimmerer W. Thomas, Norman M. Scarborough, Essentials of Entrepreneurship and Small Business Management, PHI,4 ed.

REFERENCE BOOKS:

1.	Holt H. David, Entrepreneurship: New Venture Creation, Prentice- Hall of India, New Delhi, Latest edition.
2.	Kuratko, F. Donald, Richard M. Hodgetts, Entrepreneurship: Theory, Process, Practice, Thomson, 7ed.
3.	Desai, Vasant, Dynamics of Entrepreneurship: New Venture Creation, Prentice-Hall of India, New Delhi, Latest edition.
4.	Roberts, Edward B.(ed.), Innovation: Driving Product, Process, and Market Change, San Francisco: Jossey Bass, 2002.

INNOVATION AND DESIGN THINKING

Course Code	**ME1654-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**0:0:2:0**	**Credits**	**01**
Total Teaching Hours	**15**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	To explain the concept of design thinking for product and service development
2.	To explain the fundamental concept of innovation and design thinking
3.	To discuss the methods of implementing design thinking in the real world.
	Note: Teaching-Learning Process (General Instructions) These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes. 1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes. 2. Show Video/animation films to explain concepts 3. Encourage collaborative (Group Learning) Learning in the class 4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking 5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it. 6. Topics will be introduced in multiple representations. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

List of Modules

1.	**PROCESS OF DESIGN** Understanding Design thinking Shared model in team-based design – Theory and practice in Design thinking – Explore the presentation Tools for Design Thinking Real-Time design interaction capture and analysis – Empathy for design Teaching-Learning Process Introduction about the design thinking: Chalk and Talk method Theory and practice through presentation Case studies on design thinking for real-time interaction and analysis
2.	**Design Thinking in IT** Design Thinking to Business Process modeling – Scenario-based Prototyping DT For strategic innovations Growth – Storytelling representation – Strategic Foresight - Change – Sense Making – Maintenance - Relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model design. Teaching-Learning Process Case studies on design thinking and business acceptance of the design Business model examples of successful designs
3.	Design thinking workshop Design Thinking Workshop Empathize, Design, Ideate, Prototype and Test Teaching-Learning Process Presentation by the students on the success of Live project on design thinking in a group of 4 students

Course Outcomes: Upon the successful completion of the course, students will be able to:

1.	Appreciate various design process procedure
2.	Generate and develop design ideas through a different techniques
3.	Identify the significance of Design Thinking to Understand products

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
ME1654-1.1	2	-	2	-	-	-	-	-	-	-	-	-			
ME1654-1.2	-	-	-	-	-	-	2	2	-	-	-	-			
ME1654-1.3	-	-	-	-	-	-	-	-	-	3	3	-			

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition), Second Edition, 2013.
2.	Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
3.	Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve– Apply", Springer, 2011.
4.	Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons, 2013.
5.	Yousef Haik and Tamer M. Shahin, "Engineering Design Process", Cengage Learning, SecondEdition, 2011.
6.	Jeanne Liedtka, Andrew King, Kevin Bennett, "Solving Problems with Design Thinking - Ten Stories of What Works", Columbia Business School Publishing, 2013.

E Resources

1.	www.tutor2u.net/business/presentations/. /productlifecycle/default.html
2.	https://docs.oracle.com/cd/E11108_02/otn/pdf/. /E11087_01.pdf
3.	www.bizfilings.com › Home › Marketing › Product Developmen
4.	https://www.mindtools.com/brainstm.html
5.	https://www.quicksprout.com/. /how-to-reverse-engineer-your-competit
6.	www.vertabelo.com/blog/documentation/reverse-engineering https://support.microsoft.com/en-us/kb/273814
7.	https://support.google.com/docs/answer/179740?hl=en
8.	https://www.youtube.com/watch?v=2mjSDIBaUlM thevirtualinstructor.com/foreshortening.html https://dschool.stanford.edu/.../designresources/.../ModeGuideBOOTCAMP2010L.pdf https://dschool.stanford.edu/use-our-methods/ 6. https://www.interactiondesign. org/literature/article/5-stages-in-the-design-thinking-process 7. http://www.creativityatwork.com/design-thinking-strategy-for-innovation/ 49 8. https://www.nngroup.com/articles/design-thinking/ 9. https://designthinkingforeducators.com/design-thinking/ 10. www.designthinkingformobility.org/wp-content/.../10/NapkinPitch_Worksheet.pdf
9.	Activity Based Learning (Suggested Activities in Class)/ Practical Based learning http://dschool.stanford.edu/dgift/

RESEARCH METHODOLOGY

Course Code	**ME1659-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	Explain the importance of research methodology, Explain the steps in defining the research problem.
2.	Explain methods of reviewing the literature and research design.
3.	Discuss the methods of designing sampling survey. Discuss methods of scaling and measuring of the data.
4.	Perform Hypothesis testing using the concept of mean and variance.
5.	Discuss interpretation and report writing techniques.

UNIT-I	**10 hours**

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Research Process
Defining the Research Problem: Research Problem, Selecting the Problem
Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to research problem
Research Design: Meaning of Research Design, Need for Research Design, Features of Good

UNIT-II	**10 hours**

Design of Sample Surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors,
Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary, Data, Selection of Appropriate Method for Data Collection, Case Study Method.
Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses

UNIT-III	**5 hours**

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Course Outcomes: At the end of the course student will be able to

1.	Explain the importance of research methodology, Explain the steps in defining the research problem.
2.	Explain methods of reviewing the literature and research design.
3.	Discuss the methods of designing sampling survey.
4.	Perform Hypothesis testing using the concept of mean and variance
5.	Discuss interpretation and report writing techniques.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
↓ Course Outcomes													**1**	**2**	**3**
ME1659-1.1	3	2	-	-	-	-	-	-	-	3	-	-			
ME1659-1.2	3	2	-	-	-	-	-	-	-	3	-	-			
ME1659-1.3	3	2	-	-	-	-	-	-	-	3	-	-			
ME1659-1.4	3	2	-	-	-	-	-	-	-	3	-	-			
ME1659-1.5	3	2	-	-	-	-	-	-	-	3	-	-			

1: Low 2: Medium 3: High

REFERENCE MATERIALS:	
1.	C. R. Kothari, Gaurav Garg, "Research Methodology: Methods and Techniques", New Age International 4th Edition, 2018.
2.	Ranjit Kumar, "Research Methodology a step-by step guide for beginners", SAGE Publications Ltd . 3rd Edition, 2011. (For the topic Reviewing the literature under Unit 2)
3.	Trochim, "Research Methods: the concise knowledge base", Atomic Dog Publishing, 2005.
4.	Fink A, "Conducting Research Literature Reviews: From the Internet to Paper", Sage Publications, 2009.
E Resources	
1.	NPTEL course material related to operations management, operations research and entrepreneurship

OPEN ELECTIVE COURSES

LIST OF OPEN ELECTIVE COURSES			
Sl No.	**Department**	**Course Codes**	**Open Elective Courses**
1	BT	BT1501-1	Bio Fuel Engineering
2	BT	BT1502-1	E-waste Management
3	BT	BT1503-1	Solid Waste Management
4	CS	CS2501-1	Introduction to AI and ML
5	CS	CS2502-1	Introduction to Data Structures
6	CV	CV2501-1	Disaster Management
7	CV	CV2502-1	Environmental Hygiene, Sanitation and Waste Management
8	CV	CV2503-1	Environmental Impact Assessment
9	CV	CV2504-1	Introduction to Geoinformatics
10	CV	CV2505-1	Personality Development and Soft Skills
10	CY	CY2501-1	Corrosion Science (Only for CV and ME)
11	CY	CY2502-1	Natural Products Chemistry (Only For BT)
12	EC	EC1501-1	Artificial Neural Network Systems
13	EC	EC1502-1	Introduction to MATLAB Programming: A Hands-on Approach (only for CV and BT)
14	EC	EC1503-1	Robotics
15	EC	EC2501-1	Consumer Electronics
16	EC	EC2502-1	PCB Design and Fabrication
17	EC	EC2503-1	Space Technology and Applications
18	EE	EE2501-1	Battery Management System
19	EE	EE2502-1	Biomedical Instrumentation
20	EE	EE2503-1	Electric Vehicle Technology
21	EE	EE2504-1	Fundamentals of PLC and its applications
22	EE	EE2505-1	Motors and Motor Control Circuits
23	EE	EE2506-1	Non-Conventional Energy sources
24	HU	HU1501-1	Elements of Yoga
25	HU	HU1502-1	Intellectual Property Rights
26	HU	HU1503-1	Introduction to German Language
27	HU	HU1504-1	Introduction to Japanese Language
28	HU	HU1505-1	National Cadet Corps: Organization, Functions & Capabilities
29	HU	HU1506-1	Overview of Indian Culture
30	HU	HU1507-1	Philosophy
31	HU	HU1508-1	Principles of Physical Education
32	HU	HU2501-1	Linguistics & Language Technology
33	HU	HU2502-1	Professional & Cognitive Communiqué
34	IS	IS2501-1	Introduction to Cyber Security
35	IS	IS2502-1	Python Programming
36	IS	IS2503-1	Software Engineering Practices
37	IS	IS2504-1	Web technologies

38	MA	MA1501-1	Graph Theory (for BT, CV, EC, EE, ME and RI)
39	MA	MA1502-1	Number Theory
40	MA	MA3501-1	Linear Algebra (for BT, CV, EE, ME and RI)
41	ME	ME1501-1	Automotive Engineering
42	ME	ME1502-1	Industrial Pollution Control
43	ME	ME1503-1	Sustainable Development Goals
44	ME	ME1504-1	Technology Innovation
45	MG	MG1501-1	Human Resource Management
46	MG	MG1502-1	Management Accounting and Control Systems
47	MG	MG1503-1	Operations and Quality Management
48	MG	MG1504-1	Organizational Behaviour
49	MG	MG1505-1	Taxation for Engineers
50	MG	MG1506-1	Working Capital Management
51	PH	PH2501-1	Nanotechnology
52	PH	PH2502-1	Optoelectronic Devices (EC, EE, CSE, ISE, AM and CC branches)
53	RI	RI2501-1	Autonomous Mobile Robots
54	RI	RI2502-1	Medical Robotics (for all except AI)
55	RI	RI2503-1	PLC Control of Hydraulic and Pneumatic Circuits (for all except AI)
56	RI	RI2501-1	Autonomous Mobile Robots
57	RI	RI2502-1	Medical Robotics (for all except AI)
58	RI	RI2503-1	PLC Control of Hydraulic and Pneumatic Circuits (for all except AI)

BIOFUEL ENGINEERING

Course Code:	**BT1501-1**	**Course Type:**	**OEC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Biotechnology

Course Objectives:

1.	To learn the fundamental concepts of biofuels, types of biofuels, their production technologies.
2.	To learn the concepts of feedstock utilization and energy conversion technologies.

UNIT-I

Liquid Biofuels	**15 Hours**

Description and classification of Biofuels; Primary biomass: Plant Materials-Woody biomass, Lignocellulosic and agroindustrial by-products, starchy and sugary crops. Secondary biomass: Waste residues and co-products- wood residues, animal waste, municipal solid waste. Biomass production for fuel – algal cultures, yeasts (Lipid and carbohydrate).

Production of biodiesel: Sources of Oils – edible and non-edible; Esterification and Transesterification. Free fatty acids; saponification; Single step and two step biodiesel production. Catalysts for biodiesel production – homogeneous (alkali/acidic) and heterogeneous; Lipase mediated process. General procedure of biodiesel production and purification Quality Control Aspects: GC analysis of biodiesel, fuel property measurements, ASTM (D-6751) and Indian standards (IS15607). Algal Biodiesel production.

Production of Bioethanol: Bioethanol production using Sugar; Starch and Lignocellulosic feedstocks; Pretreatment of lignocellulosic feed stock

UNIT-II

Biohydrogen and Microbial Fuel Cells	**15 Hours**

Enzymes involved in H_2 Production; Photobiological H_2 Production: Biophotolysis and Photo fermentation; H_2 Production by Fermentation: Biochemical Pathway, Batch Fermentation, Factors affecting H_2 production, Carbon sources, Detection and Quantification of H_2. Reactors for biohydrogen production.

Microbial Fuel cells: Biochemical Basis; Fuel Cell Design: Anode & Cathode Compartment, Microbial Cultures, Redox Mediators, Exchange Membrane, Power Density; MFC Performance Methods: Substrate & Biomass Measurements, Basic Power Calculations, MFC Performance: Power Density, Single vs Two-Chamber Designs, Wastewater Treatment Effectiveness;

Advances in MFC.

UNIT-III

Recovery of Biological Conversion Products	**10 Hours**

Bio gasification of municipal solid waste: Anaerobic processing; Types of digesters, Biogas plant in India.

Thermochemical processing: Planning an incineration facility, Incineration technologies: Mass burning system; Refuse derived fuel (RDF) system; modular incineration; Fluidized bed incineration; energy recovery; Fuel production through biomass incineration, Pyrolysis and gasification, hydrothermal processing.

Course Outcomes: At the end of the course student will be able to

1.	Mark the significance of biofuels and raw materials and Identify suitable feedstock for production of biofuels.
2.	Illustrate the production of liquid biofuels from various feed stocks.
3.	Demonstrate production of biohydrogen using microbial sources.
4.	Extend the concepts of microbial fuel cells towards development of specific application.
5.	Understand and apply the concepts of biochemical processing to harvest energy from waste products/streams.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
BT1501-1.1	-	2	-	-	-	-	-	-	1	-	-	-
BT1501-1.2	-	2	-	-	-	-	-	-	1	-	-	-
BT1501-1.3	-	2	-	-	-	-	-	-	1	-	-	-
BT1501-1.4	-	2	-	-	-	-	-	-	1	-	-	-
BT1501-1.5	-	2	-	-	-	-	-	-	1	-	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Drapcho, C. M., Nhuan, N. P. and Walker, T. H., "Biofuels Engineering Process Technology", Mc Graw Hill Publishers, New York, 2008.
2.	Jonathan R.M, Biofuels, "Methods and Protocols (Methods in Molecular Biology Series)", Humana Press, New York, 2009.
3.	Olsson L. (Ed.), "Biofuels (Advances in Biochemical Engineering/Biotechnology Series", Springer-Verlag Publishers, Berlin, 2007.
4.	Glazer, A. and Nikaido, H., "Microbial Biotechnology – Fundamentals of Applied Microbiology", 2 Ed., Cambridge University Press, 2007.
5.	Godfrey Boyle (Ed). "Renewable Energy- Power for sustainable future", 3rd Ed. Oxford. 2012.
6.	Ramachandran, T. V., "Management of municipal solid waste", Environmental Engineering Series. Teri Press, 2016.

E-WASTE MANAGEMENT

Course Code:	**BT1502-1**	**Course Type:**	**OEC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Biotechnology

Course Objectives:

1.	To learn fundamental concepts of E waste generation and management
2.	To understand the E waste processing and recycling methods

UNIT-I

Introduction — **15 Hours**

E-waste generation, Electronic waste in the global context, Overview of Electronics Waste Management in India, Growth of electrical and electronic industry, E-waste management and the conservation of geochemical scarce resources, E-waste management from macroscopic to microscopic scale, Sustainable Electronic-Waste Management: Implication on environment
& health hazards, E-waste legislation, Regulatory regime for e-waste, The international experience, Management of e-waste.

UNIT-II

E Waste Processing Techniques — **15 Hours**

Recent technologies in electronic-waste management, Solution and challenges in recycling waste cathode-ray tube, Mechanical Processing, Hydrometallurgical Processing, Electrometallurgical Processing, Pyrometallurgical Processing, Leaching Processes. Processing of discarded liquid crystal display for recovering Indium, Green pyrolysis of used printed wiring board powders, leaching of lead from solder material used in electrical and electronic equipment. Recovery of nickel from leaching liquor of printed circuit board by solvent Extraction, Recovery of copper from printed circuit boards waste by bioleaching. Methodology for recovery precious metals: Gold, Silver and Platinum group from electronic waste.

UNIT-III

Electronic Waste Recycling — **10 Hours**

Mechanical recycling of electronic wastes for materials recovery, Global trade in hazardous waste, Materials recycling considerations, Printed Circuit Boards, State of the art in the recycling of waste printed wiring boards, Copper recovery from printed circuit board of E-
waste, Monitors, Batteries. Chemical recycling of E-waste for clean fuel production, Recycling processes for the recovery of metal from E-waste of the LED Industry.

Course Outcomes: At the end of the course student will be able to

1.	Appraise the terms e waste and associated health hazards and identify suitable solution to combat the problems associated.
2.	Make use of a suitable e waste management strategy and abide by Govt. regulations.
3.	Apply various e waste processing techniques by identifying the type of e waste generated.
4.	Apply the leaching process as a technique to extract valuable metals from e wastes
5.	Ideate and formulate the novel concepts of e waste recycling to use them productively.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
BT1502-1.1	2	-	2	-	-	-	3	-	-	-	-	-
BT1502-1.2	2	-	2	-	-	-	3	-	-	-	-	2
BT1502-1.3	2	-	2	-	-	-	3	-	-	-	-	-
BT1502-1.4	2	-	2	-	-	-	3	-	-	-	-	-
BT1502-1.5	2	-	2	-	-	-	3	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Hugo M. V and Andréa M. Bernardes, "Electronic waste: Recycling Techniques", Springer, 2015.

SOLID WASTE MANAGEMENT

Course Code:	**BT1503-1**	**Course Type:**	**OEC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Biotechnology

Course Objectives:

1.	To learn types of solid wastes, collection, treatment and disposal methods.
2.	To understand various processing techniques and regulations of treatment and disposal.

UNIT-I

Introduction to Solid Wastes and its Segregation & Transportation	**15 Hours**

Solid waste – Definition, Sources of waste, Classification of Solid waste, Characteristics of Solid Waste (Physical, Chemical, Biological), Solid waste problems – impact on environment and health. Concept of waste reduction, recycling and reuse.
Waste collection and segregation: Solid waste generation, Onsite handling and segregation of wastes at source, Collection and storage of municipal solid wastes, Equipment used and manpower required in collection, Collection systems and routes.
Transportation: Transfer stations: types, location, maintenance, Methods and means of transportation.

UNIT-II

Processing Techniques, Recovery of Resources and Waste Disposal	**15 Hours**

Processing Techniques: Unit operations for separations and processing, mechanical and thermal volume reduction, Incineration of solid wastes – process and types of incinerators (liquid injection, rotary kiln and fluid bed), Biological processing – composting, vermicomposting, biomethanation, fermentation, Drying and dewatering of wastes.
Recovery of Resources: Heat recovery in incineration process, energy recovery and conversion of products from biological processes.
Dumping of solid wastes, Landfills – Types, site selection, preliminary design, operation, case study, Advantages and disadvantages of landfills, Leachate and landfill gases: Collection and treatment, Landfill disposal for hazardous wastes, biomedical waste.

UNIT-III

Solid Waste Management Rules and Planning Issues	**10 Hours**

Legislative trends and impacts: Major legislations, Government agencies. Municipal Solid Waste Management Act (1999), Hazardous Wastes (Handling and Management) Rules, Biomedical Waste (Handling and Management) Rule (1998), e-Waste (Management and Handling) Rule 2011.
Planning and developing a site for solid waste management, Site Remediation: Assessment and Inspection, Remedial techniques, Siting guidelines.

Course Outcomes: At the end of the course student will be able to

1.	Identify the sources, classification and characteristics of solid wastes
2.	Develop insight into the collection, transfer, and transport of solid waste.
3.	Apply waste processing techniques and recovery of resources from the waste.
4.	Select the alternatives of solid waste disposals and its impacts.
5.	Acquire knowledge about solid and hazardous waste management legislative rules.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12

BT1503-1.1	1	-	-	-	-	-	-	-	1	-	-	-
BT1503-1.2	1	1	-	-	-	1	1	-	1	-	-	-
BT1503-1.3	-	2	-	-	-	-	-	-	1	-	-	-
BT1503-1.4	-	2	-	-	-	1	1	-	1	-	-	-
BT1503-1.5	1	-	-	-	-	-	-	-	1	-	-	1

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Tchobanaglous, G., Theisen, H. and Vigil, S. A. "Integrated Solid Waste Management", McGraw – Hill. 1993.
2.	Tchobanoglous, G., Thiesen, H., Ellasen, "Solid Waste Engineering Principles and Management", McGraw – Hill, 1997.
3.	Landrefh, R. E. and Sundaresan, B. B. "Solid Waste Management in Developing Countries", Indian National Scientific Documentation Centre. New Delhi, 2000.

FUNDAMENTALS OF AI AND ML

Course Code:	**CS2501-1**	**Course Type:**	**OEC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**50**
Prerequisite	**IS1001-1**		

Teaching Department: Computer Science & Engineering

Course Objectives:

1.	Analyze the most fundamental knowledge to the students so that they can understand what the AI is.
2.	Gain a historical perspective of AI and its foundations
3.	Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4.	Experience AI development tools such as an ‘AI language’, expert system shell, and/or data mining tool.
5.	Explore the current scope, potential, limitations, and implications of intelligent systems.

UNIT-I

Introduction — **15 Hours**

What is AI? Foundation of AI, Early History of AI, The Middle Ages and Dark Ages of AI, Renaissance, Future of AI. Intelligence of AI; AI An Impossible Task, Animal Intelligence, Brain Size And Performance, Sensing And Movement, Subjective Intelligence, Iq Tests. Comparative Intelligence,
Chapter No 1: Introduction and Intelligence (Page No 11-37)

UNIT-II

Classical Artificial Intelligence — **15 Hours**

Introduction, Expert Systems, Conflict Resolution, Multiple Rules, Forward Chaining, Backward Chaining, Problems With Expert Systems, Fuzzy Logic, Fuzzification, Fuzzy Rules, Defuzzification, Fuzzy Expert System, Problem Solving. Chapter No 2: Classical AI (Page No 38-45)

UNIT-III

Foundations of Machine Learning — **10 Hours**

What is machine learning? Applications of Machine learning, Understand Data, Types of machine learning: Supervised, Unsupervised, Reinforcement Learning, Theory of learning: feasibility of learning, error and noise, training versus testing, theory of generalization, bias and variance, learning curve,.

Course Outcomes: At the end of the course student will be able to

1.	Explain the fundamental understanding of the history of artificial intelligence (AI) and its foundation
2.	Interpret the basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
3.	Describe the awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models
4.	Identify and explain the proficiency developing applications in an ‘AI language’, expert system shell, or data mining tool.
5.	Explain the fundamental concept and importance of machine learning.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CS2501-1.1	3	3	-	-	-	-	-	-	-	-	-	-
CS2501-1.2	3	3	-	-	-	-	-	-	-	-	-	-
CS2501-1.3	3	3	-	-	-	-	-	-	-	-	-	-
CS2501-1.4	3	3	2	-	-	-	-	-	-	-	-	-
CS2501-1.5	3	3	2	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Kevin Warwick, "Artificial Intelligence the basics", Typeset in Bembo by Wearset Ltd, Boldon, Tyne and Wear, Library of Congress Cataloging in Publication Data Warwick, K. ISBN: 978-0-415-56482-3 (hbk).
REFERENCE BOOKS:	
1.	Stuart Russel and Peter Norvig, "Artificial Intelligence A Modern Approach", Pearson 3rd Edition , 2016.
2.	Dan W Patterson, "Introduction to Artificial Intelligence and Expert Systems", Pearson, 1st edition 2015.
3.	Elaine Rich, "Artificial Intelligence", Mc Graw Hill 3rd Edition, 2017.
E Books / MOOCs/ NPTEL	
1.	Practical Artificial Intelligence Programming With Java, Third Edition ,Mark Watson
2.	Artificial Intelligence -http://www.nptelvideos.in/2012/11/artificial-intelligence.html
3.	http://nptel.ac.in/courses/106105077/
4.	https://www.udemy.com/artificial-intelligence
5.	https://www.edx.org/course/artificial-intelligence-ai-columbiax-csmm-101x-4

INTRODUCTION TO DATA STRUCTURES

Course Code:	**CS2502-1**	**Course Type:**	**OEC**
Teaching Hours/Week (L:T:P:S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**50**
Prerequisite	**CS1001-1**		

Teaching Department: Computer Science & Engineering

Course Objectives:

1.	Outline the concepts of data structures, types, operations, structures, pointers
2.	Implement linear data structures stacks, queues and usage of stacks in various applications.
3.	Implement the operations of singly linked lists
4.	Identify and differentiate different types of binary trees and binary search trees data structures
5.	Illustrate and classify threaded binary trees.

UNIT-I

Introduction — **15 Hours**

Data Structure, Classification (Primitive and non-primitive), data structure operations, Arrays, Pointers and structures, Dynamic Memory Allocation Functions,

Linear Data Structures – Stacks

Introduction and Definition, Representation of stack: Array and structure representation of stacks, Operations on stacks,

Applications of Stack

Conversion of Expressions, Evaluation of expressions, Recursion: Implementation, Simulating Recursion, examples on Recursion.

UNIT-II

Linear Data Structures – Queues — **15 Hours**

Introduction and Definition Representation of Queue: Array and Structure, representation of Queue, Various queue structures: ordinary queue, circular Queue

Linear Data Structures - Linked Lists

Definition and concepts singly linked List: Representation of link list in memory, Operations on singly Linked List, Circular Linked List, Doubly Linked List: Representation and Operations, Circular doubly Link list: Representation and Operations.

UNIT-III

Nonlinear Data Structures- Tree Data Structures — **10 Hours**

Basic Terminologies, Binary Trees: Properties, Representation of Binary Tree: Linear representation, Linked representation, Operations on Binary Tree: Insertion, traversals. Introduction to Binary Search Tree

Course Outcomes: At the end of the course student will be able to

1.	Acquire the fundamental knowledge of various types of data structures and pointers.
2.	Apply the fundamental programming knowledge of data structures to design stack and use them for solving problems.
3.	Apply the fundamental programming knowledge of data structures to design queues and use them for solving problems.
4.	Design various functions for implementation of linked list.
5.	Implement and apply the concept of binary trees and binary search tree data structure.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CS2502-1.1	-	-	-	-	-	-	-	-	-	-	-	-
CS2502-1.2	3	1	2	-	-	-	-	1	-	-	-	1
CS2502-1.3	3	2	2	-	-	-	-	1	-	-	-	1
CS2502-1.4	3	2	-	-	-	-	-	1	-	-	-	1

CS2502-1.5	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Aaron M. Tenenbaum, Yedidyah Langsam& Moshe J. Augenstein, “Data Structures using C”, Pearson Education/PHI, 2009.
2.	Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures in C”, 2nd edition, Universities Press, 2014.

REFERENCE BOOKS:

1.	Seymour Lipschutz, “Data Structures, Schaum’s Outlines”, Revised 1st edition, McGraw Hill, 2014.

E Books / MOOCs/ NPTEL

1.	Data Structures Using C, ISRD Group, Tata McGraw Hill, 2006.
2.	Data Structures Using C, Reema Thareja, 2nd edition, Oxford University Press, 2014
3.	Introduction to Data Structures by edx , URL: https://www.edx.org/course/
4.	Data structures by Berkley, URL: https://people.eecs.berkeley
5.	Advance Data Structures by MIT OCW , URL: https://www.mooclab.club/
6.	Data Structure by Harvard Extension School, URL: http://www.extension.harvard.

DISASTER MANAGEMENT

Course Code:	**CV2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P:S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV1002-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand difference between Disaster, Hazard, Vulnerability, and Risk.
2.	Know the Types, Trends, Causes, Consequences and Control of Disasters
3.	Apprehend Disaster Management Cycle and Framework.
4.	Know the Disaster Management in India
5.	Appreciate Applications of Science and Technology for Disaster Management.

UNIT-I

Understanding Disasters — **04 Hours**

Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management.

Types, Trends, Causes, Consequences and Control of Disasters — **10 Hours**

Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters

UNIT-II

Disaster Management Cycle and Framework — **10 Hours**

Disaster Management Cycle and Framework: Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action.

Disaster Management in India — **06 Hours**

Disaster Management in India: Disaster Profile of India – Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter-Governmental Agencies.

UNIT-III

Applications of Science and Technology for Disaster Management — **06 Hours**

Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non Structural Mitigation of Disasters S&T Institutions for Disaster Management in India

Case Studies — **04 Hours**

Study of Recent Disasters (at local, state and national level), Preparation of Disaster Risk Management Plan of an Area or Sector, Role of Engineers in Disaster Management

Course Outcomes: At the end of the course student will be able to

1.	Explain Concepts, Types, Trends, Causes of Disasters
2.	Describe Consequences and Control of Disasters
3.	Explain Disaster Management Cycle and Framework

4.	Explain the lesson learnt from the disasters in India and discuss the financial mechanism, roles and responsibilities of Non-Government and Inter-Governmental Agencies for Disaster management
5.	Describe the Applications of Science and Technology recent disasters, role of engineers for Disaster Management and prepare a report of Disaster Risk Management Plan.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CV2501-1.1	-	-	-	-	-	3	2	-	-	-	1	2
CV2501-1.2	-	-	-	-	-	3	2	-	-	-	1	2
CV2501-1.3	-	-	-	-	-	3	2	-	-	-	1	2
CV2501-1.4	-	-	-	-	-	3	2	-	-	-	1	2
CV2501-1.5	-	-	-	-	-	3	2	-	-	-	1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Noble, L. , "Introduction to environmental impact assessment. A Guide to Principles and Practice", 2nd edition, Oxford University Press, Don Mills, Ontario, 2010.
2.	Larry W. Canter, "Environmental Impact Assessment", McGraw Hill Inc. Singapore, 1996.

REFERENCE BOOKS:

1.	Morris and Therivel, "Methods of Environmental Impact Assessment", 3rd edition. New York, NY: Routledge, 2009.
2.	Hanna, K. S., "Environmental impact assessment", Practice and Participation. 2nd edition. Oxford, University Press, Don Mills, Ontario, 2009.

E Books / MOOCs/ NPTEL

1.	http://nptel.ac.in/courses/120108004/
2.	http://nptel.ac.in/courses/120108004/module3/lecture3.pdf

ENVIRONMENTAL HYGIENE, SANITATION AND WASTE MANAGEMENT

Course Code:	**CV2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P:S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV1002-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Creation of awareness among student's health issues and Swachh Bharath mission and the consequent responsibilities.
2.	To understand the culture cleanliness, engineering applications in creation of ODF (Open defecation free) concept, Importance of legal & cultural issues related to Environmental Hygiene.
3.	To know the importance of sanitation, gender sensitive sanitation issues & use of engineering technology in construction of toilets.
4.	To know the importance of waste management system, wastewater audit and waste water treatment process.
5.	To study the role of student in Swachh Bharata Abhiyan, solid and waste water treatment process.

UNIT-I

Prospective: Environmental Hygiene (EH), Sanitation, Solid Waste and Wastewater	**06 Hours**
Introduction- Swachh Bharath Mission (SBM)-Mission Objectives-Duration- Components Environmental Hygiene-Benefits-Sanitation-Waste Management. Work opportunities in Environmental Hygiene, Sanitation and Waste Management. Participatory Learning for Environmental Hygiene, Sanitation and Waste Management.	
Sociology of environmental hygiene management, solid waste and waste water and impacts	**08 Hours**
Open Defecation-Habits & attitude towards waste-Goals of SBA. Community Consciousness and Engagement on Sanitation Aspects, Roles & Responsibilities, Job Charts, Frequency, Schedules and Timelines in Swachhata Management, Culture of Cleanliness (Swachh Bharat Abhiyan), Behaviour Change Communication, Role of Habits and Attitudes in Environmental Hygiene Management, Waste and Wastewater Disposal; Change Management.	

UNIT-II

Infrastructure for Sanitation	**08 Hours**
Containment-Preparation of toilets –Toilet Types Evaluation of Construction and Maintenance of Community, Public, Institutional and Individual Sanitation Infrastructure Toilets-Proportion and Number of toilets, Gender Sensitive Sanitation Facilities, Ramps for Differently Abled, Types – Indian and Western. Faecal Sludge treatment - Single / Twin pit, Eco San, Septic Tank and Formal Sewerage.	
Solid Waste Management	**08 Hours**
Swachh Survekshan- Solid Waste management- Steps- Waste Audit-Classification Methods of Solid Waste Disposal and Management-Composting-Different types of composting- Waste Minimization-Waste Management.	

UNIT-III

Waste & Wastewater Audit	**06 Hours**
Waste Audit -Environmental Impact Assessment, Waste Characterization, Quantity Determination, Primary Collection Methods, Secondary Transportation. **Wastewater Audit**-Water Budget, Types of Wastewater, Survey of Distribution Network and Feasibility of Various Wastewater Treatment Methods.	
Swachh Bharath Mission and Inclusivity	**04 Hours**
Swacch Bharath Mission in rural & Urban Context-Gender Issues in sanitation. Role of women in Sanitation.	

Course Outcomes: At the end of the course student will be able to

1.	Creation of awareness among student's health issues and Swachh Bharath mission and the consequent responsibilities.
2.	To understand the culture cleanliness, engineering applications in creation of ODF (Open defecation free) concept, Importance of legal & cultural issues related to Environmental Hygiene.

3.	To know the importance of sanitation, gender sensitive sanitation issues & use of engineering technology in construction of toilets.
4.	To know the importance of waste management system, wastewater audit and waste water treatment process.
5.	To study the role of student in Swachh Bharata Abhiyan, solid and waste water treatment process.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CV2502-1.1	1	1	-	-	-	2	3	2	-	-	-	-
CV2502-1.2	1	1	-	-	-	2	3	2	-	-	-	-
CV2502-1.3	1	1	-	-	-	2	3	2	-	-	-	-
CV2502-1.4	1	1	-	-	-	2	3	2	-	3	-	-
CV2502-1.5	1	1	-	3	-	2	3	2	-	-	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Joanne E. Drinan and Frank Spellman, "Water and Wastewater Treatment: A Guide for the Non-engineering Professional".
2.	M. S. Bhatt and Asheref Illiyan, "Solid Waste Management: An Indian Perspective".
3.	Jagbir Singh, "Solid Waste Management: Present and Future Challenges".
4.	M. S. Bhatt, "Solid Waste Management: An Indian Perspective".
5.	T. V. Ramachandra, "Management of Municipal Solid Waste".
6.	Syed R. Qasim, "Wastewater Treatment Plants: Planning, Design and Operation".

REFERENCE BOOKS:

1.	Swachhbharatmission.gov.in/
2.	https://www.india.gov.in//swachh-bharat-mission-gramin-portal
3.	https://www.swachhsurvekshan2018.org/
4.	https://zerowasteeurope,eu/
5.	www.zerowasteindia.in/

E Books / MOOCs/ NPTEL

1.	http://www.un.org/waterforlifedecade/pdf/award_south_africa_eng_for_web.pdf
2.	http://swachhbharatmission.gov.in/sbmcms/writereaddata/images/pdf/Guidelines /Complete-set-guidelines.pdf

ENVIRONMENTAL IMPACT ASSESSMENT

Course Code:	**CV2503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P:S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV1002-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Identify the need to assess and evaluate the impact of projects on environment.
2.	Explain major principles of environmental impact assessment.
3.	Understand the different steps within environmental impact assessment.
4.	Appreciate the importance of EIA for sustainable development and a healthy environment.

UNIT-I

Evolution of EIA — **16 Hours**

Concepts of EIA, EIA methodologies (Adhoc, Network Analysis, Checklists, Map overlays, Matrix method), Screening and scoping, Rapid EIA and Comprehensive EIA, General Framework for Environmental Impact Assessment, EIA Specialized areas like environmental health impact assessment, Environmental risk analysis.

UNIT-II

14 Hours

Baseline data study, Prediction, and assessment of impacts on physical, biological, and socio-economic environment, Legislative and environmental clearance procedures in India, Public participation, Resettlement, and rehabilitation.

UNIT-III

10 Hours

Fault free analysis, Consequence Analysis, Introduction to Environmental Management Systems, Environmental management plan-Post project monitoring Environmental Audit: Cost Benefit Analysis, Life cycle Assessment. Case studies on project, regional and sectoral EIA.

Course Outcomes: At the end of the course student will be able to

1.	Understand phenomena of impacts and know the impact quantification of various projects in the environment.
2.	Liaise with and list the importance of stakeholders in the EIA process.
3.	Know the role of public in EIA studies.
4.	Overview and assess risks posing threats to the environment.
5.	Assess different case studies/examples of EIA in practice.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CV2503-1.1	1	1	-	-	-	2	3	2	-	-	-	-
CV2503-1.2	1	1	-	-	-	2	3	2	-	-	-	-
CV2503-1.3	1	1	-	-	-	2	3	2	-	-	-	-
CV2503-1.4	1	1	-	-	-	2	3	2	-	3	-	-
CV2503-1.5	1	1	-	3	-	2	3	2	-	-	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Noble, L., "Introduction to environmental impact assessment. A Guide to Principles and Practice", 2nd edition, Oxford University Press, Don Mills, Ontario, 2010.
2.	Larry W. Canter, "Environmental Impact Assessment", McGraw Hill Inc. Singapore, 1996.

REFERENCE BOOKS:

1.	Morris and Therivel, "Methods of Environmental Impact Assessment", 3rd edition. New York, NY: Routledge, 2009.

2.	Hanna, K. S., "Environmental impact assessment. Practice and Participation". 2nd edition. Oxford, University Press, Don Mills, Ontario, 2009.
E Books / MOOCs/ NPTEL	
1.	http://nptel.ac.in/courses/120108004/
2.	http://nptel.ac.in/courses/120108004/module3/lecture3.pdf

INTRODUCTION TO GEOINFORMATICS

Course Code:	**CV2504-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T: P:S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV1001-1, CV1002-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Explain the basic principles of Geoinformatics comprising Remote sensing, Photogrammetry, GPS, GNSS & GIS.
2.	Explain the stages and techniques of photogrammetry, aerial photo interpretation, visual & digital image processing, enhancement and interpretation.
3.	Explain and Appraise GIS - its components, data structures, process and operation, Map and its projections, components, preparation and overlays
4.	Explain the GIS functionality and Appraise the significance of GEOINFORMATICS (Photogrammetry, RS, GPS, GNSS & GIS) in real world applications.

UNIT-I

16 Hours

Remote sensing and its Principles: Physics of remote sensing, EM spectrum, Blackbody concept, atmospheric windows, spectral response of common earth features.
Platforms & Sensors: Ground based, Air borne and Space borne platforms, Active and Passive Sensors, Photographic sensors, scanners, radiometers, RADAR and thermal infrared, hyper spectral remote sensing, Indian satellites and sensors: capabilities, data products
Photogrammetry: Basic principles of Aerial photography and Photogrammetry, Flight procedures, Aerial Photo Interpretation and Analysis techniques.
Satellite Image Interpretation and Analysis techniques: Visual & Digital Image interpretation, Interpretation elements, False Colour Composites (FCC).

UNIT-II

15 Hours

Digital Image Processing and Analysis: Digital image formats, pre-processing and processing (DIP), image restoration/enhancement procedures, information extraction, pattern recognition concepts, post processing procedures.
Geographic Information System -concept and spatial models: Fundamentals of GIS, spatial and non-spatial data, vector and raster GIS, GIS Hardware and software, georeferencing, digitization, thematic maps, Overlay Analysis, Operation of GIS, Co-ordinate systems and map projections, Map scale, data display and cartography.

UNIT-III

09 Hours

Geoinformatics and Virtual GIS: Modern Surveying and Geoinformatics, GPS & GNSS, GIS Functionality: Introduction, data acquisition, preliminary data processing, data storage and retrieval, spatial search and analysis, graphics and interaction, Virtual GIS and Real world applications.

Course Outcomes: At the end of the course student will be able to

1.	Define and explain the principles of Remote Sensing and list various types of platforms, sensors & resolutions in RS with a special reference to Indian satellites and data products.
2.	Explain Photogrammetry, its basic principles, elements of photo interpretation, Visual & Digital Image interpretation techniques
3.	Explain different stages involved in Digital Image Processing, various image enhancement techniques, list and classify the digital image formats and the extracted information for various purposes.
4.	Explain and Appraise GIS - its components, data structures, process and operation, Map and its projections, components, preparation and Overlays.
5.	Explain the GIS functionality and appraise the significance of GEOINFORMATICS (Photogrammetry, RS, GPS, GNSS & GIS) and Virtual GIS in real world applications.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
CV2504-1.1	2	2	-	-	-	2	-	-	-	-	-	-
CV2504-1.2	2	2	-	-	-	2	1	-	-	-	-	-
CV2504-1.3	2	2	-	-	-	2	1	-	-	-	-	-
CV2504-1.4	2	2	-	-	-	2	1	-	-	-	-	-
CV2504-1.5	2	2	-	-	-	2	1	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Anji Reddy, M, "Text Book of Remote Sensing and Geographical Information Systems", Fourth Edition, BS Publication, Hyderabad, 2012.
2.	Bhatta, Basudeva, "Remote Sensing and GIS", 2nd edition, Oxford University Press, N. Delhi, 2011.
3.	Lillesand, T.M., Kiefer, R.W and Chipman, J. W., "Remote sensing and Image Interpretations", 7th edition, John Wiley and sons, New Delhi, 2015.

REFERENCE BOOKS:

1.	Anji Reddy, M. and Hari Shankar, Y., "Digital Image Processing", BS Pub., Hyd, 2006.
2.	Bernhardsen, Tor, "Geographic Information Systems", 3rd Ed., Wiley India, Delhi, 2002.
3.	Canada Centre for Remote Sensing, Fundamentals of Remote sensing-Tutorial, 2011.
4.	Chang, Kang-tsung, "Introduction to Geographic Information Systems", 4th Ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
5.	Korte, George B., "The GIS Book", Onword Press, Thomson Learning Inc., USA, 2001.
6.	Kumar, S., "Basics of Remote sensing and GIS", Laxmi Publications (P) Ltd., Delhi, 2008.
7.	Longler, Paul A., Goodchild, Michael F., Maguire, David J., Rhind. David W., "Geographic Information Systems and Science", John Wiley & Sons Ltd., ESRI Press, 2004.
8.	Sabins, F. L., "Remote Sensing: Principles and Interpretation" 3rd edn. WH Freeman and Company, New York, 1997.

E Books / MOOCs/ NPTEL

1.	https://www.youtube.com/user/edusat2004
2.	https://eclass.iirs.gov.in/login

PERSONALITY DEVELOPMENT AND SOFT SKILLS

Course Code :	**CV2505-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**1:0:2:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

This course is planned with facilitation methodology utilizing micro labs of experiential learning and the maximum number of participants in a batch may be restricted to 40 to 50 for effectiveness.

Course Objectives:

1.	Enhanced awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality
2.	Improve the various soft skill domains viz: Personal skills, professional skills, interpersonal skills and management skills of the participants
3.	Help the participants to undergo experiential learning, make them understand themselves, practice certain techniques to improve their personality traits such as self-esteem, self-confidence, positive attitude, emotional intelligence, creativity, memory skills, communication skills, presentation skills, problem solving skills, management skills, social grace, etc.
4.	Help the participants to understand how to manage time, stress, men and money

List of Sessions

1.	Introduction to Personality Development and Soft skills, Success, Leadership, Entrepreneurship; ice breaking micro labs
2.	Self-Awareness, self-esteem, Self-confidence, perceptions and attitude, values and beliefs, self-actualization
3.	Focus for Future, SMART goals, Mission, Vision
4.	Art of Listening, Verbal Communication: One-way and two-way communication, Art of Convincing
5.	Nonverbal Communication, Body language in GD and interview
6.	Interview skills, debating, Group Discussion
7.	Public speaking-types, speech preparation and delivery
8.	Mind Maps- preparation, Me chart, mind maps in studies
9.	Creative Problem-Solving skills and design thinking
10.	Empathy, Emotional Intelligence, emotional banking, Effective Meetings, Etiquettes and manners
11.	Managing Time, Men and Money
12.	Stress Management

Course Outcomes: At the end of the course student will be able to

1.	**List out** the strength and weakness of him/her and **explain** the techniques to improve self confidence and level of self-actualization **defining** their short term and long-term goals
2.	**Present** himself/herself or their ideas to self, group or a team using the proper verbal and nonverbal communication methods **exhibiting** skills in debating, GD and public speaking
3.	**Prepare** a mind map of Me chart, a session, or an event **exhibiting** their improved memory and presentation skills
4.	**Demonstrate** their improved capacity to solve a problem creatively **defining** their steps, **exhibiting** the proper emotional intelligence, etiquettes, and manners
5.	**Define** the methods to effectively manage time, stress, meeting, men and money

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
CV2505-1.1	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CV2505-1.2	-	-	-	-	-	-	-	-	2	2	2	-	-	-
CV2505-1.3	-	1	1	-	-	-	-	-	2	2	-	-	-	2
CV2505-1.4	-		1	-	-	-	-	-	-	2	1	-	-	-
CV2505-1.5	-	-	-	-	-	-	-	-	3	2	2	-	-	-

1: Low 2: Medium 3: High	
REFERENCE MATERIALS:	
1.	Allan Pease 1960 "*Body Language*" Sheldon Press, London
2.	Daniel Goleman 1998 "Working with Emotional Intelligence" Bantom Books, USA
3.	Roy M. Berko, Andrew D. Wolvin and Darlyn R. wolvin 1989 "*Communicating: A social and Career Focus"* Houghton Mifflin Company, Boston
4.	Steven Covey "*Seven Habits of Highly Effective People*"
5.	Thomas A Harris 1979 "I'am Ok You're Ok" Sterling publishers, New Delhi
6.	Tony Buzan "*Mind Maps"*

CORROSION SCIENCE

Course Code:	**CY2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CY1001-1**		

Teaching Department: Chemistry

Course Objectives:

1.	To provide fundamental understanding aspects of electrochemistry and material science related to corrosion. To understand the types of corrosion attacking on the metal and its preventions.
2.	To impart knowledge on corrosion science and its applications to the engineering materials.
3.	To identify practice for the prevention and remediation of the corrosion. To provide methodologies for measuring the corrosion performance of materials.

UNIT-I

Fundamentals of Corrosion — **09 Hours**

Definition, cost of corrosion, Corrosion Damage and consequences, Classification of corrosion, Electrochemical Aspects of corrosion, Electrochemical reactions, Different Environmental aspects, polarization and passivity, Corrosion Rate Expression, Determination. Standard electrode potential, EMF and Galvanic series, Potential-pH (Roubaix Diagram).

Forms of Corrosion — **08 Hours**

Galvanic corrosion, Crevices corrosion, Filiform corrosion, Pitting corrosion, Uniform corrosion and Atmospheric corrosion, Inter granular corrosion, Selective leaching, Erosion corrosion, Cavitation damage, Stress corrosion, Impingement attack, Inlet tube corrosion, Corrosion fatigue, Hydrogen blistering, Hydrogen embrittlement.

UNIT-II

Corrosion at Elevated Temperature — **08 Hours**

High temperature materials, Metal oxides, Pilling bed worth rule, oxide defect structure, Hot corrosion, Corrosion of mineral acids-corrosion of steel, stainless steel, Cu and Al.

Corrosion Testing — **07 Hours**

Weight loss method, Tafel extrapolation test, linear polarization test and AC impedance method.

UNIT-III

Corrosion Prevention Methods — **08 Hours**

Materials Selections, Design, change of the environments: Atmospheric corrosion, Control of atmospheric corrosion, Changing medium, Inhibitors, Cathodic and Anodic protection, Protective coatings.

Course Outcomes: At the end of the course student will be able to

1.	Explain the fundamentals of difference in electrode potential across an interface in particular a metal/ electrolyte and the relationship between rates of electrochemical reactions and the potential drop across interfaces.
2.	Analyze the causes and mechanisms of various types of corrosion including uniform, galvanic, crevice, pitting, inter granular and various modes of environmentally cracking. Acquire knowledge of influence of a materials composition, the effect of an electrolytes composition on the corrosion of metals and microstructure on its corrosion performance.
3.	Identify the materials that will exhibit adequate corrosion resistance in a particular environment and remedial action that will reduce corrosion to a acceptable level. Explain the concepts of different measuring techniques of corrosion.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CY2501-1.1	3	3	3	-	-	1	1	-	-	-	-	-

CY2501-1.2	3	3	3	-	-	1	1	-	-	-	-	-
CY2501-1.3	3	3	3	-	-	1	1	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1	Mars G Fontana, "Corrosion Engineering", 3rd Edition, Tata Mcgraw-Hill Edition.

REFERENCE BOOKS:

1	Chamberlian and K. Trethway, "Corrosion", Longman scientific and technical, John Wiley and Sons.

NATURAL PRODUCTS CHEMISTRY

Course Code:	**CY2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CY1001-1**		

Teaching Department: Chemistry

Course Objectives:

1.	Identify the structure of terpenoids and their biosynthesis. Elucidate the structure of β-carotene, haemoglobin and chlorophyll.
2.	Understand the chemistry underlying steroids and sex hormones. Get introduced to the different types of prostaglandins as well as theory and chemistry behind natural dyes.
3.	Gain knowledge on general methods of structural determination of some of the important alkaloids.

UNIT-I

Terpenoids & Carotenoids	**08 Hours**

Introduction and classification, isoprene rules, general methods of determination of structure of terpenoids. Structure elucidation of the following terpenoids-geraniol, α-pinine, camphene and farnesol. Biosynthesis of terpenoids.
Introduction and classification of carotenes. Structural elucidation of β-carotene.

Porphyrins	**07 Hours**

Introduction to porphyrins, structure and degradation products of haemoglobin and chlorophyll.

UNIT-II

Steroids	**08 Hours**

Introduction, Dile's hydrogenation. Chemistry of cholesterol, Blanc's rule, Barbier-Wielman degradation, Oppenuer oxidation. Constitution of bile acids.
Sex hormones: Chemistry of oestrone, progesterone, androsterone and testosterone.

Prostaglandins & Natural Dyes	**08 Hours**

Introduction, nomenclature, classification, and biological role of prostagladins. Structure elucidation of PGE_1, Biosynthesis of PGE_2 and $PGF_{2\alpha}$.
Introduction, Witt's theory of colour, methods of dyeing, chemical constitution of alizarin.

UNIT-III

Alkaloids	**09 Hours**

Definition, Classification and isolation of alkaloids. General methods of structural determination of alkaloids. Detailed study of structure elucidation of the following alkaloids- papaverine, cinchonine and nicotine.

Course Outcomes: At the end of the course student will be able to

1	Elucidate the structure of terpenoids like geraniol, a-pinine, camphene and farnesol. Explain the structural chemistry of carotenoids and porphyrins.
2	State the basic reactions governing steroids and sex hormones. Explain the biological role and structure of prostaglandins and state the methods employed for dyeing.
3	Apply the general methods of structural determination to elucidate the structure of alkaloids like papaverine, cinchonine and nicotine.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CY2502-1.1	3	3	-	-	-	1	1	-	-	-	-	-
CY2502-1.2	3	3	-	-	-	1	1	-	-	-	-	-
CY2502-1.3	3	3	-	-	-	1	1	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Agarwal, "Organic Chemistry of Natural Products", Vol.-I & Vol.-II, O.P. Goel Publishing House, 2014.

REFERENCE BOOKS:	
1.	K. Nakanishi, T. Goso, S. Ito, S. Natori and S. Nozoe, "Natural Products Chemistry", Vol. I & II, Academic Press, Ny, 1974.
2.	Gurudeep R. Chatwal, "Organic Chemistry of Natural Products", Vol. I & II, Himalaya Publishing House, 2013.
3.	G.A. Swal, "An Introduction to Alkaloids", Backwell Scientific Publications, 1967.
4.	Hand book of naturally occurring Compounds, Vol. II, terpenes, T.K. Davon, A.I. Scott, Academic Press, Ny, 1974.

ARTIFICIAL NEURAL NETWORK SYSTEMS

Course Code:	**EC1501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	To learn basic building blocks of ANNs and its terminology
2.	To understand the working of McCulloch-Pitts Neuron and different types of learning rules
3.	To understand decision regions, discriminant functions and training concept
4.	To understand the working of perceptron as classifier
5.	To understand the mathematics behind different types of single layer feedback networks

UNIT-I

Introduction to Artificial Neural networks	**16 Hours**

Introduction, Basic building blocks: network architecture, setting the weights, activation functions, ANN terminologies: weights, activation functions, bias, threshold, McCulloch-Pitts Neuron Model, Learning Rules

UNIT-II

Single Layer Perceptron Classifiers	**15 Hours**

Classification Model, Features, and Decision Regions, Discriminant Functions, Linear Machine and Minimum Distance Classification, Nonparametric Training Concept, Training and Classification Using the Discrete Perceptron: Algorithm and Example, Single-Layer Continuous Perceptron Networks for Linearly Separable Classifications, Multicategory Single-Layer Perceptron Networks

UNIT-III

Single-Layer Feedback Networks	**09 Hours**

Basic Concepts of Dynamical Systems, Mathematical Foundations of Discrete-Time Hopfield Networks, Mathematical Foundations of Gradient-Type Hopfield Networks. Transient Response of Continuous-Time Networks, Relaxation Modeling in Single-Layer Feedback Networks

Course Outcomes: At the end of the course student will be able to

1.	Describe the building blocks of artificial neural and terminologies
2.	Describe the working of neural network and learning rules
3.	Describe training of Single layer perceptron and classification using it.
4.	Explain use of Single layer perceptron for linearly separable and multicategory problems
5.	Explain the mathematics behind different single-layer feedback networks

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EC1501-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EC1501-1.2	3	-	-	-	-	-	-	-	-	-	-	-
EC1501-1.3	3	-	-	-	-	-	-	-	-	-	-	-
EC1501-1.4	3	-	-	-	-	-	-	-	-	-	-	-
EC1501-1.5	3	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	S. N. Sivanandam, S. Sumathi, S. N. Deepa, "Introduction to Neural Networks Using MATLAB 6.0", Tata McGraw-Hill Education, 2006
2.	Jacek M. Zurada "Introduction to Artificial Neural Systems", 1st Edition, St. Paul West Publishers-USA, 1992.
3.	Michael A Neilsen, "Neural Networks and Deep Learning", Determination Press, 2015

INTRODUCTION TO MATLAB PROGRAMMING: A HANDS-ON APPROACH

Course Code:	**EC1502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**2:0:2:0**	**Credits**	**03**
Total Teaching Hours	**27+0+26+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Electronics & Communication Engineering
Offered to Civil & BT

Course Objectives:

1.	To demonstrate basic understanding of MATLAB programming
2.	To use and write functions
3.	To use MATLAB programming for image processing

Unit-I	**27 Hours**

Introduction to MATLAB: Starting MATLAB and familiarization with its user interface, syntax and semantics, ways in which MATLAB provides help, create plots in MATLAB.
Matrices and Operators: defining matrices, manipulation of matrices, extract parts of them and combine them to form new matrices, use of operators to add, subtract, multiply, and divide matrices, and we will learn that there are several different types of multiplication and division.
Functions: creating reusable functions, how the environment inside a function is separated from the outside via a well-defined interface through which it communicates with that outside world, define a function to allow input to it when it initiates its execution.
Programmer's Toolbox: polymorphism and how MATLAB exploits it to change a function's behavior on the basis of the number and type of its inputs, random number generator, how to get input from the keyboard, how to print to the Command Window, and how to plot graphs in a Figure window, how to find programming errors with the help of the debugger, how to print to the Command Window, and how to plot graphs in a Figure window, how to find programming errors with the help of the debugger.
Selection Statement and Loops: how to use the if-statement, how to use relational operators and logical operators, how to write polymorphic functions and how to make functions resistant to error, the for-loop and the while-loop, how the break-statement works, nested loops, logical indexing and implicit loops.
Data Types: character arrays and how the characters in them are encoded as numbers, string and datetime datatype, how to produce heterogeneous collections of data via structs and cells.
File Input/Output: reading and writing files, how to create, read from, and write into MAT-files, Excel files, text files, and binary files, how to navigate among folders with MATLAB commands.
Image Processing using MATLAB: pre-processing – conversion of color image to gray scale image, decomposition of color images to single color component image, histogram of image, thresholding

List of Experiments

1	Starting MATLAB and familiarization with its user interface, syntax and semantics, ways in which MATLAB provides help, create plots in MATLAB.
2	Defining matrices, manipulation of matrices, extract parts of them and combine them to form new matrices, use of operators to add, subtract, multiply, and divide matrices, and we will learn that there are several different types of multiplication and division.
3	creating reusable functions, how the environment inside a function is separated from the outside via a well-defined interface through which it communicates with that outside world, define a function to allow input to it when it initiates its execution.
4	Polymorphism and how MATLAB exploits it to change a function's behavior on the basis of the number and type of its inputs, random number generator, how to get input from the keyboard, how to print to the Command Window
5	How to plot graphs in a Figure window, how to find programming errors with the help of the debugger, how to print to the Command Window, and how to plot graphs in a Figure window, how to find programming errors with the help of the debugger.
6	How to use the if-statement, how to use relational operators and logical operators, how to write polymorphic functions and how to make functions resistant to error.
7	The for-loop and the while-loop, how the break-statement works, nested loops, logical indexing and implicit loops.
8	Character arrays and how the characters in them are encoded as numbers, string and datetime datatype, how to produce heterogeneous collections of data via structs and cells.
9	Reading and writing files, how to create, read from, and write into MAT-files, Excel files, text files, and binary files, how to navigate among folders with MATLAB commands.

10	Reading an image, saving, basic manipulation of images, arithmetic operations
11	Pre-processing – conversion of color image to gray scale image, decomposition of color images to single color component image.
12	Histogram processing.
13	Thresholding operation.

Course Outcomes: At the end of the course student will be able to

1.	Use matrices and operators in MATLAB programming
2.	Use and write functions; use MATLAB toolbox
3.	Use toolbox and selection statement in MATLAB programming
4.	Write MATLAB programs using loops and summarize data types
5.	Summarize file input/output methods using MATLAB commands and apply pre-processing and thresholding operations on images

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EC1502-1.1	1	-	-	-	3	-	-	-	-	-	-	-
EC1502-1.2	1	-	-	-	3	-	-	-	-	-	-	-
EC1502-1.3	1	-	-	-	3	-	-	-	-	-	-	-
EC1502-1.4	1	-	-	-	3	-	-	-	-	-	-	-
EC1502-1.5	1	-	-	-	3	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Stormy Attaway, “Matlab: A Practical Introduction to Programming and Problem Solving”, Second Edition, Butterworth-Heinemann, 2011
2.	Fitzpatrick and Ledeczi, “Computer Programming with MATLAB”, eBook, 2013
3.	Rafael C. Gonzalez, Richard E. Woods and Steven L. Eddins, Digital Image Processing using MATLAB, first edition, Dorling Kindersley Pvt Ltd, 2006.

REFERENCE BOOKS:

1.	Duane C. Hanselman, Bruce L. Littlefield, “Mastering MATLAB” , first edition, Pearson, 2011

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/103/106/103106118/
2.	https://www.coursera.org/learn/matlab

ROBOTICS

Course Code:	**EC1503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	Understand Anatomy of a robot.
2.	Analyse the robot motion using translation and rotational matrix.
3.	Discuss Robot trajectory planning and robot control.
4.	Categorise the various sensors used in robotics
5.	Understand the robot programming.

UNIT-I

Introduction **16 Hours**

Definition, anatomy of robot, classification configurations, robot links and joints, robot specifications, resolution accuracy and repeatability, simple numerical problems, robot drive systems, hydraulic, pneumatic and electric drive systems, wrist and its motions, end effectors, types of end effectors, mechanical & Non-mechanical grippers, methods of constraining parts in grippers.

Motion analysis

Direct kinematics and inverse kinematics, 3D homogeneous transformations, rotation, translation and displacement matrix, composite rotation matrix, rotation matrix about an arbitrary axis.

UNIT-II

Control and trajectory planning **15 Hours**

Trajectory planning, definition, steps in trajectory planning, joint space techniques, use of a p-degree polynomial as interpolation function, cubic polynomial trajectories, linear function with parabolic blends, joint space verses, simple numerical problems on joint space trajectory planning.

Sensors

Classification, Types- Contact & Non-Contact sensors.

Machine Vision

Machine vision, functions of machine vision system, sensing and digitizing, imaging devices, analog to digital signal conversion, quantization and encoding, simple numerical problems, image storage, image processing and analysis, image data reduction, segmentation, feature extraction, object recognition, robotic machine vision applications, inspection, identification, visual surveying and navigation.

UNIT-III

Programming **09 Hours**

Introduction to robot programming, robot cell layout, work cell control and interlocks, manual programming, lead through and walkthrough programming, off-line programming, robot programming languages, examples

Course Outcomes: At the end of the course student will be able to

1.	Explain the working principle, various performance parameters of robots and identify the types of robots employed in industry.
2.	Discuss the concept of direct and inverse kinematics. Determine the position and orientation of End-Effector subjected to transformations. Demonstrate the applications of Denavit-Hartenberg (DH) method for different robot configurations.
3.	Determine the technique of trajectory planning, control schemes for robot joints and understand the types of the sensors used in robotics.
4.	Apply engineering knowledge in robot visual surveying and navigation.
5.	Analyze and formulate different types of robot cell layouts and use modern tools to write robot programs for different tasks.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												

EC1503-1.1	3	2	2	1	-	-	-	-	-	-	-	1
EC1503-1.2	3	3	2	2	-	-	-	-	3	3	-	1
EC1503-1.3	3	2	2	2	-	-	-	-	3	3	-	1
EC1503-1.4	3	2	2	1	-	-	-	-	-	-	-	1
EC1503-1.5	3	3	3	2	2	-	-	-	-	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	R. K. Mittal and I. J. Nagrath, “Robotics and Control”, Tata-McGraw-Hill Publications, 2007.
2.	Mikell P. Groover, Mitchel Weiss, Roger N. Nagel and Nicholas G. Odrey, “Industrial Robotics”, McGraw-Hill Publications, International Edition, 2008

REFERENCE BOOKS:

1.	Fu K. S., Gonzelez R. C., Lee C. S. G., "Robotics: Control, Sensing, Vision, Intelligence," , McGraw Hill Book Co., International edition, 2008.
2.	Yorem Koren, "Robotics for Engineers", McGraw-Hill Publication, International edition, 1987.
3.	Craig, J. J., "Introduction to Robotics: Mechanics and Control", 3rd Edition, Pearson PrenticeHall Publications, 2005.
4.	Schilling R. J., "Fundamentals of Robotics, Analysis and Control", Prentice-Hall Publications, Eastern Economy edition, 2007.
5.	AppuKuttan K. K., "Robotics", I.K. International Publications, First Edition, 2007.
6.	James G. Keramas, "Robot Technology Fundamentals", Cengage Learning, 1999.
7.	Richard K. Barnhart, Stephen B. Hottman, Douglas M. Marshall, Eric Shappee, "Introduction to Unmanned Aircraft Systems", CRC Press, 2012.
8.	Ghosh, "Control in Robotics and Automation", Allied Publishers.
9.	Deb, "Robotics Technology", Wiley India.

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/112105249

CONSUMER ELECTRONICS

Course Code:	**EC2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC1001-1**		

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	To provide basic knowledge on sound and transducers
2.	To provide basic knowledge on different display units and camera
3.	To understand the recording process and storage mechanism
4.	To provide basic knowledge on communication and broadcasting
5.	To understand the working of various electronic gadgets

UNIT-I

Sound & Vision — **15 Hours**

Sound: Definition and properties of sound, Transducers: Micro Phone – characteristics and types, and Loud Speakers – characteristics and types, Enclosures and baffles, mono-stereo, audio amplifiers-characteristics, Synthesizers.
Vision: Displays-LED, LCD, PLASMA, Camera: basic principle, CCTV Camera.

UNIT-II

Recording, Playback, Communication & Broadcasting Systems — **15 Hours**

Recording and Playback: Audio recording methods-magnetic recording, optical recording, digital recording, erasing methods, optical discs- recording and playback, Film projector, Theatre Sound, HiFi system.
Communications And Broadcasting: Modulation: AM, FM PCM, Radio transmitters, Radio receivers - Tuned radio frequency receiver and Superheterodyne receiver. Fiber optics, Radio and TV broadcasting. Cellular communication: digital cellular phone, establishing a call.

UNIT-III

Other Electronic Systems — **10 Hours**

Fax machine, Xerox machine, electronic Calculator, Microwave ovens, Washing Machines, A/C and refrigeration, ATM, Auto Electronics, Industrial Electronics and Robotics, Electronics in health / Medicine.

Course Outcomes: At the end of the course student will be able to

1.	Recall basics of sound and transducers.
2.	Understand the working principles of display units and CCTV camera.
3.	Explain basic working of Recording, storage devices
4.	Explain basics of communication and broadcasting
5.	Recall basic working of commonly used electronic gadgets

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EC2501-1.1	1	-	-	-	-	1	-	-	-	-	2	2
EC2501-1.2	1	-	-	-	-	1	-	-	-	-	2	2
EC2501-1.3	1	-	-	-	-	1	-	-	-	-	2	2
EC2501-1.4	1	-	-	-	-	1	-	-	-	-	2	2
EC2501-1.5	1	-	-	-	-	1	-	-	-	-	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Anand, “Consumer Electronics”, Khanna publications, 2011.
2. Bali S. P., “Consumer Electronics”, Pearson Education, 2005.

REFERENCE BOOK:

1. Gulati R. R. "Modern Television Engineering", Wiley Eastern.

PCB DESIGN AND FABRICATION

Course Code	**EC2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**1:0:4:0**	**Credits**	**03**
Total Teaching Hours	**15+0+52+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC1001-1**		

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	To enable students to gain knowledge of Schematic Design techniques & PCB design techniques
2.	To expose students to complete PCB Design & manufacturing process

Unit-I

Circuit Schematic	**05 Hours**

Introduction to Kicad schematic design tool, features, node connections, labeling, creating new component.

Unit-II

PCB Layout:	**05 Hours**

Introduction to Kicad layout editor, features, layer selections, manual and auto routing in Kicad, verification of footprint, creating footprint for a given component.

Unit-III

PCB Fabrication	**05 Hours**

Generating and verifying the PCB Gerber file, preparing artwork for a single side PCB fabrication, preparing PCB artwork for double side PCB, Etching process, tin plating, legend printing, green masking and through hole plating

List of Experiments

1	Exploring the Kicad Schematic and layout tool
2	Developing a schematic circuit for microphone preamplifier
3	Designing a single side PCB layout for microphone preamplifier
4	Developing a schematic circuit for a microcontroller development board
5	Designing a double side PCB layout for a microcontroller development board
6	Choosing a new sensor/display module and building a schematic circuit for the user level application
7	Building a layout using single or double side PCB for the sensor/display module
8	Preparing the film for the bottom copper, solder mask and top silk (legend) to fabricate a single side PCB using chemical process
9	Preparing the film for the top copper, bottom copper, top solder mask, bottom solder mask and legend to fabricate double side PCB using chemical process
10	PCB routing, etching, cutting and drilling using CNC machine

Course Outcomes: At the end of the course student will be able to

1.	Draw schematic circuit and create PCB layout for single or multilayer PCB
2.	Fabricate single and double-layer PCB

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EC2502-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EC2502-1.2	3	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Peter Dalmaris, "Kicad Like a Pro", Tech Exploration.

REFERENCE BOOKS:

1.	Peter Dalmaris, "Kicad Like a Pro", Tech Exploration.
2.	David L. Jones, "PCB Design Tutorials", Alternate zone, 2004.

E Books / MOOCs/ NPTEL	
1.	www.alternatezone.com

SPACE TECHNOLOGY AND APPLICATIONS

Course Code:	**EC2503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC1001-1**		

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	Understand the general laws governing satellite orbits and its parameters.
2.	Discuss effect of space environment on satellite signal propagation.
3.	Illustrate various segments employed in satellite and ground station.
4.	Calculate the uplink / downlink subsystem characteristics.
5.	know the effects on the EM waves in propagation through space.
6.	Explain the satellite launch in the space and their applications in remote sensing.
7.	Discuss the different communication systems used for satellite access.
8.	Summarise Advanced space systems for mobile communication, VSAT, GPS.

UNIT-I

Satellite Technology — **15 Hours**

Satellite communications: Introduction, Kepler's laws, definitions, orbital element, apogee and perigee heights, orbit perturbations, inclined orbits.
Space environment: Earth's Atmosphere, Ionosphere and Meteorological effects on space systems, propagation of signal, Transmission losses in space environment.
Satellite Technology: Space segment, Ground segment, Quality and Reliability, Satellite Communication systems.

UNIT-II

Space Applications — **15 Hours**

Launch Vehicles: Working, stages, Fuel, payload protection, Navigation, guidance and control, Reliability, launching into outer space and launch bases. Types of launch vehicles.
Space Applications: Digital DBS TV, DBS-TV System Design, Master Control Station and Uplink Antennas. Introduction, Radio and Satellite Navigation,
Remote Sensing: Introduction to Remote Sensing, Concepts and Applications of satellite Remote sensing.

UNIT-III

Advanced Space Systems — **10 Hours**

Satellite Access: Introduction, Single Access, Pre-assigned FDMA, Demand-Assigned FDMA, Spade system.
Advanced space systems: Satellite mobile services, VSAT, Radarsat, orbital communication**.** Global Positioning Satellite System (GPS).

Course Outcomes: At the end of the course student will be able to

1.	Discuss the fundamental principles of Satellite communication systems.
2.	Understand the Propagation impairments of satellite link.
3.	Explain various segments employed in satellite and ground station.
4.	Discuss the satellite launch mechanism and roll of those satellite in remote sensing.
5.	Understand the different communication systems used for satellite access and list the recent satellites that have been launched for mobile communication, GPS.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EC2503-1.1	3	2	2	-	1	-	-	-	-	-	-	-
EC2503-1.2	-	3	-	-	2	1	-	-	-	-	-	-
EC2503-1.3	3	-	-	1	-	1	1	-	-	-	-	-

EC2503-1.4	-	-	-	-	-	1	3	-	-	-	-	-
EC2503-1.5	-	-	-	-	-	3	3	2	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Dennis Roddy, “Satellite Communications”, McGraw Hill ,1996.
2.	Timothy Pratt, “Satellite Communications”, Wiley India Ltd , 2006.
3.	K Ramamurthy, “Rocket Propulsion”, McMillan Publishers India Ltd, 2010.

REFERENCE BOOKS:

1.	George Joseph, “Fundamentals of Remote Sensing”, Universities press, India 2003.
2.	B C Pande, “Remote sensing and Applications”, VIVA Books pvt ltd, 2009.
3.	Meynart Roland, “Sensors systems and next generation satellites”, SPIE Publication.
4.	Thyagarajan , “Space Environment”, ISRO Hand Book Publication.

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/101106046

BATTERY MANAGEMENT SYSTEM

Course Code:	**EE2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EE1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1	To familiarize various concepts of BMS
2	To understand functional blocks of BMS
3	To study design steps of BMS
4	To introduce hardware implementation of BMS

UNIT-I

Battery System — **08 Hours**

Introduction, Cells, Batteries, and Packs, Resistance, Li-Ion Cells, Formats, Chemistry, Safety, Safe Operating Area, Efficiency, Aging, Modeling, Unequal Voltages in Series Strings, Li-Ion BMSs, BMS Definition, Li-Ion BMS Functions, Custom Versus Off-the-Shelf, Li-Ion Batteries, SOC, DOD, and Capacity, Balance and Balancing, SOH

BMS Options — **07 Hours**

Functionality, CCCV Chargers, Regulators, Meters, Monitors, Balancers, Protectors, Functionality Comparison, Technology, Simple (Analog), Sophisticated (Digital), Technology Comparison, Topology, Centralized, Modular Master-Slave, Distributed, Topology Comparison

UNIT-II

BMS Functions — **07 Hours**

Measurement, Voltage, Temperature, Current, Management, Protection, Thermal Management, Balancing, Redistribution, Distributed Charging, Evaluation, State of Charge and Depth of Discharge, Capacity, Resistance, State of Health (SOH), External Communications, Dedicated Analog Wire, Dedicated Digital Wire, Data Link, Logging and Telemetry, Off-the-Shelf BMSs, Cell Manufacturers' BMSs, Comparison

Custom BMS Design — **08 Hours**

Using BMS ASICs , BMS ASIC Comparison, Analog BMS Design, Analog Regulator, Analog Monitor, Analog Balancer, Analog Protector, Ready-Made, Digital BMS Designs, ATMEL's BMS Processor, Elithion's BMS Chip Set, National Semiconductors' Complete BMS, Peter Perkin's Open Source BMS, Texas Instruments' bq29330/bq20z90, Texas Instruments' bq78PL114/bq76PL102, Custom Digital BMS Design, Voltage and Temperature Measurement, Current Measurement, Evaluation, Communications, Optimization, Switching, Logging, Cell Interface, Non-distributed, Distributed, Distributed Charging

UNIT-III

Deploying a BMS — **10 Hours**

Installing, Battery Pack Design, BMS Connections to Pack, BMS Connections to System, Configuring, Cell Configuration, Pack Configuration, System Configuration, Testing, Troubleshooting, Grounding, Shielding, Filtering, Wire Routing

Course Outcomes: At the end of the course student will be able to

1	Identify process to implement BMS
2	Describe various communication protocol involved in BMS
3	Illustrate functionality of BMS
4	Apply concepts of BMS using application specific IC
5	Analyse the hardware implementation aspects of BMS

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EE2501-1.1	1	3	-	-	-	-	-	-	-	-	-	-
EE2501-1.2	1	3	-	-	-	-	-	-	-	-	-	-
EE2501-1.3	1	2	3	-	-	-	-	-	-	-	-	-
EE2501-1.4	1	2	2	3	-	-	-	-	-	-	-	-
EE2501-1.5	1	3	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1	Davide Andrea, "Battery Management Systems for Large Lithium-Ion Battery Packs", ARTECH HOUSE 2010.

REFERENCE BOOKS:

1	Rui Xiong, "Battery Management Algorithm for Electric Vehicles", Springer 2019.
2	Nicolae Tudoroiu, "Battery Management Systems of Electric and Hybrid Electric Vehicles", MDPI 2021

BIOMEDICAL INSTRUMENTATION

Course Code:	**EE2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1.	The course is designed to give the basic concepts of Instrumentation involved in medical field and human physiology.
2.	To introduce an fundamental of transducers as applicable to physiology
3.	To explore the human body parameter measurements setups
4.	To make the students understand the basic concepts of forensic techniques.
5.	To give basic ideas about Electrophysiological measurements, medical imaging

UNIT-I

Physiology and transducers — **08 Hours**

Cell and its structure, Resting and Action Potential, Nervous system: Functional organization of the nervous system, Structure of nervous system, neurons, synapse, transmitters and neural communication, Cardiovascular system, respiratory system, Basic components of a biomedical system, Transducers, selection criteria, Piezo-electric, ultrasonic transducers, Temperature measurements, Fiber optic sensors.

Electro – Physiological measurements — **09 Hours**

Electrodes: Limb electrodes, floating electrodes, pre-gelled disposable electrodes, Micro, needle and surface electrodes, Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers, Isolation amplifier. ECG, EEG, EMG, ERG, Lead systems and recording methods, Typical waveforms. Electrical safety in medical environment: shock hazards, leakage current-Instruments for checking safety parameters of biomedical equipment.

UNIT-II

Non-electrical parameter measurements — **08 Hours**

Measurement of blood pressure, Cardiac output, Heart rate, Heart sound Pulmonary function measurements, spirometer, Photo Plethysmography, Body Plethysmography, Blood Gas analyzers : pH of blood, measurement of blood pCO2, pO2, finger-tip oximeter, ESR, GSR measurements

Medical Imaging — **07 Hours**

Radiographic and fluoroscopic techniques, X rays, Computer tomography, Mammography, MRI, fMRI, Ultrasonography, Endoscopy, Thermography, Different types of biotelemetry systems and patient monitoring

UNIT-III

Assisting and therapeutic equipments: — **08 Hours**

Pacemakers, Defibrillators, Ventilators, Nerve and muscle stimulators, Diathermy, Heart Lung machine, Audio meters, Dialyzers, Lithotripsy

Course Outcomes: At the end of the course student will be able to

1	Understand the physiology of biomedical system
2	Measure biomedical and physiological information
3	Discuss the application of Electronics in diagnostics and therapeutic area.
4	Analyze the images and do a prediction using image processing.
5	Understand the different equipment's used for various measurements of physiology

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
EE2502-1.1	3	3	-	2	1	1	-	-	-	-	-	-
EE2502-1.2	2	2	2	2	-	-	-	-	-	-	-	-
EE2502-1.3	3	2	2	1	2	1	-	-	-	-	-	-
EE2502-1.4	2	3	-	-	1	-	-	-	-	-	1	-
EE2502-1.5	3	3	-	-	2	-	-	-	-	-	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, "Bio-Medical Instrumentation and Measurements", II edition, Pearson Education, 2002.
2.	R. S. Khandpur, "Handbook of Bio-Medical instrumentation", Tata McGraw Hill Publishing CoLtd., 2003.
3.	J. Webster, "Medical Instrumentation", John Wiley & Sons, 1995.
4.	L. A. Geddes and L. E. Baker, "Principles of Applied Bio-Medical Instrumentation", John Wiley & Sons, 1975.
5.	David. Cooney and Michel Deckker, "Bio- Medical Engineering Principles", INC.

REFERENCE BOOKS:

1	David Cooney, "Bio-Medical Engineering Principles", 2015, 1st Edition, Marcel Deckker Pub Co., New York.

ELECTRIC VEHICLE TECHNOLOGY

Course Code:	**EE2503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EE1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1	To Understand the fundamental laws and vehicle mechanics.
2	To Understand working of Electric Vehicles and recent trends.
3	Ability to analyze different power converter topology used for electric vehicle application
4	Ability to develop the electric propulsion unit and its control for application of electric vehicles

UNIT-I

Vehicle Mechanics — **07 Hours**

Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Nonconstant FTR, General Acceleration, Propulsion System Design..

Electric and Hybrid Electric Vehicles — **07 Hours**

Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive train).

UNIT-II

Energy storage for EV and HEV — **08 Hours**

Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Supercapacitors.

Electric Propulsion — **08 Hours**

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives.

UNIT-III

Design of Electric and Hybrid Electric Vehicles — **10 Hours**

Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design.

Course Outcomes: At the end of the course student will be able to

1	Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design
2	Explain the working of electric vehicles and hybrid electric vehicles in recent trends.
3	Model batteries, Fuel cells, PEMFC and super capacitors.
4	Analyze DC and AC drive topologies used for electric vehicle application.
5	Develop the electric propulsion unit and its control for application of electric vehicles.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EE2503-1.1	2	3	-	-	-	-	-	-	-	-	-	-
EE2503-1.2	1	2	3	-	-	-	-	-	-	-	-	-
EE2503-1.3	1	2	3	-	-	-	-	-	-	-	-	-
EE2503-1.4	1	2	3	-	-	-	-	-	-	-	-	-
EE2503-1.5	1	2	2	-	-	-	-	-	-	-	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1	Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.
2	M. Ehsani, Y. Gao, S.Gay and Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2005.

REFERENCE BOOKS:

1	Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles", Springer, 2013.
2	C.C. Chan and K.T. Chau, "Electric Vehicle Technology", OXFORD University, 2001
3	Chris Mi, M. Abul Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles Principles And Applications with Practical Perspectives", Wiley Publication, 2001

E Books / MOOCs/ NPTEL

1.	Introduction to Mechanics | Coursera
2.	Electric Vehicles - Part 1 - Course (nptel.ac.in)
3.	NPTEL: Electrical Engineering - Introduction to Hybrid and Electric Vehicles
4.	Hybrid Vehicles (edX) | MOOC List (mooc-list.com)
5.	Electric Cars: Technology | My MOOC (my-mooc.com)

FUNDAMENTALS OF PLC AND ITS APPLICATIONS

Course Code:	**EE2504-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1.	To understand main parts and their functions, basic sequence of operation of PLC.
2.	To study the different programming languages and fundamental wiring diagrams.
3.	To explain the functions of PLC counter instructions, applying combinations of counters and timers to control systems.
4.	To explain the basic operation of PLC closed-loop control system, various forms of mechanical sequencers and their operations
5.	To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes

UNIT-I

Programmable Logic Controllers	**02 Hours**
Introduction, Parts of a PLC, Principles of Operation, PLC Size and Application.	
PLC Hardware Components	**05Hours**
The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Human Machine Interface (HMIs).	
Basic Programming Language	**05Hours**
Ladder diagrams, Ladder conventions, Logic functions with timing diagram, latching, multiple outputs, entering programs, Functional blocks, Program examples, instruction list, branch codes, programming examples, Sequential functions charts, branching and convergence, actions, Structured Text, conditional and iteration statements	
Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs	**03Hours**
Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.	

UNIT-II

Programming Timers	**02 Hours**
Introduction, Necessity of Energy Storage and Methods of Energy Storage (Classification and brief description using block diagram representation)	
Programming Counters	**04 Hours**
Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.	
Program Control Instructions	**05 Hours**
Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction.	
Data Manipulation Instructions	**02 Hours**
Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control.	
Math Instructions	**02 Hours**
Math Instructions, Addition Instruction, Subtraction Instruction, Multiplication Instruction, Division Instruction, Other Word-Level Math Instructions, File Arithmetic Operations	

UNIT-III

Sequencer and Shift Register Instructions	**05 Hours**
Mechanical Sequencers, Sequencer Instructions, Sequencer Programs, Bit Shift Registers, Word Shift Operations.	
Process Control, Network Systems, and SCADA	**05 Hours**
Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA).	

Course Outcomes: At the end of the course student will be able to

1.	Identify main parts, functions of PLC and describe basic circuitry for I/O modules to select PLC for desired application
2.	Apply suitable logic using various programming languages to achieve specific control mechanism for a given application
3.	Identify timer/counter resources of a PLC to design control logic for interfaced device.
4.	Interpret data manipulation and math instructions as they apply to a PLC program
5.	Develop programs that use shift registers and explain functions of control elements of a closed loop control system

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EE2504-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EE2504-1.2	1	3	-	-	-	-	-	-	-	-	-	-
EE2504-1.3	1	2	3	-	-	-	-	-	-	-	-	-
EE2504-1.4	1	2	3	-	-	-	-	-	-	-	-	-
EE2504-1.5	1	2	3	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Frank Petruzella, "Programming Logic Controllers", Fifth Edition.
2.	W Bolton, "Programmable Logic controllers", 6th edition, Elsevier- newness, 2015.

REFERENCE BOOKS:

1.	John W Webb, Ronald A Reis, "Programmable logic controllers - principles and applications", 5th edition, 2nd impression, Pearson education, 2009
2.	L. A Bryan, E. A Bryan, "Programmable Controller Theory and Implementations", 2nd edition, 2003
3.	S. P. Sukhumi, J. K. Nayak, “Solar Energy: Principles Collection and Storage”, 3rd edition, McGraw-Hill Education (India) , 2009.

E Books / MOOCs/ NPTEL

1.	https://library.automationdirect.com/category/product/programmable-control/
2.	https://www.coursera.org/lecture/intelligent-machining/programmable-logic-controllers-plc-fGz3r
3.	https://www.udemy.com/course/plc-programming-from-scratch/

MOTORS AND MOTOR CONTROL CIRCUITS

Course Code:	**EE2505-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EE1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1.	Study architecture of induction motor and synchronous motor
2.	Understanding control of AC motor
3.	Study principle of operation of different dc motors
4.	Understand the different types of control techniques
5.	Study different sensors and their role in control of a motor

UNIT-I

AC Motor Designs — **08 Hours**

Introduction, Three phase AC motor architecture, Torque speed curve, wound rotor, Synchronous motors Single phase AC motors, split phase motor, capacitor start and shaded pole motors, Universal and gear motors, AC Motor Specifications, Specifying an AC motor for an application.

AC Motor Control: — **07 Hours**

AC motor Enclosures, AC motor control components, Manual motor starting systems, Direct On Line Starter, semi-automatic star delta starter, fully automatic star delta starter, control circuit for sequence operation of two motors

UNIT-II

DC Motors — **07 Hours**

DC motor principle of operation, Brushed DC motors, shunt, series and compound wound motors, Brushless DC motors, driving a brushless DC motor, Commutation, Specifying a DC motor

DC Motor Control and Stepper Motors — **08 Hours**

Stepper motor principles of operation, Illustrative example of a stepper motor drive, stepper motor specification and operation, commercial stepper motor drive chips and packages, Direction Controller- H Bridge, Speed Controller: Pulse Width Modulation (PWM), Armature Controller: Variable resistance, DC vs.AC motors

UNIT-III

Sensors — **10 Hours**

Unipolar Hall Effect Switches, Omnipolar Hall Effect Switches, Latched Hall Effect Switches, Current Sensors: Shunt resistor, Current-sensing transformer, Hall effect current sensor, Speed/position sensors: Quadrature encoder, Hall effect tachometer, Back EMF/Sensorless control method, BLDC motor control with Hall sensor, Block diagram approach of BLDC Fan and Motor Control

Course Outcomes: At the end of the course student will be able to

1.	Demonstrate an understanding of the general principles of AC Motor.
2.	Understand the basic principles of AC motor controls which includes starters, contactors, and control relays
3.	Demonstrate an understanding of the general principles of DC Motor.
4.	Understand the basic principles of DC motor controls which includes starters, contactors, and control relays
5.	Set up sensors in order to give feedback to a control circuit

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												

EE2505-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EE2505-1.2	2	3	3	-	-	2	-	-	-	-	-	-
EE2505-1.3	3	-	-	-	-	-	-	-	-	-	-	-
EE2505-1.4	2	3	3	-	-	2	-	-	-	-	-	-
EE2505-1.5	2	3	3	-	-	2	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	S. K. Bhattacharya Birjindersingh, "Control of electrical machines", New Age International.
2.	Gary J. Rockis & Glen A. Mazura, "Electrical Motor Controls", 5th Edition, ISBN number is 9780826912268

REFERENCE BOOKS:

1.	Stephen L. Herman, "Industrial Motor Control", Delmar Publishers, Inc., latest Edition.

E Books / MOOCs/ NPTEL

13.	https://www.coursera.org/learn/motors-circuits-design
14.	http://ww1.microchip.com/downloads/en/appnotes/00894a.pdf

NON-CONVENTIONAL ENERGY SOURCES

Course Code:	**EE2506-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EE1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1.	To understand the principle of extraction of energy from conventional, nonconventional sources
2.	To understand the working principle and applications of solar based thermal, electrical and PV systems.
3.	To justify the usage of energy storage techniques and understand the process of design and implement wind based energy conversion systems.
4.	To understand the process of design and implement biomass based energy conversion systems

UNIT-I

Energy Sources	**03 Hours**
Introduction, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Classification of Energy Resources, Conventional Energy Resources- Availability and their Limitations, Non-Conventional Energy Resources- Classification, Advantages, Limitations, Comparison of Conventional and Non-Conventional Energy Resources, World Energy Scenario, Indian Energy Scenario	
Solar Energy Basics	**05 Hours**
Introduction, Solar Constant, Basic Sun-Earth Angles – definitions and their representation, Solar Radiation Geometry (numerical problems), Estimation of Solar Radiation of Horizontal and Tilted Surfaces (numerical problems), Measurement of Solar Radiation Data – Pyranometer and Pyrheliometer	
Solar Thermal Systems	**04 Hours**
Principle of Conversion of Solar Radiation into Heat, Solar Water Heaters (Flat Plate Collectors), Solar Cookers – Box type, Concentrating dish type, Solar driers, Solar Still, Solar Furnaces, Solar Green House.	
Solar Electric Systems	**04 Hours**
Solar Thermal Electric Power Generation, Solar Pond and Concentrating Solar Collector(Parabolic Trough, Parabolic Dish, Central Tower Collector), Advantages and Disadvantages; Solar Photovoltaic – Solar Cell fundamentals, characteristics, classification, construction of module, panel and array. Solar PV Systems-stand-alone and grid connected, Applications- Street lighting, Domestic lighting and Solar Water pumping systems.	

UNIT-II

Energy Storage	**04 Hours**
Introduction, Necessity of Energy Storage and Methods of Energy Storage (Classification and brief description using block diagram representation)	
Wind Energy	**04 Hours**
Introduction, Wind and its Properties, History of Wind Energy Wind Energy Scenario – World and India. Basic principles of WECS, Classification, Parts of a WECS, Derivation for Power in the wind, Electrical Power Output and Capacity Factor of WECS. Wind site selection consideration, Advantages and Disadvantages of WECS.	
Biomass Energy	**06 Hours**
Introduction, Photosynthesis process, Biomass fuels, Biomass conversion technologies, Urban waste to Energy Conversion, Biomass Gasification, Biomass to Ethanol Production, Biogas production from waste biomass, Factors affecting biogas generation, types of biogas plants- KVIC and Janata model, Biomass program in India	

UNIT-III

Energy From Ocean	**05 Hours**

Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant, Classification of Tidal Power Plant, Estimation of Energy – Single basin and Double basin type TPP (no derivations, Simple numerical problems), Advantages and Limitation of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle), Hybrid cycle, Site-selection criteria, Biofouling, Advantages & Limitation of OTEC

Emerging Technologies	**05 Hours**

Fuel Cell, Small Hydro Resources, Hydrogen Energy and Wave Energy (Principle of Energy generation using block diagrams, advantages and limitations)

Course Outcomes: At the end of the course student will be able to

1.	Describe non-conventional energy sources and solar radiation geometry to estimate and measure solar radiation.
2.	Apply the principle of solar radiation into heat to understand the operation of solar thermal and solar electric systems.
3.	Describe energy storage methods and wind–energy conversion systems to understand the factors influencing power generation.
4.	Review the biomass conversion technologies to design biomass-based energy systems.
5.	Describe tidal, ocean thermal and fuel cell energy conversion systems to understand emerging non-conventional energy technologies.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EE2506-1.1	2	3	-	-	-	1	2	1	-	-	-	-
EE2506-1.2	2	3	-	-	-	1	2	1	-	-	-	-
EE2506-1.3	2	3	-	-	-	1	2	1	-	-	-	-
EE2506-1.4	2	3	-	-	-	1	2	1	-	-	-	-
EE2506-1.5	2	3	-	-	-	1	2	1	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Rai G. D., “Non-Conventional Sources of Energy”, 4th Edition, Khanna Publishers, New Delhi, 2007.

REFERENCE BOOKS:

1. Mukherjee D. and Chakrabarti, S., “Fundamentals of Renewable Energy Systems”, New Age International Publishers, 2005.

2. Khan, B. H., “Non-Conventional Energy Resources”, TMH, New Delhi, 2006.

3. S. P. Sukhumi, J. K. Nayak “Solar Energy: Principles Collection and Storage”, 3rd edition, McGraw-Hill Education (India) , 2009.

E Books / MOOCs/ NPTEL

1. https://nptel.ac.in/courses/108108078

ELEMENTS OF YOGA

Course Code:	**HU1501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P:S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	To give a brief history of the development of Yoga
2.	Identify names of different classical texts on Yoga
3.	To illustrate how Yoga is important for healthy living
4.	To explain the Asanas and other Yogic practices
5.	To explain, how Yoga practices can be applied for overall improvement

UNIT-I

Yoga — **09 Hours**

Meaning and initiation, definitions and basis of yoga, History and development, Astanga yoga, Streams of yoga. Yogic practices for healthy living.
General guidelines for Yoga practices for the beginners: Asanas, Pranayama.

Classification of Yoga and Yogic texts — **07 Hours**

Yogasutra of Patanjali, Hatha yogic practices- Asanas, Pranayama, Dharana, Mudras and bandhas.

UNIT-II

Yoga and Health — **06 Hours**

Concept of health and Diseases-Yogic concept of body – pancakosa viveka, Concept of disease according to Yoga Vasistha.

04 Hours

Yogic concept of healthy living- rules & regulations, yogic diet, ahara, vihara. Yogic concept of holistic health.

Applied Yoga for elementary education — **04 Hours**

Personality development- physical level, mental level, emotional level. Specific guidelines and Yoga practices for - Concentration development, Memory development

UNIT-III

Yoga and physical development — **05 Hours**

Mind-body, Meditation, Yogasanas and their types. Different Yoga practices and Benefits.

05 Hours

Specific guidelines and Yoga practices for – Flexibility, Stamina, Endurance (Surya Namaskara)

Course Outcomes: At the end of the course student will be able to

1.	Understand a brief history of the development of Yoga
2.	Know important practices and principles of Yoga
3.	Explain how Yoga is important for healthy living
4.	Practice meditation to improvement of concentration etc.
5.	Have knowledge about specific guidelines of yoga practices

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
HU1501-1.1	-	-	-	-	-	1	-	-	1	-	-	1
HU1501-1.2	-	-	-	-	-	1	-	-	1	-	-	3
HU1501-1.3	-	-	-	-	-	2	-	-	1	-	-	3
HU1501-1.4	-	-	-	-	-	3	-	-	2	-	-	3
HU1501-1.5	-	-	-	-	-	2	-	-	2	-	-	3

1: Low 2: Medium 3: High	
TEXTBOOKS:	
1.	B. K. S. Iyengar, “Light on Yoga: The Classic Guide to Yoga by the World’s Foremost Authority”, Thorsons publisher 2016.
2.	Makarand Madhukar Gore, “Anatomy and Physiology of Yogic Practices: Understanding of the Yogic Concepts and Physiological Mechanism of the Yogic Practices”, Motilal Banarsidass Publishers; 6 edition (2016).
3.	Swami Satyananda Saraswati, “Asana, Pranayama, Mudra and Bandha: 1”, Yoga Publications Trust.
REFERENCE BOOKS:	
1.	Ann Swanson, "Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice".
2.	Dianne Bondy, "Yoga for Everyone : 50 Poses For Every Type of Body".
E Books / MOOCs/ NPTEL	
1.	https://onlinecourses.swayam2.ac.in/aic19_ed29/preview
2.	https://youtu.be/FMf3bPS5wDs

INTELLECTUAL PROPERTY RIGHTS

Course Code	**HU1502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Humanities

Course Objectives:

1.	Understand the creativity component in intellectual property, different types of legal protection of intellectual properties and other basic concepts of Intellectual property.
2.	Analyze different types of protection for inventions, different types of agreements and treaties for Intellectual properties with an ability to examine patent types, specifications and patent search and database for 'prior art'.
3.	Understand the basic procedure of drafting claims, apply for patents, other legal forms of intellectual property rights and also to examine the protocol involved in protection of inventions like patents.

UNIT - I

Introduction to Intellectual Property	**08 Hours**

Invention and Creativity - Intellectual Property (IP) – Importance, Jurisprudential definition and concept of property, rights, duties and their correlation; History and evaluation of IPR – like Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications.

Agreements and Treaties	**08 Hours**

History - General Agreement on Trade and Tariff (GATT). Indian Position vis-a-vis WTO and Strategies; TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; International convention relating to Intellectual Property - Establishment of WIPO - Mission and Activities – Budapest Treaty; PCT; Indian Patent Act 1970 & recent amendments – Patent (Amendment) Rules, 2017

UNIT - II

Basics of Patents and Concept of Prior Art	**08 Hours**

Introduction to Patents; Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; Specifications: Provisional and complete; Forms and fees Invention in the context of "prior art"; Patent databases; Searching International Databases; Country-wise patent searches (USPTO, EPO, WIPO, IPO, etc.)

Patent filing procedures	**08 Hours**

National & PCT filing procedure; Time frame and cost; Status of the patent applications filed; Structure of Patent document, Precautions while patenting – disclosure/non-disclosure; Financial assistance for patenting - introduction to existing schemes; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies.

UNIT - III

Case Studies	**08 Hours**

Patents: Biological Cases - i) Basmati rice ii) Turmeric iii) Neem; Non-biological cases – (i) TVS V/S Hero, (ii) Samsung V/S Nokia – Copyright and related rights – Trade Marks – Trade secrets - Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition; Technology transfer and license agreements (US anti-HIV drug license to Africa).

Course Outcomes: At the end of the course student will be able to

1.	Have a General understanding of the Intellectual Property Rights.
2.	Have awareness of different forms of intellectual property rights, national and international IPR related legislations.
3.	Have a general understanding about the provisions, privileges and limitations of intellectual property right holders with an understanding of the legal aspects (civil or criminal) of the use of intellectual property rights.

4.	Acquire Knowledge of National and International Trade Agreements and Agencies functioning in relation to intellectual property rights
5.	Be aware and have a general understanding of patenting procedures and licensing.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
HU1502-1.1	-	3	3	2	-	3	-	-	2	2	-	3
HU1502-1.2	2	2	3	-	-	3	-	3	1	1	2	2
HU1502-1.3	2	-	-	2	-	3	-	-	2	2	2	3
HU1502-1.4	-	-	1	1	-	3	-	-	1	2	-	3
HU1502-1.5	3	2	1	-	-	3	-	-	3	1	-	2

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	BAREACT, "Indian Patent Act 1970 Acts & Rules", Universal Law Publishing Co. Pvt. Ltd., 2007.
2.	Kankanala C., "Genetic Patent Law & Strategy", 1st Edition, Manupatra Information Solution Pvt. Ltd., 2007.
3.	Subbaram N.R., "Handbook of Indian Patent Law and Practice", S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.
4.	Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
5.	Intellectual Property Today: Volume 8, No. 5, May 2001.
6.	M B Rao, "WTO and International Trade", Vikas Publishing House Pvt. Ltd.
7.	Correa, Carlos M. "Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options", Zed Books, New York 2000.
8.	Wadehra, B. L. "Law relating to patents, trademarks, copyright designs & geographical indications", 2 ed. Universal Law Publishing 2000.
9.	Sinha, Prabhas Chandra, "Encyclopedia of Intellectual Property Rights", 3 Vols. Eastern Book Corporation, 2006.
10.	Rachna Singh Puri and Arvind Vishwanathan, “Practical Approach to Intellectual Property Rights”; I. K. International Publishing House Pvt. Ltd.

E-RESOURCES:

1.	http://www.w3.org/IPR/
2.	http://www.wipo.int/portal/index.html.en
3.	http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
4.	www.patentoffice.nic.in
5.	www.iprlawindia.org/

INTRODUCTION TO GERMAN LANGUAGE

Course Code	**HU1503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical

Course Objectives:

1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.
2.	Differentiate between nomnative and akkusative cases with transitive and intransitive verbs, and negation with Kein/e/er
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.
4.	Differentiate preposition forms when used exclusively in akkusative or Dative forms or on combination of the two cases
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.

UNIT - I

15 Hours

Introduction: Mein Name ist (saying who you are, greeting people and saying goodbye, asking people where they come from and where they live. Language point: I and you), Lesen der politischen Karte der Welt, Nationalitaeten und Spachen, Die Uhrzeit (The time) telling time and talking about daily routine, Tage der Woche, die Monate, die vier Jahreszeiten, die Jahre
Mir geht es gut: Asking people how they are, saying how you are, saying which cities and counries people come from, Language points: verb endings),
Wie schreibt man das (how do you write that?) Counting from 1-100 and above, alphabet, spelling our names and words, talking about us and them. Language points: Yes-no questions

Artikel (Articles): As in English, there are definite (der/die/das) and indefinite (ein/eine) articles:
the der/die/das; a/an ein/eine
Die vier Fälle (The four cases): Nominativ, Akkusativ, Dativ, Genitiv(Not in level A-1)
Deklination des bestimmten Artikels der/die/das
Deklination des unbestimmten Artikels ein/eine
(Deklination/Declension: the variation of the form of a noun, pronoun, or adjective, by which its grammatical case, number, and gender are identified)
Deklination von Substantiven (Declension of nouns) (Singular and Plural)
(German nouns are declined by attaching certain endings to them, according to case, number and gender. This helps to differentiate between subjects, objects and indirect objects).

Nominativ und Akkusativ(nominative and accusative cases)
The verb determines the case of the noun. Some verbs only go with the nominative, others only with the accusative (or the dative). Thus, German verbs are either transitive or intransitive.
(Nominative and accusative cases) Intransitive Verben (intransitive verbs) Transitive Verben (transitive verbs)

Negation „kein/e/er "(negation with „kein/e/er ")
(Singular und Plural)
The negation of the indefinite article (ein/eine/ein) is kein/keine/kein. For this, you just have to put a „k" at the beginning of the declined form of ein/eine/ein.
Peter sieht ein Haus. Negation Peter sieht kein Haus.
(Peter sees a house. negation Peter does not see a house.)

(With examples, writing and hearing exercises, and German to English Glossary as applicable)

UNIT - II	
	14 Hours

Dativ (the dative)
(You are already familiar with verbs which require a direct accusative object in addition to the subject, which is in the nominative case. But there also some verbs which require a dative object besides the subject. To identify the dative object you ask "(To) whom?")

Der Plural (the plural)
There are many different forms of the plural in the German language. Principally, the gender and the ending of the noun determine the plural form. Then, you either attach a plural ending to the noun, change a vowel, or keep the noun as it is in the singular.

Das Personalpronomen (the personal pronoun)
The personal pronoun is a substitute for a noun. Its forms are determined by the case, number and gender of the noun which is to be replaced.

Die Formen des Personalpronomen im Nominativ
(The nominative forms of the personal pronoun):

Präpositionen (prepositions)
German prepositions are followed by an object, either in the accusative or the dative case.Some prepositions always take an accusative object, others always a dative object. But thereare also prepositions which can be followed by both. In this case, the question "Where(to)?"
(□ accusative) or "Where?" (□ dative) determines the case of the object.

Präpositionen mit Akkusativ und Dativ
(Prepositions with accusative and dative)
1.Präpositionen mit Akkusativ (prepositions with accusative)
2.Präpositionen mit Dativ (prepositions with dative)
3.Präpositionen mit Akkusativ oder Dativ (prepositions with accusative or dative)

(With examples, writing and hearing exercises, and German to English Glossary as applicable)

UNIT - III	
	11 Hours

Konjugation von Verben im Präsens
(Conjugation of verbs in present tense)
Verbs are conjugated by attaching certain endings, depending on the person and number ofthe subject.

Trennbare und untrennbare Verben
(separable and inseparable verbs)
Verbs with prefixes are dinstinguished between separable and inseparable verbs.
The prefix of an inseparable verb must never be separated from the stem. Here the stress is on the stem: be-kommen. The prefix of a separable verb gets separated from the stem when the verb is conjugated. In the infinitive, the stress is on the prefix: an-kommen
1.Trennbare Verben (separable verbs)
2.Untrennbare Verben (inseparable verbs)

Konjugation von Verben im Perfekt
(Conjugation of verbs in present perfect)
The present perfect (Perfekt) describes something which happened in the past and isespecially used in spoken German. It is formed with the present tense form of „haben“ or
„sein“ and the past participle of the main verb.
1. Die Bildung des Partizips
(the formation of the past participle)
2. Die Bildung des Perfekts mit „haben“ und „sein“
(the formation of the present perfect with „haben“ and „sein“)

Modalverben (modal verbs)
A modal verb is rarely used as a main verb; instead, it usually modifies the main verb. Whilethe main verb remains in the infinitive, the modal verb is conjugated.
In German, there are 7 modal verbs:
können (can/be able), dürfen (may/be allowed), wollen (want),
müssen (must/have to), sollen (shall), mögen (to like), möchten (wish/would like)
1. Konjugation der Modalverben
(Conjugation of the modal verbs)
2. Stellung des Modalverbs im Satz
(Position of the modal verb within a sentence)
(With examples, writing and hearing exercises, and German to English Glossary as applicable)

Course Outcomes: At the end of the course student will be able to

1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.
2.	Differentiate between nomnative and akkusative cases with transitive and intransitive verbs, and negation with Kein/e/er
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.
4.	Differentiate preposition forms when used exclusively in akkusative or Dative forms or on combination of the two cases
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
HU1503-1.1	-	-	-	-	-	3	-	-	2	1	-	1
HU1503-1.2	-	-	-	-	-	3	-	-	2	1	-	1
HU1503-1.3	-	-	-	-	-	3	-	-	2	1	-	1
HU1503-1.4	-	-	-	-	-	3	-	-	2	1	-	1
HU1503-1.5	-	-	-	-	-	3	-	-	2	1	-	1

1: Low 2: Medium 3: High

TEXT BOOKS:

1.	Ulrich Haessermann, Georg Dietrich, Christianne C. Guenther, Diethelm Kaminski, Ulrike Woods and Hugo Zenker, Sprachkurs Deutsch Neusaffung 1, Unterrichtswerk fuer Erwachsene, Verlag Moritz Diesterweg, Universitaetsdruckerei H. Stuertz AG Wuerzburg, 1989.
2.	Paul Coggle and Heiner Schenke, Teach Yourself German (a complete course in understanding, speaking and writing), Teach Yourself Books, Hodden & Stoughton Educational, UK, 2001
3.	Langenscheidt German In 30 Days: Book + Cd Paperback, www.amazon.in, – 1 September 2011

REFERENCE MATERIALS:

1.	Deutsche Sprachlehre für Ausländer.
2.	Themen Aktuell (Text and workbook).
3.	Deutsch als Fremdsprache 1A.
4.	Tangram Aktuell 1A/1B (Text and workbook).
5.	Wherever required the Videos/Audios are also played in the class room sessions

E-RESOURCES:

1.	https://onlinecourses.nptel.ac.in/noc21_hs30/preview NPTEL-Swayam, German-I by Prof. Milind Brahme | IIT Madras
2.	https://www.traingerman.com/en/ powered by Sprachinstitut TREFFPUNKT Online

INTRODUCTION TO JAPANESE LANGUAGE

Course Code	**HU1504-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P:S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department:

Course Objectives:

1.	Have basic spoken communication skills
2.	Write Simple Sentences
3.	Listen and comprehend basic Japanese spoken Japanese
4.	Read and understand basic Japanese characters including Kanji

UNIT - I

(Lessons 1-6) **15 Hours**

Grammar – Introduction, Alphabets, Accents, Noun, Pronoun, Present Tense, Past tense
Vocabulary – Numbers, Days, week days, months, Seasons, Nature, Dialogs and Video Clips

UNIT - II

(Lessons 7-13) **14 Hours**

Communication skills – Time, Addective, Seasons, Conversation, Q&A, Hobby, 5-W/1-H, Entering School/Company, Body Parts, Colours, Features etc**.**

UNIT - III

(Lessons 14-20) **11 Hours**

Japanese Counting System, Birth/Death, Dialogs (Going to Party, Restaurant), My day, Success/Failure, Kanji Characters, and sentence making, Video Clips

Course Outcomes: At the end of the course student will be able to

1.	Understand Simple words, expressions and sentences, spoken slowly and distinctly
2.	Speak slowly and distinctly to comprehend
3.	Read and Understand common words and sentences
4.	Ask Basic questions and speak in simple sentences
5.	Write Hiragana/Katakana and Kanji (120) characters.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
HU1504-1.1	-	-	-	-	-	3	-	-	2	1	-	1
HU1504-1.2	-	-	-	-	-	3	-	-	2	1	-	1
HU1504-1.3	-	-	-	-	-	3	-	-	2	1	-	1
HU1504-1.4	-	-	-	-	-	3	-	-	2	1	-	1
HU1504-1.5	-	-	-	-	-	3	-	-	2	1	-	1

1: Low 2: Medium 3: High

NATIONAL CADET CORPS: ORGANIZATION, FUNCTIONS AND CAPABILITIES

Course Code	**HU1505-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P:S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Chemistry

Course Objectives:

1.	To create evolved youth, who will be equipped to contribute in the development of the nation.
2.	To train students so as to achieve their physical and mental endurance. To acquire body language of smart soldier and to inculcate the sense of authority by commanding the troop under him/her.
3.	To inculcate spirit of adventure, undertake adventure activities, to hone leadership qualities and risk-taking abilities.
4.	To understand and develop life skills, soft skills and to improve emotional quotient of the student.
5.	To impart basic military training, to develop awareness about the defense forces and expose learners to military ethos / values

UNIT - I

NCC: Aims, Objectives and Organization	**07 Hours**

NCC General, Aims, Objectives and Organization of NCC. Duties of NCC Cadets, NCC Camps: Types and Conduct. National Integration: Importance and Necessity, Unity in Diversity.

Personality Development	**07 Hours**

Self-Awareness, Empathy, Critical and Creative Thinking, Decision Making and Problem Solving. Communication Skills, Coping with stress and emotions. Leadership: Traits, Indicators, motivation, moral values, Honor Code. Social Service and Community Development.

UNIT - II

Naval Communication and Seamanship	**08 Hours**

Naval Communication: Introduction, Semaphore, Navigation: Navigation of Ships- Basic requirements, Chart work.

Seamanship: Introduction to Anchor work, Rigging Capsule, Boat work- Parts of Boat, Boat pulling instructions, Whaler sailing instructions. Ship Modeling.

Disaster management and environmental awareness	**08 Hours**

Disaster Management- Organization, Types of Disasters, Essential Services, Assistance, Civil Defence organization. Adventure Activities.

Dos and Don’ts, Fire services and Firefighting, Environmental Awareness and Conservation.

UNIT - III

Naval Orientation	**10 Hours**

Naval Orientation- Armed Forces and Navy Capsule, EEZ Maritime Security & ICG. Border & Coastal Areas: Security setup and Boarder/Coastal management in the area. Naval Orientation: Modes of Entry- IN, ICG, Merchant Navy.

Border and Coastal areas: Security Challenges & role of cadets in Border management

Course Outcomes: At the end of the course student will be able to

1.	Display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion.
2.	Demonstrate the sense of discipline, improve bearing, smartness, turnout and develop the quality of immediate and implicit obedience of orders, with good reflexes.
3.	Acquaint, expose & provide knowledge about Army/Navy/ Air force and acquire information about expanse of Armed Forces, service subjects and important battles.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1505-1.1	-	-	-	-	-	3	3	1	-	-	-	-	-	-
HU1505-1.2	-	-	-	-	-	3	3	-	-	-	-	-	-	-
HU1505-1.3	-	-	-	-	-	-	-	-	1	-	-	-	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. R.K. Guptha, "Cadets Handbook", Ramesh Publishing House, New Delhi.

OVERVIEW OF INDIAN CULTURE

Course Code	**HU1506-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Humanities

Course Objectives:

1.	To understand the relevance of Culture in Human Life, dynamism of Indian Culture and Arts through ages.
2.	To understand the local culture and its vibrancies.
3.	To develop awareness about Indian Society, Culture and Arts under Western rule.
4.	To comprehend different dimension and aspects of the Indian culture and arts.
5.	To appreciate cultural performances in India.

UNIT - I

Knowing Culture	**08 Hours**
What is Culture, Different aspects of Culture, Cultural expression, Importance of Culture	
Influence of Culture	**07 Hours**
Relationship of Culture with: Language, Religion and History, Gender	

UNIT - II

Media and Culture	**07 Hours**
Role of News Papers, Indian Cinema, Music, Advertisements	
Languages, Literature and Culture	**07 Hours**
Role of Sanskrit, Vedas, Upanishads, Ramayana and Mahabharata, Puranas, other Sanskrit Literature, Buddhist and Jain Literature, Dravidian Languages and Literature, North Indian Languages and Literature, Subaltern Literature	

UNIT - III

Arts and Culture	**07 Hours**
Indian Theatre and Performing Arts, Ritual performances, and Tuluva cultural and ritual performances.	
(Self-study Component) **Contribution of Indian History to Culture**	**04 Hours**

Ancient India – Persian and Macedonian invasions and its impact on Indian Culture, Development of Culture and Arts during the Mauryan Empire (Ashoka), the Guptas, the South Indian Dynasties – the Cholas, Nalanda as a Centre of Learning.
Medieval India – Life of People under Delhi Sultanate, Rise of Islam and Sufism, Political Scene of India, Bhakti Movement, Folk Arts, Rise of Modern Indian Languages.
Modern India – British Ruling and its impact on Indian Culture, Social and Religious Reforms, Indian National Movement and Achievement of Independence.

Course Outcomes: At the end of the course student will be able to

1.	Examine how the culture has a very important role in human life and growth of human civilization and have a general awareness on historical perspective of growth of Indian Culture and Arts.
2.	Appreciate their own local culture from an academic perspective.
3.	Know about the impact of Western Rule in India and Indian Struggle for Freedom and also its impact on Indian Culture and Arts and able to appreciate and the role of language in connecting people, growth of culture and arts beyond the barriers of religion and ages.
4.	Take interest in learning these forms of arts, and also appreciate and preserve them for the future generations feeling proud of Indian Culture, Arts and Architecture.
5.	Appreciate art performances in India which will enable them to get exposed to an artistic sphere, which eventually help them to be creative and imaginative.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												

HU1506-1.1	-	1	-	-	-	3	-	3	3	1	-	3
HU1506-1.2	-	-	-	2	-	3	-	2	3	3	-	3
HU1506-1.3	-	-	-	-	-	3	-	1	-	-	-	1
HU1506-1.4	-	-	-	-	-	3	-	2	1	2	-	3
HU1506-1.5	-	-	-	-	-	3	-	3	3	3	-	2

1: Low 2: Medium 3: High

PHILOSOPHY

Course Code	**HU1507-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Visiting

Course Objectives:

1.	To provide a new understanding based on which one can move to overcome the current problems, both at the individual level as well as at the societal level.
2.	To introduce an orientation course for humanities courses in general and for philosophy courses in particular.
3.	To relate philosophy to literature, culture, society and lived experience.
4.	To train students in already available philosophical systems.
5.	To bridge the gap between theory and practice.

UNIT - I

Knowledge (Vidya) and Ignorance (Avidya)	**14 Hours**

Upanishads
Six systems orthodox and Heterodox schools of Indian philosophy
Greek philosophy

Origin of the universe

NasidiyaSukta: “Who really knows?”
Brhadaranyaka Upanishad; Chandogya Upanishad: Non-Self, real and unreal
Taithriya Upanishad: SikshaValli
Plato’s Symposium: Lack as the source if desire and knowledge.
Socratic method of knowledge as discovery
Language: word as root of knowledge (Bhartrahari’s Vakyapadiyam)
Fourteen Knowledge basis as a source of Vidya: Four Vedas, six auxiliary sciences (vedangas); Purana, Nyaya, Mimamsa and Dharma Sastras.

UNIT - II

Knowledge as Power	**16 Hours**

Francis Bacon. Knowledge as both power and self- realization in Bhagavad Gita.

Knowledge as Oppression

M. Foucault. Discrimination between Ram and Satyam in Indian Philosophy.

Knowledge as Invention

Modern definition of creativity; scientific activity in the claim that science invents new things at least through technology.

UNIT - III

	10 Hours

Knowledge about the self, transcendental self; knowledge about society, polity and nature
Knowledge about moral an ethics codes.

Course Outcomes: At the end of the course student will be able to

1.	To provide a new understanding based on which one can move to overcome the current problems, both at the individual level as well as at the societal level.
2.	To introduce an orientation course for humanities courses in general and for philosophy courses in particular.
3.	To relate philosophy to literature, culture, society and lived experience.
4.	To train students in already available philosophical systems.
5.	To bridge the gap between theory and practice.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12

↓ Course Outcomes												
HU1507-1.1	-	-	-	-	-	3	-	-	2	1	-	1
HU1507-1.2	-	-	-	-	-	3	-	-	2	1	-	1
HU1507-1.3	-	-	-	-	-	3	-	-	2	1	-	1
HU1507-1.4	-	-	-	-	-	3	-	-	2	1	-	1
HU1507-1.5	-	-	-	-	-	3	-	-	2	1	-	1

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	Copleston, Frederick, "History of Philosophy", Vol. 1. Great Britain: Continuum.
2.	Hiriyanna, M. , "Outlines of Indian Philosophy", Motilal Banarsidass Publishers; Fifth Reprint edition, 2009.
3.	Sathaye, Avinash, "Translation of Nasadiya Sukta".
4.	Raju, P. T. "Structural Depths of Indian Thought", Albany: State University of New York Press.
5.	Plato, Symposium, Hamilton Press

PRINCIPLES OF PHYSICAL EDUCATION

Course Code	**HU1508-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Physical Education

Course Objectives:

1.	Express understanding of constitution of sports organizations
2.	Demonstrate considerate familiarity of various food practices
3.	Grasp understanding of first aid and physical education
4.	Awareness on the importance of exercise
5.	Leadership skills and the rules of different sports

UNIT - I

15 Hours

History of Physical Education - Olympic games, Modern Olympic games, Olympic Ideals & Objectives, Olympic Symbols, Olympic Flag, Olympic Emblem, Olympic Motto, Olympic Flame, Asian games
International Olympic Committee (IOC), Indian Olympic Association (IOA)
Sports awards - Eligibility, Objectives & Criteria
Yoga - Meaning and Importance
World Health organization (WHO)

UNIT - II

14 Hours

Concept of Health - Meaning of Health, Health Definition, Factors Affecting Health, Qualities of Healthy Person. Health Hazards of College Students, Physical Fitness and Exercises.
Food and Nutrition - Food & Nutrition Defined, Nutrients and their Functions - i) Proteins ii) Carbohydrates iii) Fats iv) Vitamins
Balanced Diet & Malnutrition
Health Education - Meaning of Health Education, Health Education Defined, Scope of Health Education, Importance of Health Education.
Posture - Concept of Posture, Correct Postures, Common Postural Defects
First Aid - First Aid Defined, Need and importance of First Aid, The Requisites of First Aid, Scope of First Aid, Qualities of a First Aider, Fundamental Principles to be followed and the Duties to be performed by the First Aider, First Aid in Different Cases.
Physical Education - Concept of Physical Education, Physical Education Defined, Importance of Physical Education, Scope of Physical Education, Aims and Objectives of Physical Education.
Teaching Aid in Physical Education
Competition - Introduction, Types of competition, Knock out, League or Round Robin Tournament.

UNIT - III

11 Hours

Training in Sports – Meaning, Principles, Warming Up & Limbering Down
Importance of Anatomy and Physiology in Physical Education, Oxygen Debt and Second wind
Leadership and Supervision – Leadership, Qualities of a good leader in Physical Education, Types of Leadership in Physical Education - 1. Teacher Leadership 2. Student Leadership.
Measurement & specification of various playing fields – Cricket, Volley Ball, Basket Ball, Badminton, Ball Badminton, Foot Ball, Hand Ball & their basic playing skills.

Course Outcomes: At the end of the course student will be able to

1.	Demonstrate knowledge of structure of the world sports organizations
2.	Display understanding of different type of food and nutrition for a healthy diet
3.	Comprehend awareness of first aid and physical education
4.	Elucidate about training and the importance of Physical Education
5.	Aware of leadership skills and the knowledge of various sports

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
HU1508-1.1	-	-	-	-	-	3	-	-	2	1	-	1
HU1508-1.2	-	-	-	-	-	3	-	-	2	1	-	1
HU1508-1.3	-	-	-	-	-	3	-	-	2	1	-	1
HU1508-1.4	-	-	-	-	-	3	-	-	2	1	-	1
HU1508-1.5	-	-	-	-	-	3	-	-	2	1	-	1

1: Low 2: Medium 3: High

LINGUISTICS & LANGUAGE TECHNOLOGY

Course Code	**HU2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P:S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**
Pre-requisite	**HU1001-1 (Technical English)**		

Teaching Department: Humanities

Course Objectives:

1.	Introspect about the consciousness in one's language
2.	Learn pronunciation and how the process helps to communicate effectively.
3.	Build contextual speech and writing with the pedagogy in sentence structure.
4.	Improve skill of applying language to enunciate words.
5.	Progress on the speech aspects by understanding the acquisition of Second Language.

UNIT - I

Introduction to Linguistics	**08 Hours**

Broad understanding of Linguistics, Language and characteristic features, Scientific Language, Levels of Linguistic Analysis (Phonetics, Phonology, Morphology, Syntax and Semantics); Approach to Linguistics (Traditional, Structural and Cognitive).

Phonology and Morphology	**08 Hours**

Perspectives in Linguistics, Phonemes, Allophones, Phonemic Analysis, Morphology and Morphemes, Word building process, Morphological Analysis.

UNIT - II

Syntax	**16 Hours**

Constituent structure (Simple Sentence, Noun Phrase, Verb Phrase, Prepositional Phrase, Adjective Phrase, Adverb Phrase, Structure Rules), Tree Diagrams, Case

UNIT - III

Sociolinguistics & Psycholinguistics, Artificial Intelligence	**08 Hours**

Notion of Language Variety, Languages in Contact, Language and Mind, Error Analysis.

Course Outcomes: At the end of the course student will be able to

1.	Understand the importance of language and its facets.
2.	Demonstrate knowledge of sounds and competence in process of word building.
3.	Evolve to reason the constituent parts of a sentence.
4.	Understand the techniques of how 'meaning' is applied.
5.	Analyze errors in day-to-day-conversations and how language is related to society.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
HU2501-1.1	-	1	-	-	1	1	-	-	1	-	-	2
HU2501-1.2	-	-	2	-	-	-	-	-	2	2	-	-
HU2501-1.3	2	3	-	3	-	-	-	-	3	2	-	-
HU2501-1.4	-	-	-	-	2	-	-	-	1	2	-	-
HU2501-1.5	-	2	-	-	-	2	1	-	-	-	-	1

1: Low 2: Medium 3: High

REFERENCE MATERIALS:	
1.	Akmaijan, A, R. A. Dimers and R. M. Harnish. "Linguistics: An Introduction to Language and Communication". London: MIT Press, 1979.
2.	Chomsky, Noam. "Language in Mind". New York: Harcourt Brace Jovanovich, 1968.
3.	Fabb, Nigel. "Sentence Structure". London: Routledge, 1994.
4.	Hockett, C. "A Course in Modern Linguistics". New York: Macmillan, 1955.
5.	O'Grady, W., O. M. Dobrovolsky and M. Aronoff. "Contemporary Linguistics: An Introduction". New York: St. Martin's Press, 1991.
6.	Pride, J. B. and J. Holmes. "Sociolinguistics". Harmondsworth: Penguin, 1972.
7.	Richards, J. C. "Error Analysis: Perspectives in Second Language Acquisition". London: Longman, 1974.
8.	Salkie, R. "The Chomsky Update: Linguistics and Politics". London: Unwin Hyman Ltd., 1990.
9.	Sinclair, J. M. C. H. and R. M. Coulthard. "Towards an Analysis of Discourse". Oxford: OUP, 1975.
10.	Thomas, Linda. "Beginning Syntax". Oxford: Blackwell, 1993.
11.	Verma, S. K. and N. Krishnaswamy. "Modern Linguistics: An Introduction". New Delhi: OUP, 1989.
12.	Wekker, Herman and Liliane Haegeman. "A Modern Course in English Syntax". Kent: Croom Helm, 1985.

PROFESSIONAL & COGNITIVE COMMUNIQUÉ

Course Code	**HU2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P:S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**
Pre-requisite	**HU1001-1 (Technical English)**		

Teaching Department: Humanities

Course Objectives:

1.	To Problematize Commonsense & Apply Critical thinking skills
2.	Comprehend etiquettes and manners in different situations
3.	Be gender sensitive in both offline and online behavior
4.	Exhibit better comprehension of the social implications of human body
5.	Understand the importance of reading and writing skills

UNIT - I

Common sense and Emotional Intelligence	**15 Hours**

Common sense, Commonsensical Consensus, Critical thinking, Unsettling commonsensical Consensus, Role of language in Common sense and Critical Thinking;Nature & Functions of Emotional Intelligence, Emotions, Intelligence and Creativity, Growth of Emotional Intelligence

Etiquettes & Workplace

Etiquette, Workplace Etiquettes, Workplace Readiness Skills, Significance of Cross-Cultural Understanding; Cultural Sensitivity, Impact of social media in Workplace

UNIT - II

Social Networking Sites and its Impacts	**15 Hours**

Emergence of social media, Impact on Gender and Self Representation, Regulatory and Liberatory aspects of social media, Offline Norms & Online Behaviour

Gender and Body

Gender & Sex, Genderization, Homogeneity and Heterosexuality, Gender Expressions, Gender Schooling, Representations of Body, Objectification, Gender Perspectives of Body, Different Ways of Seeing the Body, Discipline & Coercion, ISA & RSA

UNIT - III

Writing	**10 Hours**

Types of Writing, Note Taking Methods, Plagiarism

Reading

Styles of Reading, Types of Reading, Scanning, Skimming

Course Outcomes: At the end of the course student will be able to

1.	Problematize Commonsense & Apply Critical thinking skills
2.	Comprehend etiquettes and manners in different situations
3.	Be gender sensitive in both offline and online behavior
4.	Exhibit better comprehension of the social implications of human body
5.	Understand the importance of reading and writing skills

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
HU2502-1.1	-	3	-	-	-	-	-	-	3	3	-	3
HU2502-1.2	-	2	-	-	-	-	-	3	2	3	-	2
HU2502-1.3	-	3	-	-	-	-	-	-	2	2	-	3
HU2502-1.4	-	3	-	-	-	-	-	-	2	2	-	3
HU2502-1.5	-	2	-	-	-	-	-	-	3	3	-	2

1: Low 2: Medium 3: High

REFERENCE MATERIALS:	
1.	Geetha.V. Gender. Kolkatta: Web Impressions, 2009.
2.	Bailey, Jane, et al. "Negotiating with Gender Stereotypes On Social Networking Sites: From "Bicycle Face" to Facebook." Journal of Communication Enquiry 37.2 (2013): 91-112.
3.	Barry, Peter. "Beginning Theory". New Delhi: Viva Books, 2010.
4.	Berger, John. "Ways of Seeing". London: Penguin Books, 1977.
5.	Cranny-Francis, Anny, et al. "Gender Studies: Terms and Debates". New York: Palgrave Macmillan, 2003.
6.	Gauntlett, David. "Media, Gender and Identity: An Introduction". London: Routledge, 2008
7.	Pilcher, Jane, and Imelda Whelehan. "50 Key Concepts in Gender Studies". London: Sage, 2004. Print.
8.	Jeanne, Haraway Donna. Simians, Cyborgs, and Women. London: Free Association Books, 1991. Web.
9.	Koskela, Hille. "Webcams, TV Shows and Mobile Phones: Empowering Exhibitionism." Surveillance & Society 2.3 (2004): 199-215.Web.
E-RESOURCES:	
1.	http://www.cyberpsychology.eu/view.php?cisloclanku=2009061501/ >.
2.	http://www.surveillance-and-society.org/articles2(2)/webcams.pdf
3.	http://eprints.rclis.org/19790/>.

INTRODUCTION TO CYBER SECURITY

Course Code:	**IS2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**IS1651-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Define the area of cybercrime and forensics.
2.	Explain the motive and causes for cybercrime, detection and handling.
3.	Investigate Areas affected by cybercrime.
4.	Illustrate tools used in cyber forensic

UNIT-I

Introduction to Cybercrime — **15 Hours**

Cybercrime - Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cyber Crimes. **[T1: 1.1-1.5]**

Cyberoffenses: How Criminals Plan Them

How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing. **[T1: 2.1-2.8]**

Mobile and Wireless Devices

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops. **[T1: 3.1-3.12]**

UNIT-II

Tools and methods used in Cybercrime — **14 Hours**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. **[T1: 4.1-4.12]**

Phishing and Identity Theft

Introduction to Phishing, Identity Theft (ID Theft). **[T1: 5.1-5.3]**

UNIT-III

Understanding Computer Forensics — **11 Hours**

Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics. **[T1: 7.1-7.19]**

Course Outcomes: At the end of the course student will be able to

1.	Comprehend the Cyber crime and its origin
2.	Analyse the cyber crimes in mobile and wireless devices
3.	Apply tools and methods used in Cyber crimes
4.	Analyse Phishing and and ID Theft

5.	Comprehend Digital Forensics

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
IS2501-1.1	2	-	-	-	-	1	-	3	-	-	-	-
IS2501-1.2	-	3	-	1	-	2	-	-	2	-	-	-
IS2501-1.3	-	3	2	-	-	-	-	-	-	-	-	-
IS2501-1.4	2	-	-	-	-	2	-	-	-	-	-	-
IS2501-1.5	-	-	-	-	-	-	-	3	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013.

REFERENCE BOOKS:

1. Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions", John Wiley & Sons, Inc, ISBN: 978 -1-118 -84965 -1, 2014.
2. James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials", CRC Press, 15-Dec 2010. Anti- Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw-Hill.

INTRODUCTION TO CYBER SECURITY

Course Code:	**IS2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**IS1651-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Define the area of cybercrime and forensics.
2.	Explain the motive and causes for cybercrime, detection and handling.
3.	Investigate Areas affected by cybercrime.
4.	Illustrate tools used in cyber forensic

UNIT-I

Introduction to Cybercrime — **15 Hours**

Cybercrime - Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cyber Crimes. **[T1: 1.1-1.5]**

Cyberoffenses: How Criminals Plan Them

How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing. **[T1: 2.1-2.8]**

Mobile and Wireless Devices

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops. **[T1: 3.1-3.12]**

UNIT-II

Tools and methods used in Cybercrime — **14 Hours**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. **[T1: 4.1-4.12]**

Phishing and Identity Theft

Introduction to Phishing, Identity Theft (ID Theft). **[T1: 5.1-5.3]**

UNIT-III

Understanding Computer Forensics — **11 Hours**

Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics. **[T1: 7.1-7.19]**

Course Outcomes: At the end of the course student will be able to

1.	Comprehend the Cyber crime and its origin
2.	Analyse the cyber crimes in mobile and wireless devices
3.	Apply tools and methods used in Cyber crimes
4.	Analyse Phishing and and ID Theft
5.	Comprehend Digital Forensics

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
IS2501-1.1	2	-	-	-	-	1	-	3	-	-	-	-
IS2501-1.2	-	3	-	1	-	2	-	-	2	-	-	-
IS2501-1.3	-	3	2	-	-	-	-	-	-	-	-	-
IS2501-1.4	2	-	-	-	-	2	-	-	-	-	-	-
IS2501-1.5	-	-	-	-	-	-	-	3	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Sunit Belapure and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013.

REFERENCE BOOKS:

1. Thomas J. Mowbray, “Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions”, John Wiley & Sons, Inc, ISBN: 978 -1-118 -84965 -1, 2014.
2. James Graham, Ryan Olson, Rick Howard, “Cyber Security Essentials", CRC Press, 15-Dec 2010. Anti- Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw-Hill.

PYTHON PROGRAMMING

Course Code:	**IS2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CS1001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Construct Python programs using data types and looping.
2.	Design object-oriented Python programs using classes and objects.
3.	Design useful stand-alone and CGI applications in

UNIT-I	**15 Hours**

Introduction: Introduction to python, Installing Python; basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages. Conditions, Boolean logic, logical operators; ranges;
Control Statements: if-else, loops (for, while); short-circuit (lazy) evaluation.
String Manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa, Binary, octal, hexadecimal numbers
Lists, Tuples, and Dictionaries: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.

UNIT-II	**15 Hours**

Functions: Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design.
Recursive functions.
Classes and OOP: Classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, inheritance, polymorphism, operator overloading (_eq_, _str_, etc); abstract classes; exception handling, try block.

UNIT-III	**10 Hours**

File Handling: Manipulating files and directories, Reading from Text Files, Writing to Text Files, Reading from Binary Files, Writing to Binary Files, Seeking Within Files, Creating and Reading a formatted file (csv or tab-separated).
Graphical User Interfaces: event-driven programming paradigm; creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames Simple CGI form.

Course Outcomes: At the end of the course student will be able to

1.	Demonstrate the basics of Python programming like data types and looping
2.	Apply the basic data structures in solving the problems
3.	Experiment with usage of functions in a given problem
4.	Develop Objects by creating classes and apply object-oriented features
5.	Develop applications in Python using File Programming &User Interface

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												

IS2502-1.1	1	2	1	-	-	-	-	-	-	-	-	-
IS2502-1.2	1	2	1	-	-	-	-	-	-	-	-	-
IS2502-1.3	1	2	2	-	-	-	-	-	-	-	-	-
IS2502-1.4	1	2	2	-	-	-	-	-	-	-	-	-
IS2502-1.5	1	2	2	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Kenneth A. Lambert, "The Fundamentals of Python: First Programs", 2011, Cengage Learning, ISBN: 978-1111822705.

REFERENCE BOOKS:

1.	Think Python. PDF is free.

SOFTWARE ENGINEERING PRACTICES

Course Code:	**IS2503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**IS1651-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Outline software engineering principles and activities involved in building large software programs.
2.	Explain the importance of architectural decisions in designing the software.
3.	Describe the process of Agile project development.
4.	Recognize the importance of software testing and describe the intricacies involved in software evolution.
5.	Identify several project planning and estimation techniques and explain the importance of software quality.

UNIT-I

Introduction	**15 Hours**
Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Case Studies.	
Software Processes	
Models: Waterfall Model, Incremental Model and Spiral Model; Process activities	
Requirements Engineering	
Functional and non-functional requirements, Requirements engineering processes, Requirements Elicitation and Analysis, Requirements specification, Software requirements document, Requirements validation & management.	

UNIT-II

System Models	**15 Hours**
Context models, Interaction models, Structural models, Behavioral models.	
T Architectural Design	
Architectural design decisions. Architectural Views and patterns, Application architectures.	
Design and implementation	
Object oriented Design using UML.	
Agile Software Development	
Agile methods, Plan-driven and agile development, Extreme Programming, Agile project management.	

UNIT-III

Project Management	**10 Hours**
Risk management, Teamwork.	
Project Planning	
Software pricing, Plan-driven development, Project Scheduling.	
Quality Management	
Software quality, Reviews and inspections, Software measurement and metrics, Software standards.	

Course Outcomes: At the end of the course student will be able to

1.	Recognise the basics of software system, component, process and Software Requirement Specification to meet desired needs within realistic constraints and outline the professional and ethical responsibility
2.	Describe the waterfall, incremental and iterative models and architectural design in implementing the software
3.	Make use of the techniques, skills, modern engineering design tools and agile methods necessary for engineering practice.
4.	Describe the methods for maintaining software system.

5.	Discuss project planning and management and illustrate the quality of software products

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
IS2503-1.1	-	3	1	-	-	-	-	2	-	-	-	-
IS2503-1.2	1	3	1	-	-	-	-	-	-	-	-	-
IS2503-1.3	1	1	3	-	-	-	-	-	-	-	-	-
IS2503-1.4	1	3	2	-	-	-	-	-	-	-	-	-
IS2503-1.5	1	2	2	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education, 2012.

REFERENCE BOOKS:

1.	Roger S. Pressman: "Software Engineering-A Practitioners approach", 7th Edition, Tata McGraw Hill, 2017.
2.	Pankaj Jalote: "An Integrated Approach to Software Engineering", Wiley, India, 2010.

E Books / MOOCs/ NPTEL

1.	http://agilemanifesto.org/
2.	http://www.jamesshore.com/Agile-Book/
3.	https://www.mooc-list.com/course/uml-class-diagrams-software-engineering-edx
4.	https://www.mooc-list.com/course/enterprise-software-lifecycle-management-edx

WEB TECHNOLOGIES

Course Code:	**IS2504-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**IS1651-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Illustrate the Semantic Structure of HTML and CSS
2.	Compose forms and tables using HTML and CSS
3.	Design Client-Side programs using JavaScript and Server-Side programs using PHP
4.	Illustrate the Database connectivity using PHP
5.	Examine JavaScript frameworks such as jQuery

UNIT-I

Introduction to HTML	**15 Hours**

HTML tags and simple HTML forms, web site structure, HTML table, Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colours and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.

UNIT-II

Client side Scripting	**15 Hours**

Introduction to JavaScript: JavaScript language – declaring variables, scope of variables functions, event handlers (on click, on submit etc.), Document Object Model, Form validations. Introduction to PHP: Declaring variables, data types, arrays, strings, operations, expressions, control structures, functions, Reading data from web form controls like Text Boxes, radio buttons, lists etc.,

UNIT-III

PHP Databases	**10 Hours**

Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, File Handling in PHP, PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, jQuery Introduction: What is jQuery, Adding jQuery in to your web pages, jQuery Syntax, jQuery Selectors, jQuery Events.

Course Outcomes: At the end of the course student will be able to

1.	Adapt HTML and CSS syntax and semantics to build web pages
2.	Construct and visually format tables and forms using HTML and CSS.
3.	Experiment with the usage of Event handling and Form validation using JavaScript.
4.	Understand the principles of object-oriented development using PHP and Database concepts.
5.	Inspect JavaScript frameworks like jQuery which facilitates developers to focus on core features.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
IS2504-1.1	1	2	-	2	-	-	-	-	-	-	-	1
IS2504-1.2	1	-	-	2	-	-	-	-	-	-	-	1
IS2504-1.3	1	2	-	2	3	-	-	-	-	-	-	1
IS2504-1.4	1	2	-	2	3	-	-	-	-	-	-	1
IS2504-1.5	1	-	-	2	3	-	-	-	-	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India. (ISBN:978-9332575271).
E Books / MOOCs/ NPTEL	
1.	nptel.ac.in/courses/106105084/11

GRAPH THEORY

Course Code:	**MA1501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mathematics

Course Objectives:

1.	Explain subgraphs, bipartite graphs, isomorphic graphs etc. Apply the concept of trees and its properties
2.	Distinguish between Hamilton and Eulerian graph. Distinguish between planar and nonplanar graphs and apply their properties to solve problems.
3.	Represent a graph in terms of adjacency matrix, incidence matrix etc. and vice-versa.
4.	Find the shortest path between two vertices in a graph. Find minimal spanning tree.

UNIT-I

Introduction to graphs	**11 Hours**
Graphs and Graph Models, digraphs, Konigsberg bridge problem. Special Types of Graphs: Subgraphs-spanning and induced subgraphs, Isomorphism of graphs. Some Special Simple Graphs, complete graph, Bipartite Graphs. Connectivity: point and line connectivity Trees and its properties.	
Euler and Hamilton graphs	**04 Hours**
Eulerian and Hamiltonian graphs and their applications.	

UNIT-II

Planar graphs	**09 Hours**
Euler's polyhedron formula, outer planar graphs, applications	
Colorability	**07 Hours**
Chromatic number, five color theorem, chromatic polynomial, Applications of graph coloring.	
Representation of graphs	
Adjacency matrix, incidence matrix, circuit matrix, cut set matrix. Path matrix	

UNIT-III

Network Flows	**04 Hours**
Max -flow and Min-cut Theorem(statement), problems.	
Shortest paths in weighted graphs	
Dijkstra's algorithm to find shortest paths.	
Spanning trees	**05 Hours**
Algorithms to find a spanning tree, minimal spanning tree-Kruskal's & Prim's algorithm.	

Course Outcomes: At the end of the course student will be able to

1.	Distinguish between bipartite and complete bipartite graphs, identify whether two graphs are isomorphic, find subgraphs of a graph etc.
2.	Distinguish between Eulerian and Hamiltonian graphs.
3.	Identify whether a graph is planar and to find the chromatic polynomial of a graph.
4.	Representing graphs interms of Matrices.
5.	Apply algorithmic methods to find the shortest path between two given vertices. Use a suitable algorithm to find a minimal spanning tree.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MA1501-1.1	3	3	-	-	-	-	-	-	-	-	-	-
MA1501-1.2	2	1	-	-	-	-	-	-	-	-	-	-
MA1501-1.3	2	3	-	-	-	-	-	-	-	-	-	-
MA1501-1.4	3	2	-	-	-	-	-	-	-	-	-	-
MA1501-1.5	3	2	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High	
TEXTBOOKS:	
1.	F. Harary, "Graph theory", Narosa Publishing House, 1988.
2.	Narsing Deo, "Graph Theory with applications to Engg. and Comp. Sciences", PHI,1974.
3.	Kenneth H. Rosen, "Discrete Mathematics and its applications", Tata McGraw Hill, VEdition-2003.
REFERENCE BOOKS:	
1.	D. B. West, "Introduction to Graph Theory", PHI,2001.
2.	Chartrand and Zhang, "First Course in Graph Theory", 2012
E Books / MOOCs/ NPTEL	
1.	http://diestel-graph-theory.com.
2.	https://nptel.ac.in/courses/111106102

NUMBER THEORY

Course Code:	**MA1502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mathematics

Course Objectives:

1.	Understand the divisibility of integers, study of prime numbers and basic properties of congruences.
2.	Study Fermat's little theorem and understand Euler's function.
3.	Study the existence of primitive roots and quadratic residues.
4.	Study the cryptographic applications in number theory.

UNIT-I

Divisibility and the theory of congruences	**15 Hours**

Division algorithm, Euclid's algorithm for the greatest common divisor. Linear Diophantine equations. Prime numbers, fundamental theorem of arithmetic. Basic properties of congruences, Linear congruences and Chinese reminder theorem.

UNIT-II

	07 Hours

Fermat's theorem, Wilson's theorem, Euler's Phi function, Euler's theorem.

Primitive roots and Quadratic congruences	**08 Hours**

Order of an integer modulo n, primitive roots for primes, Euler's criterion, Legendre symbol and its properties.

UNIT-III

Cryptography	**10 Hours**

Introduction to public key cryptography, RSA cryptosystem, an application of primitive roots to cryptography.

Course Outcomes: At the end of the course student will be able to

1.	Use divisibility and Greatest common divisor in Euclidean algorithm. Solve Diophantine equations. Identify prime factorization of an integers.
2.	Understand the properties of congruences. Use Chinese reminder theorem to find solution of system of linear congruences
3.	Use Fermat's Little Theorem and Wilson's Theorem. Use of Euler's Phi function.
4.	Identify primitive roots of an integers. Apply Euler's criterion and Legendre symbols.
5.	Code and decode numbers in the RSA cryptosystem.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MA1502-1.1	2	3	-	-	-	-	-	-	-	-	-	-
MA1502-1.2	2	3	-	-	-	-	-	-	-	-	-	-
MA1502-1.3	2	3	-	-	-	-	-	-	-	-	-	-
MA1502-1.4	2	3	-	-	-	-	-	-	-	-	-	-
MA1502-1.5	2	3	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	D. Burton, "Elementary Number Theory", McGraw-Hill, 2005.
2.	Niven, H.S. Zuckerman & H.L. Montgomery, "Introduction to the Theory of Numbers", Wiley, 2000.

REFERENCE BOOKS:

1.	H. Davenport, "The Higher Arithmetic", Cambridge University Press, 2008.
2.	G. A. Jones & J. M. Jones, "Elementary Number Theory", Springer UTM, 2007.
3.	Thomas Koshy, "Elementary Number Theory with Applications", 2nd edition, Elsevier, 2007.

4.	William J. LeVeque, "Fundamentals of Number Theory".
E Books / MOOCs/ NPTEL	
1.	http://refkol.ro/matek/mathbooks/ro.math.wikia.com%2520wiki%2520Fisiere pdf_incarcate/Elementary-Number-Theory.pdf
2.	https://nptel.ac.in/courses/111104138
3.	https://nptel.ac.in/courses/111103020

LINEAR ALGEBRA

Course Code:	**MA3501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**MA1001-1 and MA2009-1**		

Teaching Department: Mathematics

Course Objectives:

1.	Understand the concepts of vectors, bases.
2.	Determine the kernel, range, rank, and nullity of a linear transformation and apply them suitably in their field of study.
3.	Find the canonical forms and appraise its importance in various fields.
4.	Make use of Gram-Schmidt process to produce an orthonormal basis.
5.	Learn the concepts of singular value decomposition and PCA.

UNIT-I

Vector spaces	**08 Hours**
Vector spaces, subspaces, bases and dimensions, coordinate vecotrs, null spaces and column spaces of the matrices.	
Linear Transformations	**07 Hours**
Linear transformations, rank-nullity theorem, algebra of linear transformations, change of basis, linear operators, linear functionals, transpose of a linear transformation.	

UNIT-II

Canonical Forms	**08 Hours**
Review of characteristic values, similarity of matrices, Cayley Hamilton theorem, annihilating polynomials, invariant subspaces, Jordan and rational canonical forms.	
Inner Product Spaces	**07 Hours**
Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization, Least-squares problems.	

UNIT-III

Symmetric Matrices and Quadratic Forms	**10 Hours**
Diagonalization, quadratic forms, constrained optimization, singular value decomposition and principal component analysis. Applications to linear recurrence relations.	

Course Outcomes: At the end of the course student will be able to

1.	Interpret vectors in two and three-dimensional spaces both algebraically and geometrically.
2.	Analyze the concept of a linear transformation as a mapping from one vector space to another and be able to calculate its matrix representation with respect to standard and nonstandard bases.
3.	Understand the concepts of Jordan and rational canonical forms.
4.	Make use of Gram-Schmidt process to produce an orthonormal basis and also able to use least square approximation method to obtain the solution of ill conditioned system.
5.	Apply techniques of constrained optimization singular value decomposition and PCA for problems arising in various engineering fields.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MA3501-1.1	3	2	-	-	-	-	-	-	-	-	-	-
MA3501-1.2	2	2	-	-	-	-	-	-	-	-	-	-
MA3501-1.3	3	1	-	-	-	-	-	-	-	-	-	-
MA3501-1.4	3	2	-	-	-	-	-	-	-	-	-	-
MA3501-1.5	3	2	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Kenneth Hoffman and Ray Kunze, "Linear Algebra," 2nd edition, Pearson Education (Asia) Pte. Ltd, 2004.

2.	David C. Lay, “Linear Algebra and its Applications”,3rd edition, Pearson Education (Asia) Pte. Ltd, 2005.
REFERENCE BOOKS:	
1.	M. Artin, "Algebra", Prentice Hall of India, 2004.
2.	Gilbert Strang, “Linear Algebra and its Applications”, 4th edition, Thomson Learning Asia, 2003.
3.	Bernard Kolman and David R. Hill, “Introductory Linear Algebra with Applications”, Pearson Education (Asia) Pte.Ltd, 7th edition ,2003.
4.	Sheldon Axler, “Linear Algebra Done Right”, Springer International Publication, Third Edition, 2015.

AUTOMOTIVE ENGINEERING

Course Code:	**ME1501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	Get an idea on the different components of an engine and its types with lubrication system.
2.	Understand the fuel supply system and ignition systems used in automobiles.
3.	Demonstrate the working of transmission system.
4.	Explain the importance of suspension system, steering geometry and drives in automobiles
5.	Know the concept of braking system, tyres and emission control.

UNIT-I

Engine Components and Cooling & Lubrication Systems — **08 Hours**

SI & CI engines, Cylinder arrangements and their relative merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Choice of materials for different engine co mponents, engine positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication arrangements, crankshaft/flywheel position sensor, accelerator pedal sensors, engine coolant water temperature sensor.

Fuel Supply Systems for SI and CI Engines — **08 Hours**

Fuel mixture requirements for SI engines, types of carburetors, si mple carburetor, multi point and single point fuel injection systems, CRDI, fuel transfer pumps: AC Mechanical Pump, SU Electrical Pumps, injectors, Fuel gauge sensor, Throttle position sensor, Mass air flow sensors.

Ignition Systems : Battery Ignition systems, magneto Ignition system, Transistor assisted contacts. Electronic Ignition, Automatic Ignition advance systems, Lighting systems, Rain/Light sensors, starting device (Bendix drive)

Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-II

Power Trains — **07 Hours**

Clutches - Single plate, multiplate and centrifugal clutches. Gear box: Necessity for gear ratios in transmission, Constant m esh gear box, Synchromesh gear box, principle of automatic transmission, Vehicle Speed Sensors, calculation of gear ratios, Types of transmission systems. No numerical.

Drive to Wheels — **08 Hours**

Propeller shaft, universal joints, Hotchkiss. and torque tube drives, differential, rear axle, steering geometry, camber, king pin inclination, included angle, castor, toe in & toe out, condition for exact steering, power steering, over steer, under steer & neutral steer, Steering angle sensors, numerical problems.

Suspension and Springs: Requirements, leaf spring, coil spring, Torsion bar suspension systems, independent suspension for front Wheel, Air suspension system. Collective bargaining; Characteristics, Necessity, Forms Safety & Health; Industrial accidents, Safety Quality circle; Meaning, Structure

Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-III

Brakes — **09 Hours**

Types of brakes, mechanical, compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, Drum brakes.

Tyres: Desirable tyre properties, Types of tyres.

Automotive Emission: Automotive exhaust emissions, sources and emission control method: EGR, SCR, Emission Standards, Exhaust sensors.

Electric Vehicles.

Pedagogy Chalk and talk method, Power Point Presentation

Course Outcomes: At the end of the course student will be able to

1.	Describe and demonstrate the layout of an automobile and components of an automobile engine. Explain cooling and lubrication systems.

2.	Explain and demonstrate the fuel supply and Ignition systems for SI and CI engines.
3.	Describe and demonstrate the transmission system
4.	Explain and demonstrate the components of drive to wheel and suspension system, calculate the parameters of steering geometry.
5.	Describe and demonstrate automotive braking system. Explain types and construction of tyres and wheels. Explain the significance of automotive emissions and its controlling methods

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
ME1501-1.1	3	1	-	-	-	1	-	-	3	1	-	1
ME1501-1.2	3	1	-	-	-	1	-	-	3	1	-	1
ME1501-1.3	3	1	1	-	-	1	-	-	3	1	-	1
ME1501-1.4	2	3	1	-	-	1	-	-	3	1	-	1
ME1501-1.5	3	1	1	-	-	1	1	1	3	1	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	S. Srinivasan, "Automotive Mechanics", Tata McGraw Hill, 2003.
2.	Kirpal Singh, "Automobile Engineering", Vol I and II, 2013.
3.	A. K. Babu, "Automotive Electrical and Electronics", Khanna Publishers, 2nd edition, 2016.

REFERENCE BOOKS:

1.	R. B. Gupta, "Automobile Engineering", Satya Prakashan, 4th Edn., 1984 .
2.	Naran G, "Automobile Engineering", Khanna Publishers 2002

INDUSTRIAL POLLUTION CONTROL

Course Code:	**ME1502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	Know the Consequences of pollution, relationship between man and environment over the last few decades, necessity of modern awareness on pollution and how carbon audit can help in developing a carbon strategy.
2.	Identify the Importance of Meteorology in pollution control and global warming, various types of plume dispersions and its effect; analyze various levels of plume height for different pollutants.
3.	Distinguish Particulates and fly ash separation techniques such as cyclone separator, electrostatic precipitator efficiency calculations etc.
4.	Illustrate Formation, measurement and control techniques for Smoke and gaseous pollutants.
5.	Summarize the Effects of water, soil, plastics and odor pollution their control techniques, Different Pollution Control Acts, Legal aspects of pollution control and how these acts can help in bringing down the pollution rate.

UNIT-I

Introduction to Pollution	**08 Hours**

Man and the environment, types of pollution and its consequences, Changing environmental management concept, sustainable industrial growth, carbon audit, Ill effects of various pollutants, permissible concentration levels & AQI.

Meteorology	**08 Hours**

Meteorology, Wind rose, Lapse rate, plume dispersion studies & Numerical problems.
Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-II

Separation techniques	**08 Hours**

Different types of Particulates, Need for Separation techniques, Sources of Particulates Matter Fly Ash Electrostatic precipitator (Problems) Theory of settling processes (Design Problems), Bag House fabric filter Cyclone separator Spray Tower Scrubbers & Venturi Scrubber

Smoke and gaseous pollutants:	**08 Hours**

Smoke- White, blue and black smoke, Sources of smoke, T,T,T-O Principle of smoke Measurement of stack smoke intensity using Ringlemann Chart and Smokescope &Bosch Smoke meter, Domestic and Industrial Incinerators-Design factors, Pollutant gaseous So2, Co, UBHC, Nox their ill effects and & control methods.
Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-III

	08 Hours

Water, soil, noise, and odor pollution, their control methods, problems associated with nuclear reactors, Legal aspects of pollution control in India, brief details of Euro and BS standards
Pedagogy: Chalk and talk method, Power Point Presentation

Course Outcomes: At the end of the course student will be able to

1.	Identify the various types of pollutants and distinguish between them with regards to Particulate matters and AQI.
2.	Outline the instruments for Meteorological measurements, distinguish types of plume dispersions and its effect; analyze the concentration of various gaseous pollutants from T-Z diagrams
3.	Explain the Particulates and fly ash separation techniques, compare and Interpret their efficiency
4.	Illustrate Formation, measurement and control techniques for Smoke and gaseous pollutants
5.	Identify Effects of water, soil, plastics and odor pollution on environmental Pollution and explain the Legal aspects of pollution control.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
ME1502-1.1	1	-	-	1	-	3	3	2	1	2	-	3
ME1502-1.2	1	2	1	1	3	2	3	1	1	1	-	2
ME1502-1.3	1	2	2	1	1	2	3	1	1	1	-	1
ME1502-1.4	1	1	1	1	1	2	3	1	1	1	-	2
ME1502-1.5	1	-	-	1	-	2	3	1	1	1	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	“Environmental Pollution Control Engineering", Wiley Eastern Ltd.,
2.	Gilbert M Masters, “Introduction to Environmental Engineering & Science”, PHI,1995
3.	C. S Rao, “Environmental Pollution Control Engineering", New Age Int.
REFERENCE BOOKS:	
1.	Henry C. Perkins, “Air Pollution”, Mc-Graw Hill, 1974.
2.	W. L. Faith, “Air Pollution control”, John Wiley
E Books / MOOCs/ NPTEL	
1.	http://nptel.ac.in/courses/105106119/36

SUSTAINABLE DEVELOPMENT GOALS

Course Code:	**ME1503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	To provide the knowledge, skills, attitudes and values necessary to address sustainable development challenges
2.	Address the global challenges including poverty, inequality, climate change, environmental degradation, peace and justice.
3.	To learn more and take action.
4.	Addresses critical global challenges put forth by UN.
5.	Analyze how sustainable development can be achieved in practice.

UNIT-I

08 Hours

The origin, development and idea of the SDGs History and origins of the Sustainable Development Goals. What are the SDGs? What are their aims, methodology and perspectives? How are they related to the Millennium Development Goals?

SDGs and Society — **08 Hours**

Ensuring resilience and primary needs in society In-depth discussion and analysis of goals related to poverty, hunger, health & well-being and education

Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-II

SDGs and Society — **14 Hours**

Strengthening Institutions for Sustainability In-depth discussion and analysis of goals related to gender equality, affordable and clean energy, sustainable cities & communities, and peace, justice & strong institutions SDGs and the Economy: Shaping a Sustainable Economy In-depth discussion and analysis of goals related to work & economic growth, industry, innovation & infrastructure, inequalities, responsible production & consumption

Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-III

SDGs and the Biosphere — **10 Hours**

Development within Planetary Boundaries In-depth discussion and analysis of goals related to clean water, climate, life below water and life on land

Realizing the SDGs: Implementation through Global Partnerships In-depth discussion and analysis of SDG 17 which aims to implement the SDGs through partnerships, finance, technology and the development of coherence between policies.

Pedagogy: Chalk and talk method, Power Point Presentation

Course Outcomes: At the end of the course student will be able to

1.	Summarize the UN"s Sustainable Development Goals and how their aims, methodology and perspectives.
2.	Analyze the major issues affecting sustainable development and how sustainable development can be achieved in practice.
3.	Identify and apply methods for assessing the achievement/possibilities of sustainable development in Nitte gram panchayath.
4.	Evaluate the implications of overuse of resources, population growth and economic growth. sustainability & Explore the challenges the society faces in making transition to renewable resource use.
5.	Create skills that will enable students to understand attitudes on individuals, society and their role regarding causes and solutions in the field of sustainable development.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
ME1503-1.1	1	2	1	1	1	3	3	1	1	1	-	2
ME1503-1.2	2	2	1	1	1	3	3	2	1	1	-	1
ME1503-1.3	3	2	2	1	1	3	3	2	3	1	-	1
ME1503-1.4	3	2	3	1	1	3	3	2	1	1	-	1
ME1503-1.5	1	2	2	1	1	3	3	2	2	2	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Sachs, Jeffrey D. "The age of sustainable development" Columbia University Press, 2015
2. Gagnon, B., Leduc, R., and Savard, L., "Sustainable development in engineering: a review of principles and definition of a conceptual framework", Cahier de recherche / Working Paper 08-18, 2008.

REFERENCE BOOKS:

1. Elliott, Jennifer, "An introduction to sustainable development", Routledge, 2012.

E Books / MOOCs/ NPTEL

1. https://www.un.org/sustainabledevelopment/poverty/

TECHNOLOGICAL INNOVATION

Course Code:	**ME1504-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	Understand basics of operations management and Quality.
2.	Define the concept of technological innovation.
3.	Discuss Innovation management and the difference between Invention and Innovation.
4.	Appreciate the importance of Innovation as a management process and Innovation management techniques.
5.	Discuss the Innovation system, Understand the importance of Technology management and Transfer and basics of Technological Forecasting.

UNIT-I

Production and Operations Management and Introduction to Quality Concepts	**04 Hours**
Production and Operations Management: Introduction - Functions within business organizations - the operation management function - Classification of production systems. Introduction to Quality Concepts: The Meaning of Quality and Quality Improvement - Key dimensions of Quality - Concept of cost of quality - Customers' perception of quality.	
Introduction to Technological Innovation	**09 Hours**
Basic Concepts and Definitions: Technology - Technology Management – Invention – Creativity – Innovation - The Concept of Technological Innovation - Innovation Posture, Propensity and Performance - Innovation Measurement - Key factors linking creativity and innovation – Classifications of Innovations – Innovation Process.	
Startup Idea Pitching	**03 Hours**

UNIT-II

Introduction to Innovation Management and Innovation & Competitiveness	**07 Hours**
Introduction to Innovation Management: Innovation Management Through Management of Knowledge and Education – Types of Learning - Difference Between Innovation and Invention - Types and Characteristics of Innovation. Innovation and Competitiveness: Case Study – Barriers for Innovation and Competitiveness	
Innovation as a Management Process	**08 Hours**
Activities to enhance companies' capacity for innovation – Management of Technological Innovation: Corporate Perspective, National Perspective, Theoretical Perspective and Individual Perspective - Challenges in Technological Innovation Management - Case Study in Technological Innovation Management - Innovation Management Techniques (IMTs).	

UNIT-III

Innovation Systems and Technology Management & Transfer	**04 Hours**
Innovation Systems: The Concept of Innovation Systems - Innovation Systems: Sectoral, Regional, National. Technology Management and Transfer: Technology Transfer - Impacts of MNCs in technology transfer	
Introduction to Technological Forecasting	**05 Hours**
Introduction - Applications & Limitations of Technological Forecasting – Technology Forecasting Techniques – Exploratory Forecasting – Normative Forecasting – Delphi Technique – Problems of Technological Forecasting	

Course Outcomes: At the end of the course student will be able to

1.	Define operations management and quality.
2.	Describe technological innovation and its key features for business.

3.	Discuss innovation management and the difference between invention and innovation.
4.	Explain innovation as a management process, its management and perspectives. Understand Innovation management techniques.
5.	Explain innovation systems, technology management transfer and basics of technological forecasting.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
ME1504-1.1	3	2	-	-	-	1	1	-	1	-	-	1
ME1504-1.2	3	2	-	-	-	1	1	-	1	-	-	1
ME1504-1.3	2	2	-	-	-	1	1	-	1	-	-	1
ME1504-1.4	2	2	-	-	-	1	1	-	1	-	-	1
ME1504-1.5	3	2	-	-	-	1	1	-	1	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Carayannis, Elias G., Samara, Elpida T., Bakouros, Yannis L., "Innovation and Entrepreneurship Theory, Policy and Practice", Springer, 2015.

REFERENCE BOOKS:

1. Dick Whittington, "Digital Innovation and Entrepreneurship", Cambridge University Press, 2018.

E Books / MOOCs/ NPTEL

1. https://krishi.icar.gov.in/jspui/bitstream/123456789/46063/1/21_Technological%20forecasting.pdf dtd 12/06/2022
2. http://www.oipec.eu/wp-content/uploads/2017/07/Introduction-to-Technology-Forecasting.pdf dtd 12/06/2022

HUMAN RESOURCE MANAGEMENT

Course Code:	**MG1501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	To develop a meaningful understanding of HRM theory, functions and practices.
2.	To understand concepts and skills recruitment.
3.	To understand the concepts of training and development.
4.	To deal with employees' grievances, safety and health types of organizations.
5.	To understand the concepts of e-HRM.

UNIT-I

Human Resource Management & HRP — **08 Hours**

Introduction, meaning, nature, scope of HRM. Major functions of HRM, Personnel Management vs Human Resource Management, job design, job evaluation, job analysis, job specification, job enlargement, job enrichment. Role of HR Manager.HR Planning. Process HRP.

Recruitment — **08 Hours**

Definition, Sources and Methods of Recruitment Selection: Definition and Process of Selection. Cost benefit analysis of selection.

Placement: Meaning, Induction/Orientation, Internal Mobility, Transfer, Promotion, Demotion and Employee Separation. Performance Appraisal methods.

Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-II

Training and development — **07 Hours**

Training v/s development, stages in training, Training Methods, Executive Development, Methods and Development of Management Development, Career and Succession Planning.

Compensation — **08 Hours**

Employee remuneration, rewards, Wage and Salary Administration, Bonus, fringe benefits. Internal Mobility, External Mobility, Trade union Act (Amendment) 2001.

Employee Grievances: Employee Grievance procedure. Discipline procedure

Collective bargaining; Characteristics, Necessity, Forms Safety & Health; Industrial accidents, Safety Quality circle; Meaning, Structure

Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-III

IHRM and e-HRM — **09 Hours**

Managing IHRM. e-HR Activities, Global recruitment, selection, expatriates. Industrial conflict –Causes, Types, Prevention and Settlement.

Aspects of e-HRM,e-Job design & Analysis, Ethical issues in employment

Pedagogy: Chalk and talk method, Power Point Presentation

Course Outcomes: At the end of the course student will be able to

1.	Describe the basic concepts of HRM & HRP.
2.	Elucidate the HRM functions of recruitment, selections, and appraisal.
3.	Apply the training, development and compensation methods in HRD.
4.	Identify the employee grievances to spell out the remedial measures.
5.	Infer the concepts of e-HRM and I-HRM.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MG1501-1-1.1	3	-	-	-	-	1	-	-	1	1	-	1
MG1501-1-1.2	3	-	-	-	-	1	-	-	1	1	-	1
MG1501-1-1.3	3	-	-	-	-	1	-	-	1	1	-	1
MG1501-1-1.4	3	-	-	-	-	1	-	-	1	1	-	1

MG1501-1-1.5	3	-	-	-	-	1	-	-	1	1	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	P Courseba Rao, "Essentials of Human Resource Management & Industrial Relations", Third Revised Edition.
REFERENCE BOOKS:	
1.	John M. Ivancevich, "Human Resource Management", 10/e, McGraw Hill.
2.	Flippo, "Human Resource Management".
E Books / MOOCs/ NPTEL	
1.	http://edx.nimt.ac.in/courses/course-v1:nimtX+PGDM1212+2017_H1/about

MANAGEMENT ACCOUNTING AND CONTROL SYSTEM

Course Code:	**MG1502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Management

Course Objectives:

1.	Apply Cost Accounting concepts and techniques in the decision-making process.
2.	Make decisions such as pricing, special order pricing, make-or-buy and elimination of a part of the company or replacement of equipment.
3.	Understand the relevance of different types of costs in the decision-making process such as relevant costs, sunk costs or controllable costs.
4.	Understand fundamental concepts in Financial, Cost & Management Accounting.
5.	Develop analytical skills associated with the preparation and interpretation of Financial Statement

UNIT-I

Introduction to Cost and Management Accounting and Marginal Costing — **07 Hours**

Cost Accounting – Meaning, Objectives and Scope, Management Accounting – Meaning, Objectives and Scope, Tools and Techniques of Management Accounting, Relationship of Cost Accounting, Financial Accounting, Management Accounting and Financial Management, Conflicts in Profit versus Value Maximization Principle, Role of Management Accountant in Decision Making.

Marginal Costing — **08 Hours**

Meaning, Advantages, Limitations and Applications. Breakeven Analysis, Cost Volume Profit Analysis, P/V Ratio and its Significance, Margin of Safety, Absorption Costing: System of Profit Reporting and Stock Valuation, Difference between Marginal Costing and Absorption Costing, Income Measurement under Marginal Costing and Absorption Costing. (Practical Problems)

UNIT II

Standard Costing and Budgetary Control — **07 Hours**

Standard Costing – Definition, Significance and Applications, Various Types of Standards, Installation of Standard Costing System-for Material, Labour, and Overhead. Variance Analysis for Materials, Labour and Overheads, Accounting Treatment of Variances. Benchmarking for Setting of Standards, Variance Reporting to Management. (Practical Problems)

Budgetary Control — **08 Hours**

Budget Concept, Manual, Fixed and Flexible Budgets, Preparation and Monitoring of Various Types of Budgets, Budgetary Control System- Advantages, Limitations and Installation. Zero Base Budgeting, Programme and Performance Budgeting. (Practical Problems)

UNIT III

Fund Flow and Cash Flow Statement — **05 Hours**

Fund Flow Statement Analysis – Definition, Features, Steps for Preparation of Fund Flow Statement.

Cash Flow Statement Analysis — **05 Hours**

Classification, Preparation of Cash Flow Statement, Uses of Cash Flow statement, Difference between Cash Flow and Fund Flow Statement. (Practical Problems)

Course Outcomes: At the end of the course student will be able to

1.	Describe the Cost Accounting concepts and techniques in the decision making process.
2.	Elucidate the Make decisions such as pricing, special order pricing, make-or-buy and elimination of a part of the company or replacement of equipment.
3.	Apply the relevance of different types of costs in the decision making process such as relevant costs, sunk costs or controllable costs.
4.	Identify fundamental concepts in Financial, Cost & Management Accounting.
5.	Infer the analytical skills associated with the preparation and interpretation of Financial Statement

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MG1502-1-1.1	3	-	-	-	-	1	-	-	1	1	-	1

MG1502-1-1.2	3	-	-	-	-	1	-	-	1	1	-	1
MG1502-1-1.3	3	-	-	-	-	1	-	-	1	1	-	1
MG1502-1-1.4	3	-	-	-	-	1	-	-	1	1	-	1
MG1502-1-1.5	3	-	-	-	-	1	-	-	1	1	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	M.Y. Khan and P.K. Jain. “Management Accounting”, McGraw-Hill Education
2.	Robert N. Anthony, “Management Accounting”, Richard Dirwin.
3.	I.M. Pandey , “Management Accounting”, Vikas Publishing House.
4.	Paresh shaw, “Management Accounting”, Oxford University Press.
5.	A. Murthy and S. Gurusamy , “Management Accounting”, McGraw Hill.
6.	NM Singhvi and Ruzbeh J. Bodhanwala, “Management Accounting”, PHI learning Pvt. Ltd.

OPERATIONS AND QUALITY MANAGEMENT

Course Code:	**MG1503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Management

Course Objectives:

1.	Define production/operations management. Differentiate between Production and service system and types of production systems Discuss continuous and intermittent production systems with their advantages and disadvantages. Discuss CRM and ERP systems.
2.	Solve problems on fundamentals of statistics and normal distribution. Draw and Analyze variable process control charts and determine process capability.
3.	Discuss Total Quality Management tools and methods. Calculate reliability of series and parallel systems using the information on failure rate and time.
4.	Solve decision-making problems using break even analysis and decision tree methods. Apply the concepts of Design and System capacity. Solve problems on faculty location using break even analysis and transportation method. Solve problems related to product and process layouts.
5.	Use concepts of replacement theory to solve problems of replacing items that fail gradually and suddenly.

UNIT-I

Production and Operations Management — **06 Hours**

Introduction, Functions within business organizations, the operation management function, Classification of production systems, Productivity, factors affecting productivity, Introduction to Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP).

Philosophy of statistical process control and modeling process quality — **11 Hours**

Normal distribution tables, Finding the Z score, Central limit theorem, Chance and assignable causes of variation, Statistical Basis of the Control Charts (basic principles, choices of control limits, significance of control limits, warning limits)

Control charts for variables: Control Charts for X-Bar and R- Charts, Type I and Type II errors, Simple Numerical Problems,

Process capability: The foundation of process capability, Natural Tolerance limits, c_p – process capability index, c_{pk}, p_p – process performance index, summary of process measures. Numerical problems. Concept of Six sigma.

Pedagogy: Chalk and talk method, Power Point Presentation

UNIT II

Quality Concepts and Reliability — **06 Hours**

Introduction to Quality Concepts: The Meaning of Quality and Quality Improvement, Key dimensions of Quality, Concept of cost of quality. Customers' perception of quality.

TOTAL Quality Management: Definition, Principles of TQM, Gurus of TQM, Benefits of TQM.

Managing Quality: Quality circles, Continuous Improvement- Juran's Trilogy, PDSA cycle, Kaizen, 7 QC tools.

Introduction to reliability, Mean time to failure, Mean time between failures, Bath tub curve, Reliability of series and parallel systems, Numerical problems on the above topics.

Operations Management activities — **12 Hours**

Decision Making: The decision process, characteristics of operations decisions, use of models - decision making environments. Break even Analysis, Decision trees.

Capacity Planning: Importance of capacity decisions, defining and measuring capacity, determinants of effective capacity. Design, System an actual capacity. System efficiency and utilization. Determination of Equipment requirement for a single stage production processes. Numerical problems on the above.

Facilities location planning: Need for location decisions, nature of locations decisions, general procedure for making locations decisions, Use of Breakeven analysis and Transportation algorithms for making location decisions.

Facilities layout planning: Need for layout decisions. Minimizing material handling cost in process ayout using Load distance analysis, Simple line balancing problems in product layout.

UNIT III

Replacement Theory	**05 Hours**
Replacement policy for equipment which deteriorates gradually. Replacement of items that fail suddenly. Pedagogy: Chalk and talk method, Power Point	

Course Outcomes: At the end of the course student will be able to

1.	Define production/operations management. Differentiate between Production and service system and types of production systems Discuss continuous and intermittent production systems with their advantages and disadvantages. Discuss CRM and ERP systems.
2.	Solve problems on fundamentals of statistics and normal distribution. Draw and Analyze variable process control charts and determine process capability.
3.	Discuss Total Quality Management tools and methods. Calculate reliability of series and parallel systems using the information on failure rate and time.
4.	Solve decision-making problems using break even analysis and decision tree methods. Apply the concepts of Design and System capacity. Solve problems on faculty location using break even analysis and transportation method. Solve problems related to product and process layouts.
5.	Use concepts of replacement theory to solve problems of replacing items that fail gradually and suddenly.

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MG1503-1-1.1	2	1	-	-	-	-	-	-	-	-	2	-
MG1503-1-1.2	2	2	-	-	-	-	-	-	-	-	2	-
MG1503-1-1.3	1	1	-	-	-	-	-	-	-	-	2	-
MG1503-1-1.4	3	2	-	-	-	-	-	-	-	-	3	-
MG1503-1-1.5	1	1	-	-	-	-	-	-	-	-	1	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Joseph G Monks, "Production / Operations Management", McGraw Hill Books
2.	William J Stevenson, "Production and Operations Management", Tata McGraw Hill, 8th Edition.
3.	RC Gupta, "Statistical Quality Control", Khanna Publishers, New Delhi, 2005.
4.	N.D. Vohra, "Quantitative Techniques in Management", Tata McGraw Hill, 2015

REFERENCE BOOKS:

1.	E.L. Grant and R.S. Leavenworth, "Statistical Quality Control", 7th edition, McGraw- Hill publisher, 2004.
2.	Prem Kumar Gupta, D S. Hira, "Operations Research", S Chand Publications, New Delhi, 2nd edition 2008, Prentice Hall.
3.	W S Messina, "Statistical Quality Control for Manufacturing Managers", Wiley & Sons, Inc. New York, 1987
4.	Montgomery, Douglas, "Statistical Quality Control", 5th Edition, John Wiley & Sons, Inc. 2005, Hoboken, NJ.
5.	Jerry Banks, "Principles of Quality Control", Wiley & Sons, Inc. New York.

ORGANIZATIONAL BEHAVIOUR

Course Code:	**MG1504-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Management

Course Objectives:

1.	Describe the Nature and Characteristics, Determinants and Approaches of Organizational Behaviour. Describe the concepts of Perception, Attitudes and values and their implications.
2.	Describe the concepts of learning and motivation along with their managerial implications.
3.	Describe the concepts of Leadership along with their managerial implications.
4.	Discuss the concepts of group dynamics and conflict management along with their implications.
5.	Discuss the concepts of Organization culture and change and conflict management along with their implications.

UNIT-I

15 Hours

Introduction: Conceptual Foundation of Organisational Behaviour; Nature and Characteristics; Determinants; Contributing Disciplines; Challenges and Opportunities for Organisational Behaviour, Models and Approaches of Organizational Behaviour, OB and Emotional Intelligence.

Perception, Attitude, and Values: Nature, Process, Importance, Factors Influencing Perception; Attribution Theory of Perception; Issues Involved in Perception: Selective Perception, Halo Effect, Contrast Effect, Projection, Stereotyping; Concept of Pygmalion Effect; an overview of Emotions and feelings, Values, Beliefs and Attitudes with Managerial Implications.

Learning: Concept; Theories of Learning: Conditioning, Social Learning, Managerial Implication of Learning Theories. Reinforcement.

Motivation: Concept, Major Theories and Process of Motivation: Maslow's Need-Hierarchy Theory; Herzberg's Motivation-Hygiene Theory; McGregor's Theory X and Theory Y; Goal- Setting Theory; ERG Theory; Vroom's Expectancy Theory; Equity Theory; Managerial implications of Various Theories.

Pedagogy: Chalk and talk method, Power Point Presentation, Case studies

UNIT II

15 Hours

Leadership: Concept and Functions; Style and Theories of Leadership: Traits, Behavioural and Situational/ Contingency Groups of Theories; Inspirational approaches to Leadership; Charismatic Leadership, Transformational Leadership, and Transactional Leadership, Contemporary Leadership Roles; Challenges to the Leadership Construct; Substitutes and Neutralizers to Leadership.

Group Behaviour: Groups: Concept and Classification; Stages of Group Development; Group Structure; Roles and Norms; Premise and Issues; Group Decision-Making: Group vs Individual; Groupthink and Groups Shift; Group Decision Making Techniques and Process.

Conflict Management: Concept; Causes; Types; Stages; Effects; Management of Conflicts.

Pedagogy: Chalk and talk method, Power Point Presentation, Case studies

UNIT III

10 Hours

Organizational Culture: Concept; Dominant Culture; Strong vs Weak Cultures ; Creating and Sustaining Culture; Employees Learning of The Culture; Creating a Customer-Responsive Culture.

Organizational Changes: Concept and Forces for Change; Managing Planned Changes; Resistance to Change; Approaches to Manage Organizational Change; Organizational Development; Culture-Boundedness of Managing the Change.

Pedagogy: Chalk and talk method, Power Point Presentation, Case studies

Course Outcomes: At the end of the course student will be able to

1.	Describe the Nature and Characteristics, Determinants and Approaches of Organizational Behaviour. Describe the concepts of Perception, Attitudes and values and their implications.
2.	Describe the concepts of learning and motivation along with their managerial implications.
3.	Describe the concepts of Leadership along with their managerial implications.
4.	Discuss the concepts of group dynamics and conflict management along with their implications.

5.	Discuss the concepts of Organization culture and change and conflict management along with their implications.

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
MG1504-1-1.1	2	-	-	-	-	-	-	-	3	1	-	-
MG1504-1-1.2	2	-	-	-	-	-	-	-	3	1	-	-
MG1504-1-1.3	1	-	-	-	-	-	-	-	3	1	-	-
MG1504-1-1.4	3	-	-	-	-	-	-	-	3	1	-	-
MG1504-1-1.5	1	-	-	-	-	-	-	-	-	1	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Robbins, SP Stephen P, Timothy Judge and Nehasika Vohra, "Organisational Behaviour", 12th or 16th edition, Pearson Education, 2011.
2.	Fred Luthans, "Organisational Behaviour", 11th edition, Mc Graw Hill, 2009.

REFERENCE BOOKS:

1.	W. Newstrom, John, "Organisational Behaviour", 10th edition, Tata Mc Graw –Hill 2009.
2.	Paul Heresy, Kenneth H. Blanchard, and Dewey E. Johnson, "Management of Organisational Behaviour", Leading Human Resources, 2008.
3.	Dr S S Khanka, "Organisational Behaviour", S. Chand & Co, New Delhi, 2008.
4.	Sanghi Seema, "Organisational Behaviour", Pearson, 2011.

TAXATION FOR ENGINEERS

Course Code:	**MG1505-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Management

Course Objectives:

1.	To make students understand the overview of Income Tax Law in India.
2.	To make students understand the basic concepts of income tax such as residential status, tax incidence.
3.	To make students understand the income tax provisions involved in determination of income from salary, House property, business and profession, capital gain and other sources.
4.	To help students understand the determination of tax liability Individual assessees.
5.	To make students understand the deductions u/s 80.

UNIT-I

Basic concepts and Explanation under various Heads of Income	**15 Hours**

Basic concepts: Assessment Year, Previous Year, Person, Assessee, Income, Charges on Income, Gross Total Income, Capital and Revenue Receipts, Residential status, Connotation of income, Deemed to accrue or arise in India, Incidence of tax, Tax Planning, Tax Evasion, Tax Management. (Problems on Residential Status of Individual assessee)

Explanation under various Heads of Income: Income from Salary (theory, basic and full-fledged problems on allowances, perquisites and retirement benefits)

UNIT II

Income under the head Profit and gains of Business or Professions and Income under Capital Gain	**15 Hours**

Income under the head Profit and gains of Business or Professions and its computation - basis - Method of accounting - Scheme of business deductions/ allowance - Deemed profits - maintenance of books, (Problems on computation of Income from Business/ Profession of Individual assessee)
Income under Capital Gain: Basis of charge, Transfer of capital asset, inclusion & exclusion from Capital Asset, Capital Gain, Computation of Capital Gains (theory & problems), Exemptions/deductions from capital gains

UNIT III

Income from House Property and Other Sources	**10 Hours**

Income from House Property - Basic problems on House Property
Income from Other Sources (theory only)
Deductions under section 80C to 80U (No problems - Provisions only)

Course Outcomes: At the end of the course student will be able to

1.	Exhibit an understanding of the Income Tax Law in India.
2.	Identify the nature of Incomes and their tax incidence.
3.	Demonstrate how to determine the income from salary, house property, business and profession, capital gain.
4.	Demonstrate the determination of tax liability of Individual assessees.
5.	Exhibit a clear understanding of various provisions of deductions u/s 80.

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MG1505-1-1.1	2	-	-	-	-	1	-	-	1	-	2	1
MG1505-1-1.2	2	-	-	-	-	1	-	-	1	-	2	1
MG1505-1-1.3	3	-	-	-	-	1	-	-	1	-	2	1
MG1505-1-1.4	3	-	-	-	-	1	-	-	1	-	2	1
MG1505-1-1.5	3	-	-	-	-	1	-	-	1	-	2	1

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Vinod Singhania, "Students Guide to Income Tax", Taxman Publications.
2.	Mehrotra & Goyal, "Direct Tax", Sahitya Bhavan.
3.	Lal & Vashisht, "Direct Tax", Pearson Ed. 28E.
4.	V S Datey, "Indirect Taxes", Taxman Publications.
5.	Vinod Singhania, "Direct Taxes", Taxman Publications.
6.	T N Manoharan, "Students Guide to Income Tax", Snow White.
7.	Kul Bushan, "How to deal with VAT", Pearson Education/PHI, 1/e.
8.	Mahesh Chandra & Shukla , "Income Tax Law & Practice", Pragathi Publications.
9.	Dr.Pillai, "VAT", Jaico Publications.

WORKING CAPITAL MANAGEMENT

Course Code:	**MG1506-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Need of the Course: The course will enable the student to manage activities in the area of working capital in an enterprise and help the students to do advance study in the field of financial-management through detailed analysis of financial statements, liquidity crises, cash optimization, credit analysis etc. The student will learn how to apply sound techniques for managing inventory.

Description of the Course: Every business needs adequate liquid resources in order to maintain day-to-day cash flow. It needs enough cash to pay wages and salaries as they fall due and to pay creditors if it is to keep its workforce and ensure its supplies. Maintaining adequate working capital is not just important in the short-term. Sufficient liquidity must be maintained in order to ensure the survival of the business in the long-term as well. Even a profitable business may fail if it doesn't have adequate cash flow to meet its liabilities as they fall due.

Teaching Department: Management

Course Objectives:

1.	Discuss the importance of working capital management.
2.	Evaluate working capital requirement.
3.	Assess the challenges faced in managing working capital in domestic and international operations.
4.	Plan for financing working capital requirement.

UNIT-I

Working Capital Decisions, Working Capital Management and Sources of Working Capital — **15 Hours**

Working Capital Decisions: Meaning, Concepts, components Importance & types of working Capital.
Working Capital Management: Meaning, objectives, Principles, Importance of adequate working capital & consequences of inadequate working capital, Dangers of excessive working capital, determinants of working capital - operating cycle and Cash cycle. Approaches to determine an appropriate financing mix, Estimation of working capital requirements (problems) important working capital ratios.
Sources of Working Capital: Financing of long term working capital & short term working capital. Factoring - Meaning mechanism, Functions, types, merits & demerits.

UNIT II

Liquidity Management and Receivable Management — **15 Hours**

Liquidity Management: Cash Management - Meaning - Objectives of Cash Management - Nature of Cash - Motives of holding cash - Cash Management planning aspects - Cash Budgets (Problems), Cash Management control aspects - Concentration banking - Lock box system - Playing the float - Cash Management models - William J Baumol Model - Miller-Orr Model (Problems using these models)

Receivable Management: Definition, Objectives, cost and benefits of receivable. Credit policy & its variables. Types of Credit policy & their merits & demerits, Factors influencing the size of investment in receivables. Control of receivables. Framing optimum credit policy & Average collection period (Problems)

UNIT III

Inventory Management — **10 Hours**

Meaning of Inventory - Need/Purpose of holding inventory - Benefits of holding inventory - Risk and cost of holding inventory - Management of Inventory - Objectives of Inventory Management - Techniques of Inventory Management - Economic Order Quantity (EOQ) - Determination of Stock levels - ABC analysis - Just in Time (JIT).

Course Outcomes: At the end of the course student will be able to

1.	Understand the meaning of working capital
2.	Realize the importance of management of working capital in an organization
3.	Learn about some key liquidity ratios used to understand more about a business' working capital position
4.	Understand various techniques used to manage working capital.
5.	Be aware of the techniques of cash, inventory and receivables management.

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
MG1506-1-1.1	2	-	-	-	-	1	-	-	-	1	2	1
MG1506-1-1.2	2	-	-	-	-	1	-	-	-	1	2	1
MG1506-1-1.3	2	-	-	-	-	1	-	-	-	1	2	1
MG1506-1-1.4	2	-	-	-	-	1	-	-	-	1	2	1
MG1506-1-1.5	2	-	-	-	-	1	-	-	-	1	2	1

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Sekhar Satya G.V., "Working Capital Management", 1/e; New Delhi: Wiley, 2014.
2.	Bhalla V. K., "Working Capital Management", 1/e; New Delhi: S. Chand Publishing, 2014.
3.	Sagner James S., "Working Capital Management, Applications and Cases", 1/e, New Delhi: Wiley, 2015.

NANOTECHNOLOGY

Course Code:	**PH2501 -1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**PH1001 -1**		

Teaching Department: PHYSICS

Course Objectives:

1.	To understand the basic scientific concepts of nanoscience, properties of nano materials, synthesis and fabrication of nano materials.
2.	To understand the various characterization techniques of nano materials.
3.	Study of carbon nano technology and its characterizations.
4.	To understand the applications of nano technology in various science, engineering and technology fields.

UNIT-I

Properties of Materials	**07 Hours**

Introduction: History of nano science, definition of nano meter, nanomaterials, nano technology. Classification of nano materials. Crystal symmetries, crystal directions, crystal planes, Band structure.
Properties Of Materials: Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

Synthesis and Fabrication	**08 Hours**

Synthesis of bulk polycrystalline samples, growth of single crystals, Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography, Requirements for realizing semiconductor nano structure, growth techniques for nano structures.

UNIT-II

Characterization Techniques	**15 Hours**

X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy (TEM), scanning probe microscopy (SEM), atomic force microscopy (AFM), piezoresponse microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, UV-VIS-IR Spectrophotometers, Magnetic and electrical measurements and Infrared/ Raman, EPR and NMR

UNIT-III

Carbon Nano Technology	**05 Hours**

Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalling diamond films, grapheme, and applications of carbon nano tubes.

Applications of Nano Technology	**05 Hours**

Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin films, applications of quantum dots.

Course Outcomes: At the end of the course student will be able to

1.	Ability to choose the appropriate nano material to meet the requirerment of a particular application.
2.	Identify the essential concepts used in nanotechnology.
3.	Identify the materials, properties, synthesis and fabrication of nanomaterials.
4.	Understand the various characterization techniques of nano materials.
5.	Applications of nanomaterials in various fields

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
PH2501-1.1	3	3	-	-	-	-	-	-	-	-	-	-
PH2501-1.2	3	3	-	-	-	-	-	-	-	-	-	-
PH2501-1.3	3	3	-	-	-	-	-	-	-	-	-	-

PH2501-1.4	3	3	-	-	-	-	-	-	-	-	-	-
PH2501-1.5	3	3	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	M.S. Ramachandra Rao, Shubra Singh, "Nano science and nano technology", Wiley publishers.

REFERENCE BOOKS:

1.	Charles P. Poole, Jr. Frank J. Owens, "Introduction to Nano Technology", Wiley publishers.
2.	Jermy J Ramsden, "Nanotechnology", Elsevier publishers.
3.	A. K. Bandyopadhyay, "Nano Materials", New Age publishers.
4.	T. Pradeep, "Nano Essentials", TMH.
5.	M. A. Shah, "Nanotechnology the Science of Small", Wiley publishers.
6.	Phani Kumar, "Principles of Nanotechnology", Scitech.

E Books / MOOCs/ NPTEL

1.	https://youtu.be/ebO38bbq0_4
2.	https://youtu.be/0MzIh7wkgMs

OPTOELECTRONIC DEVICES

Course Code:	**PH2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**PH1001 -1**		

Teaching Department: PHYSICS

Course Objectives:

1.	To understand the basic principles of construction, working and applications of various optoelectronic devices.
2.	Study of sources of radiation like lasers and LED, their specific properties and hence their use for applications.
3.	Study of radiation detectors like semiconductor detector, diode as detector and photo multiplier.
4.	Understanding the fabrication and applications of optical fibers, optical modulators and waveguides for optical communication

UNIT-I

Optical processes in Semiconductor, Display devices & Optical fibers — **15 Hours**

Elements of optical phenomena in Semiconductors- fundamentals of Fermi-Dirac distribution, band structure, direct and indirect band gap semiconductors, generation-recombination mechanisms, absorption and emission processes.
Display devices- cathode ray tube, liquid crystal display, charge coupled devices, plasma display.
Optical fibers- types of fibers, modes of propagation, attenuation and losses, optical fiber communication system, advantages.

UNIT-II

Optical Sources and Detectors — **15 Hours**

Lasers- basic principles, optical resonator-types, modes and quality factor, practical lasers- Nd-YAG, CO2, Excimer laser, Semiconductor laser- basic structure, laser action, heterojunction laser, quantum well laser, applications.
Light emitting diode- electroluminescence in p-n junction, LED characteristics, efficiency and responsivity, Heterojunction LED, Surface-Emitting LED and Edge emitting LED.
Photo detectors- photo conductor detector, junction photo diode, p-i-n photo diode, avalanche photo diode. Photo multiplier tube.

UNIT-III

Integrated Optics and Modulators — **10 Hours**

Modulation of light- Analog and digital modulation, Direct modulation - using LED and Semiconductor diode laser (SDL). External modulation - Electro-optic modulators (Pockels effect), Electro-absorption modulators. Acousto-optic modulation. Waveguides- device structure, waveguide devices – waveguide lenses, light bending devices, optical power dividers, directional couplers, waveguide polarizer, wavelength multiplexers and demultiplexers. Waveguide coupling. Optoelectronic integrated circuit

Course Outcomes: At the end of the course student will be able to

1.	Ability to choose the appropriate device to meet the requirement of a particular application.
2.	Making modifications to device structures by understanding the factors affecting their performance.
3.	Attempting better efficiency and utility through an understanding of the principles of performance.
4.	Use the technical knowledge acquired to troubleshoot and rectify devices and circuits.
5.	Explore the possibility of designing devices with better characteristics.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
PH2502-1.1	3	3	-	-	-	-	-	-	-	-	-	-
PH2502-1.2	3	3	-	-	-	-	-	-	-	-	-	-
PH2502-1.3	3	3	-	-	-	-	-	-	-	-	-	-
PH2502-1.4	3	3	-	-	-	-	-	-	-	-	-	-
PH2502-1.5	3	3	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High	
TEXTBOOKS:	
1.	P.R.Sasikumar, "Photonics – an introduction", PHI Learning Pvt. Ltd.,New Delhi, 2012 edition.
2.	Pallab Bhattacharya, “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., New Delhi, 2006.
REFERENCE BOOKS:	
1.	J.Wilson and J.Haukes, "Opto electronics- an introduction", Prentice Hall of India, New Delhi.
2.	Jasprit Singh, ‘"Opto electronics- an introduction to Materials and Devices", McGraw Hill international ed., 1998.
3.	A.Ghatak and Thyagarajan, "Introduction to opto electronics", New Age International Publication.
E Books / MOOCs/ NPTEL	
1.	http://nptel.ac.in/courses/115102026/

AUTONOMOUS MOBILE ROBOTS

Course Code:	**RI2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC 1001-1, ME 1003-1**		

Teaching Department: Robotics and Artificial Intelligence

Course Objectives:

1.	Explain different types of locomotion in mobile robots to obtain a required task.
2.	Understand the different types of kinematics and dynamics involved in a mobile robot.
3.	Study the different types of sensors used in an autonomous mobile robot.
4.	Understand the different types of algorithms to identify the position of the mobile robot.
5.	Understand the various algorithms for planning and navigation of the mobile robot.

UNIT-I

Robot locomotion — **07 Hours**

Types of locomotion, hopping robots, legged robots, wheeled robots, stability, maneuverability, and controllability.

Mobile robot kinematics and dynamics — **09 Hours**

Forward and inverse kinematics, holonomic and nonholonomic constraints, kinematic models of simple car and legged robots, dynamics simulation of mobile robots.

UNIT-II

Perception — **07 Hours**

Proprioceptive/Exteroceptive and passive/active sensors, performance measures of sensors, sensors for mobile robots like global positioning system (GPS), Doppler effect-based sensors, vision-based sensors, uncertainty in sensing, filtering.

Localization — **07 Hours**

Odometric position estimation, belief representation, probabilistic mapping, Markov localization, Bayesian localization, Kalman localization, and positioning beacon systems.

UNIT-III

Introduction to planning and navigation — **10 Hours**

Path planning algorithms based on A-star, Dijkstra, Voronoi diagrams, probabilistic roadmaps (PRM), rapidly exploring random trees (RRT), Markov Decision Processes (MDP), stochastic dynamic programming (SDP).

Course Outcomes: At the end of the course student will be able to

1.	Explain different types of locomotion in mobile robots to obtain a required task.
2.	Identify the different types of kinematics and dynamics involved in a mobile robot.
3.	Apply the different types of sensors used in an autonomous mobile robot.
4.	Apply the different types of algorithms to identify the position of the mobile robot.
5.	Apply the various algorithms for planning and navigation of the mobile robot to reach the destination.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
RI2501-1.1	3	3	3	3	2	1	-	-	-	-	-	3
RI2501-1.2	3	3	3	3	2	1	-	-	-	-	-	3
RI2501-1.3	3	3	3	3	2	1	-	-	-	-	-	3
RI2501-1.4	3	3	3	3	2	1	-	-	-	-	-	3
RI2501-1.5	3	3	3	3	2	1	-	-	-	-	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1. R. Siegwart, I. R. Nourbakhsh, "Introduction to Autonomous Mobile Robots", The MIT Press, 2011.
2. Peter Corke, "Robotics, Vision and Control: Fundamental Algorithms in MATLAB", Springer Tracts in Advanced Robotics, 2011.

3.	S. M. LaValle, “Planning Algorithms”, Cambridge University Press, 2006. (Available online http://planning.cs.uiuc.edu/)
REFERENCE BOOKS:	
1.	Thrun, S., Burgard, W., and Fox, D., "Probabilistic Robotics". MIT Press, Cambridge, MA, 2005.
2.	Melgar, E. R., Diez, C. C., "Arduino, and Kinect Projects: Design, Build, Blow Their Minds", 2012.
3.	H. Choset, K. M. Lynch, S. Hutchinson, G. Kantor, W. Burgard, L. E. Kavraki, and S. Thrun, "Principles of Robot Motion: Theory, Algorithms, and Implementations", PHI Ltd., 2005.
E Books / MOOCs/ NPTEL	
1.	https://archive.nptel.ac.in/courses/112/106/112106298/
2.	https://www.edx.org/course/autonomous-mobile-robots

MEDICAL ROBOTICS
(For All except AI)

Course Code:	**RI2502-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**PH 1001-1, IS 1001-1, CY 1001-1**		

Teaching Department: Robotics and Artificial Intelligence

Course Objectives:

1.	Understand the types of medical robots used in the field of healthcare.
2.	Explain the various localization and tracking sensors
3.	Understand the applications of surgical robots with the help of few case studies
4.	Understand Rehabilitation of limbs and brain machine interface with the help of few case studies
5.	Understand the design methodology of medical robots.

UNIT-I

Introduction	**07 Hours**
Types of medical robots - Navigation - Motion Replication - Imaging - Rehabilitation and Prosthetics - State of art of robotics in the field of healthcare. Localization And Tracking	
Position sensors requirements	**09 Hours**
Tracking - Mechanical linkages - Optical - Sound-based - Electromagnetic -Impedance-based - In-bore MRI tracking - Video matching - Fiber optic tracking	

UNIT-II

Control Modes Radiosurgery	**07 Hours**
Orthopedic Surgery - Urologic Surgery and Robotic Imaging - Cardiac Surgery – Neurosurgery – case studies.	
Rehabilitation	**07 Hours**
Rehabilitation for Limbs - Brain-Machine Interfaces - Steerable Needles – case studies.	

UNIT-III

Design of Medical Robots	**10 Hours**
Characterization of gestures to the design of robots- Design methodologies- Technological choices - Security	

Course Outcomes: At the end of the course student will be able to

1.	Describe the types of medical robots and the concepts of navigation and motion replication.
2.	Describe about the sensors used for localization and tracking
3.	Explain the applications of surgical robots
4.	Explain the concepts in Rehabilitation of limbs and brain machine interface
5.	Classify the types of assistive robots and analyze the design characteristics, methodology and technological choices for medical robots.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
RI2502-1.1	3	-	1	-	-	-	-	-	-	-	-	1
RI2502-1.2	3	-	1	-	-	-	-	-	-	-	-	1
RI2502-1.3	3	-	1	-	-	-	-	-	-	-	-	1
RI2502-1.4	3	-	1	-	-	-	-	-	-	-	-	1
RI2502-1.5	3	-	3	-	-	-	-	-	-	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, "Robot Modeling and Control", Wiley Publishers, 2006.
2.	Paula Gomes, "Medical robotics- Minimally, Invasive surgery", Woodhead, 2012.
3.	Achim Schweikard, Floris Ernst, "Medical Robotics", Springer, 2015.

REFERENCE BOOKS:	
1.	Jocelyne Troccaz, "Medical Robotics", Wiley-ISTE, 2012.
2.	Vanja Bonzovic, "Medical Robotics", I-tech Education publishing Austria, 2008.
3.	Daniel Faust, "Medical Robotics", Rosen Publishers, 2016.
4.	Jocelyne Troccaz, "Medical Robotics", Wiley, 2013.
E Books / MOOCs/ NPTEL	
1.	https://www.futurelearn.com/courses/medtech-ai-and-medical-robots
2.	https://web.stanford.edu/class/me328/

PLC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS
(For All except AI)

Course Code:	**RI2503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EE 1001-1, EC 1001-1**		

Teaching Department: Robotics and Artificial Intelligence

Course Objectives:

1.	To understand the fundamentals of fluid power transmission systems
2.	To design various hydraulic system components.
3.	To design various pneumatic system components.
4.	Learn various types of hydraulic and pneumatic power circuits.
5.	Learn various types of applications in fluid power circuits using PLC.

UNIT-I

Fluid power systems and fundamentals	**06 Hours**

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, General types of fluids - Properties of hydraulic fluids -Fluid power symbols. Basics of Hydraulics-Applications of Pascal's Law

Hydraulic system components	**05 Hours**

Sources of Hydraulic Power: Pumping theory - Pump classification - construction and working of pumps - Variable displacement pumps, pump performance. Actuators: Linear hydraulic actuators-Single acting and double acting cylinders, Rotary actuators - Fluid motors.

Control Components	**04 Hours**

Direction control valve - Valve terminology - Various center positions. Shuttle valve - check valve - pressure control valve - pressure reducing valve, sequence valve. Flow control valves - Fixed and adjustable Safety valves.

UNIT-II

Pneumatic system components	**07 Hours**

Pneumatic Components: Properties of air. Compressors. FRL Unit -Air control valves, Quick exhaust valves and pneumatic actuators- cylinders, air motors. Basics of low-cost automation

Fluidics & Pneumatic circuit design	**08 Hours**

Fluidics - Introduction to fluidic devices, simple circuits. Introduction to Electrohydraulic Pneumatic logic circuits, PLC applications in fluid power control, Sequential circuit design for simple applications using classic, cascade, logic with Karnaugh- Veitch Mapping and combinational circuit design methods.

UNIT-III

Fluid power circuits	**10 Hours**

Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Ladder diagram. Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram for various circuits, motion controllers, use of field busses in circuits. Electronic drive circuits for various Motors.

Course Outcomes: At the end of the course student will be able to

1.	Compare the basics of hydraulics to the performance of fluid power systems
2.	Explain the working principle of hydraulic systems including pumps and control components.
3.	Explain the working principle of pneumatic systems and their components.
4.	Design various types of Electrohydraulic and electro pneumatic circuits
5.	Design various types of applications in fluid power circuits using PLC.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
RI2503-1.1	3	2	3	2	3	-	-	-	-	-	-	3
RI2503-1.2	3	2	3	2	3	-	-	-	-	-	-	3
RI2503-1.3	3	2	3	2	3	-	-	-	-	-	-	3
RI2503-1.4	3	2	3	2	3	-	-	-	-	-	-	3
RI2503-1.5	3	2	3	2	3	-	-	-	-	-	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Majumdar S.R., "Pneumatic systems - Principles and maintenance", Tata McGraw Hill, 2008.
2.	Anthony Esposito, "Fluid Power with Applications", Pearson Education 2009.

REFERENCE BOOKS:

1.	Majumdar S.R., "Oil Hydraulics", Tata McGraw-Hill, 2000.
2.	Harry L. Stevart D. B, "Practical guide to fluid power", Taraoeala sons and Port Ltd.Broadey, 2010.
3.	Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 2011.
4.	Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 2011.

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/108/105/108105088/
2.	https://plc-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering
3.	http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/COEP_KNOWLEDGE_SEEKERS/labs/exp1/theory.html

HUMANITIES, SOCIAL SCIENCES & MANAGEMENT COURSES

ಆಡಳಿತ ಕನ್ನಡ (KANNADA FOR ADMINISTRATION)

Course Code	**HU1003-1**	**Course Type**	**MNC**
Teaching Hours/Week (L:T:P:S)	**1:0:0:0**	**Credits**	**0**
Total Teaching Hours	**15+0+0+0**	**CIE + SEE Marks**	**50+0**

Teaching Department: Any Department

Course Objectives:

1.	ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡದ ಜೊತೆಗೆ ಕ್ರಿಯಾತ್ಮಕ ಕನ್ನಡವನ್ನು, ಕನ್ನಡ ಸಾಹಿತ್ಯ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಡು ನುಡಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2.	ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು ಮತ್ತು ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
3.	ಕನ್ನಡ ಭಾಷಾ ಬರೆಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗು ಅವುಗಳನಿವಾರಣೆ.
4.	ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆಸರ್ಕಾರಿ ಪತ್ರ ವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಡಿಸುವುದು.
5.	ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡ ದಪದಗಳ ಪರಿಚಯ ಮಾಡಿ ಕೊಡುವುಧು.

UNIT - I	
ಲೇಖನಗಳು: 1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ: ಹಂಪನಾಗರಾಜಯ್ಯ 2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ: ಒಂದು ಅಪೂರ್ವಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ 3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ – ವಿತಾವಿಯ ಆಡಳಿತ ಕನ್ನಡ ಪುಸ್ತಕದಿಂದ ಆಯ್ದ ಲೇಖನ **ಕಾವ್ಯಭಾಗ (ಆಧುನಿಕಪೂರ್ವ)** 1. ವಚನಗಳು: ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿಲಕ್ಕಮ್ಮ 2. ಕೀರ್ತನೆಗಳು: ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ - ಪುರಂದರದಾಸ 3. ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳುಮನವೆ - ಕನಕದಾಸ 4. ತತ್ವಪದಗಳು: ಸಾವಿರ ಕೊಡಗಳಸುಟ್ಟು - ಶಿಶುನಾಳಪಂಥಷರೀಫ 5. ಶಿವಯೋಗಿ: ಬಾಲಲೀಲಾ ಮಹಾಂತ ಶಿವಯೋಗಿ 6. ಜನಪದಗೀತೆ: ಬೀಸುವಪದ, ಬಡವರಿಗೆ ಸಾವ ಕೊಡಬೇಡ	**06 Hours**

UNIT – II	
ಕಾವ್ಯಭಾಗ (ಆಧುನಿಕ) 1. ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ: ಡಿ.ವಿ.ಜಿ. 2. ಕುರುಡು ಕಾಂಚಾಣ: ದ.ರಾ.ಬೇಂದ್ರೆ 3. ಹೊಸಬಾಳಿನ ಗೀತೆ: ಕುವೆಂಪು 4. ಹೆಂಡತಿಯ ಕಾಗದ: ಕೆ .ಎಸ್. ನರಸಿಂಹಸ್ವಾಮಿ 5. ಮಬ್ಬಿನಿಂದ ಮಬ್ಬಿಗೆ: ಜಿ. ಎಸ್. ಶಿವರುದ್ರಪ್ಪ 6. ಆಮರ ಈ ಮರ: ಚಂದ್ರಶೇಖರ ಕಂಬಾರ 7. ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು: ಸಿದ್ಧಲಿಂಗಯ್ಯ **ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಪರಿಚಯ, ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ** 1. ಡಾ. ಸ ರ್ಎಂ ವಿಶ್ವೇಶ್ವರಯ್ಯ – ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ: ಎ ಎನ್ಮೂರ್ತಿ ರಾವ್	**06 Hours**

2. ಯುಗಾದಿ: ವಸುಧೇಂದ್ರ

3. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ. ಚಿ. ಬೋರಲಿಂಗಯ್ಯ

UNIT – III

ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ: 1. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ: ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ 2. 'ಕ' ಮತ್ತು 'ಬ' ಬರಹ ತಂತ್ರಾಂಶಗಳು ಮತ್ತು ಕನ್ನಡ ಟೈಪಿಂಗ್ 3. ಕನ್ನಡ: ಕಂಪ್ಯೂಟರ್ಶಬ್ದಕೋಶ 4. ತಾಂತ್ರಿಕ ಪದಕೋಶ: ತಾಂತ್ರಿಕ ಹಾಗೂ ಪಾರಿಭಾಷಿಕ ಕನ್ನಡ ಪದಗಳು	**03 Hours**

Course Outcomes: At the end of the course student will be able to

1.	ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡದ ಜೊತೆಗೆ ಕ್ರಿಯಾತ್ಮಕ ಕನ್ನಡವನ್ನು, ಕನ್ನಡಸಾಹಿತ್ಯ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಡುನುಡಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2.	ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು ಮತ್ತು ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
3.	ಕನ್ನಡ ಭಾಷಾ ಬರೆಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗು ಅವುಗಳ ನಿವಾರಣೆ.
4.	ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರ ವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
5.	ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುಧು.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓** 1	2	3
HU1003-1.1	-	-	-	-	-	-	-	3	-	-	1	1			
HU1003-1.2	-	-	-	-	-	-	-	2	-	-	1	1			
HU1003-1.3	-	-	2	-	-	-	1	2	-	-	1	1			
HU1003-1.4	-	-	-	-	-	-	-	1	-	-	-	-			
HU1003-1.5	-	-	1	-	-	-	-	3	-	-	1	1			

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	ಸಂಕ್ಷಿಪ್ತ ಕನ್ನಡನಿಗಂಟು (ಪರಿಷ್ಕೃತ), ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು.
2.	ಆಡಳಿತ ಪದಕೋಶ, ಕನ್ನಡ ಅಭಿವೃದ್ಧಿಪ್ರಾಧಿಕಾರ, ಬೆಂಗಳೂರು.
3.	ಕಾನೂನು ಪದಕೋಶ (ಪರಿಷ್ಕೃತ) ಕನ್ನಡ- ಇಂಗ್ಲಿಷ್, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂಗಳೂರು.
4.	ಡಿ.ಎನ್. ಶಂಕರ್ಭಟ್, ಕನ್ನಡವಾಕ್ಯಗಳ ಒಳರಚನೆ, ೨೦೦೬, ಭಾಷಾಪ್ರಕಾಶನ, ಮೈಸೂರು.
5.	ಕನ್ನಡ ಭಾಷಿಕ (ಅವಿಸ್ತರ)- ಪ್ರಬಂಧ ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ, ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮುಕ್ತ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಮೈಸೂರು.
6.	ಆಡಳಿತ ಕನ್ನಡ, ಎಚ್ಚೆಸ್ಕೆ, ಚೇತನ ಬುಕ್ಹೌಸ್, ಮೈಸೂರು.

BALAKE KANNADA (COMMUNICATION IN KANNADA)

Course Code	HU1003-1	Course Type	MNC
Teaching Hours/Week (L: T: P: S)	1:0:0:0	Credits	0
Total Teaching Hours	15+0+0+0	CIE + SEE Marks	50+0

Teaching Department: Any Department

Course Objectives:

1.	The course will enable the students to cognize Kannada and communicate in basic Kannada language.

UNIT - I

Basic Kannada Grammar Personal Pronouns, Possessive Forms, Interrogative words Possessive forms of nouns, Dubitive question and Relative nouns Qualitative, Quantitative and Colour Adjectives, Numerals Predictive Forms, Locative Case Dative Cases, and Numerals Ordinal numerals and Plural markers Defective / Negative Verbs and Colour Adjectives Permission, Commands, encouraging and Urging words (Imperative words and sentences) Accusative Cases and Potential Forms used in General Communication Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs Comparative, Relationship, Identification and Negation Words Different types of forms of Tense, Time and Verbs Formation of Past, Future and Present Tense Sentences with Verb Forms Karnataka State and General Information about the State Kannada Language and Literature Do's and Don'ts in Learning a Language	**06 Hours**

UNIT – II

Kannada Language Script Part – 1	**06 Hours**

UNIT – III

Kannada Vocabulary List & Kannada Words in Conversation	**03 Hours**

Course Outcomes: At the end of the course student will be able to

1.	Understand the parts of speech of Kannada
2.	Know the script in Kannada
3.	Able to Converse daily usages in Kannada
4.	Enrich Basic Kannada Vocabulary
5.	Have knowledge about Karnataka and its culture

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1003-1.1	-	-	-	-	-	-	-	3	-	-	1	1		
HU1003-1.2	-	-	-	-	-	-	-	2	-	-	1	1		
HU1003-1.3	-	-	2	-	-	-	1	2	-	-	1	1		
HU1003-1.4	-	-	-	-	-	-	-	1	-	-	-	-		
HU1003-1.5	-	-	1	-	-	-	-	3	-	-	1	1		

1: Low 2: Medium 3: High	
REFERENCE MATERIALS:	
1.	English –Kannada Rapidex Dictionary of Spoken Words, S N Raju, Bengaluru
2.	English Kannada Standard Dictionary, D K Bharadwaj, Sankeshwar Printers Pvt Ltd, Bengaluru
3.	ಮಾತಾಡುವ ಕನ್ನಡ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು (೨೦೧೮).
4.	ಸಂಕ್ಷಿಪ್ತ ಕನ್ನಡನಿಗಂಟು (ಪರಿಷ್ಕೃತ), ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು.
5.	ಆಡಳಿತ ಪದಕೋಶ, ಕನ್ನಡ ಅಭಿವೃದ್ಧಿಪ್ರಾಧಿಕಾರ, ಬೆಂಗಳೂರು.
6.	ಕನ್ನಡ ಭಾಷಾಕೈಪಿಡಿ, ಸಂಗಮೇಶ್ಸವ ದತ್ತಿಮಠ, ರೂಪರಶ್ಮಿ ಪ್ರಕಾಶನ, ಗುಲ್ಬರ್ಗ, ೧೯೯೫.
7.	ಡಿ.ಎನ್. ಶಂಕರ್ಭಟ್, ಕನ್ನಡ ವಾಕ್ಯಗಳ ಒಳ ರಚನೆ, ೨೦೦೮, ಭಾಷಾ ಪ್ರಕಾಶನ, ಮೈಸೂರು.
8.	ಕಾನೂನು ಪದಕೋಶ (ಪರಿಷ್ಕೃತ) ಕನ್ನಡ- ಇಂಗ್ಲಿಷ್, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂಗಳೂರು.

UNIVERSAL HUMAN VALUES

Course Code:	**HU1004-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L: T: P: S)	**1:0:0:0**	**Credits**	**01**
Total Teaching Hours	**15+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Humanities

Course Objectives:

1.	Enable students appreciate values, skills and behaviour with an appropriate understanding of 'Self' to attain sustained happiness and prosperity with right aspirations of life.
2.	Develop a holistic perspective among the students towards physical needs and prosperity of life.
3.	Develop a holistic approach and understand the importance of co-existence and living in harmony ensuring mutually fulfilling interaction with the society and nature.
4.	Strengthening of self-reflection.
5.	Development of commitment and courage to act.

UNIT-I

Need, Basic Guidelines, Content and Process for Value Education — **06 Hours**

Self-Exploration; 'Natural Acceptance' and Experiential Validation; Continuous Happiness and Prosperity; Right understanding, Relationship and Physical Facility; Understanding Happiness and Prosperity - living in harmony at various levels.

UNIT-II

Understanding Harmony in the Human Being, Family and Society — **06 Hours**

Understanding human being as a co-existence of the sentient 'I' and the material 'Body; the needs of Self ('I') and 'Body'; the Body as an instrument; Holistic perspective of Physical needs and Prosperity; Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

UNIT-III

Whole existence as Coexistence: Implications of the above Holistic Understanding of Harmony and Professional Ethics — **03 Hours**

Understanding the harmony in the Nature and Existence; Existence as Co-existence, Holistic perception of harmony at all levels of existence; Natural acceptance of human values, Professional Ethics

Course Outcomes: At the end of the course student will be able to

1.	Have a better self-exploration and understanding with a capacity to identify the priorities of life.
2.	Generate Sustainable solution to problems with focus on human values and value-based living.
3.	Have an understanding of the Holistic perspective of Physical needs
4.	Understand and practice living in harmony, co-existence and natural acceptance
5.	Exhibit Professional Ethics in the workplace

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
HU1004-1.1	-	-	-	-	-	-	-	3	-	-	2	2	-	-	-
HU1004-1.2	-	-	-	-	-	-	-	2	-	-	2	2	-	-	-
HU1004-1.3	-	-	2	-	-	-	1	2	-	-	2	2	-	-	-
HU1004-1.4	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
HU1004-1.5	-	-	1	-	-	-	-	3	-	-	2	2	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	R R Gaur, R Sangal, G P Bagaria, "Human Values and Professional Ethics", Excel Books, New Delhi, 2010

REFERENCE BOOKS:

1.	A Nagaraj, "Jeevan Vidya: Ek Parichaya", Jeevan Vidya Prakashan, Amarkantak, 1999
2.	A.N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004
3.	The Story of Stuff (Book).
4.	Mohandas Karamchand Gandhi, "The Story of My Experiments with Truth"

5.	E. F Schumacher, "Small is Beautiful"
6.	Cecile Andrews, "Slow is Beautiful"
7.	J C Kumarappa, "Economy of Permanence"
8.	Pandit Sunderlal, "Bharat Mein Angreji Raj"
9.	Dharampal, "Rediscovering India"
10.	Mohandas Karamchand Gandhi, "Indian Home Rule"
11.	Maulana Abdul Kalam Azad, "India Wins Freedom"
12.	Romain Rolland, "Vivekananda"
13.	Romain Rolland, "Gandhi"

ESSENCE OF INDIAN CULTURE

Course Code:	**HU1005-1**	**Course Type:**	**HEC**
Teaching Hours/Week (L: T: P: S):	**1:0:0:0**	**Credits:**	**01**
Total Teaching Hours:	**15**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Respective Department

Course Objectives:

1.	To facilitate students with the concepts of Indian Culture and to make them understand the roots of knowledge system.
2.	To acquaint students with Indian Culture and inculcate an ability to analyze it.
3.	To apply various approaches for the enhancement of living ideals based on Indian traditional knowledge.

UNIT-I

Introduction to Traditional Knowledge — **6 Hours**

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge and its characteristics, Traditional Knowledge vis-a-vis Indigenous Knowledge, Traditional Knowledge vis-a-vis Western Knowledge

UNIT-II

Significance of Traditional Knowledge — **6 Hours**

Value of Traditional Knowledge in global economy, Role of Government in harnessing Traditional Knowledge, Traditional medicine system, Traditional Knowledge in agriculture. food and healthcare.

UNIT-III

Holistic Healthcare for Human Well-being — **3 Hours**

Definition of Ayurveda, Ayurveda for Life, Health and Well-being, Introduction to principles of Ayurvedic healing and Astanga Ayurveda.

Course Outcomes: At the end of the course student will be able to

1.	Identify the concept of Traditional Knowledge and its importance.
2.	Explain the need for and importance of protecting Traditional Knowledge.
3.	Illustrate the various enactments related to Traditional Knowledge.
4.	Familiarize the importance of Holistic Healthcare.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1005-1.1	-	-	-	-	-	-	-	-	-	2	2	3	-	-
HU1005-1.2	-	-	-	-	-	-	-	-	-	3	2	3	-	-
HU1005-1.3	-	-	-	-	-	-	-	-	-	3	2	3	-	-
HU1005-1.4	-	-	-	-	-	-	-	-	2	2	2	2	-	-
HU1005-1.5	-	-	-	-	-	-	-	-	1	2	2	2	-	-

1: Low 2: Medium 3: High

REFERENCES:

1. Jha, A., “Traditional Knowledge System in India”, Atlantic Publishers, 2002.

2. Kapoor, K., & Danino, M., “Knowledge Traditions and Practices of India”, 2012.

3. Kapil Kapoor, Michel Danino, "Knowledge Traditions and Practices of India", Medknow Publications and Media.

4. Jha, R.N., “Science of Consciousness Psychotherapy and Yoga Practices”, Delhi: Vidyanidhi Prakashan, 2015.

5.	TEDx Talks. (2015, February 6). Unleashing the Power of Traditional Medicine | Dr. Arvind Singh [Video file]. Retrieved from https://www.youtube.com/watch?v=LZP1StpYEPM

INTRODUCTION TO IPR

Course Code:	**HU1006-1**	**Course Type:**	**HSMC**
Teaching Hours/Week (L: T: P: S):	**1:0:0:0**	**Credits:**	**01**
Total Teaching Hours:	**15**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Respective Department

Course Objectives:

1.	Enhancing the learning system through innovation and creative thinking skills for effective business process.
2.	Acquaint with special challenges of starting new ventures.
3.	Facilitate Entrepreneurial skills in recognizing opportunities for competitive advantages.
4.	Provide insights of financial aspects in planning and executing a business plan.
5.	Ascertain the role of IPR to protect innovations and intangible assets.

UNIT-I

Intellectual Property Rights (IPR) — **6 Hours**

Introduction to IPR: Business Perspective, IPR in India – Genesis and Development, International Context, Concept of IP Management, Uses in marketing

UNIT-II

Types of Intellectual Property — **6 Hours**

Patent - Procedure, Licensing and Assignment, Infringement and Penalty, Trademark, Example of Trademarks - Domain name, Geographical Indications, Copyright, Industrial Designs, Class Discussion - Major Court Cases regarding violation of Patents

UNIT-III

Basic Tenets of Information Technology Act, 2000 — **3 Hours**

IT Act – Introduction, E-Commerce and Legal Provisions, E- Governance, Digital signature and Electronic Signature, Cybercrimes

Course Outcomes: At the end of the course student will be able to

1.	Comprehend Innovation, its process and sources.
2.	Apply the process of building an innovative organization.
3.	Recognize the characteristics of different types of Entrepreneurships
4.	Formulate a business plan based on a business idea in Technology.
5.	Interpret basic tenets of Information Technology Act, 2000.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1006-1.1	-	-	-	-	-	-	-	-	-	2	-	3	-	-
HU1006-1.2	-	-	-	-	-	-	-	-	-	3	-	3	-	-
HU1006-1.3	-	-	-	-	-	-	-	-	-	3	-	3	-	-
HU1006-1.4	-	-	-	-	-	-	-	-	2	2	-	2	-	-
HU1006-1.5	-	-	-	-	-	-	-	-	1	2	-	2	-	-

1: Low 2: Medium 3: High

REFERENCES:

1.	Tidd, J., & Bessant, J., “Managing Innovation: Integrating Technological, Market and Organizational Change”, Wiley, 2021.
2.	Case Study Materials: To be distributed for Class Discussion
3.	Reddy, G. B., “Intellectual Property Rights and the Law”, Gogia Law Agency, 2012.
4.	Wadehra, B. L., “Law relating to Intellectual Property”, Universal Law Publishing Co., 2011.

SOCIAL CONNECT AND RESPONSIBILITY

Course Code:	**HU1007-1**	**Course Type:**	**AEC**
Teaching Hours/Week (L: T: P: S):	**1:0:0:0**	**Credits:**	**01**
Total Teaching Hours:	**15**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Respective Department

Course Objectives:

1.	Understand Rural Society
2.	Acquire the knowledge about Rural Economy
3.	Know the working of rural administration
4.	Familiarize the different rural schemes of Governance

UNIT-I

Appreciation of Rural Society — **3 Hours**

Rural Society, Caste and Gender relations, Rural values, Nature and Resources, Rural infrastructure.

Understanding Rural Economy & Livelihood — **3 Hours**

Agriculture, Farming, Landownership, Water Management, Animal Husbandry, Non-Farm Livelihoods and Artisans, Rural Entrepreneurs.

UNIT-II

Rural Institutions — **3 Hours**

Traditional Rural Organizations, Self-help Groups, Panchayat Raj Institutions - Gram Sabha, Gram Panchayat, Standing Committees

Rural Development Programmes — **3 Hours**

History of Rural Development in India, Current National Programmes - Sarva Shiksha Abhiyaan, Beti Bachao – Beti Padhao, Ayushmaan Bharath, Swachh Bharath, PM Awaas Yojana, Skill India, Decentralised Planning, NRLM, MNREGA

UNIT-III

Corporate Social Responsibility (CSR) — **3 Hours**

Global Guidelines on CSR, Growing Importance of CSR, CSR in India

Course Outcomes: At the end of the course student will be able to

1.	Comprehend Rural Society and its Economy
2.	Identify the working of Rural Administration and different rural schemes
3.	Grasp the working of Corporate Social Responsibility

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1007-1.1	-	-	-	-	-	-	-	-	-	-	2	3	-	-
HU1007-1.2	-	-	-	-	-	-	-	-	-	-	2	3	-	-
HU1007-1.3	-	-	-	-	-	-	-	-	-	-	2	3	-	-

1: Low 2: Medium 3: High

REFERENCES:

1. UGC., “Unnat Bharat Abhiyan”, 2020
2. Agarwal, S.K., “Corporate Social Responsibility in India”, SAGE Publication, 2008.
3. Unnat Bharat Abhiyan. (n.d.). Unnat Bharat Abhiyan Brochure. Retrieved from https://unnatbharatabhiyan.gov.in/app/webroot/files/brochure.pdf

LIFE SKILLS FOR ENGINEERS			
Course Code:	**HU1008-1**	**Course Type:**	**AEC**
Teaching Hours/Week (L: T: P: S):	**1:0:0:0**	**Credits:**	**01**
Total Teaching Hours:	**15**	**CIE + SEE Marks:**	**50+50**
Teaching Department: Respective Department			

Course Objectives:

1.	Understand Time Management, Managing Information Overload, Coping with Peer pressure and Stress Management
2.	Familiarize the Science behind Personal Health Management and Addictions
3.	Appreciate the importance of cultivating good hobbies, need for forming good habits and discarding bad habits and holding difficult conversations during crises
4.	Comprehend the importance of Creative Thinking, Continuous and Lifelong Learning, Collaboration and Team Work
5.	Equip them to excel in real work environment proactively

UNIT-I

Introduction to Life Skills — **3 Hours**

Meaning and Importance of Life Skills, Competitive Job market, Fast paced changes in Technology, Proliferation of Electronic Gadgets and harmful online content.

Time Management

Introduction to Time Management, Impulsive Behaviour vis-a-vis goal Directive Behaviour, Time log, Information Overload and coping with Information & Communication Technology (ICT) Revolution; Proliferation of Electronic Media; Exponential growth in online content; Impact of Information Overload on human brain

Science behind Personal Health Management — **3 Hours**

Ignorance in Society on health issues, World Health Organization (WHO) - Definition of Health, Human Evolution, Importance of physical work for human body & mind, Dangers of sedentary lifestyle, Germ diseases versus Lifestyle diseases, Integrating physical exercise into daily life

Science behind Addictions

Addiction - Meaning, Neurology and Hormonal basics of Addictive Behaviour, How addictions are formed; Harmful effects of addictions on Physical and Mental Health, Recognizing addictions in oneself, Coming out of addictions

UNIT-II

Need for cultivating good hobbies — **3 Hours**

Need for Hobbies in maintaining Work-Life Balance; how hobbies help in maintaining good physical and mental health, Various Hobbies

Habits

Difference between hobbies & habits, Cultivating good habits & discarding bad habits: Role of habits for a successful life, How habits form; Analyzing one's own habits; Recognizing useless & harmful habits, Cultivating & Sustaining useful habits

Peer pressure and How to cope with it — **3 Hours**

Human being as a Social Animal, Physical Pain & Social Pain; Awareness of Harmful Social Pressure, Role of Prefrontal Cortex in Judgement and Decision Making, why teenagers are vulnerable to peer pressure, strategies to overcome harmful peer pressure

Stress Management

Stress, Types of Stress, Fight & Flight Response of Humans; Harmful effects of chronic stress; Symptoms of Poor Coping Skills of Stress, Stress & Psychiatric problems, Easy coping strategies for stress

UNIT-III

Continuous & Lifelong Learning — **3 Hours**

Accelerated change in Technology Landscape, Shorter Life Cycles of Technologies, Need for Continuous Learning of other skills

Team Working Skills & Collaboration

Team Work – Meaning, Skills and Relevance, Importance of Collaboration to succeed in one's own career, How to be a good team member

Course Outcomes: At the end of the course student will be able to

1.	Apply the concept of Time Management, cope with Information Overload and withstand harmful peer pressure
2.	Comprehend the need to stay away from addictions by realizing the biological basis behind these concepts
3.	Develop good hobbies to maintain ideal work-life balance
4.	Develop the aptitude for finding creative solutions to problems and realize the importance of continuous and lifelong learning
5.	Demonstrate positive and progressive abilities

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1008-1.1	-	-	-	-	-	-	-	-	-	2	1	3	-	-
HU1008-1.2	-	-	-	-	-	-	-	-	-	3	2	3	-	-
HU1008-1.3	-	-	-	-	-	-	-	-	-	3	1	3	-	-
HU1008-1.4	-	-	-	-	-	-	-	-	2	2	1	2	-	-
HU1008-1.5	-	-	-	-	-	-	-	-	1	2	1	2	-	-

1: Low 2: Medium 3: High

REFERENCES:

1.	Lieberman, D.E., "The Story of the Human Body", Pantheon Books, 2013.
2.	Ratey, J.J., "Spark. Little Brown Spark", 2013.
3.	De Bono, E., "Creative Thinking", Penguin UK, 2016.
4.	Pachter, B., "The Power of Positive Confrontation", Da Capo Lifelong Books, 1999.
5.	Duhigg, C., "The Power of Habit", Random House Trade Paperbacks, 2012.
6.	Sharma, S., & Mishra, B., "Communication Skills for Engineers and Scientists", PHI Learning, 2009.
7.	Tracy, B., "Time Management", AMACOM, 2014.

INDIAN KNOWLEDGE SYSTEMS

Course Code:	**HU1009-1**	**Course Type:**	**HEC**
Teaching Hours/Week (L: T: P: S):	**1:0:0:0**	**Credits:**	**01**
Total Teaching Hours:	**15**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Respective Department

Course Objectives:

1.	Enhance knowledge about the History of Ancient India and Rich Culture of the country
2.	Gain an introduction to ancient Indian Engineering Technology and Architecture
3.	Familiarize Indian indigenous wisdom in Modern scientific paradigm
4.	Understanding the Scientific Value of the Traditional Knowledge of our country
5.	Comprehend and compare the Ancient and Current Knowledge Systems

UNIT-I

Indian History — **6 Hours**

History - Land, Environment, and people in Ancient India; Ancient Education System, Takṣaśilā and Nālandā University, Hunting to Agriculture; Introduction to Vedas and Upanishads; Great Indian Epics; Indian Festivals

UNIT-II

Engineering, Technology, and Architecture — **6 Hours**

Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Metallurgy, Engineering Science and Technology in the Vedic Age and Post-Vedic Records, Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, Marine Technology

UNIT-III

Science, Astronomy, and Mathematics — **3 Hours**

Concept of Matter, Life and Universe, Gravity, Sage Agastya's Model of Battery, Velocity of Light, Vimāna: Aeronautics, Vedic Cosmology and Modern Concepts, History and Culture of Astronomy, Sun, Earth, Moon, Eclipses, Rotation of Earth, Concepts of Zero and Pi, Number System, Pythagoras Theorem and Vedic Mathematics.

Course Outcomes: At the end of the course student will be able to

1.	Understand the relevance of studying history
2.	Comprehend the origin of Vedas and epics
3.	Realize the scientific value of the Traditional Knowledge of India
4.	Converting the Bhāratīya wisdom into the applied aspect of the modern scientific paradigm
5.	Preserve and disseminate Indian Knowledge Systems in Research and Societal applications

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1009-1.1	-	-	-	-	-	-	-	-	-	-	2	3	-	-
HU1009-1.2	-	-	-	-	-	-	-	-	-	-	3	3	-	-
HU1009-1.3	-	-	-	-	-	-	-	-	-	-	2	3	-	-
HU1009-1.4	-	-	-	-	-	-	-	-	-	-	2	2	-	-
HU1009-1.5	-	-	-	-	-	-	-	-	-	-	2	2	-	-

1: Low 2: Medium 3: High

REFERENCES:

1. Tripati, R.S., "History of Ancient India", Motilal Banarsidass, 1942.

2.	Mahajan, V.D.. "Ancient India", S. Chand and Company, 1985.
3.	Ramasubramanian, K., & Srinivas, M.D., "Development of Calculus in India", 2010.
4.	Ramasubramanian, K., Srinivas, M.D., & Sriram, M.S., "The Traditional Indian Planetary Model and its Revision by Nilakantha Somayaji", 2011.
5.	Srinivas, M.D., "Proofs in Indian Mathematics", Hindustan Book Agency, 2005.
6.	Srinivas, M.D., "The Algorithmic Approach of Indian Mathematics", 2015.
7.	Srinivas, M.D. "Indian Tradition of Science: An Introductory Overview", 2016.
8.	Rahika, M., & Balasubramanian, A.V., "Ayurvedic Principles of Food and Nutrition", Part 1. Lok Swasthya Parampara Samvardhan Samithi, 1990.

ENHANCING SELF-COMPETENCE

Course Code:	**HU2001-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**26+0+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite			

Teaching Department: Humanities

Course Objectives:

1.	Introspect and learn about oneself.
2.	Develop professional writing skills.
3.	Acquaint with the various social behaviour and etiquette.
4.	Apply the techniques of fundamental communication skills.
5.	Develop necessary techniques for formal presentations.

UNIT-I

Personality Traits	**09 Hours**
Types & Kinds of personality, Ways to Identify Self (SWOT Analysis, Johari Window), Concepts of Self-Management and Self-Motivation	
Effective Communication Skills	
One-way and Two-way Communication, Interpersonal & Social Skills	

UNIT-II

Social Behaviour and Cultural Etiquette	**09 Hours**
Time Management, Personal Grooming, Making Small Talk, Customs & Manners	
Professional Presentation Techniques	
Formal Presentation, Sensitivity towards multi-cultural workspaces	

UNIT-III

Job-Related Communication	**08 Hours**
Resume & Cover Letter, Formal E-mails, Framing Requests, Greetings, Salutations, Close	

Course Outcomes: At the end of the course student will be able to

1.	Understand the importance of human conduct.
2.	Demonstrate knowledge of theory and competence in office communication.
3.	Develop and assess various types of communication.
4.	Be Familiar with the current practices of social behaviour.
5.	Prepare and deliver presentation appropriate for the workplace.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
HU2001-1.1	-	1	-	-	-	2	2	-	3	-	-	-	-	-	-
HU2001-1.2	-	-	-	-	-	-	-	3	2	1	-	1	-	-	-
HU2001-1.3	-	-	2	-	-	2	2	2	-	-	-	2	-	-	-
HU2001-1.4	-	3	-	-	-	-	-	-	2	3	2	-	-	-	-
HU2001-1.5	2	2	-	1	-	-	-	-	2	-	-	-	-	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	R R Gaur, R Sangal, G P Bagaria, “Human Values and Professional Ethics”, Excel Books, New Delhi, 2010.
2.	Ronald B Adler and Jeanne Marquardt Elmhorst, "Communicating at Work – Principles and Practices for Business and the Professions", 6th Edition, McGraw Hill College.
3.	Stephen R. Covey, "The 7 Habits of Highly Effective People", Simon & Schuster, 1994.
4.	Sarvesh Gulati, "Corporate grooming and Etiquette", Rupa Publications India Pvt. Ltd., 2010.
5.	Fred. Luthans, "Organizational Behaviour", McGraw Hill International.
6.	Tom Rath, “Strengths Finder 2.0", Gallup Press, 2007.

7.	M Ashraf Rizvi, "Effective Technical Communication", Tata McGraw- Hill, 2005.
8.	Stephen P. Robbins, "Organizational Behaviour", Prentice Hall.
9.	Dale Carnegie, "How to Win Friends and Influence People", Gallery Books, 2016.

EMPLOYABILITY SKILL DEVELOPMENT - I

Course Code:	**UM1003-1**	**Course Type**	**MNC**
Teaching Hours/Week (L: T: P: S)	**1:0:0:0**	**Credits**	**00**
Total Teaching Hours	**15+0+0+0**	**CIE + SEE Marks**	**50+00**

Teaching Department: Civil Engineering

Course Objectives:

1.	To explain the students the necessity of clearing the aptitude tests irrespective of the written test is for jobs or higher education.
2.	To assess the readiness of the students to appear for the aptitude test and assisting them to better it if already ready, else train them.
3.	To evaluate the understanding of the students in answering quantitative multiple-choice questions and guide them to improve it.
4.	To evaluate the preparedness of the students to answer the analytical and logical questions.
5.	To evaluate the quality of the students with regard to their professional language grammar, vocabulary and communication skills.

UNIT-I

Quantitative — **06 Hours**

Numbers (Odd, even, H.C.F & L.C.M, Square roots & cube roots, Average, Percentage), Ratios & Proportions, Partnership, Time & work, Pipes & Cistern, Speed, Problems on trains, Problems on boats & streams, Allegation & Mixtures.

UNIT-II

Analytical/ Logical — **06 Hours**

Numerical logic (next number in series, odd man out), Coded language, Syllogism, Direction (N-E-W-S), Seating arrangement, Blood relations, Statement & Conclusion

UNIT-III

Verbal — **03 Hours**

Vocabulary (root words, prefix, suffix, synonyms, antonyms), One-word substitution, Idiom/phrases, Sentence completion, Active & Passive voice, Direct and indirect speech.

Course Outcomes: At the end of the course student will be able to

1.	Answer the quantitative multiple-choice questions.
2.	Analyse the analytical and logical questions.
3.	Improve the professional language grammar, vocabulary and communication skills.
4.	Clear the aptitude tests of any employer or higher educational institution.
5.	Advance in the chosen field of interest by appending aptitude skills with the technical skills

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
UM1003-1.1	3	3	-	-	-	-	-	-	2	2	1	-			
UM1003-1.2	3	3	-	-	-	-	-	-	2	2	1	-			
UM1003-1.3	3	3	2	-	-	-	-	-	2	2	1	-			
UM1003-1.4	3	3	2	-	-	-	-	-	2	2	1	-			
UM1003-1.5	3	3	2	-	-	-	-	-	2	2	1	-			

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Aggarwal R.S, "Quantitative Aptitude for Competitive Examinations", S Chand Publishing.
2.	Aggarwal R.S, "A modern approach to verbal and non-verbal reasoning", S Chand Publishing.

REFERENCE BOOKS:

1.	Bharath Patodi and Aditya Choudhary, “Verbal Ability & Comprehension”, Disha Publication, Second edition, 2015.
2.	Shakuntala Devi, “Joy of numbers”, Orient Black Swan.
3.	Shakuntala Devi, “More puzzles to puzzle you”, Orient Black Swan.
E Books / MOOCs/ NPTEL	
1.	https://www.indiabix.com
2.	https://www.faceprep.in

EMPLOYABILITY SKILL DEVELOPMENT - II

Course Code:	**UM1004-1**	**Course Type**	**MNC**
Teaching Hours/Week (L: T: P: S)	**1:0:0:0**	**Credits**	**0**
Total Teaching Hours	**15+0+0+0**	**CIE + SEE Marks**	**50+00**

Teaching Department: Civil Engineering

Course Objectives:

1.	To explain the students the necessity of clearing the aptitude tests irrespective of the written test is for jobs or higher education.
2.	To assess the readiness of the students to appear for the aptitude test and assisting them to better it if already ready, else train them.
3.	To evaluate the understanding of the students in answering quantitative multiple-choice questions and guide them to improve it.
4.	To evaluate the preparedness of the students to answer the analytical and logical questions.
5.	To evaluate the quality of the students with regard to their professional language grammar, vocabulary and communication skills.

UNIT-I

Quantitative — **06 Hours**

Permutations & Combinations, Area, volume & surface areas, Profit & loss, Simple and compound interest, Logarithms, Stocks & Shares, Discounts (True discounts, bankers' discount), Clocks & Calendars

UNIT-II

Analytical/ Logical — **04 Hours**

Cause & Effect statements, Scenario based questions, Figure series & mathematical puzzles, Statement & assumption, Reasoning analogies, Tables, bar charts, Line graphs & Pie charts, Data sufficiency.

UNIT-III

Verbal — **03 Hours**

Sentence corrections (Pronoun errors & misplaced modifiers, Parallel construction & Parallel Comparison, Tense usage, Subject-verb agreement), Verbal analogies, Reading comprehension (simple passage, difficult passage), Inferences from passages.

Course Outcomes: At the end of the course student will be able to

1.	Answer the quantitative multiple-choice questions.
2.	Analyse the analytical and logical questions.
3.	Improve the professional language grammar, vocabulary and communication skills.
4.	Clear the aptitude tests of any employer or higher educational institution.
5.	Advance in the chosen field of interest by appending aptitude skills with the technical skills

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
UM1004-1.1	3	3	-	-	-	-	-	-	2	2	1	-			
UM1004-1.2	3	3	-	-	-	-	-	-	2	2	1	-			
UM1004-1.3	3	3	2	-	-	-	-	-	2	2	1	-			
UM1004-1.4	3	3	2	-	-	-	-	-	2	2	1	-			
UM1004-1.5	3	3	2	-	-	-	-	-	2	2	1	-			

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Aggarwal R.S, "Quantitative Aptitude for Competitive Examinations", S Chand Publishing.
2.	Aggarwal R.S, "A modern approach to verbal and non-verbal reasoning", S Chand Publishing.

REFERENCE BOOKS:

1.	Bharath Patodi and Aditya Choudhary, "Verbal Ability & Comprehension", Disha Publication, Second edition, 2015.

2.	Shakuntala Devi, “Joy of numbers”, Orient Black Swan.
3.	Shakuntala Devi, “More puzzles to puzzle you”, Orient Black Swan.
E Books / MOOCs/ NPTEL	
1.	https://www.indiabix.com
2.	https://www.faceprep.in

ENGINEERING PROJECT MANAGEMENT

Course Code:	**MG1001-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand various organizational forms/structures Bar charts, Milestone charts and Work breakdown structure. Have the knowledge of Activity, Event, Different type of floats, Forward pass, Backward pass.
2.	Construction of network diagrams, determine activity start and finish times. Know about CPM, the project management tool
3.	Know three-time estimates referring to PERT, Scheduling, Monitoring and Updating. Resource Planning-leveling and allocation.
4.	Acquire the knowledge of Cost control in construction, Linear programming, Transportation models.
5.	Know about Material Management, Store management, Purchase management and Inventory control management.

UNIT-I

Project Organization	**07 Hours**

Project Organization, Formal and Informal organization, Organization Structures, Bar chart, Milestone chart, Work Breakdown Structure, Cost breakdown structure. Activity and event, Activity start and finish times, Forward and backward pass, Floats – Definition, Different types.
Line and staff organizations, AON & AOA diagrams.

Project Planning	**09 Hours**

Network Analysis, Construction of network diagrams using predecessor relationships, Fulkerson's rule of numbering events, CPM Analysis – Significance.
Determination of Earliest and Latest Event Times, Critical Path and various floats.

UNIT-II

Project Monitoring	**06 Hours**

PERT Analysis - Importance, Time Estimates-Optimistic time, Pessimistic time, most likely time, Scheduling, Monitoring and Updating. Line of Balance Scheduling.
Resource Planning-leveling Allocation, Introduction to Risk Management, Risk Register.

Project Control	**08 Hours**

Project cost analysis, Time-Cost Trade-off. Cost Control in Construction, Linear Programming-Graphical method. *Theory of simplex method, Transportation models*

UNIT-III

Material Management	**10 Hours**

Material Management- Scope, objectives and functions, Store Management-Objectives and functions, Purchase management and inventory control Management.

Course Outcomes: At the end of the course student will be able to

1.	To **develop** bar charts, milestone charts and WBS
2.	To **analyze** and **solve** problems on activities and events
3.	To **determine** the project completion period and to **estimate** the probability of completing the project within the specified period.
4.	To **optimize** the project cost and duration by time cost trade off method
5.	To **apply** the knowledge to procure and manage material for the project.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
MG1001-1.1	3		2										3	2	
MG1001-1.2	2		2										3	2	
MG1001-1.3	2		2										3	2	

MG1001-1.4	2		2										3	2	
MG1001-1.5	2		2										3	2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Peurifoy. R L, “**Construction Planning, Equipment and Methods**”, Mc Graw Hill. (March 2010)

2. Srinath L.S, “**PERT and CPM**”, East West Press Private Ltd New Delhi. (2010)

REFERENCE BOOKS:

1. Frank Harris and Ronald McCaffer, “**Modern Construction Management**”, 6th Ed., Blackwell Science Ltd. (March 2013).

2. B.C Punmia, “*Pert and CPM*”, Lakshmi publication.(December 2001)

3. Paul Harris, Planning & Control Using Microsoft Project (2016)

4. Chatfield, Johnson Microsoft Project 2016 Step By Step (2016)

5. Construction Planning and Management Paperback by U K Srivastava (May 2000)

E Books / MOOCs/ NPTEL

1. *https://onlinecourses.nptel.ac.in/noc17ce16*

MANAGEMENT & ENTREPRENEURSHIP

Course Code:	**MG1003-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Any

Course Objectives:

1.	To introduce the field of management, task of the manager, importance of planning and types of planning, staff recruitment and selection process.
2.	To discuss the ways in which work is allocation, structure of organizations, modes of communication and need of coordination between the manager and staff
3.	To explain the role and importance of the entrepreneur and their functions in economic development and the concepts of entrepreneurship.
4.	To discuss the importance of Small-Scale Industries and methods for generating new business ideas and business opportunities
5.	To introduce the concepts of financial concepts in enterprises.

UNIT-I

Management:	**03 Hours**
Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management & Administration, Management as a Science, Art &Profession.	
Planning:	**03 Hours**
Nature, Importance and Purpose of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making.	
Organizing and Staffing	**04 Hours**
Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees – meaning, Types of Committees, Centralization Versus Decentralization of Authority and Responsibility, Span of Control (Definition only), Nature and Importance of Staffing, Process of Selection and Recruitment.	
Directing and Controlling	**04 Hours**
Meaning and Nature of Directing-Leadership Styles, Motivation Theories Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination. Controlling – Meaning, Steps in Controlling	

UNIT-II

Social Responsibilities of Business:	**03 Hours**
Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics, and Corporate Governance.	

Entrepreneurship	**05 Hours**
Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship.	
Modern Small Business Enterprises	**05 Hours**
Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs, Ancillary Industry and Tiny Industry (Definition only).	
Institutional Support for Business Enterprises	**02 Hours**
Introduction, Policies & Schemes of Central–Level Institutions, State-Level Institutions	
UNIT-III	
Finance Management in enterprises	**10 Hours**
Introduction, functions, Accounting and Bookkeeping, Financial Statements, Working Capital Management, Break even Analysis, Financial ratio Analysis.	

Course Outcomes: At the end of the course student will be able to

1.	Describe the field of management, the task of the manager, planning, and steps in decision making.
2.	Discuss the structure of the organization, importance of staffing, leadership styles, modes of communication, techniques of coordination, and importance of managerial control in the business.
3.	Describe the concepts of entrepreneurship and a businessman's social responsibilities towards different groups.
4.	Develop an understanding of the role of SSI's in the development of country and state/central level institutions/agencies supporting business enterprises.
5.	Apply the concepts of financial management for effective use in enterprises

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
MG1003-1.1	3	-	-	-	-	-	-	2	2	-	3	-	-	1
MG1003-1.2	3	-	-	-	-	-	-	2	2	-	3	-	-	2
MG1003-1.3	3	-	-	-	-	-	-	2	2	-	3	-	-	2

MG1003-1.4	3	-	-	-	-	-	-	2	2	-	3	-	-	2
MG1003-1.5	3	-	-	-	-	-	-	2	2	-	3	-	-	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	P. C. Tripathi, P. N. Reddy, "Principles of Management", McGraw Hill, 6th Edition, 2017.
2.	Poornima M. Charanthimath, "Entrepreneurship Development and Small Business Enterprises", Pearson 2nd Edition, 2014.
3.	W.D Stevenson, "Elements of Power System Analysis", 4th edition, TMH, 2001.

REFERENCE BOOKS:

1.	Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 2007.
2.	Harold Koontz, Heinz, Weihrich, "Essentials of Management: An International, Innovation and Leadership perspective", McGraw Hill, 10th Edition, 2016.

Holistic Education Courses

ESSENCE OF INDIAN CULTURE

Course Code:	**HU1005-1**	**Course Type:**	**HEC**
Teaching Hours/Week (L: T: P: S):	**1:0:0:0**	**Credits:**	**01**
Total Teaching Hours:	**15**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Respective Department

Course Objectives:

1.	To facilitate students with the concepts of Indian Culture and to make them understand the roots of knowledge system.
2.	To acquaint students with Indian Culture and inculcate an ability to analyze it.
3.	To apply various approaches for the enhancement of living ideals based on Indian traditional knowledge.

UNIT-I

Introduction to Traditional Knowledge — **6 Hours**

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge and its characteristics, Traditional Knowledge vis-a-vis Indigenous Knowledge, Traditional Knowledge vis-a-vis Western Knowledge

UNIT-II

Significance of Traditional Knowledge — **6 Hours**

Value of Traditional Knowledge in global economy, Role of Government in harnessing Traditional Knowledge, Traditional medicine system, Traditional Knowledge in agriculture. food and healthcare.

UNIT-III

Holistic Healthcare for Human Well-being — **3 Hours**

Definition of Ayurveda, Ayurveda for Life, Health and Well-being, Introduction to principles of Ayurvedic healing and Astanga Ayurveda.

Course Outcomes: At the end of the course student will be able to

1.	Identify the concept of Traditional Knowledge and its importance.
2.	Explain the need for and importance of protecting Traditional Knowledge.
3.	Illustrate the various enactments related to Traditional Knowledge.
4.	Familiarize the importance of Holistic Healthcare.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1005-1.1	-	-	-	-	-	-	-	-	-	2	2	3	-	-
HU1005-1.2	-	-	-	-	-	-	-	-	-	3	2	3	-	-
HU1005-1.3	-	-	-	-	-	-	-	-	-	3	2	3	-	-
HU1005-1.4	-	-	-	-	-	-	-	-	2	2	2	2	-	-
HU1005-1.5	-	-	-	-	-	-	-	-	1	2	2	2	-	-

1: Low 2: Medium 3: High

REFERENCES:

1.	Jha, A., “Traditional Knowledge System in India”, Atlantic Publishers, 2002.
2.	Kapoor, K., & Danino, M., “Knowledge Traditions and Practices of India”, 2012.
3.	Kapil Kapoor, Michel Danino, "Knowledge Traditions and Practices of India", Medknow Publications and Media.

4.	Jha, R.N., “Science of Consciousness Psychotherapy and Yoga Practices”, Delhi: Vidyanidhi Prakashan, 2015.
5.	TEDx Talks. (2015, February 6). Unleashing the Power of Traditional Medicine | Dr. Arvind Singh [Video file]. Retrieved from https://www.youtube.com/watch?v=LZP1StpYEPM

INDIAN KNOWLEDGE SYSTEMS

Course Code:	**HU1009-1**	**Course Type:**	**HEC**
Teaching Hours/Week (L: T: P: S):	**1:0:0:0**	**Credits:**	**01**
Total Teaching Hours:	**15**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Respective Department

Course Objectives:

1.	Enhance knowledge about the History of Ancient India and Rich Culture of the country
2.	Gain an introduction to ancient Indian Engineering Technology and Architecture
3.	Familiarize Indian indigenous wisdom in Modern scientific paradigm
4.	Understanding the Scientific Value of the Traditional Knowledge of our country
5.	Comprehend and compare the Ancient and Current Knowledge Systems

UNIT-I

Indian History — **6 Hours**

History - Land, Environment, and people in Ancient India; Ancient Education System, Takṣaśilā and Nālandā University, Hunting to Agriculture; Introduction to Vedas and Upanishads; Great Indian Epics; Indian Festivals

UNIT-II

Engineering, Technology, and Architecture — **6 Hours**

Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Metallurgy, Engineering Science and Technology in the Vedic Age and Post-Vedic Records, Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, Marine Technology

UNIT-III

Science, Astronomy, and Mathematics — **3 Hours**

Concept of Matter, Life and Universe, Gravity, Sage Agastya's Model of Battery, Velocity of Light, Vimāna: Aeronautics, Vedic Cosmology and Modern Concepts, History and Culture of Astronomy, Sun, Earth, Moon, Eclipses, Rotation of Earth, Concepts of Zero and Pi, Number System, Pythagoras Theorem and Vedic Mathematics.

Course Outcomes: At the end of the course student will be able to

1.	Understand the relevance of studying history
2.	Comprehend the origin of Vedas and epics
3.	Realize the scientific value of the Traditional Knowledge of India
4.	Converting the Bhāratīya wisdom into the applied aspect of the modern scientific paradigm
5.	Preserve and disseminate Indian Knowledge Systems in Research and Societal applications

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1009-1.1	-	-	-	-	-	-	-	-	-	-	2	3	-	-
HU1009-1.2	-	-	-	-	-	-	-	-	-	-	3	3	-	-
HU1009-1.3	-	-	-	-	-	-	-	-	-	-	2	3	-	-
HU1009-1.4	-	-	-	-	-	-	-	-	-	-	2	2	-	-
HU1009-1.5	-	-	-	-	-	-	-	-	-	-	2	2	-	-

1: Low 2: Medium 3: High

REFERENCES:

1. Tripati, R.S., "History of Ancient India", Motilal Banarsidass, 1942.

2.	Mahajan, V.D.. “Ancient India”, S. Chand and Company, 1985.
3.	Ramasubramanian, K., & Srinivas, M.D., “Development of Calculus in India”, 2010.
4.	Ramasubramanian, K., Srinivas, M.D., & Sriram, M.S., “The Traditional Indian Planetary Model and its Revision by Nilakantha Somayaji”, 2011.
5.	Srinivas, M.D., “Proofs in Indian Mathematics”, Hindustan Book Agency, 2005.
6.	Srinivas, M.D., “The Algorithmic Approach of Indian Mathematics”, 2015.
7.	Srinivas, M.D. “Indian Tradition of Science: An Introductory Overview”, 2016.
8.	Rahika, M., & Balasubramanian, A.V., “Ayurvedic Principles of Food and Nutrition”, Part 1. Lok Swasthya Parampara Samvardhan Samithi, 1990.

Department Specific Vocational Education Course

CONSTRUCTION PRACTICE

Course Code:	**CV1551-1**	**Course Type:**	**VEC**
Teaching Hours/Week (L:T:P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Civil Engineering

Course Objectives:

1.	To give idea of basic of setting out operations and construction of masonry units.
2.	To estimate the quantity of steel reinforcement required for different elements of work.
3.	To realize the importance of Plumb bob, mercury level and tape in the construction activities.
4.	To create the awareness about various construction activities related in the construction of a building.
5.	To create the awareness about various tests and repair methods used in buildings.

List of Experiments

1.	Study of construction tools, plumbing tools and sanitary fixtures.
2.	Demonstration of Safety kits and accessories used at construction site- Personal Protective Equipment (PPE).
3.	Setting out of center line for a small building.
4.	Construct one thick brick wall in English bond for a height of Two layer.
5.	Construct one thick brick wall in Flemish bond for a height of Two layer.
6.	Prepare Bar Bending Schedule & Fabrication of reinforcements for a doubly reinforced beam.
7.	Prepare Bar Bending Schedule & Fabrication of reinforcements for a lintel with chejja.
8.	Prepare Bar Bending Schedule & Fabrication of reinforcements for a column with footing Mat.
9.	Plastering for a new masonry wall surface (1 square meter area) with CM (1:6)
10.	Prepare a plan and fabricate for PVC pipe layout using valves, fixtures, adhesive solvents and fittings from over head tank to wash basin/tap and excute it.
11.	Identification of retention of pressure in Plumbing system.
12.	

Course Outcomes: At the end of the course student will be able to

1.	Give basic idea of setting out operations, bar bending schedule and use of construction tools.
2.	Study the plumbing accessories and its applications in Civil Engineering buildings.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
CV2601-1.1	2			2		2			2	2			3	2	
CV2601-1.2	2			2		2		3	2				3	2	

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. Davis, Troxell and Hawk, "Testing of Engineering Materials", International Student Edition – Mc Graw Hill Book Co. New Delhi-1982.
2. Fenner, George, "Mechanical Testing of Materials", published by Philosopical library - 1965.

3.	Holes K A, "Experimental Strength of Materials", English Universities Press Ltd. London-1962.
4.	Suryanarayana A V K, "Testing of Metallic Materials",, Prentice Hall of India Pvt. Ltd. New Delhi -1979.
5.	Kukreja C B- Kishore K, "Material Testing Laboratory Manual", Ravi Chawla Standard Publishers & Distributors -1996.
6.	Relevant IS codes

UNIVERSITY CORE COURSES

INTERNSHIP-I

Course Code	**UC1001-1**	**CIE Marks**	**100**
Teaching Hours/Week (L: T: P: S)	**-**	**SEE Marks**	-
Total Hours of Pedagogy	80-90 Hours (During I/II semesters)	**Total Marks**	**100** (Evaluation in I/II/III Semester and grades earned shall be included in IV Semester grade card)
Credits	**2**	**Exam Hours**	**--**

Course objective

1. This course is meant to provide students an opportunity to be involved in Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the institution; contribution at incubation/ innovation /entrepreneurship cell of the institution; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working for consultancy/ research projects within the institution and Participation in all the activities of Institute's Innovation Council.

Activities: Refer Appendix B - 3.4 for details

Course outcomes

1. Experience the working in Inter / Institutional activities
2. Work in teams and communicate efficiently both written and oral.
3. Develop the ability to do work in different activities, which will provide the necessary understanding and contribute to the same and provide a foundation to undergo higher level training in subsequent internships.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
UC2001-1.1	3	1	-	-	1	-	-	-	2	3	1	-	-	-	-
UC2001-1.2	3	1	-	-	1	-	-	-	2	3	1	-	-	-	-
UC2001-1.3	3	1	-	-	1	-	-	-	2	3	1	-	-	-	-

1: Low 2: Medium 3: High

INTERNSHIP - II

Course Code:	**UC2001-1**	**Course Type**	**UCC**
Teaching Hours/Week (L: T: P: S)	**-**	**Credits**	**08**
Total Teaching Hours	**-**	**CIE + SEE Marks**	**50+50**
Prerequisite			

Course Objectives:

1.	This course is meant to provide students an avenue to understand the work environment, ethics and practices in an industry/organization and take up assignments/jobs in the future.

Course Outcomes: At the end of the course student will be able to

1.	Analyse and Develop technical solutions for a specific problem that is assigned to them.
2.	Communicate ideas that are developed through brainstorming, presentation and prepare a report.
3.	Understand and inculcate industry practices in their professional career.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
↓ Course Outcomes													**1**	**2**	**3**
UC2001-1.1	3	2	-	-	1	1	-	-	2	3	1	-	1	1	1
UC2001-1.2	3	2	-	-	1	1	-	-	2	3	1	-	1	1	1
UC2001-1.3	3	2	-	-	1	1	-	-	2	3	1	-	1	1	1

1: Low 2: Medium 3: High

MAJOR PROJECT

Course Code:	**UC3001-1 & UC3002-1**	**Course Type:**	**UCC**
Teaching Hours/Week (L: T: P: S):	**24**	**Credits:**	**2+8**
Total Teaching Hours:	**-**	**CIE + SEE Marks:**	**(100+0) + 100+100**

Course Objectives:

1.	To perform effective literature survey, identification of research problem / project idea.
2.	To develop skills of planning to execute the project
3.	To assess the needs and necessity of a project.
4.	To learn time management and documentation.
5.	To expose the students to research aspects like literature review, executing experiments and analysis of results.
6.	To expose the students to research aspects like literature review, executing experiments and analysis of results.

A group of students (not more than 4) is assigned to a guide/project supervisor. The students must do a thorough literature review and come out with a project plan. They are expected submit a project proposal (not more than 10 pages) including project idea, protocols, designs (if any), expected outcome, major requirements, and approximate budget. They shall present the same in a proposal seminar in front of the panel of internal examiners (involving guide) and shall get their proposal approved. The presentation must involve projected timeline of the project execution.

Assessment Details (both CIE and SEE)

CIE procedure: Shall involve project proposal, proposal seminar, continuous evaluation of the project progress by Guide and HOD. Monthly progress is evaluated.

Semester End Examination:

SEE procedure:
i)Single discipline: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.
ii) Interdisciplinary: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.

SCHEME OF EVALUATION:
Project demonstration, Viva voce
Total marks: 100 Marks

The distribution of marks shall be proportioned based on the type of the project and it is based on fulfilling the following requisites.
The evaluation of students is proposed to be done by internal faculty with active involvement of industrial personnel. The evaluation may be based on following criteria:

- Punctuality and Attendance ¨ Interpersonal relations
- Sense of Responsibility
- Clarity of concepts, principles and procedures
- Self-expression/communication skills

- Report Writing Skills
- Creativity/conceiving new and unusual ideas
- Problem-solving skills

At the end of the project work course students are required to submit a working model of the equipment they have designed and developed or if it is a theoretical or experimental work, they are expected to study a detailed analysis and findings from their work.

Course Outcomes: At the end of the course student will be able to

1.	Use various methods or sources for finding literature and analyze data for relevance and appropriateness to the research project undertaken.
2.	Identify and propose suitable methods of analysis and/or design or develop appropriate experiments to address the specific research objectives.
3.	Apply suitable standardized method/s for experimental design.
4.	Analyze and interpret the research findings and compare with reported results to arrive at suitable conclusions.
5.	Adopt appropriate documentation protocol to organize research findings, learn good laboratory practices and work in a team.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**		**9**	**10**	**11**	**12**	**PSO↓**		
↓ Course Outcomes														**1**	**2**	**3**
UC3001-1/UC3002-1.1	-	1	-	-	2	2	3	1		-	-	-	1	1	2	2
UC3001-1/UC3002-1.2	-	1	2	1	1	-	1	2		1	-	1	1	1	2	2
UC3001-1/UC3002-1.3	-	1	2	2	1	-	1	1		1	1	1	1	1	2	2
UC3001-1/UC3002-1.4	1	3	2	2	1	2	2	3		3	3	3	2	1	2	2
UC3001-1/UC3002-1.5	-	1	1	-	1	2	2	3		3	3	3	1	1	2	2

1: Low 2: Medium 3: High