Regulations and Curriculum for

Bachelor of Technology (B.Tech.)
in
Information Science and 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)
University Enclave, Medical Sciences Complex, Deralakatte,
Mangaluru – 575 018, Karnataka INDIA
Tel: +91-824-2204300/01/02/03, Fax: 91-824-2204305
Website: www.nitte.edu.in E-mail: info@nitte.edu.in

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	14ENGR09D2
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 Information Science & 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 1
REGULATIONS 3
1. INTRODUCTION 3
2. ELIGIBILITY FOR ADMISSION 4
3. PROGRAM PATHS, EXIT OPTIONS, AND DURATION OF THE B. TECH. PROGRAM 5
4. DEGREE PROGRAMS 7
5. CREDIT SYSTEM 7
6. REGISTRATION 8
7. ADD/DROP/AUDIT OPTIONS 9
8. COURSE STRUCTURE: 10
9. ATTENDANCE REQUIREMENT: 17
10. WITHDRAWAL FROM THE PROGRAM 18
11. EVALUATION SYSTEM 19
12. EVALUATION OF PERFORMANCE 24
13. COMMUNICATION OF GRADES 25
14. REQUIREMENTS FOR VERTICAL PROGRESSION 25
15. AWARD OF CLASS 26
16. APPEAL FOR REVIEW OF GRADES 26
17. AWARD OF DEGREE 26
18. GRADUATION REQUIREMENTS AND CONVOCATION 30
19. AWARD OF PRIZES, MEDALS, CLASS & RANKS 31
20. CONDUCT AND DISCIPLINE 31
21. APPENDIX - A 33
22. APPENDIX-B 37

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	1^{st} yr. of UG Degree	A candidate completing 10+2 years with Diploma of Vocation or passed 12^{th} std. or equivalent vocational training with NCrF level 4	**UG Certificate***	4.5
2	2^{nd} 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 Honours	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)	Civil Engineering	(CV)
iv)	Electronics & Communication Engineering	(EC)
v)	Electrical & Electronics Engineering	(EE)
vi)	Information Science & Engineering	(IS)
vii)	Mechanical Engineering	(ME)
viii)	Artificial Intelligence and Machine Learning Engineering	(AM)
ix)	Computer and Communication Engineering	(CC)
x)	Robotics and Artificial Intelligence Engineering	(RI)
xi)	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)

4.1 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.

(e) **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.

(f) **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.

(g) **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.

(h) **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)

(i) **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.

(j) **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.

(k) **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.

(l) **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.

(m) **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.

(n) **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.

(o) **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	Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1.	BSC	MA1002-1	Calculus and Differential Equations	MA	3	0	0	3	50	50	100	3
2.	BSC	PH1001-1	Engineering Physics	PH	3	0	2	3	50	50	100	4
3.	ESC	CV1001-1	Elements of Civil Engineering	CV	3	0	0	3	50	50	100	3
4.	ESC	EC1001-1	Basic Electronics	EC	3	0	0	3	50	50	100	3
5.	ESC	EC1002-1	Applied Digital Logic Design	EC	2	0	2	3	50	50	100	3
6.	HSMC	HU1001-1	Technical English	HU	1	0	2	3	50	50	100	2
7.	HSMC	HU1002-1	Constitution of India	HU	1	0	0	1	50	50	100	1
8.	MNC	ME1004-1	Engineering Visualization	ME	2	0	0	0	50	0	50	0
9.	MNC	UM1001-1	Skill Development Lab Group-A	Any	0	0	4	0	0	0	0	0
				TOTAL	**18**	**0**	**10**	**19**	**400**	**350**	**750**	**19**

II SEMESTER

Sl. No.	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1.	BSC	MA1004-1	Discrete Mathematics & Numerical Methods	MA	3	0	0	3	50	50	100	3
2.	BSC	CY1001-1	Engineering Chemistry	CY	3	0	2	3	50	50	100	4
3.	ESC	CS1001-1	Problem-Solving through Programming	CS	3	0	2	3	50	50	100	4
4.	ESC	EE1001-1	Basic Electrical Engineering	EE	3	0	2	3	50	50	100	4
5.	ESC	ME1003-1	Elements of Mechanical Engineering	ME	3	0	0	3	50	50	100	3
6.	AEC	BT1651-1	Biology for Engineers	BT	1	0	0	1	50	50	100	1
7.	AEC	CS1651-1	IT Skills	CS	1	0	2	3	50	50	100	2
8.	MNC	CV1002-1	Environmental Science	CV	1	0	0	1	50	50	100	0
9.	MNC	UM1002-1	Skill Development Lab Group-B	Any	0	0	4	0	0	0	0	0
				TOTAL	**18**	**0**	**12**	**20**	**400**	**400**	**800**	**21**

Mandatory Internship-I*								
1.	INT	UC1001-1	Internship – I (Activity based internship)	Mandatory Intra Institutional Internship of duration (80 - 90 Hours) to be completed during I & II Semesters. *The grades will be included in	100	--	100	2

				the IV semester grade card (Refer 11.5.2 for details)				

III 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	J					
1.	BSC	MA2001-1	Statistics and Probability Theory	MA	3	0	0	0	03	50	50	100	3
2.	IPCC	CS2001-1	Data Structures	IS	3	0	2	0	03	50	50	100	4
3.	IPCC	CS2002-1	Object Oriented Programming	IS	3	0	2	0	03	50	50	100	4
4.	PCC	IS2101-1	Computer Organization & Design	IS	3	0	0	0	03	50	50	100	3
5.	PCC	IS1102-1	Introduction to Data Science	IS	3	0	0	√	03	50	50	100	3
6.	PCC	IS1602-1	Unix Shell and System Programming	IS	0	0	2	0	03	50	50	100	1
7.	HSMC	HU2001-1	Enhancing Self Competence	HU	2	0	0	0	03	50	50	100	2
8.	MNC	HU1003-1	Kannada (Balake / Samskrithika)	Any Dept.	1	0	0	0	-	50	-	50	0
9.	HEC	HU1005-1	Essence of Indian Culture	HU	1	0	0	0	-	50	-	50	0
				TOTAL	**19**	**0**	**6**	**-**	**21**	**450**	**350**	**800**	**20**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs													
9	MNC	MA1012 -1	Bridge course - Calculus & Differential Equations	MA	3	0	0	0	3	100	0	100	0

IV SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical	PBL	Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1.	BSC	MA2005-1	Linear Algebra and its Applications	MA	3	0	0	0	03	50	50	100	3
2.	IPCC	CS3004-1	Design and Analysis of Algorithms	IS	3	0	2	0	03	50	50	100	4
3.	IPCC	IS2001-1	Internet & Web Programming	IS	3	0	2	0	03	50	50	100	4
4.	PCC	CS2102-1	Database Management Systems	IS	3	0	0	√	03	50	50	100	3
5.	PCC	IS1103-1	Introduction to Software Engineering	IS	3	0	0	0	03	50	50	100	3
6.	PCC	IS1601-1	Database Applications	IS	0	0	2	0	03	50	50	100	1

			Lab										
7.	HSMC	HU1004-1	Universal Human Values	Any Dept	1	0	0	0	01	50	50	100	1
8.	AEC	ME1654-1	Innovations and Design Thinking	ME	1	0	0	0	01	50	50	100	1
9.	VEC	ISx5xx-1	Department specific Vocational Education Course	IS	0	0	2	0	03	50	50	100	1
10.	UCC	UC1001-1	Internship – I (Activity based internship)	Mandatory Intra Institutional 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	-	100	2
				TOTAL	**17**	**0**	**8**	**-**	**23**	**550**	**450**	**1000**	**23**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs													
10	MNC	MA1014-1	Bridge course - Discrete Math & Numerical Methods	MA	3	0	0	0	3	100	0	100	0

V SEMESTER

Sl. No.	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical	PBL	Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1.	IPCC	IS3001-1	Data Communication and Networking	IS	3	0	2	0	3	50	50	100	4
2.	IPCC	IS2002-1	Machine Learning Foundations	IS	3	0	2	0	3	50	50	100	4
3.	PCC	IS3101-1	Operating Systems Fundamentals	IS	3	0	0	0	3	50	50	100	3
4.	PCC	IS3603-1	Mobile Application Development Lab	IS	0	0	2	0	3	50	50	100	1
5.	PEC	ISxxxx-1	Professional Elective-I	IS	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	IS	1	0	2	0	3	50	50	100	2
		HU1010-1	Research Methodology	Any Dept.	2	0	0	0	3	50	50	100	2
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	IS	1	0	0	0	-	50	-	50	1
				TOTAL	**16/17**	**0**	**8/6**	**-**	**20**	**450**	**400**	**850**	**20**

VI SEMESTER

Sl. No.	Course and Course code	Course Title	Teaching Dept.	Teaching Hours/Week	Examination	Credits

					Theory Lecture	Tutorial	Practical	PBL	Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1.	IPCC	IS4001-1	Information & Network Security	IS	3	0	2	0	3	50	50	100	4
2.	PCC	IS3102-1	Automata Theory & Compiler Design	IS	3	0	0	0	3	50	50	100	3
3.	PCC	IS3601-1	C# and .NET Framework Lab	IS	0	0	2	0	3	50	50	100	1
4.	PEC	ISxxxx-1	Professional Elective - II	IS	3	0	0	0	3	50	50	100	3
5.	PEC	ISxxxx-1	Professional Elective - III	IS	3	0	0	0	3	50	50	100	3
6.	OEC	XXX5XX-1	Open Elective –I	Any Dept.	3	0	0	0	3	50	50	100	3
7.	HSMC	MG1003-1	Management & Entrepreneurship	IS	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	**19**	**0**	**4**	**-**	**22**	**400**	**400**	**800**	**21**

VII SEMESTER

Sl. No.	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week				Examination				Credits
					Theory	Tutorial	Practical	Self-Study	Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	IPCC	IS3002-1	Ethical Hacking and Network Defence	IS	3	0	2	0	3	50	50	100	4
2.	PCC	IS3602-1	Internet of Things Lab	IS	0	0	2	0	3	50	50	100	1
3.	PEC	ISXXXX-1	Professional Elective - IV	IS	3	0	0	0	3	50	50	100	3
4.	PEC	ISXXXX-1	Professional Elective – V	IS	3	0	0	0	3	50	50	100	3
5.	OEC	XXX5XX-1	Open Elective –II	Any Dept.	3	0	0	0	3	50	50	100	3
6.	HSMC	MG1002-1	Financial Management	IS	3	0	0	0	3	50	50	100	3
7.	HEC	HU1009-1	Indian Knowledge Systems	Any Dept.	1	0	0	0	-	50	-	50	1
8.	UCC	UC3001-1	Major Project Phase I	IS	-	-	4	-	-	100	-	100	2
				TOTAL	**16**	**0**	**8**	**-**	**18**	**450**	**300**	**750**	**20**

VIII SEMESTER

Sl. No.	Course and Course code	Course Title	Teaching Hours/Week			Examination				Credits
			Theory Lecture	Tutorial	Project/ Self study	Duration in hr	CIE Marks	SEE Marks	Total Marks	

				L	T	J/S					
1.	UCC	UC2001-1	Internship- II	Mandatory Research Internship / Industry Internship of total 8 weeks (320 – 360h) 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 Center of Excellences. Two contact hours /week for interaction between the project guide and students.			3	100	100	200	8
			TOTAL	**-**	**-**	**-**	**6**	**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

CGPA	Classification
7.00-& above	**First Class with Distinction**
6.00-6.99	**First Class**
5.00-5.99	**Second Class**

50-54	5	C	Average
40-49	4	P	Pass
00-39	0	F	Fails
Absent	0	AB	Absent

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.)

i) **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.

ii) 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:

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

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 the 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**
≥ 7.00	$\geq 70\%$	First class with Distinction
≥ 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 4th 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 12^{th} 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 Information Science and 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 (ii) Conduction/Execution (iii) Viva-Voce	 04 10 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	Institute Faculty (mentor)
		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	issued from the relevant authorized Authority	together with External Expert, if any.
3	Festival (Technical / Business / Others) Events.	Excellent	80 to 100		
		Good	60 to 79		
		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	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

B. Tech. in Information Science & Engineering

Vision:
Excellence in information science and engineering through a strong research and teaching environment that address the emerging global challenges and market demands.

Mission:
- To provide outstanding education and research training to the students for their productive careers in industry, academia and government.
- To provide a learning environment that promotes excellence and innovation, ethical practice and responsibility towards society.
- To prepare the students to practice their professions competently to meet the ever- changing needs of society and to continue learning their discipline, allowing them to move into other related fields.
- To promote active learning, critical thinking, and engineering judgment coupled with business and entrepreneurial skills.

Program Educational Objectives (PEOs):
- Graduates must gain both theoretical and practical knowledge to identify, formulate & solve challenges in Information Science & Engineering problems.
- Graduates must work productively as Information Science Engineers, including supportive and leadership roles on multidisciplinary teams.
- Graduates must communicate effectively, recognize and incorporate societal needs and constraints in their professional endeavors, and practice their profession with high regard to legal and ethical responsibilities.
- Graduates must engage in life-long learning, such as graduate study, to remain current in their profession and be leaders in our technological society.

Program Specific Outcomes (PSOs):
PSO1: Design, develop and test software systems to provide solutions to real world problems.
PSO2: Equip students with skills to analyze, design and recommend the appropriate IT infrastructure required for the implementation of a project.

Program Outcomes (POs):
Engineering Graduates will be able to:
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.

Course Numbering Scheme

Branch Code		Course Level	Course Code			Separator	Version
Letter	Letter	Number	Number	Number	Number	-	Number

Branch Code	IS is 2 Letter code for the Department of Information Science & Engineering
Course Level	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
Course Code	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
Separator	"_" is used as a separator between the Course code and the version
Version	Version is a 1-digit number that can have a value between 1-9 and indicates minor revisions of the same course.

B. Tech. (IS): 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 - I

I SEMESTER

SI No.	Course and Course code		Course Title	Teaching Department	Teaching hours/Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/Drawing	Duration in hours	CIE	SEE	Total Marks	
					L	T	P					
1	BSC	MA1002-1	Calculus and Differential Equations	MA	3	0	0	3	50	50	100	3
2	BSC	PH1001-1	Engineering Physics	PH	3	0	2	3	50	50	100	4
3	ESC	CV1001-1	Elements of Civil Engineering	CV	3	0	0	3	50	50	100	3
4	ESC	EC1001-1	Basic Electronics	EC	3	0	0	3	50	50	100	3
5	ESC	EC1002-1	Applied Digital Logic Design	EC	2	0	2	3	50	50	100	3
6	HSMC	HU1001-1	Technical English	HU	1	0	2	3	50	50	100	2
7	HSMC	HU1002-1	Constitution of India	HU	1	0	0	1	50	50	100	1
8	MNC	ME1004-1	Engineering Visualization	ME	2	0	0	0	50	0	50	0
9	MNC	UM1001-1	Skill Development Lab Group-A	Any	0	0	4	0	0	0	0	0
				Total	18	0	10	19	400	350	750	19

Note:
BSC: Basic Science Course, **ESC**: Engineering Science Course, **HSMC**: Humanity and Social Science & Management Courses, **AEC** –Ability Enhancement Courses, **MNC**: Mandatory Non credited course **UM**: University Mandatory

CALCULUS AND DIFFERENTIAL EQUATIONS

Course Code	**MA1002-1**	**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, partial differentiation, vector differentiation, differential equations, multiple integrals and become skilled for solving problems in science and engineering.

UNIT-I

Differential Calculus — **7 Hours**

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

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-II

Vector Differential Calculus — **7 Hours**

Vector algebra(review), scalar and vector valued functions, gradient, directional derivative and hessian of multi-variable function, Divergence, and curl of a vector valued function. Solenoidal and irrotational vectors.

Ordinary and Partial Differential Equations — **8 Hours**

Ordinary differential equations(review), linear and nonlinear differential equations. Second and higher order

linear differential equations with constant coefficients.
Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions. Classification of second order PDES. Solution of P.D.E by the method of separation of variables.

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.	Apply the concept of radius of curvature and mean value theorems.
2.	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.
3.	Solve the vector functions and their derivatives for engineering applications.
4.	Apply the concepts of ordinary and partial differential equations in engineering problems.
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
MA1002-1.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MA1002-1.2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MA1002-1.3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
MA1002-1.4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MA1002-1.5	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.
3.	Murray R. Spiegel, Seymour Lipschutz, Dennis Spellman, "Vector Analysis", Schuam's outlines series, 2nd edition, 2009.

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.
5.	W.E. Boyce and R.C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India, 2009.
6.	E.A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.
7.	G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007.
8.	Shanthi Narayan, "Differential Calculus, 6th edition, Shyam Lal Charitable Trust, Delhi.

E Books / Moocs/ NPTEL

1.	*http://nptel.ac.in/courses/111106100/*
2.	*https://nptel.ac.in/courses/122101003*
3.	*http://nptel.ac.in/courses/111106100/*

ENGINEERING PHYSICS

Course Code:	**PH1001-1**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P):	**3:0:2**	**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 and semiconductor devices
4.	To explain the properties of superconductors and their applications.
5.	To explain the principle, working and applications of lasers & optical fibers.

UNIT-I	
Wave mechanics	**08 Hours**
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 normalization 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 & X-rays	**07 Hours**
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	**11 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	**04 Hours**
Introduction to superconductors, characteristic properties. Type-I and Type-II superconductors. BCS theory (qualitative). Applications of superconductors. Numerical examples.	
UNIT-III	
Lasers	**05 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	**05 Hours**
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 (Any 10 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.

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
PH1001-1.1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
PH1001-1.2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
PH1001-1.3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
PH1001-1.4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
PH1001-1.5	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.

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)	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**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 plane and ladder friction
5.	Understand centroid and moment of inertia of regular geometrical areas

UNIT-I

08 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.

Engineering mechanics: basic idealizations, definition of force, characteristics of a force, classification of force system, principle of transmissibility,

Coplanar concurrent force system: resolution of force, composition of forces, resultant and equilibrant, resultant of coplanar concurrent force system.

08 Hours

Coplanar non-concurrent force system: 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, conditions of equilibrium for coplanar concurrent force system, concept of free body diagram, equilibrium of coplanar concurrent force system.

UNIT-II

08 Hours

Support Reactions: Types of beams, loads, and supports, support reactions for statically determinate beams with point load (normal and inclined), uniformly distributed load, uniformly varying loads, and moments.

08 Hours

Friction: Theory of friction, types of friction, Coulumb's laws of friction, limiting friction, angle of friction, plane friction and ladder friction.

UNIT-III

08 Hours

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

Moment of Inertia: 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, and circular areas from the method of integration; moment of inertia of regular geometrical areas and L, I, T and C sections.

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 plane and ladder
5.	Determine the centroid and moment of inertia of regular geometrical areas 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):	**3:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1. To familiarize the student with Semiconductor devices like Diodes, Transistors and their applications
2. To analyze the working of simple electronic circuits involving Op-amps, 555 Timer and Linear Regulator ICs.
3. To understand the fundamentals of Modern communication system.
4. To introduce the fundamentals of Embedded Systems

UNIT-I

Diodes and their Applications	**06 Hours**

Semiconductor Diode, Diode Equivalent circuits, Load Line analysis, Half Wave Rectifier, Full wave Bridge Rectifier, capacitor, and choke filter circuit (only qualitative approach). Zener Diode and its use in Voltage Regulation

Transistors and their Applications	**09 Hours**

Bipolar Junction Transistor: Construction and operation, Common Emitter and Common Base Characteristics, DC load line analysis, RC coupled amplifier (frequency response excluded), BJT as a switch, BJT circuit to switch ON/OFF an LED

Field Effect Transistor: Construction and Characteristics of JFET, Transfer Characteristics, Enhancement mode MOSFETs, CMOS Inverter.

UNIT-II

Op-Amp & Linear IC Applications	**11 Hours**

Introduction, Op-Amp Specifications, Differential & Common-Mode operation, Op-Amp applications: Inverting/Non-Inverting Amplifier, Summing, Integrator, Differentiator, Comparator. 555 Timer IC in

Astable mode. 78XX series IC Voltage Regulators.

Feedback and Oscillator Circuits	**05 Hours**

Feedback– Principle and advantages of negative feedback, Voltage series feedback amplifier. Concept of positive feedback, Op-Amp Oscillators – RC phase shift, Hartley and Colpitts's Oscillator

UNIT-III

Fundamentals of Communication and Embedded Systems	**09 Hours**

Modern communication system scheme (Block scheme), Information source, Input Transducers, Transmitter, Channels, Receivers, Noise, 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.	Explain the operation of Rectifiers; Design a rectifier circuit, given the specification for output Voltage, PIV, and ripple factor; Design a Zener voltage regulator for the given specification of output voltage and Power;
2.	Explain the construction and operation of Bipolar transistor in CE or CB Mode; Explain the use of BJT in Amplification as well as switching operations; Explain the construction and operation of JFET or MOSFET; Explain the operation of a CMOS Inverter;
3.	List the ideal and practical parameters for an Op-Amp; Define Op-amp Specifications; Explain the use of Op-Amp in Amplification, Summing, Integration, Differentiation and comparison; Design an Astable Multivibrator, using 555 Timer IC, for the given frequency and duty cycle;
4.	List the advantages and disadvantage of Negative Feedback; Explain the impact of negative feedback on Amplifier gain, Input and Output Impedance for a Series Voltage Negative feedback; Explain the operation of Op-Amp based RC Phase-shift, Hartley, and Colpitts Oscillator
5.	Explain the scheme of a Modern Communication System; List the differences between a general computing system and Embedded System; Describe the differences between Harvard and Von-Neuman, RISC and CISC system architectures

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EC1001-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EC1001-1.2	3	-	-	-	-	-	-	-	-	-	-	-
EC1001-1.3	3	-	-	-	-	-	-	-	-	-	-	-
EC1001-1.4	3	-	-	-	-	-	-	-	-	-	-	-
EC1001-1.5	3	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", 11th Edition, PHI, 2016
2.	Simon Haykin, "Introduction to Analog and Digital Communications", Wiley Publishers, 2nd Edition, 2019
3.	Theodore Rappaport, "Wireless Communications: Principles and Practice", Pearson, 2nd Edition, 2016
4.	Shibu K V, "Introduction to Embedded Systems", TATA Mc Graw Hill Edu., 2nd Edition, 2016

E Books / MOOCs/ NPTEL

1.	*https://nptel.ac.in/courses/117107095*
2.	*https://nptel.ac.in/courses/117103063*
3.	*https://www.coursera.org/learn/electronics?#syllabus*
4.	*https://www.coursera.org/learn/diode-pn-junction-metal-semiconductor-*

	contact?specialization=semiconductor-devices#syllabus
5.	https://www.coursera.org/learn/transistor-field-effect-transistor-bipolar-junction-transistor?specialization=semiconductor-devices

APPLIED DIGITAL LOGIC DESIGN

Course Code:	**EC1002-1**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T: P):	**2:0:2**	**Credits:**	**03**
Total Teaching Hours:	**26+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	To understand the basics of number systems and conversion
2.	To understand the functions of different logic gates, De-Morgan's theorem and simplify the Boolean Equations using Karnaugh Maps and Q-M method
3.	To understand the operation of Combinational Logic circuits like Decoders, Encoders, multiplexers, Adders/Subtractors, Binary comparators and multiplier.
4.	To understand the operation of Latches/Flip-Flops, Master-Slave Flip-Flops, Edge-Triggered flip-flops, and their uses
5.	To understand the basics of number systems and conversion

UNIT-I

Fundamentals of Digital Design	**10 Hours**

Difference between Analog and Digital Signals, Number System: Binary, Octal and Hexadecimal. Conversion – between Decimal, Binary and Hexadecimal number systems. Boolean algebra, De-Morgan's theorem, Simplification of Boolean expressions, Basic and Universal gates, Realization of Boolean expressions using basic and universal gates. Introduction to Combinational Logic, Canonical Forms, Generation of switching equations from truth tables, Karnaugh map - 3, 4 variables, incompletely specified functions, Introduction to Min/Max term equations, Quine-McCluskey method

UNIT-II

Design of Combinational Logic and Introduction to Flip-Flops	**11 Hours**

Adders and Subtractors, Cascading adders/subtractors, Look ahead carry adder, Decoders, Encoders, Digital multiplexers, Binary comparators, Array Multipliers.
Basic Bistable element, Latches, SR latch, Switch debounce, SR Flip-Flops, D Flip flop, T flip flop, JK flip flops, Conversion of JK flip flop to D flip flop and T flip flop, Master slave JK, 0's and 1's catching problem, Edge triggered flip flop

UNIT-III

Application of Flip Flops	**05 Hours**

Characteristic equations. Design of ripple counter using T-flip flop, Design of shift register using D- flip flop, Design of synchronous counter using clocked D-flip flop

Suggested List of Experiments

1.	Introduction to digital circuit simulation software
2.	Introduction to Basic gates, Universal gates
3.	Realization of logic circuits using universal gates, Realization of De-Morgan's theorem
4.	Realization of Combinational logic circuits
5.	Realization of Sequential logic circuits

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

1.	Compare Analog & Digital Signals; Convert the number from one numbering system to another;
2.	Simplify the logic expressions using Boolean Algebra or K-Map or QM Method; Realize the logic expression using Basic/Universal Gates;

3.	Analyse and Design different Combinational logic circuits such as Decoders, Encoders, Multiplexers, Adders, Subtractors, Binary Comparators and Array Multipliers.
4.	Describe the operation of Latches, Flip flops, Mater-Slave Flip flops, Edge triggered Flip-flops.
5.	Make use of Flip flops to design Registers, Synchronous/Asynchronous Counters.

Course Outcomes Mapping with Program Outcomes & PSO

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

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Morris Mano, "Digital Design", Prentice Hall of India, 3rd Edition.
2. Donald D. Givone, "Digital Principles and Design", McGraw Hill, 2002.

REFERENCE BOOKS:

1. John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2001.
2. D. P. Kothari and J. S Dhillon, "Digital Circuits and Design", Pearson, 2016.
3. Charles H Roth, "Fundamentals of Logic Design", Cengage Learning.

E Books / MOOCs/ NPTEL

1. *https://nptel.ac.in/courses/117106086*

TECHNICAL ENGLISH

Course Code	**HU1001-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L: T:P)	**1:0:2**	**Credits**	**02**
Total Teaching Hours	**13+0+26**	**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

Phonetics & Pronunciation	**8 Hours**

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 Accent

Communication Skills	**8 Hours**

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, Analyze, Interpret and Describe the critical ideas, values, and themes through literary works	
UNIT - III	
Writing Skills	**8 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
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

TEXT BOOK:

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

REFERENCE MATERIALS:

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

E Resources

1. *https://www.macmillandictionary.com/dictionary/british/*

CONSTITUTION OF INDIA

Course Code	**HU1002-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L: T:P)	**1:0:0**	**Credits**	**01**
Total Teaching Hours	**13+0+0**	**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	**6 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	**5 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	**2 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
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 Materials:

1.	Introduction to the Constitution of India; Dr. Durga Das Basu; Twentieth Edition, LexisNexis Butterworths Wadhwa, Nagpur, Haryana, India, Reprint 2011.
2.	Introduction to Constitution of India; M.V. Pylee; Fourth Revised Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2005.
3.	Introduction to Constitution of India; Brij Kishore Sharma; Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.

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 Resources	
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

ENGINEERING VISUALIZATION

Course Code:	**ME1004-1**	**Course Type**	**MNC**
Teaching Hours/Week (L: T: P)	**2:0:0**	**Credits**	**-**
Total Teaching Hours	**26+0+0**	**CIE + SEE Marks**	**50+00**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	To impart and inculcate understanding of the concept of orthographic projection and projection of plane surfaces and solids in different positions in first angle projection system.
2.	To develop the lateral surfaces of solid objects and to draw the isometric projection of simple solids.

UNIT-I

Orthographic Projection	**6 Hours**
Introduction to orthographic projection, Quadrants, principal planes, principal views, Difference between First angle and third angle projection, Dimensioning, Conventions employed for drawing.	
Projection of plane surfaces	**4 Hours**
Triangle, Square, Rectangle, Pentagon, Hexagon and Circle in simple position (Resting on HP with inclination to HP and VP, true length with true inclination only)	
Projection of Solids	**4 Hours**
Prisms, Pyramids, Cones, and Cylinders in simple position (Resting on HP with inclination to HP and VP, true length with true inclination only)	

UNIT-II

Development of Lateral surfaces of solids	**6 Hours**
Right regular Prisms, Pyramids, Cylinders, and cones (with single section plane)	
Isometric projection	**6 Hours**
Isometric scale, Isometric dimensions, 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.	Draw the orthographic projections of a plane surface and solids for a given position using Solid Edge software.
2.	Draw the development of lateral surfaces of standard solid objects. Draw isometric projection of solid objects individually or in combination using 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
ME1003-1.1	1	-	-	-	-	-	-	-	1	1	-	1	1	1	1
ME1003-1.2	1	-	-	-	-	-	-	-	1	1	-	1	1	1	1
ME1003-1.3	1	-	-	-	-	-	-	-	1	1	-	1	1	1	1
ME1003-1.4	1	-	-	-	-	-	-	-	1	1	-	1	1	1	1
ME1003-1.5	1	-	-	-	-	-	-	-	1	1	-	1	1	1	1

1: Low 2: Medium 3: High	
TEXTBOOKS:	
1.	Engineering Drawing by N. D. Bhat & V. M. Panchal, Pramod R. Ingle, 53 Ed., Charotar Publishing House, Gujarat, 2014.
2.	Engineering Drawing by K R Gopalakrishna, Subhas publishers, Bangalore, 32nd edition, 2012.
REFERENCE BOOKS:	
1.	A Primer on computer aided Engineering Drawing, Published by VTU, Belgaum, 8th edition, 2011.
2.	Engineering Drawing and Computer Graphics, Shah, Pearson, 2010
3.	Engineering Graphics, Agarwal & Agarwal, TMH, Second edition, 2013
4.	A Text book of Engineering Graphics and Drafting by P. S. GILL, 11th Ed., S. K. Kataria & sons, ISBN- 8185749612, 9788185749617, New Delhi, 2009.
E Books / MOOCs/ NPTEL ----	

SKILL DEVELOPMENT LAB GROUP-A

Course Code:	**UM1001-1**	**Course Type**	**MNC**
Teaching Hours/Week (L: T: P)	**0:0:4**	**Credits**	**-**
Total Teaching Hours	**0+0+40**	**CIE + SEE Marks**	**-**

1.Automotive Skill Lab

Teaching Department: Mechanical Engineering

Automotive Basics, Engines, Transmission and Electrical Wiring

2.Welding Skill Lab

Teaching Department: Mechanical Engineering

1. Introduction to the joining and welding process.
2. Introduction to the arc welding process
3. Difference between manual metal arc welding (SMAW) and Metal inert gas (MIG) welding
4. Hands-on practice on MIG welding using virtual welding machine
5. Hands-on practice on SMAW using arc welding machine

3.Fluid Power Skill Lab

Teaching Department: Robotics and Artificial Intelligence

Basics of Pneumatics, Hydraulics and Electro Hydraulics

4.Bio Fuel Skill Lab

Teaching Department: Biotechnology

Detailed explanation on Biofuel programme of Karnataka State Bioenergy Development Board, Biofuels such as Biodiesel, Bioethanol and Biogas as alternative fuels, Biofuel production Raw materials such as Seeds and Used cooking oil, Environmental Benefits of Biofuels

Demonstration of Biodiesel production process for Lab and Pilot scale (50L capacity), Oil quality analysis, Biodiesel production (chemicals required, reaction, duration etc.) Purification and Fuel quality analysis, Soap preparation using by- product Glycerine.

****

B. Tech. (IS): 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 - I

II SEMESTER

SI No.	Course and Course code		Course Title	Teaching Department	Teaching hours/Week			Examination				Credits
					Theory Lecture L	Tutorial T	Practical/ Drawing P	Duration in hours	CIE	SEE	Total Marks	
1	BSC	MA1004-1	Discrete Mathematics & Numerical Methods	MA	3	0	0	3	50	50	100	3
2	BSC	CY1001-1	Engineering Chemistry	CY	3	0	2	3	50	50	100	4
3	ESC	CS1001-1	Problem-Solving through Programming	CS	3	0	2	3	50	50	100	4
4	ESC	EE1001-1	Basic Electrical Engineering	EE	3	0	2	3	50	50	100	4
5	ESC	ME1003-1	Elements of Mechanical Engineering	ME	3	0	0	3	50	50	100	3
6	AEC	BT1651-1	Biology for Engineers	BT	1	0	0	1	50	50	100	1
7	AEC	CS1651-1	IT Skills	CS	1	0	2	3	50	50	100	2
8	MNC	CV1002-1	Environmental Science	CV	1	0	0	1	50	50	100	0
9	MNC	UM1002-1	Skill Development Lab Group-B	Any	0	0	4	0	0	0	0	0
				Total	18	0	12	20	400	400	800	21

Note:
BSC: Basic Science Course, **ESC**: Engineering Science Course, **HSMC**: Humanity and Social Science & Management Courses, **AEC** –Ability Enhancement Courses, **MNC**: Mandatory Non credited course **UM**: University Mandatory

Mandatory Internship-I*								
1.	INT	UC1001-1	Internship – I (Activity based internship)	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

DISCRETE MATHEMATICS & NUMERICAL METHODS

Course Code	**MA1004-1**	**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 set theory and relations, propositional and predicative logics, numerical methods, Fourier series and transforms and become skilled for solving problems in science and engineering.

UNIT-I

Set Theory and Logic	**8 Hours**

Sets- operations on sets, product sets and partitions (review)
Relations- representation of relations as matrices and digraphs, equivalence relations.
Functions- permutations functions, functions for computer science.

Fundamentals of logic Propositional logic, logical operations(review), rules of inference Predicates calculus.	
Graph Theory	**7 Hours**
Graphs: Basic terminologies, some special simple graphs, bipartite graphs, adjacency matrices, incidence matrices, graph isomorphism, connectivity- vertex and edge connectivity, Euler and Hamiltonian graphs and their applications, planar graphs, graph coloring and their applications.	
UNIT-II	
Numerical Methods:	**15 Hours**
Roots of algebraic and transcendental equations- Newton Raphson method, Regula Falsi method. Numerical solution of ordinary differential equations- Taylor's series method, Modified Euler's method and Runge –Kutta method of fourth order. Numerical solution of partial differential equations-classification of partial differential equations, examples, solution of Laplace and Poisson equations by standard five-point formulae, solution of heat and wave equations by explicit method.	
UNIT-III	
Fourier Series and Transforms:	**10 Hours**
Periodic functions, Euler's formulae, Fourier series of odd and even functions, functions with arbitrary period, half range series. Fourier transform, inverse Fourier transform, convolution theorem, Fourier sine and cosine transforms. Discrete Fourier transform (DFT) and Fast Fourier transform (FFT)- applications.	

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

1.	Represent a relation in terms of matrix and digraph, apply permutation functions for encoding and decoding simple text messages and establish by deduction the validity of an argument using inference rules. Identify suitable data structure for representing a graph, apply the concept of connectivity in real life problems.
2.	Identify suitable data structure for representing a graph, apply the concept of connectivity in real life problems.
3.	Apply numerical methods to find solutions of algebraic equations and ordinary differential equations.
4.	Apply numerical methods to solve partial differential equations.
5.	Apply the analytical technique to express periodic function as a Fourier sine and cosine series and apply the concepts of Fourier- transforms to solve 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**
MA1004-1.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MA1004-1.2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MA1004-1.3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MA1004-1.4	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MA1004-1.5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Kenneth H. Rosen, "Discrete Mathematics and its applications", Tata McGraw Hill, V Edition 2003.
2.	B.S. Grewal, J. S. Grewal, "Numerical Methods in Engineering and Science", Khanna Publishers, 6th edition, 2002.
3.	Martin Vetterli, Jelena Kovacevic and Vivek Goyal, "Foundations of Signal Processing" , Cambridge University Press, 2014.

REFERENCE BOOKS:

1.	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition (Reprint),

	2016.
2.	Bernard Kolman, Robert C. Busby, Sharon Ross, "Discrete Mathematical Structures" III edition, PHI 2001."Discrete and Combinatorial Mathematics" - Ralph P. Grimaldi, Pearson Education, Asia, IV Edition-2002.
3.	Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, Asia, IV Edition-2002.
4.	J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with applications to computer Science" Tata McGraw Hill-1987
5.	S.S.Sastry, "Introductory methods of Numerical Analysis" , Prentice Hall, 2nd edn.1990.
6.	M.K.Jain, S.R.K. Iyengar and R.K. Jain "Numerical methods for Scientific and Engineering computations", Wiley Eastern, edn.1985.
E Books / MOOCs/ NPTEL	
1.	*http://www.nptelvideos.in/2012/11/discrete-mathematical-structures.html*
2.	*http://cglab.ca/~discmath/notes.html*
3.	*http://ocw.mit.edu/courses/mathematics/ (online course material)*
4.	*http://www.nptelvideos.in/2012/11/discrete-mathematical-structures.html*
5.	*http://cglab.ca/~discmath/notes.html*

ENGINEERING CHEMISTRY

Course Code:	**CY1001-1**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T:P):	**3:0:2**	**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.
4.	To provide students with practical knowledge of quantitative analysis of materials by classical methods.
5.	Familiarize with the practical knowledge of chemistry enabling their skill development by instrumental methods of analysis.

UNIT-I

Electrochemical Cells & Battery Technology	**8 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.

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 & Metal Finishing	**7 Hours**
Corrosion - definition, Electro-chemical theory of corrosion, Factors affecting the rate of corrosion. Differential metal corrosion- galvanic series, Differential aeration corrosion - Waterline and pitting corrosion. Stress corrosion. Corrosion Control: Protective coatings; Inorganic coating - Anodizing and Phosphating. Metal coating - Galvanization and Tinning, cathodic protection. 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	**7 Hours**
Definition, Classification, free radical mechanism of polymerization of vinyl chloride. 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.	
Water Chemistry	**6 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	**2 Hours**
Introduction, classification of nanomaterials. Synthesis of nanomaterials by microwave, combustion, chemical vapour deposition, and sol-gel methods. Applications of nanomaterials.	
UNIT-III	
Chemical Fuels	**6 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.	
Liquid Crystals	**4 Hours**
Introduction, classification- Thermotropic, and Lyotropic with examples. Types of mesophases - 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

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 nitrogen ammonia in each sample of fertilizer using a standard hydrochloric acid solution.
4.	Determination of manganese dioxide in Pyrolusite using standard potassium permanganate solution.
5.	Determination of Iron in the given sample of Hematite ore solution using potassium dichromate crystals by external indicator method.
6.	Determination of Chemical Oxygen Demand (COD) of the given industrial waste Water sample.
7.	Potentiometric estimation of FAS using standard $K_2Cr_2O_7$solution.

8.	Colorimetric determination of iron.
9.	Conductometric estimation of an Acid mixture using standard NaOH solution.
10.	Determination of pKa of a weak acid using pH meter.
11.	Determination of the viscosity coefficient of a given liquid using Ostwald's viscometer.
12.	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 electroless plating.
2.	a) Analyze the different types of polymers, their synthetic routes, and applications. b) Understand the prime problems faced in boiler feed water, subsequent remedial measures undertaken and analyze the quality of water. c) Identify the synthetic approaches undertaken for designing nanomaterials.
3.	Identify the methodologies used to analyze as well as improvise on chemical fuels. 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	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CY1001-1.2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CY1001-1.3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CY1001-1.4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CY1001-1.5	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Engineering Chemistry by P.C. Jain & Monica Jain., DhanpatRai Publications, New Delhi,2015.
2.	Engineering chemistry by R V Gadag & A Nityananda Shetty., IK International Publishing House Private Ltd. New Delh,2016.
3.	Physical Chemistry, by P. W. Atkins, Oxford Publications. (Eighth edition-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, Mc Graw HillPublications.2006.
5.	Vogel's textbook of quantitative inorganic analysis, revised by J.Bassett, R.C. Denny, G.H. Jeffery, 4thEd.
6.	Laboratory manual in Engineering Chemistry Sudharani, Dhanpatrai Publishing Company, New Delhi.

E Books / MOOCs/ NPTEL

1.	http://bcs.whfreeman.com/vollhardtschore5e/default.asp.
2.	https://www.ttu.ee/public/m/Mehaanikateaduskond/Instituudid/Materjalitehnika_instituut/MTX9100/Lecture11_Synthesis.pdf.
3.	http://nptel.ac.in/courses/113108051/module1/lecture1.pdf

PROBLEM SOLVING THROUGH PROGRAMMING

Course Code:	**CS1001-1**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T: P):	**3:0:2**	**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

Introduction To Computer System: **15 Hours**

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

Decision Making and Branching: **15 Hours**

Decision making with if statement, Simple if Statement, the if…else statement, Nesting of if…else statements, Theelse…if ladder, the switch statement, the go to 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

Strings:	**10 Hours**

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 $ax^2+bx+c=0$
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= $\sqrt{}$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

1.	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.
2.	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.
3.	Write a C program to transpose a matrix of order M x N and find the trace of the resultant matrix.
4.	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.
5.	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.
6.	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.
7.	Write a C program to enter the information like name, register number, marks in 6 subjects 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

8.	Write a C program, to implement a bubble sort technique using 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,

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-4.02.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):	**3:0:2**	**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	**04 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	**05 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, 10^{th} Edition, 2010.
2.	Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, 3^{rd} 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; 7^{th} 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/

ELEMENTS OF MECHANICAL ENGINEERING

Course Code:	**ME1003-1**	**Course Type**	**ESC**
Teaching Hours/Week (L: T: P)	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**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 Airconditioning.
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
ME1003-1.1	3	1	-	-	-	1	-	1	-	1	-	-	-	-	-
ME1003-1.2	3	1	-	-	-	-	-	-	-	1	-	-	-	-	-
ME1003-1.3	3	2	-	-	-	-	-	-	-	1	-	-	-	-	-
ME1003-1.4	3	2	-	-	-	-	-	-	1	1	-	-	-	-	-
ME1003-1.5	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:	**BT1651-1**	**Course Type:**	**AEC**
Teaching Hours/Week (L: T: P):	**1:0:0**	**Credits:**	**01**
Total Teaching Hours:	**15+0+0**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Biotechnology

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	**05 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	**05 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.	Analyze 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→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
BT1651-1.1	3	-	-	-	-	-	-	-	1	-	-	1
BT1651-1.2	3	-	-	-	-	-	-	-	1	-	-	1
BT1651-1.3	3	3	-	-	-	-	2	-	1	-	-	1
BT1651-1.4	3	3	-	-	-	-	2	-	1	-	-	1

BT1651-1.5	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:	**CS1651-1**	**Course Type:**	**AEC**
Teaching Hours/Week (L: T: P):	**1:0:2**	**Credits:**	**02**
Total Teaching Hours:	**15+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Computer 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.	Describe the use of Microsoft excel in data analysis
5.	Discuss the basic concepts of IoT.

Suggested List of Experiments

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 Wishlist (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 operation: Sum
8	Create user account and demonstrate use of Google drive, Google docs, Google Form
9	Data Analysis using Microsoft Excel
10	Hacker Earth, Hack rank/ Demonstration of IoT (Demonstrate Internet of Things using examples a. Smart home b. Smart city c. Smart farming)

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.	Understand the basics of Microsoft excel.
5.	Comprehend the basic concepts of IoT

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
CS1651-1.1	3	-	-	-	2	-	-	-	-	-	-	-
CS1651-1.2	3	1	-	-	-	-	-	-	-	-	-	-
CS1651-1.3	3	2	-	-	2	-	-	-	-	-	-	-
CS1651-1.4	2	-	-	-	-	-	-	-	-	-	-	-
CS1651-1.5	3	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Suman M, Chinmaya Dash, R Sreenivas Rao "Digital Fluency", Himalaya Publishing House Pvt. Ltd., 2021.
2.	Melwyn Amrithraj, Prem Sagar, Pradeep, "Digital Fluency", Himalaya Publishing House Pvt. Ltd., 2021.
3.	R G Saha, Dr. Kantesha S, Niha Asif, "Digital Fluency", Himalaya Publishing House Pvt. Ltd., 2021.

REFERENCE BOOKS:

1.	Randy Connolly and Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India.

E Books / MOOCs/ NPTEL

1.	*https://www.sas.com/en_in/insights/analytics/machine-learning.html*
2.	*https://www.aig.com/IoT*
3.	14 Types of Phishing Attacks That IT Administrators Should Watch For (syscloud.com)
4.	6 Common Phishing Attacks and How to Protect Against Them (tripwire.com)
5.	Important Applications of Cloud Computing (jigsawacademy.com)
6.	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)	**1:0:0**	**Credits**	**00**
Total Teaching Hours	**15+0+0**	**CIE + SEE Marks**	**50+00**

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:
Definition, sources_ 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-
Non-renewable 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	**04 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.

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

1.	Identify the significance of environmental practice in their daily life and in the Engineering practices.
2.	Create awareness about environmental conditions.

3.	Follow environmentally appropriate behaviour.
4.	Understand the importance of their surroundings.
5.	Understand Current environmental issues of 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
CV1002-1.1	-	2	-	-	-	-	-	2	-	-	-	-	1	-	-
CV1002-1.2	-	-	-	1	-	-	-	-	-	1	-	-	1	-	-
CV1002-1.3	1	-	-		1	-	-	-	-	-	-	-	1	-	-
CV1002-1.4	1	-	-	1	-	-	-	-	-	-	-	-	1	-	-
CV1002-1.5	-	-	3	-	-	-	-	-	-	-	3	-	1	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Benny Joseph, "Environmental Studies", Tata McGraw Hill Publ. Co., New Delhi, 2005.
2. Rajagopalan, R., "Environmental Studies: From Crisis to Cure", Oxford University Press, London, 2005.

REFERENCE BOOKS:

1. Balasubramanya, N and Chatwal, Gurdeep R., "Environmental Studies", Himalaya Publishing House, Mumbai, 2007.
2. Barucha, E., "Environmental Studies", University Grants Commission, New Delhi, 2004.
3. Bhatia, S. C, "Environmental Chemistry", CBS Publishers, New Delhi, 2005.
4. De, A.K. and De, A. K., "Environmental Studies", 2006.
5. Keller, Edward A., "Environmental Geology", CBS Publishers and Distributors, Delhi, 1985.

SKILL DEVELOPMENT LAB GROUP-B

Course Code:	**UM1002-1**	**Course Type**	**MNC**
Teaching Hours/Week (L: T: P)	**0:0:4**	**Credits**	**00**
Total Teaching Hours	**0+0+40**	**CIE + SEE Marks**	**00**

1. HAM Radio & Internet Radio

Teaching Department: MCA and Electronic and Communication Engineering

HAM Radio

Session 1: Basics of HAM Radio, Applications, Frequency Bands, Equipment for HAM Radio station set up, Morse codes, global competitions, and antenna system

Session 2: Examination contents to become Member of HAM Radio club, hands on session using HAM Radio hand held devices

INTERNET RADIO

Part I

a) Introduction to Internet Radio Technology and Basics of Internet Radio
b) Listening
c) Streaming
d) Popularity
e) Broadcasting Freedom
f) History

1. Broadcasting Room visit and demo
2. Recording Studio Visit & Demo with introduction to Radio Nitte

Part II

3. Introduction to Steinberg Cubase Digital Audio Work Station (DAW)
4. Cubase & VST (Virtual Studio Technology)

5. Cubase History & Versions and Notable users
6. Introduction to Cubase User Interface
7. Introduction to Music Production
8. Creating a new project and setting up of project environment in Cubase
9. Create, Produce, Mix and Export demonstration

2. Land Line Marking Skill

Teaching Department: Civil Engineering

1. Introduction of the Surveying essential for normal life.
2. Linear measurement using tape.
3. Setting out right angles using cross-staff and tape.
4. Setting out of polygon using tape Area measurement.

3. Art of trouble shooting day-to-day electrical equipment

Teaching Department: Electrical and Electronic Engineering

1. Effective use of tester
2. Identification of phase, neutral and earth using test lamp
3. Demonstration of safety devices
4. Hands on operating ceiling fan
5. Working principle of Induction Motor/ Water Pump
6. Internal structure of Hybrid EV
7. Internal structure of 3 wheeler fully electric vehicle
8. Different types of motor assembly for EV

4. Fabrication Lab

Teaching Department: AIC

Electronics Fab Lab

This lab is comprised of accessible digital electronics tools, IoT boards and sensors and computing systems to enable users to go from simulation of IoT electronic circuits in real time all the way to building basic working models of circuits, systems and operational projects which can be used in real-time applications for sensing, home automation, repair and testing.

Shopfloor Fab Lab

This lab is comprised of a complete set of hand tools, power tools and fine tools along with digital design to enable users to go from digitally designed projects which can be built using a combination of tools to achieve perfect finish, sturdy design, and process-based thinking towards large and complex projects

Digi Fab Lab

This lab is comprised of the modern CNC digital tools of laser cutting, routing, 3D printing and plotting to enable users to learn the fundamentals of machine-based production, customization, and revenue generation through application of computers, design, and materials for machining.

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															

****

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

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

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

HOLISTIC COMPONENTS

HUMANITIES

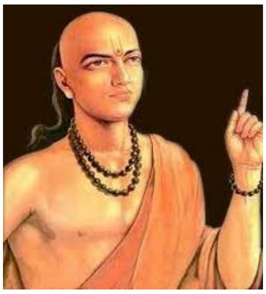
Holistic education is not only about teaching the basic subjects, but it is more about redefining the way a student should be taught. The purpose of holistic language teaching is the development of the learners' ability to handle both their language oral skills as well as maximizing their life skills. 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 students 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 **Kanada**(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.

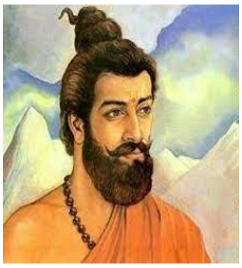
All sciences were originated from philosophy. Physics was called natural philosophy until the 19th century, but once it was proven to be correct it was no longer philosophy and became a science. Physics is the science of the natural world, more specifically dealing with the matter, energy, space-time, 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.

ANCIENT SEERS OF INDIA – CHEMISTRY

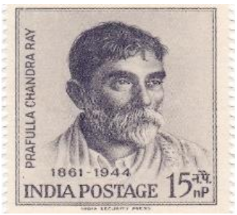
In ancient India, chemistry was called **Rasayan Shastra, Rasa-Vidya, Rasatantra and Rasakriya** all of which roughly mean '***Science of Liquids***'. There also existed chemical laboratories which were called **Rasakriya-nagaram**/**Rasakriya-shala**, which literally mean '***School where liquids are 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.

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 chapters 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 establishing 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, 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 10^{53}** (10 to the power 53) with specific names. The largest used number today is **Tera 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 ज्ञ(Gnya)=5 च(Cha)=6 छ(Cha)=7 ज(Ja)=8 झ(Ja)=9 ञ(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

****

B.Tech. (ISE): 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 and Course code		Course Title	Teaching Dept.	Teaching Hours/Week				Examination				Credits
					Theory Lecture (L)	Tutorial (T)	Practical/Drawing (P)	PBL (J)	Duration in hr	CIE Marks	SEE Marks	Total Marks	
1.	BSC	MA2001-1	Statistics and Probability Theory	MA	3	0	0	0	03	50	50	100	3
2.	IPCC	CS2001-1	Data Structures	IS	3	0	2	0	03	50	50	100	4
3.	IPCC	CS2002-1	Object Oriented Programming	IS	3	0	2	0	03	50	50	100	4
4.	PCC	IS2101-1	Computer Organization & Design	IS	3	0	0	0	03	50	50	100	3
5.	PCC	IS1102-1	Introduction to Data Science	IS	3	0	0	√	03	50	50	100	3
6.	PCC	IS1602-1	Unix Shell and System Programming	IS	0	0	2	0	03	50	50	100	1
7.	HSMC	HU2001-1	Enhancing Self Competence	HU	2	0	0	0	03	50	50	100	2
8.	MNC	HU1003-1	Kannada (Balake / Samskrithika)	Any Dept.	1	0	0	0	-	50	-	50	0
9.	HEC	HU1005-1	Essence of Indian Culture	Any Dept.	1	0	0	0	-	50	-	50	0
				TOTAL	**19**	**0**	**6**	**-**	**21**	**450**	**350**	**800**	**20**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs													
9	MNC	MA1012 -1	Bridge course - Calculus & Differential Equations	MA	3	0	0	0	3	100	0	100	0

IV SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week				Examination				Credits
					Theory Lecture (L)	Tutorial (T)	Practical (P)	PBL (J)	Duration in hr	CIE Marks	SEE Marks	Total Marks	
1	BSC	MA2005-1	Linear Algebra and its Applications	MA	3	0	0	0	03	50	50	100	3
2.	IPCC	CS3004-1	Design and Analysis of Algorithms	IS	3	0	2	0	03	50	50	100	4
3.	IPCC	IS2001-1	Internet & Web Programming	IS	3	0	2	0	03	50	50	100	4
4.	PCC	CS2102-1	Database Management Systems	IS	3	0	0	√	03	50	50	100	3
5.	PCC	IS1103-1	Introduction to Software Engineering	IS	3	0	0	0	03	50	50	100	3
6.	PCC	IS1601-1	Database Applications	IS	0	0	2	0	03	50	50	100	1

			Lab										
7.	HSMC	HU1004-1	Universal Human Values	Any Dept	1	0	0	0	01	50	50	100	1
8.	AEC	ME1654-1	Innovations and Design Thinking	ME	1	0	0	0	01	50	50	100	1
9.	VEC	ISx5xx-1	Department specific Vocational Education Course	IS	0	0	2	0	03	50	50	100	1
10.	UCC	UC1001-1	Internship – I (Activity based internship)	Mandatory Intra Institutional 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	-	100	2
				TOTAL	**17**	**0**	**8**	**-**	**23**	**550**	**450**	**1000**	**23**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs													
10	MNC	MA1014-1	Bridge course - Discrete Math & Numerical Methods	MA	3	0	0	0	3	100	0	100	0

3rd Year Scheme

V SEMESTER													
Sl. No.	**Course and Course code**		**Course Title**	**Teaching Dept.**	**Teaching Hours/Week**				**Examination**				**Credits**
					Theory Lecture	**Tutorial**	**Practical**	**PBL**	**Duration in hr**	**CIE Marks**	**SEE Marks**	**Total Marks**	
					L	**T**	**P**	**J**					
1.	IPCC	IS3001-1	Data Communication and Networking	IS	3	0	2	0	3	50	50	100	4
2.	IPCC	IS2002-1	Machine Learning Foundations	IS	3	0	2	0	3	50	50	100	4
3.	PCC	IS3101-1	Operating Systems Fundamentals	IS	3	0	0	0	3	50	50	100	3
4.	PCC	IS3603-1	Mobile Application Development Lab	IS	0	0	2	0	3	50	50	100	1
5.	PEC	ISxxxx-1	Professional Elective-I	IS	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	IS	1	0	2	0	3	50	50	100	2
		HU1010-1	Research Methodology	Any Dept.	2	0	0	0	3	50	50	100	2
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	IS	1	0	0	0	-	50	-	50	1
				TOTAL	**16/ 17**	**0**	**8/6**	**-**	**20**	**450**	**400**	**850**	**20**

VI SEMESTER

Sl. No.	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical	PBL	Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1.	IPCC	IS4001-1	Information & Network Security	IS	3	0	2	0	3	50	50	100	4
2.	PCC	IS3102-1	Automata Theory & Compiler Design	IS	3	0	0	0	3	50	50	100	3
3.	PCC	IS3601-1	C# and .NET Framework Lab	IS	0	0	2	0	3	50	50	100	1
4.	PEC	ISxxxx-1	Professional Elective - II	IS	3	0	0	0	3	50	50	100	3
5.	PEC	ISxxxx-1	Professional Elective - III	IS	3	0	0	0	3	50	50	100	3
6.	OEC	XXX5XX-1	Open Elective –I	Any Dept.	3	0	0	0	3	50	50	100	3
7.	HSMC	MG1003-1	Management & Entrepreneurship	IS	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	**19**	**0**	**4**	**-**	**22**	**400**	**400**	**800**	**21**

4th Year Scheme

VII SEMESTER

Sl. No.	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week				Examination				Credits
					Theory	Tutorial	Practical	Self-Study	Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
9.	IPCC	IS3002-1	Ethical hacking and Network Defence	IS	3	0	2	0	3	50	50	100	4
10.	PCC	IS3602-1	Internet of Things Lab	IS	0	0	2	0	3	50	50	100	1
11.	PEC	ISXXXX-1	Professional Elective - IV	IS	3	0	0	0	3	50	50	100	3
12.	PEC	ISXXXX-1	Professional Elective – V	IS	3	0	0	0	3	50	50	100	3
13.	OEC	XXX5XX-1	Open Elective –II	Any Dept.	3	0	0	0	3	50	50	100	3
14.	HSMC	MG1002-1	Financial Management	IS	3	0	0	0	3	50	50	100	3
15.	HEC	HU1009-1	Indian Knowledge Systems	Any Dept.	1	0	0	0	-	50	-	50	1
16.	UCC	UC3001-1	Major Project Phase I	IS	-	-	4	-	-	100	-	100	2
				TOTAL	**16**	**0**	**8**	**-**	**18**	**450**	**300**	**750**	**20**

VIII SEMESTER

Sl. No.	Course and Course code		Course Title	Teaching Hours/Week			Examination				Credits
				Theory Lecture	Tutorial	Project/ Self study	Duration in hr	CIE Marks	SEE Marks	Total Marks	
				L	T	J/S					
3.	UCC	UC2001-1	Internship- II	Mandatory Research Internship / Industry Internship of total 8 weeks (320 – 360h) to be completed in one/two stretches during the vacation periods between IV to VII semesters			3	50	50	100	8
4.	UCC	UC3002-1	Major Project Phase II	Student should carry out project in research institute/industry/intra institute Center of Excellences. Two contact hours /week for interaction between the project guide and students.			3	100	100	200	8
TOTAL				**-**	**-**	**-**	**6**	**150**	**150**	**300**	**16**

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

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

(Effective from the academic year 2022 - 23)

Program Specific Ability Enhancement Courses [AEC]	
Course Code	**Course Title**
IS1651-1	Professional Ethics
HU1010-1	Research Methodology
IS2651-1	C++ Programming
IS2652-1	Fundamentals of Angular and ReactJS
IS2653-1	Technical Content Writing

Open Electives offered to other branch students by the Department [OEC]	
Course Code	**Course Title**
IS2501-1	Introduction to Cyber Security
IS2502-1	Python Application Programming
IS2503-1	Software Engineering Practices
IS2504-1	Web technologies

Program Specific Vocational Enhancement Courses [VEC]	
Course Code	**Course Title**
IS1551-1	Python Programming Fundamentals

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

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

(Effective from the academic year 2022 - 23)

List of Professional Elective Courses [PEC]			
Group-1		**Group-2**	
IT Management Stream			
Code	**Elective Course Title**	**Code**	**Elective Course Title**
IS2201-1	Information Storage Management	IS2301-1	Innovation Management & Business Models
IS3201-1	iOS App Development using Xcode and Swift	IS3301-1	Nosql Database
IS3202-1	Robotic Process Automation Design & Development	IS1301-1	Supply Chain Management and Enterprise Resource Planning
IS1201-1	Total Quality Management for Sustainable Growth	IS2302-1	User Interface Design
Software Engineering and Development Stream			
Code	**Elective Course Title**	**Code**	**Elective Course Title**
IS3211-1	Advanced Java Programming	IS2311-1	Agile Technology
IS2212-1	Business Intelligence and its Applications	IS3312-1	Full Stack Development
IS2213-1	Object Oriented Modeling and Design	IS3313-1	Human Computer Interaction
IS2214-1	Software Testing	IS2314-1	Software Architecture and Design Patterns
Networks & Security Stream			
Code	**Elective Course Title**	**Code**	**Elective Course Title**
IS4221-1	Adhoc Wireless Networks	IS3321-1	Blockchain Technology
IS4222-1	Computing in Communication Networks	IS4321-1	Intrusion Detection System
IS4223-1	Network Engineering	IS4322-1	Wireless Networks and Mobile Computing
IS4224-1	Software Defined Networks	IS4323-1	Wireless Sensor Networks
Data Science and Machine Intelligence Stream			
Code	**Elective Course Title**	**Code**	**Elective Course Title**
IS2231-1	Artificial Intelligence	IS3331-1	Data Mining
IS2232-1	Bio Informatics	IS3332-1	Deep Learning
IS3233-1	Fundamentals of Image Processing	IS3333-1	Game Theory & Applications
IS1231-1	Introduction to Drones	IS3334-1	Social and Web Analytics
General Stream			
Code	**Elective Course Title**	**Code**	**Elective Course Title**
IS3241-1	Cloud Computing	IS3341-1	AI and ML in Healthcare
IS3242-1	Graphics and Animation	IS3342-1	Computer Vision
IS3243-1	Multicore Architecture & Programming	IS3343-1	Operations Research
IS3244-1	Multimedia Processing	IS3344-1	Virtual Reality

Courses from Basic Science

STATISTICS & PROBABILITY THEORY

Course Code:	**MA2001-1**	**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	**MA1002-1**		

Teaching Department: Mathematics

Course Objectives:

1.	Understand the basic principles of probability, Bayes theorem, understand the definitions of discrete, continuous, and joint random variables, compute the mean, variance and covariance of random variables.
2.	Define the binomial, uniform, Poisson, exponential and normal random variables use these principles in problem solving situations.
3.	Understand the concepts of statistical population and sample, variables and attributes. Learn about moments and their use in studying various characteristics of data and various distributions.

UNIT-I

PROBABILITY THEORY — **16 Hours**

Finite sample space, probability, conditional probability and independence, Bayes' theorem. One dimensional random variable: discrete and continuous random variable, probability functions, cumulative distribution function, expectation and variance.
Two-dimensional random variable: joint pdf, marginal pdf's , covariance (CO1)

Distributions: Binomial, Poisson, Uniform, Normal and exponential distributions.
Moment generating function- properties and simple problems.(CO2)

UNIT-II

SAMPLING DISTRIBUTION AND ESTIMATION — **14 Hours**

Random Sample, Sample mean, sample variance, sampling distribution of mean, Central limit theorem, sampling distributions of proportions and sums. Student's t-distribution, Chi-square distribution. Sample distribution of variance.
Estimation: Point estimation, interval estimation, confidence intervals for means and variance. (CO3)

CURVE FITTING AND REGRESSION

Least square principle, fitting of straight lines, polynomials and exponential curves.
Correlation, Rank correlation, Coefficient of correlation, Linear regression. (CO4)

UNIT-III

STOCHASTIC PROCESS — **10 Hours**

Stochastic processes, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, transition probabilities, Birth-death process, Queuing theory – M/M/1 Model, simple problems.(CO5)

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

1.	Apply the concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.
2.	Define and explain the different statistical distributions (e.g., Normal, Binomial, Poisson) and the areas of their application.
3.	Explain the concept of correlation and the difference between positive and negative correlation. Compute the correlation coefficient, r , Explain and apply the least square errors method numerically and algebraically to find the curve of best fit.
4.	Able to apply the central limit theorem to sampling distribution. Translate real-world problems into probability models.
5.	Identify and apply the most appropriate stochastic process technique for a given applied problem. Calculate probabilities of absorption and expected hitting times for discrete time Markov chains with absorbing states.

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
MA2001-1.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
MA2001-1.2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
MA2001-1.3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
MA2001-1.4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
MA2001-1.5	3	2	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Paul L Meyer, "Introductory Probability and Statistical Applications", Addison-Wesley Publishing Company, 2nd Edition (Reprint), 1970.
2.	Hogg and Craig, "Introduction to mathematical Statistics", Pearson Education, New Delhi, 6th Edition.

REFERENCE BOOKS:

1.	Schaum Outlines, "Probability and Statistics", Mc Graw Hill, 3rd edition, 2010.
2.	T. Veerarajan, "Engineering Mathematics", McGraw-Hill, New Delhi, 2008.
3.	B. V. Ramana, "Higher Engineering Mathematics", Tata Mc Graw –Hill, New Delhi,2010.

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/110107114
2.	https://nptel.ac.in/courses/111105090
3.	https://nptel.ac.in/courses/111102098

LINEAR ALGEBRA AND ITS APPLICATIONS

Course Code:	**MA2005-1**	**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	**MA1002-1, MA1007-1**		

Teaching Department: Mathematics

Course Objectives:

1.	Learn to apply elementary row operations to solve linear systems of equations and find the eigenvalues and eigenvectors of a matrix.
2.	Find the eigenvalues and eigenvectors of a square matrix using the characteristic polynomial and will know how to diagonalize a matrix, when this is possible
3.	Understand real vector spaces and subspaces, linear independence and dependence, and find basis and dimension of a vector space, row space, column space and null space of a matrix.
4.	Define a linear transformation and find the matrix associated with it; determine the kernel and range of a transformation; find inner product of vectors, orthogonal and an orthonormal basis.
5.	Learn basic concepts of real quadratic forms, decomposition of matrices and solve problems on the same.

UNIT-I

Matrices **15 Hours**

Elementary transformation of a matrix, Echelon form and rank of a matrix. Consistency and solution of system of linear equations - Gauss elimination method, LU Decomposition method and approximate solution by Gauss Seidel method.

Trace, relation between trace and Eigen values of a matrix, Eigen values and Eigen vectors of symmetric matrices, Rayleigh's power method to find the largest eigen value and eigen vector of square matrices. Diagonalization.

UNIT-II

Vector Space	**08 Hours**
Vector spaces, subspaces, linearly dependent and independent vectors, basis and dimension, coordinates, row space, column space and null space.	
Linear Transformations	**07 Hours**
Linear transformations, algebra of linear transformations, representation of transformations by matrices, isomorphism, Range and Null space of a linear transformation. Rank – nullity theorem. Inner products, orthogonal sets of projections, Gram-Schmidt's orthogonalization process.	

UNIT-III

Matrix Decompositions	**10 Hours**
Quadratic forms, QR-factorization, least-squares problems, singular value decomposition and principal component analysis.	

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

1.	Solve the system of linear equations for exact or approximate solutions.
2.	Compute and use eigenvectors and eigenvalues.
3.	Analyze finite dimensional vector spaces and subspaces over a field and their properties, including the basis structure of vector spaces.
4.	Relate matrices and linear transformations, apply the properties of inner product and determine orthogonality on vector spaces and orthogonal bases.
5.	Derive and utilize Quadratic forms, SVD and QR factorization of the matrix for efficiently solving problems 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
MA2005-1.1	3	1	-	-	-	-	-	-	-	-	-	-	-	-
MA2005-1.2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
MA2005-1.3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
MA2005-1.4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
MA2005-1.5	3	2	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Kenneth Hoffman And Ray Kunze, "Linear Algebra", Prentice-Hall, 2nd edition, 1971
2.	David C. Lay, "Linear Algebra and Its Applications", Pearson Education, Inc., 5th edition, 2016.

REFERENCE BOOKS:

1.	Seymour Lipschutz And Marc Lars Lipson, "Schaum's outlines - Linear Algebra", McGraw-Hill, 4th Edition, 2002.
2.	Gilbert Strang, "Introduction to Linear Algebra", Wellesley-Cambridge Press, 5th Edition, 2016.
3.	Gerald Farin, Dianne Hansford, "Practical Linear Algebra, A Geometry Toolbox", Chapman and Hall, 4th edition, 2021.
4.	Sheldon Axler, "Linear Algebra Done Right", Springer Nature, 3rd Edition, 2015.

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/111101115
2.	https://archive.nptel.ac.in/courses/111/106/111106135/
3.	https://nptel.ac.in/courses/110104024

Professional Core Courses (Theory)

COMPUTER ORGANIZATION & DESIGN			
Course Code:	**IS2101-1**	**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	**EC1002-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	**Learn** the basic structure and operation of a digital computer
2.	**Learn** arithmetic unit and **perform** fixed point and floating-point addition, subtraction, multiplication and division in binary 2's complement number system
3.	**Understand** the basic processing unit in terms of control unit, execution of instructions, write control sequences for instructions. **Learn** the instruction and thread level parallelism.
4.	**Explore** the design of hierarchical memory system including cache memories and virtual memory. Compare the performance.
5.	**Discuss** serial and parallel communication with I/O devices and standard I/O interfaces available.

UNIT-I

15 Hours

BASIC COMPUTER ORGANIZATION:

Functional units, Basic Operational Concepts, Performance, Instructions execution and straight-line sequencing, Branching, condition codes.

ARITHMETIC OPERATIONS:

Multiplication of Positive Numbers, Signed Operand Multiplication, Integer Division, IEEE standard for Floating-point Numbers.

UNIT-II

15 Hours

BASIC PROCESSING UNIT:

Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control.

INPUT/OUTPUT ORGANIZATION:

Accessing I/O Devices, Interrupts –Interrupt Hardware, Enabling and Disabling Interrupts, Exceptions, Handling Multiple Devices, Controlling Device Requests, Buses, Direct Memory Access, PCI Bus and USB(Basics only).

UNIT-III

10 Hours

MEMORY SYSTEMS:

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories –Mapping Functions, FIFO and LRU replacement policies, Performance Considerations, Virtual Memories.

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

1.	**Outline** the basic structure and operation of a digital computer
2.	**Learn** arithmetic unit and **perform** fixed point and floating-point addition, subtraction, multiplication and division in binary 2's complement number system
3.	**Understand** the fine grain details of basic processing unit in terms of control unit, execution of instructions and learn the scope for instruction and thread level parallelism. **Implementation** of instructions for single and multiple bus configuration.
4.	**Explain** different ways of communication with I/O devices and standard I/O interfaces.
5.	**Demonstrate** the computer architecture concepts in the design of hierarchical memory system including cache memories and virtual memory.

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

IS2101-1.1	3					1			1	1		1	3	
IS2101-1.2	3	2				1			1	1		1	3	
IS2101-1.3	3	2	1			1			1	1		1	3	
IS2101-1.4	3	1				1			1	1		1	3	
IS2101-1.5	3	2	2			1			1	1		1	3	

1: Low 2: Medium 3: High

TEXTBOOK:	
1.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky**, "**Computer Organization", 5th Edition, TMH, 2011.
REFERENCE BOOKS:	
1.	William Stallings, "Computer Organization & Architecture", 7th Edition, PHI, 2006.
2.	Vincent P. Heuring & Harry F. Jordan, "Computer Systems Design and Architecture", 2nd Edition, Pearson Education, 2004.
3.	David A. Patterson, John L. Hennessy, "Computer Organization and Design", 4th Edition Elsevier, 2012.
4.	John P.Hayes, "Computer Architecture", 2nd edition, McGraw Hill, 1988
5.	John L. Hennessey and David A. Patterson**, "**Computer Architecture, A Quantitative Approach", 6th Edition, Elsevier, 2017
6.	Shameem Akhter and Jason Roberts, "Multicore programming- Increasing performance through software multithreading", Intel press, 2006
E Books / MOOCs/ NPTEL	
1.	https://dcs.abu.edu.ng/staff/sani-ahmad-hassan/course materials/COSC303_LEC.pdf
2.	http://www.cse.iitm.ac.in/~vplab/courses/comp_org/
3.	http://www.ddegjust.ac.in/studymaterial/msc-cs/ms-07.pdf
4.	http://nsec.sjtu.edu.cn/data/MK.Computer.Organization.and.Design.4th.Edition.Oc t.2011.pdf

INTRODUCTION TO DATA SCIENCE

Course Code:	**IS1102-1**	**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	-------		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Explain the concepts of data mining and types of Analytics
2.	Illustrate the use of different datamining algorithm
3.	Describe the basic concepts of R programming
4.	Apply the Data visualization concepts using R programs
5.	Get the idea of lookup functions and Pivot Tables and Illustrate the use of Data validation and Data Visualization

UNIT-I

15 Hours

Introduction to Data Science: Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields.

Introduction to Data Mining: What is data mining, Challenges, Data Mining Tasks, Phases of data mining Benefits of data mining, What Kinds of Data Can Be Mined, What Kinds of Patterns Can Be Mined, Major Issues in Data Mining, PREPROCESSING: Data Quality, Major Tasks in Data Pre-processing, Data Reduction, Data Transformation and Data Discretization, Data Cleaning and Data Integration. **DATA WAREHOUSING AND ON-LINE ANALYTICAL PROCESSING**: Data Warehouse basic concepts, Data Warehouse Modelling - Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation.

Classification: Decision Trees Induction, Rule Based Classifiers, Nearest Neighbour Classifiers, Bayesian Classifiers. K-Means**.,** Regression Model, Apriori Algorithm in datamining.

UNIT-II

15 Hours

R Programming Basics: Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions.
Data Visualization using R: Reading and getting data into R (External Data): Using CSV files, Excel files.
Working with R Charts and Graphs: Histograms, Box plots, Bar Charts, Line Graphs, Scatter plots, Pie Charts.

UNIT-III

10 Hours

Introduction to Data Analysis using Excel: Introduction to Data Mining, Business Intelligence, Statistical Analysis, Predictive Analytics, Text Analytics,
Data Analysis Process: Excel Formulas and Functions — Learn with Basic Examples, Logical Functions in Excel — IF, AND, OR, Nested IF and NOT. Conditional Formatting, Sorting and Filtering, Subtotals with Ranges.
Data Quick Analysis: Understanding Lookup Functions, PivotTables, Data Visualization, Data Validation. What-If Analysis, Importing Data into Excel, Data Model, Exploring Data with PivotTable

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

1.	Apply the Concepts of data science in various fields
2.	Study different data mining algorithm
3.	Describe R basics, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors,
4.	Analysis the data using different R graphs and Charts.
5.	Acquire the knowledge of data analysis and carry out the data analysis process.

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
IS1102-1.1	2									1		1		
IS1102-1.2	2	2								1		1		
IS1102-1.3	2	3								1		1		3
IS1102-1.4	2	2	3							1		1		2
IS1102-1.5	2									1		1		2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Microsoft Excel 2019 Data Analysis and Business Modelling (Business Skills), 6th Edition, Wayne L Winston, ISBN-13: 978-1509305889, ISBN-10: 1509305882.
2. Tilman M. Davies, "The Book of R: A First Course in Programming and Statistics", No Starch Press; 1st edition,2016.
3. Jiawei Han, Micheline Kamber, Jian Pei (2012), Data Mining: Concepts and Techniques,

REFERENCE BOOKS:

1. Paul Mc Fedries, Microsoft Excel 2019 Formulas and Functions (Business Skills), 1st Edition, ISBN-13: 978-1509306190, ISBN-10: 1509306196.
2. Gil Raviv, Collect, Combine, and Transform Data Using Power Query in Excel and Power BI (Business Skills) 1st Edition, ISBN-13: 978-1509307951, ISBN-10: 1509307958.
3. Devin Knight, Mitchell Pearson, Bradley Schacht, Erin Ostrowsky, Microsoft Power BI Quick Start Guide: Bring your data to life through data modelling, visualization, digital storytelling, and more, 2nd Edition, ISBN-13: 978-1800561571, ISBN-10: 1800561571
4. Andrie de Vries and Joris Meys, R for Dummies, 2nd Edition, John Wiley & Sons' 2nd edition, 2015.
5. Hadley Wickham, Garrett Grolemund, R for data Science: Import, Tidy, Transform, Visualize, And Model Data, O′Reilly; 1st edition, 2017.
6. Andrew Oleksy, Data Science with R: A Step by Step Guide With Visual Illustrations & Examples.

E Books / MOOCs/ NPTEL

1. Excel Skills for Data Analytics and Visualization Specialization
2. https://www.coursera.org/specializations/excel-data-analytics-visualization

3.	IBM Data Analytics with Excel and R Professional Certificate

INTRODUCTION TO SOFTWARE ENGINEERING

Course Code:	**IS1103-1**	**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	--		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Get Knowledge of basic SW engineering methods and practices, and their appropriate application.
2.	Describe software engineering layered technology and Process frame work.
3.	Understand software process models such as the waterfall and evolutionary models.
4.	To make them understand the concepts of Project Management for planning to execution of projects.

UNIT-I	**15 Hours**

Introduction: Professional Software Development, Software Engineering Ethics, Case Studies. Software Processes: Software Process Models: The Waterfall Model, Incremental development and Spiral Model; Process activities. Requirements Engineering: Functional and non-functional requirements, Software requirements document, Requirements specification, Requirements engineering processes, Requirements Elicitation and Analysis, Requirements validation, Requirements management.
Text Book 1: Chapter No.: 1,2-2.1,2.2,4

UNIT-II	**15 Hours**

System Modeling: Context models, Interaction models, Structural models, Behavioural models, Model Driven Engineering 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.
Text Book 1: Chapter No.: 5,6,7-7.1,3-3.1-3.4

UNIT-III	**09 Hours**

Project Management: Risk management, Managing People, Teamwork Project Planning: Software pricing, Plan-driven development, Project Scheduling, Agile Planning, Estimation Techniques.
Text Book 1: Chapter No.: 22,23

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→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	
IS1103-1.1	3	2	1										2	3	
IS1103-1.2	3	2	1										2	3	
IS1103-1.3	2	3	3										2	2	
IS1103-1.4	3	3	3										2	2	
IS1103-1.5	3	3	3										3	3	

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-engineeringedx 2.
4.	https://www.mooc-list.com/course/enterprise-software-lifecycle-managementedx 3.
5.	https://www.mooc-list.com/course/mastering-software-engineering-interviewcoursera

DATABASE MANAGEMENT SYSTEMS

Course Code:	**CS2102-1**	**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	**CS1002-1**		

Teaching Department: Computer Science & Engineering

Course Objectives:

1.	Provide a strong foundation in database concepts, design and application.
2.	Understand the concepts of relational model and relational algebra in database design.
3.	Learn structured query language (SQL) to an intermediate/advanced level and evaluate the result set.
4.	Understand the use of normalization techniques for building effective database design. Learn the concepts of NOSQL Systems to manage bigdata.
5.	Demonstrate the use of File organization and Indexing, Concurrency Control and transactions in databases.

UNIT-I

Databases and Database Users:	**15 Hours**

Databases and Database Users: Introduction, An Example, Characteristics of the database approach.
Database System Concepts and Architecture: Three-Schema Architecture and data Independence, Database languages and interfaces.
Data Modeling Using the Entity–Relationship (ER) Model: Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database, ER Diagrams, Naming Conventions, and Design issues.
The Relational Data Model and Relational Database Constraints: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, transactions, and dealing with constraint violations.
The Relational Algebra: Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory. Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations; Examples of Queries in Relational Algebra.
Relational Database Design by ER-to-Relational Mapping: Relational Database Design Using ERto-Relational Mapping.
(T1: 1.1, 1.2, 1.3, 2.2, 2.3, 3.3-3.7, 5.1-5.3, 8.1-8.5 ,9.1)

UNIT-II

Basic SQL:	**15 Hours**

Basic SQL: SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic retrieval queries in SQL, Insert, Delete and Update Statements in SQL,
More SQL: Complex Queries, Views, and Schema Modification: More complex SQL retrieval queries, Specifying constraints as assertions and Actions as Triggers, Views in SQL, Schema Change Statements in SQL.
Basics of Functional Dependencies and Normalization for Relational Databases: Informal design guidelines for relation schemas, Functional Dependencies, Normal Forms Based on Primary Keys, general definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

Relational Database Design Algorithms and Further Dependencies: Inference Rules, Equivalence, and Minimal cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema.
(T1: 6.1-6.4 ,7.1-7.4, 14.1-14.5, 15.1, 15.2,15.3)

UNIT-III

Storage and Indexing, Query Evaluation, Transaction Management	10 Hours

Storage and Indexing: File Organizations and Indexing, Index Data structures, Comparison of File Organizations.
Tree Structured Indexing: B+ Tree: A Dynamic Index Structure.
Overview of Query Evaluation: Introduction to Query Optimization, What a Typical Optimizer Does.
Overview of Transaction Management: The ACID Properties, Transactions and Schedules. Concurrent Executio of Transactions, Lock-Based Concurrency Control.
Concurrency Control: 2PL, Serializability and Recoverability
(T2: 8.2, 8.3, 8.4, 10.2, 12.4, 12.6, 14.4, 16.1-16.4, 17.1)

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

1.	Illustrate the concepts of database objects for the given problem.
2.	Identify and enforce integrity constraints on a database using RDBMS.
3.	Apply structured query language for (SQL) for database manipulation.
4.	Model normalized database structures by creating simple database systems. Understand the concepts of NOSQL Systems to manage bigdata
5.	Illustrate the concepts of File organization and Indexing, Concurrency Control and transactions in databases.

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
CS2102-1.1	2									1		1			
CS2102-1.2	2	2								1		1			
CS2102-1.3	2	3								1		1		3	
CS2102-1.4	2	2	3							1		1		2	
CS2102-1.5	2									1		1		2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Database Systems Models, Languages, Design and Application Programming, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2.	Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, Indian Edition, McGraw Hill Education.

REFERENCE BOOKS:

1.	Database System Concepts, Silberschatz Korth and Sudharshan, 6th Edition, McGraw Hill, 2013.

E Books / MOOCs/ NPTEL

1.	https://www.udemy.com/course/introduction-to-basic-database-concepts/, Introduction to Basic Database Concepts (Udemy).
2.	https://www.udemy.com/course/database-management-systems-mysql/, Database Management Systems – MySQL (Udemy).
3.	https://swayam.gov.in/nd1_noc19_cs46/preview, Database Management System (Swayam).

OPERATING SYSTEMS FUNDAMENTALS

Course Code:	**IS3101-1**	**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, CS2001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Explain the concepts, principles and services of operating system.

2.	Identify fundamental operating system concepts such as processes, inter-process communication, threads, CPU scheduling and demonstrate them.
3.	Assess the need of concurrency and synchronization and apply them to write concurrent programs and analyze the cause for the occurrence of deadlocks and determine solutions to overcome the deadlocks.
4.	Study the concepts of main memory and virtual memory allocation methods and demonstrate them.
5.	Analyze the need for file system concepts, directory implementation and disk scheduling algorithms and demonstrate them.

UNIT-I	
Operating System structure: Operating System Services, User and Operating System interface, System calls, System Services, Linkers and Loaders, **Process Management:** Process concept; Process scheduling; Operations on processes; Inter-process communication. **Threads:** Multithreading Models. **CPU Scheduling:** Basic concepts, Scheduling criteria, Scheduling algorithms, Thread scheduling	**14 Hours**
UNIT-II	
Process Synchronization: The Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Monitors, Classical problems of synchronization. **Deadlocks:** System model; Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, avoidance, detection and recovery from deadlock. **Main Memory:** Paging, Structure of page table, Swapping	**13 Hours**
UNIT-III	
Virtual Memory: Demand paging, Copy-on-write, Page replacement, Allocation of frames. Implementing File System: File system Concepts, File System Structure, Operations and implementation, Directory implementation, Allocation methods, Free space management. disk scheduling algorithms	**13 Hours**

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

1.	***Recognise*** the structural components of operating system.
2.	***Demonstrate*** the creation and termination of the processes, threads and CPU scheduling algorithms.
3.	llustrate critical section problem and demonstrate the Peterson's solution. Investigate the Deadlock condition and determine the solution to avoid.
4.	Summarize Main memory and Virtual Memory allocation methods and prepare a page replacement schedule to the given set of page requirement request.
5.	Classify file systems based on operations and implementations and illustrate the disk scheduling algorithms.

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
IS3101-1.1	3	2												
IS3101-1.2	3	2											1	2
IS3101-1.3	3	2											1	2
IS3101-1.4	3	2											1	2
IS3101-1.5	3	2											1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Operating System Concepts, Abraham Silberschatz, Greg Gagne, Peter B. Galvin, 10th Edition, John Wiley & Sons, 2018, ISBN: 9781119320913
2.	P.C.P. Bhatt: Operating Systems, 2nd Edition, PHI, 2006.
3.	Harvey M Deital: Operating systems, 3rd Edition, Addison Wesley, 1990.

REFERENCE BOOKS:

1.	D.M Dhamdhere: Operating systems –A concept based Approach, 2nd Edition, Tata McGraw- Hill, 2002.

2.	P.C.P. Bhatt: Operating Systems, 2nd Edition, PHI, 2006.
3.	Harvey M Deital: Operating systems, 3rd Edition, Addison Wesley, 1990.
E Books / MOOCs/ NPTEL	
1.	http://www.uobabylon.edu.iq/download/M.S%2020132014/ Operating_System_Concepts_8th_Edition%5BA4%5D.pdf
2.	http://iips.icci.edu.iq/images/exam/Abraham-Silberschatz-Operating-System-Concepts--9th2012.12.pdf
3.	https://freevideolectures.com/university/iit-bombay/
4.	https://www.cse.iitb.ac.in/~mythili/os/

AUTOMATA THEORY AND COMPILER DESIGN

Course Code:	**IS3102-1**	**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	**MA1007-1, CS2001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Introduce concepts in automata theory.
2.	Identify different formal language classes and their relationships.
3.	Design grammars and recognizers for different formal languages.
4.	Introduce the major concept areas of language translation and compiler design.
5.	Differentiate Scanner and Parser phases of compiler.
6.	Extend the knowledge of parser by parsing LL parser and LR parser.

UNIT-I

INTRODUCTION	**9 Hours**
Introduction to Automata Theory: Central Concepts of Automata theory, Deterministic Finite Automata(DFA), Non- Deterministic Finite Automata(NFA) ,Epsilon- NFA, NFA to DFA Conversion, Minimization of DFA.	
Introduction to Compiler Design: Language Processors, Phases of Compilers	
REGULAR LANGUAGES AND LEXICAL ANALYSIS	**6 Hours**
Regular Expressions and Languages: Regular Expressions, Finite Automata and Regular Expressions, Proving Languages Not to Be Regular	
Lexical Analysis Phase of compiler Design: Role of Lexical Analyzer, Input Buffering, Specification of Token, Recognition of Token.	

UNIT-II

CONTEXT-FREE LANGUAGES AND PARSING	**7 Hours**
Context Free Grammars: Definition and designing CFGs, Derivations Using a Grammar, Parse Trees, Ambiguity and Elimination of Ambiguity, Elimination of Left Recursion, Left Factoring.	
Syntax Analysis Phase of Compilers: part-1: Role of Parser, Top-Down Parsing	
PUSHDOWN AUTOMATA AND PARSING	**8 Hours**
Definition of the Pushdown Automata, The Languages of a PDA.	
Syntax Analysis Phase of Compilers: Part-2: Bottom-up Parsing, Introduction to LR Parsing: SLR, More Powerful LR parsers.	

UNIT-III

TURING MACHINES	**2 Hours**
The Turing machine definition and problems.	
Other Phases of Compiler	**8 Hours**
Other Phases of Compilers: Syntax Directed Translation- Syntax-Directed Definitions, Evaluation Orders for SDD's. Intermediate-Code Generation- Variants of Syntax Trees, Three-Address Code. Code Generation- Issues in the Design of a Code Generator.	

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

1.	Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation.
2.	Make use of regular expressions to identify corresponding tokens in lexical analyser.
3.	Apply context free grammar to solve problems in Syntax Analysis phase.

4.	Design pushdown automata for solving problems in parsing.
5.	Acquire fundamental understanding of the structure of a Compiler and Turing Machine.

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
IS3102-1.1	3	2												
IS3102-1.2	3	2	2											1
IS3102-1.3	2	2	3											2
IS3102-1.4	3	2	2											1
IS3102-1.5	3	2	1											2

(L/1 = Low 30%-49%, M/2 = Medium 50%-69%, H/3 = High >70%)

TEXTBOOKS:

1.	John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson.
2.	Alfred W Aho, Ravi Sethi, Jeffrey D Ullman, Compilers- Principles, Techniques and Tools, Pearson, 2nd Edition.

REFERENCE BOOKS:

1.	An Introduction to formal languages and Automata, Peter, Linz 5th edition.
2.	John Martin, Introduction to languages and theory of computation, Tata McGraw Hill.
3.	John R Levine, Tony Mason & Doug Brown, UNIX Programming Tools- lex and yacc, O'Reilly Publication.
4.	Andrew W Apple, Modern Compiler Implementation in C, Cambridge University Press.
5.	Kenneth C Louden, Compiler Construction Principles & Practice, Thomson Education.

E Books / MOOCs/ NPTEL

1.	https://www.eecs.wsu.edu/~ananth/CptS317/Lectures/index.htm
2.	https://nptel.ac.in/courses/106/104/106104123/
3.	https://nptel.ac.in/courses/106/106/106106049/#
4.	https://www.jflap.org/

Bridge Courses for Lateral Entry Students

Bridge course – CALCULUS & DIFFERENTIAL EQUATIONS			
Course Code:	**MA1012-1**	**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**
Prerequisite	-----		

Teaching Department: Mathematics

Mandatory Non – credit course (MNC): 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 differential calculus, partial differentiation, Vector differentiation and Integration and become skilled for solving problems in science and engineering.

UNIT-I	12 Hours

Differential Calculus

Polar curves, angle between the radius vector and the tangent, angle of intersection of two curves, derivatives of arcs and radius of curvature -cartesian, parametric and polar forms (No Derivation). Taylor's theorem for functions of single variable. Mean value theorems.

Partial Differentiation

Partial derivatives of simple functions, Total differentiation - differentiation of composite and implicit functions. Taylor's theorem for functions of two variables, maxima and minima for functions of two variables.

UNIT-II

Vector Differential Calculus	17 Hours

Vector algebra(review), scalar and vector valued functions, gradient, directional derivative and hessian of multivariable function, Divergence and curl of a vector valued function.

Ordinary and Partial Differential Equations

Ordinary differential equations(review), linear and nonlinear differential equations. Second and higher order linear differential equations with constant coefficients.

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions. Solution of P.D.E by the method of separation of variables.

UNIT-III

Multiple Integrals	11 Hours

Double integrals and triple integrals, Evaluation by change of order of integration, change of variables and applications to area and volume.

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

1.	Apply the concept of radius of curvature and mean value theorems.
2.	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.
3.	Solve the vector functions and their derivatives for engineering applications.
4.	Apply the concepts of ordinary and partial differential equations in engineering problems.
5.	Apply the notion of multiple integrals to find areas and volumes.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
MA1012-1.1	3	2										
MA1012-1.2	2	2										
MA1012-1.3	3	1										
MA1012-1.4	3	2										
MA1012-1.5	3	2										

1: Low 2: Medium 3: High

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.
3. Murray R. Spiegal: "Vector Analysis", Schuam publishing Co.

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 – DISCRETE MATH & NUMERICAL METHODS

Course Code:	**MA1014-1**	**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

Mandatory Non – credit course (MNC): 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 set theory and relations, propositional and predicative logics, numerical methods, Fourier series and transforms and become skilled for solving problems in science and engineering.

UNIT-I

15 Hours

Set Theory and Logic

Sets- operations on sets, product sets and partitions (review).
Relations- representation of relations as matrices and digraphs, equivalence relations.
Functions- permutations functions, functions for computer science.

Fundamentals of logic

Propositional logic, logical operations(review), rules of inference Predicates calculus.

Graph Theory

Graphs: Basic terminologies, some special simple graphs, bipartite graphs, adjacency matrices, incidence matrices, graph isomorphism, connectivity- vertex and edge connectivity, Euler and Hamiltonian graphs and their applications, planar graphs, graph coloring and their applications.

UNIT-II

15 Hours

Numerical Methods

Roots of algebraic and transcendental equations- Newton Raphson method, Regula Falsi method.
Numerical solution of ordinary differential equations- Taylor's series method, Modified Euler's method and

Runge –Kutta method of fourth order.

Numerical solution of partial differential equations- Classification of partial differential equations, examples, solution of Laplace and Poisson equations by standard five-point formulae, solution of heat and wave equations by explicit method.

UNIT-III

Multiple Integrals	**10 Hours**

Fourier series and Transforms

Periodic functions, Euler's formulae, Fourier series of odd and even functions, functions with arbitrary period, half range series. Fourier transform, inverse Fourier transform, Convolution theorem, Fourier sine and cosine transforms.

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

1.	Represent a relation in terms of matrix and digraph, apply permutation functions for encoding and decoding simple text messages and establish by deduction the validity of an argument using inference rules. Identify suitable data structure for representing a graph, apply the concept of connectivity in real life problems
2.	Identify suitable data structure for representing a graph, apply the concept of connectivity in real life problems.
3.	Apply numerical methods to find solutions of algebraic equations and ordinary differential equations.
4.	Apply numerical methods to solve partial differential equations.
5.	Apply the analytical technique to express periodic function as a Fourier sine and cosine series and apply the concepts of Fourier- transforms to solve engineering problems.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MA1014-1.1	3	2										
MA1014-1.2	3	2										
MA1014-1.3	2	2										
MA1014-1.4	2	2										
MA1014-1.5	3	2										

1: Low 2: Medium 3: High

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.	T. Veerarajan, "Engineering Mathematics", McGraw-Hill, New Delhi, 2008.
2.	B. V. Ramana, "Higher Engineering Mathematics", Tata Mc Graw –Hill, New Delhi, 2010.

Integrated Professional Core Courses

DATA STRUCTURES

Course Code:	**CS2001-1**	**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	**CS1001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Outline the concepts of data structure, its operations, and Memory allocation functions and design the programs using arrays and structures, pointers, pointer to structure.
2.	Implement linear data structure stack and usage of stacks in various applications.
3.	Implement linear data structure Ordinary Queue, Circular Queue and priority queues
4.	Implement the operations of singly linked lists and circular linked lists, doubly linked list and circular doubly lists.
5.	Identify and differentiate different types of binary trees and binary search trees data structures and also implement them and illustrate threaded binary trees, expression trees, graph representation and techniques of hashing.

UNIT-I — **15 Hours**

INTRODUCTION:

Data Structure Definition, Classification (Primitive and non-primitive), data structure operations, Pointers and Dynamic Memory Allocation functions with programming examples

Arrays and Structures: Arrays in C, Dynamically allocated arrays, Structures and Union, Array of Structures and Pointer to Structure, Programming Example.

Linear Data structures-Stack: Introduction and Definition, Representation of stack: Array and structure representation of stacks, Primitive operations on stacks

Applications of Stack: Conversion of Expressions

Algorithms and C programs with tracing Examples: For evaluating postfix expression, infix to postfix conversion.

Recursion: Definition, Implementation, Examples on Recursion with tracing: Factorial function, Fibonacci sequence and Tower of Hanoi

UNIT-II — **15 Hours**

Linear Data Structures-Queue: Introduction and Definition, Representation of Queue: Array and Structure representation of Queue, Other queue structures: circular queue, priority queue.

Linear Data Structures-Linked List: Singly Linked List and chains, Representing chain in C using dynamic variables, Inserting and deleting nodes, Other list Operations on singly Linked List, Stack and Queues using linked lists, Header Nodes, Representation of Linked list using arrays.

Circular Linked List, Doubly Linked List and Circular doubly Link list : Representation and Operations

UNIT-III — **10 Hours**

NONLINEAR DATA STRUCTURES - TREE DATA STRUCTURES:

Introduction: Tree definition, Terminology, **Binary Trees:** Definition, Types, Properties, Representation of Binary Tree: Array representation, Linked representation, Binary Tree traversals- Preorder, Inorder and postorder. **Threaded binary Trees:** Definition, types, Data structure and memory representation of threaded tree, Binary Search Tree: Definition, Construction- Searching, Insertion operations, deletion process, Traversal examples

Expression Tree: Constructing expression tree for a given expression, traversals, Evaluation of expression, programming examples

Nonlinear Data structures – Graphs:

Representation of graphs: Definition, types and terminology, Matrix representation, Adjacency list chain and sequential representation.

Hashing: Hash Table organizations, Hashing Functions, Over flow handling.

Suggested List of Experiments

1.	Pointer implementations using arrays and structures

2.	Stack static implementation.
3.	Queue static implementation.
4.	Application of stack data structure.
5.	Different types of queue.
6.	Tower of Hanoi problem using recursion.
7.	Singly Linked list implementation.
8.	Dynamic implementation of stack data structure.
9.	Dynamic implementation of queue data structure.
10.	Circular linked list implementation.
11.	Doubly linked list and Circular doubly linked list implementation.
12.	Binary Tree Construction and Tree traversal operations.
13.	Construction of Binary Search Tree and postfix expression 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, dynamic memory allocation and design the programs using arrays, structures and pointers.
2.	Apply the fundamental knowledge of data structures to design stack and use them for solving problems.
3.	Apply the fundamental knowledge of data structures to design queues and use them for solving problems.
4.	Design and develop singly linked lists, circular linked lists and doubly linked list.
5.	Acquire the knowledge of trees and implement binary trees and binary search tree data structure, advanced trees, representation of graphs and hashing 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	
CS2001-1.1															
CS2001-1.2	3	1	2					1				1	3	3	
CS2001-1.3	3	2	2					1				1	3	3	
CS2001-1.4	3	2						1				1	3	3	
CS2001-1.5															

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.

OBJECT ORIENTED PROGRAMMING			
Course Code:	**CS2002-1**	**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	**CS1001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Learn fundamental features of object-oriented language and JAVA programming constructs.
2.	Develop and run simple Java programs using OOPS concepts of java.
3.	Create multi-threaded programs and event driven Graphical User Interface (GUI) programming using swing package.

UNIT-I

INTRODUCTION:	**15 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.
(Textbook 1, Chapter – 6-9)

UNIT-II

EXCEPTION HANDLING AND MULTITHREADED PROGRAMMING	**15 Hours**

Exception Handling – Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, multiple catch Clauses, Nested try statements, throw, and throws, finally.
Multithreaded Programming – The Java Thread Model, The Main Thread, creating a Thread, Creating Multiple Threads, Using is Alive () and join (), Thread Priorities.
File Handling – Serial Access Files, File Methods.
Event Handling - Two Event Handling Mechanisms, the Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model.
(Textbook 1, Chapter – 10-11, 19, 22)

UNIT-III

FRAMEWORKS:	**10 Hours**

Generics-What are Generics? A Simple Generics Example, A Generic class with two type parameters, The general form of a generic class, Creating a Generic method, Generic Interfaces.
Collections framework- Collection Interfaces – List, Set, Queue. Collection classes – ArrayList, LinkedList, HashSet, LinkedHashSet, TreeSet, PriorityQueue, Stack, Arrays.
(Textbook 1, Chapter – 14, 17)
Swings – The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Event Handling, Jlabel and ImageIcon; JTextField; The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable.
(Textbook 1, Chapter - 29, 30)

Suggested List of Experiments

1.	Use java program to demonstrate the OOP concepts.
2.	Demonstrate the file handling using Java
3.	Implement the java programs that uses the concepts of exception handling, multi-threading.
4.	Developing of user interfaces using the swings concepts of Java.
5.	Develop Java program to store and retrieve data from database.
6.	Java programs to establish network connectivity
7.	Demonstrate the web application development using servlets and JSP
8.	Mini Project

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

1.	Develop classes and apply object-oriented features to solve real world problems.
2.	Develop robust Java programs using exception handling features, implement multiple inheritance using interfaces and organize the application classes using packages.
3.	Develop programs that can run concurrent tasks using multithreading and perform basic file operations.
4.	Develop GUI applications using Java swings and manage various events generated by user interactions with the UI using event handling mechanisms.
5.	Develop type independent classes using generics; Choose and apply the right data structure to manage collection of data using the collections framework.

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
CS2002-1.1	3	1	3		1							2	2	3	
CS2002-1.2	3	1	3		2							2		3	
CS2002-1.3	3	1	3		3							2		3	
CS2002-1.4	3	1	3		3							2	2	3	
CS2002-1.5	3	1	3		3							2		3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Herbert Scheldt, Java the Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
2.	Jan Graba, An Introduction to Network Programming with Java, 2007, Springer Publications.

REFERENCE BOOKS:

1.	Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education, 2008, ISBN:9788131720806
2.	Rajkumar Buyya, S Thamarasiselvi, Xingchen chu, Object oriented Programming with Java, Tata McGraw Hill education private limited.
3.	Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning.
4.	E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

E Books / MOOCs/ NPTEL

1.	Online course material by Oracle :http://docs.oracle.com/javase/tutorial/index.html
2.	https://www.udemy.com/courses/search/?q=java&price=pricefree&view=grid
3.	Oracle: www.oracle.com/events/global/en/java.../java-a-beginners-guide-1720064.pdf
4.	NPTEL:www.nptelvideos.com/java/java_video_lectures_tutorials.php

DESIGN AND ANALYSIS OF ALGORITHMS

Course Code:	**CS3004-1**	**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	**CS1001-1, CS2001-1**		

Teaching Department: Information Science Engineering

Course Objectives:

1.	Analyze the non-recursive and recursive algorithms and to represent the efficiency of these algorithms in terms of the standard Asymptotic notations.
2.	Devise the Brute Force and Divide and Conquer techniques to design the algorithms and apply these methods in designing algorithms to solve a given problem.
3.	Explain the Decrease and Conquer, Transform and Conquer algorithm design techniques, and Time versus Space Trade-offs.
4.	Get the idea of Greedy method and dynamic programming methods and apply these methods in designing algorithms to solve a given problem.

5.	Describe and illustrate the idea of Backtracking and Branch and Bound algorithm design techniques to solve a given problem.

UNIT-I	**14 Hours**

INTRODUCTION:
What is an Algorithm? Fundamentals of Algorithmic Problem Solving **(Text Book-1: Chapter 1: 1.1 to 1.2)**

FUNDAMENTALS OF THE ALGORITHMS EFFICIENCY:
Analysis Framework, Asymptotic Notations and Standard notations and common functions Mathematical Analysis of Non-recursive and Recursive Algorithms.
(Text Book-1: Chapter 2: 2.1 to 2.4)

BRUTE FORCE:
Background, Selection Sort, Brute-Force String Matching.
(Text Book-1: Chapter 3: 3.1, 3.2)

DIVIDE AND CONQUER:
Merge sort, Quick sort, Binary Search
(Text Book-1: Chapter 4: 4.1 to 4.3)

UNIT-II	**13 Hours**

DECREASE & CONQUER:
General method, Insertion Sort, Graph algorithms: Depth First Search, Breadth First Search, Topological Sorting.

TRANSFORM AND CONQUER:
General method, Balanced Search Trees, Heaps and Heap sort.

TIME AND SPACE TRADEOFFS:
Input Enhancement in String Matching: Horspool's algorithm.
(Text Book-1: Chapter 5: 5.1, 5.3, Chapter 6: 6.3 to 6.4, Chapter 7: 7.2)

DYNAMIC PROGRAMMING:
General method, The Floyd-Warshall Algorithm, The Knapsack problem.
(Text Book-1: Chapter 8: 8.2).

UNIT-III	**13 Hours**

GREEDY TECHNIQUE:
General method of Greedy technique, Single-Source Shortest Paths: General method, The Bellman-Ford algorithm, Single-Source Shortest Paths in DAGs, Dijkstra's Algorithm
(Text Book-2: Chapter 24: 24.1 to 24.3).
Minimum Spanning Trees: Prim's Algorithm, Kruskal's Algorithm, Optimal Tree problem: Huffman Trees
(Text Book-1: Chapter 9: 9.1, 9.2, 9.4).

BACKTRACKING:
General method, N-Queens problem, Subset-sum problem.
(Text Book-1: Chapter 12: 12.1)

BRANCH AND BOUND:
General method, Assignment Problem, Travelling Salesman problem, Knapsack Problem. **(Text Book-1: Chapter 12: 12.2**)

Suggested List of Experiments

1.	Various Sorting/Searching algorithms
2.	Graph traversals –DFS and BFS, Connectivity and Reachability of graphs
3.	Topological Sorting
4.	Descending Priority Queue using Heap
5.	Horspool string matching algorithm
6.	Binomial coefficient, Warshall's algorithm, Floyd's algorithm, Knapsack problem using Dynamic Programming and by using memory functions.
7.	Prim's, Kruskal's, Dijkstra's algorithms
8.	N-Queens problem.

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

1.	**Explain** the algorithmic problem solving, algorithm design techniques and standard Asymptotic notations. **Apply** the general procedure of non-recursive and/or recursive algorithms to obtain worst-

	case running times of algorithms using asymptotic analysis.
2.	**Interpret** the brute-force, divide-and-conquer paradigms and explain when an algorithmic design situation calls for it. **Relate** algorithms that employ these paradigms. **Develop** and implement an algorithm to demonstrate its performance using these paradigms. For the given algorithm, develop the recurrence; **Analyze** and **Simplify** the recurrence to obtain the performance of divide-and-conquer algorithm.
3.	**Explain** the Decrease and Conquer, Transform and Conquer algorithm design paradigms, string matching algorithms and hashing concepts. **Develop** and implement an algorithm and demonstrate its performance using these paradigms.
4.	**Identify** and **explain** the greedy technique and dynamic-programming paradigm as to when an algorithmic design situation calls for it. **Relate** algorithms that employ these paradigms. **Develop** and implement an algorithm and demonstrate its performance using these paradigms. **Discover** the shortest-path and minimum spanning tree problems by assuming shortest-paths algorithms and minimum spanning tree algorithms respectively.
5.	**Describe** the Backtracking, Branch and Bound algorithm design paradigms and explain when an algorithmic design situation calls for it. **Relate** algorithms that employ these paradigms. **Develop** and implement an algorithm and demonstrate its performance using these paradigms.

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
CS3004-1.1	2	3												2
CS3004-1.2	2	2	3	2	3				1			1		3
CS3004-1.3	2	3		2	3				1			1		3
CS3004-1.4	2	2	3	2	3				1			1		3
CS3004-1.5	2	3		2	3									2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Anany Levitin, "Introduction to the Design & Analysis of Algorithms", 2nd Edition, Pearson Education, 2011.
2.	Thomas H. Cormen, Charles E.Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI, 2014.

REFERENCE BOOKS:

1.	Horowitz E., Sahni S., Rajasekaran S, "Computer Algorithms", Galgotia Publications, 2001.
2.	R.C.T. Lee, S.S. Tseng, R.C. Chang & Y.T.Tsai, "Introduction to the Design and Analysis of Algorithms A Strategic Approach", Tata McGraw Hill, 2005.

E Books / MOOCs/ NPTEL

1.	http://www.facweb.iitkgp.ernet.in/~sourav/daa.html
2.	http://nptel.ac.in/courses/106101060/ https://www.coursera.org/specializations/algorithms
3.	http://nptel.ac.in/courses/106101060/ https://www.coursera.org/specializations/algorithms

INTERNET & WEB PROGRAMMING

Course Code:	**IS2001-1**	**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	**CS1002-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Gain exposure to a basic website repository, including its directory structure and HTML document contents.
2.	Configure in-line, internal, and external CSS stylesheets.

3.	Configure your website to track pageviews and user events.

UNIT-I	**14 Hours**

Basics of HTML: Formatting text by using tags, Creating hyperlinks and anchors. Basics of CSS: CSS formatting text using style sheets, Creating tables, formatting tables, incorporate sound and video: audio and video in HTML5, HTML multimedia basics, embedding video clips, incorporating audio on web page.

UNIT-II	**13 Hours**

What is JavaScript, Syntax, usage of super global variables, PHP syntax and variables, comments passing information with PHP, Integrating web forms and databases, displaying queries in table. Functional Components in React JS, What is JSX?, Inline Styling with JSX in React JS, JavaScript Variable in JSX, Handling Forms

UNIT-III	**13 Hours**

What is Node JS?, Advantages of Node JS, Node JS HTTP Module, File System Module, Node js Events: The EventEmitter Object, Upload Files, Send an Email, Nosql database: Introduction to MongoDB, Creating a Database, Insert, Find, Sort, Delete, Drop Collection

Suggested List of Experiments

1.	Implement a Web site for Information Technology department Using a) Frameset b) Tables c) Internal Linking d) Headers e) List Items f) Hyperlink for mailing
2.	Develop a JavaScript program to get Register Number as Input and print the Student's total mark and grades.
3.	Write a HTML code that takes name and email as input and display the entered details using $_GET array/ $_POST array.
4.	Write Java script code that will change the colour of the background to red when the user brought the focus to the object and change the color to green when user has left the focus on the object.
5.	Write a PHP code to Connect to Database, Create a table Department (Dname, Dno, Number_Of_faculty)
6.	Write a PHP program to connect to database. Create a table named “Student” with following fields (sno, sname, percentage). Insert 3 records of your choice. Display the names of the students whose percentage is between 35 to 75 in a tabular format
7.	Use the createServer() method to create an HTTP server
8.	Use File system Module to perform following operations on file Read files ● Create files ● Update files ● Delete files ● Rename files
9.	Example programs on Inline Styling with JSX in React JS, JavaScript Variable in JSX, Handling Forms
10.	Mongo DB database creation with queries

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. Construct and visually format tables and forms using HTML and CSS
2.	To learn Client-Side programs using JavaScript and Server-Side programs using PHP. Understand the principles of object-oriented development using PHP, Inline styling with JSX
3.	To learn creating methods on HTTP server and file operations using Node.JS MongoDB database creation and queries

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	
IS2001-1.1	1	2	1	2			2					2		1	
IS2001-1.2	1	2				1						1			
IS2001-1.3			1	3			1				1	2		2	
IS2001-1.4															

IS2001-1.5															

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1stEdition, Pearson Education India. (ISBN:978-9332575271)
REFERENCE BOOKS:	
1.	Robin Nixon, "Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5", 4thEdition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
2.	Luke Welling, Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
3.	Nicholas C Zakas, "Professional JavaScript for Web Developers", 3rd Edition, Wrox/Wiley India,2012. (ISBN:978-8126535088)
E Books / MOOCs/ NPTEL	
1.	https://www.coursera.org/learn/front-end-react#syllabus
2.	https://www.udemy.com/course/react-the-complete-2021-guide-with-nodejs-and-mongo-db/

DATA COMMUNICATION AND NETWORKING

Course Code:	**IS3001-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L: T: P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+25**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**IS2101-1**		

Teaching Department: Information science & Engineering

Course Objectives:

1.	Compare different frame formats.
2.	Comprehend different network layer functionalities.
3.	Design and Analyze different Routing and congestion control algorithms.
4.	Analyze the working of transport layer.
5.	Identify Internet control protocols and Internet transport protocols in computer network.

UNIT-I	**16 Hours**

Introduction to networks: Network hardware, Network software, Reference models
Physical Layer: Guided transmission media, Wireless transmission
The Data link layer: Design issues of DLL, Error detection and correction, Elementary data link protocols, Sliding window protocols.
The medium access control sublayer: The channel allocation problem, Multiple access protocols.
Network Layer (Part-I):
Network layer design issues: Store and Forward Packet Switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented Service, Comparison of Virtual Circuit and Datagram Subnets;
Routing algorithms: The Optimality Principal, Shortest Path Routing, Flooding. Distance Vector Routing, Link state Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing, Routing for Mobile Hosts, Routing in Ad hoc Networks.
Congestion Control Algorithms: Approaches to Congestion Control, Traffic-Aware Routing, Admission Control, Traffic Throttling, Load Shedding;
Quality of Service: Application Requirements, Traffic Shaping, Packet Scheduling, Admission Control, Integrated Services, Differentiated Services

UNIT-II	**15 Hours**

Network layer (Part – II):
Internetworking: How networks differ, How Networks Can Be Connected, Tunneling, Internetwork Routing, Fragmentation;
The Network Layer in the Internet: The IP Version 4 Protocol, IP Addresses, IP Version 6, Internet Control Protocols, OSPF, BGP, Internet Multicasting, Mobile IP.
The Transport Layer:
The Transport Service: Services Provided to the Upper Layers, Transport Service Primitives,

Elements of Transport Protocols: Addressing, Connection Establishment, Connection Release, Error Control and Flow Control, Multiplexing, Crash Recovery;
The Internet Transport Protocols (UDP): Introduction to UDP.

UNIT-III	09 Hours

The Internet Transport Protocols (TCP): Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, TCP Connection Management Modeling, TCP Sliding Window, TCP Timer Management, TCP Congestion Control.

The Application Layer:

Principles of Network Applications:

Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet;

The Web and HTTP: Overview of HTTP, Non-Persistent and Persistent Connections, HTTP Message Format;

DNS: The Internet's Directory Service, Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages;

Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Formats, Mail Access Protocols.

Suggested List of Experiments

Framing

Design a program in which sender module should count the no of bytes in the frame and receive module should display each frame received.
Design a program to implement bit stuffing, encoding and decoding concept in data link layer.

Error control

Design and implement CRC error detection method used in data link layer.

Socket Programming

Design a program to implement client server model (TCP) using socket programming.
Design a program to implement client server model (UDP) using socket programming.

Routing Algorithm

Design and implement a program to route the packet in a network using distance vector algorithm.

Congestion Control

Design a program for congestion control using leaky bucket algorithm.

Simulate peer-to-peer communication between a client and a server using Point-to-Point protocol. Apply NetAnim software to demonstrate the scenario graphically. Analyze packet parameters by creating trace file using Ascii trace metrics.

Simulate to implement a bus topology using Point-to-Point protocol between a client and a LAN with 4 nodes. The LAN use CSMA during packet transmission. Apply NetAnim software to demonstrate the scenario graphically. Analyze packet parameters by creating trace file using Ascii trace metrics.

Simulate peer-to-peer communication between a client and a server using CSMA protocol. Apply NetAnim software to demonstrate the scenario graphically. Analyze packet parameters by creating trace file using Ascii trace metrics.

Simulate to implement the star topology using Point-to-Point protocol. Apply NetAnim software to demonstrate the scenario graphically. Analyze packet parameters by creating trace file using Ascii trace metrics.

Simulate the transmission of ping messages over a network topology consisting of 3 nodes n0, n1 and n2, where node n0 and n1 are the pingers. Analyze the working of ping using Wireshark.

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

1.	Express the basic concept of computer network.
2.	Design the network layer and the related issues.
3.	Explain the congestion control, and prevention methods.
4.	Explain different type of networks and protocols.
5.	Explain network applications and describe application layer protocols.

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
IS3001-1.1	3	2												2
IS3001-1.2	3	2	2											2
IS3001-1.3	3	2	2											2
IS3001-1.4	3	2												2
IS3001-1.5	2	2												2

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Computer Networks, Andrew S. Tanenbaum David J. Wetherall, 5th Edition, Pearson, ISBN 10: 1292024224, 2014
2.	Computer Networking. A Top-down Approach, James F. Kurose, Keith W. Ross, Pearson, ISBN: 1292153598, 2017
REFERENCE BOOKS:	
1.	Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition.
2.	Data and Computer Communication, 8th Edition, William Stallings, Prentice Hall, 0132433109, 2007.
3.	Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
E Books / MOOCs/ NPTEL	
1.	https://www.digimat.in/nptel/courses/video/106105183/L01.html
2.	http://www.digimat.in/nptel/courses/video/106105081/L25.html
3.	https://nptel.ac.in/courses/106105081

MACHINE LEARNING FOUNDATIONS

Course Code:	**IS2002-1**	**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	**MA1002-1, MA1007-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Understand the history of machine learning.
2.	Learn principles of supervised learning
3.	Explain various applications of Techniques in association analysis.
4.	Use different unsupervised learning techniques to solve the problem specification
5.	Understand the methods of parametric and non-parametric methods on real time data analysis.

UNIT-I	**15 Hours**

Foundations of Machine Learning

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

Measures of Similarity and Dissimilarity: Transformation, similarity and dissimilarity between simple attributes, Euclidean distance, Minkowski distance, Similarity measures for binary data: Simple matching coefficient, Jaccard coefficient, Cosine similarity, Correlation.

Classification: Preliminaries; General approach to solving a classification problem; Confusion Matrix, Decision tree induction, How decision tree works?, Hunt's algorithm, Design issues, Methods for expressing attribute test conditions, Measures for selecting best fit, Algorithm for decision tree induction; Rule-based classifier: How rule based classifier works, Rule ordering schemes, Sequential covering algorithm, Nearest-neighbor classifier: Selecting K value, KNN algorithm.

UNIT-II	**15 Hours**

Association Analysis–1: Problem definition, Frequent item set generation, Apriori principle, Candidate generation and pruning, Rule Generation in Apriori algorithm.

Association Analysis – 2: FP-Growth algorithm, Evaluation of association patterns, Effect of skewed support distribution, Sequential patterns.

Cluster Analysis: Different types of clustering: Hierarchical vs partitional, Exclusive vs overlapping, Fuzzy clustering, Complete vs partial. Types of clusters: Well separated, Prototype based clusters, Graph based clusters, Density based clusters, Conceptual clusters, K-means clustering algorithm, centroids and objective functions, Choosing initial centroids, time space complexity of K-means, K-means additional issues, Strengths and weakness of k-means, Agglomerative hierarchical clustering, Key issues in hierarchical clustering, Strengths and weaknesses, DBSCAN algorithm, Cluster Evaluation: Overview, Unsupervised cluster evaluation using cohesion and separation.

UNIT-III	10 Hours

Parametric Methods: Introduction Maximum Likelihood Estimation, Bernoulli Density, Multinomial Density, Gaussian (Normal) Density, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator Parametric Classification Regression Tuning Model Complexity: Bias/Variance Dilemma, Model Selection Procedures.

Nonparametric Methods: Introduction, Nonparametric Density Estimation, Histogram Estimator, Kernel Estimator, k-Nearest Neighbor Estimator, Generalization to Multivariate Data, Nonparametric Classification, Condensed Nearest Neighbor.

Suggested List of Experiments

1.	Demonstrate importing a dataset, identifying, and handling missing values, encoding categorical data and feature scaling using machine learning libraries.
2.	Implement the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
3.	Demonstrate the working of Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
4.	Construct a decision tree based on ID3 algorithm. Use an appropriate dataset for building the decision tree and apply this knowledge to classify a new sample.
5.	Demonstrate application of Linear regression to predict the stock market prices of any organization.
6.	Demonstrate the use of Support Vector Machine algorithm for a regression problem on any preferred dataset and evaluate the performance of the model
7.	Write a program to implement *k*-Nearest Neighbor classification algorithm on the iris flower dataset and visualize the results.
8.	Demonstrate image segmentation using K-means clustering algorithm and visualize the results.
9.	Apply Hierarchical clustering on customer segmentation dataset and visualize the clusters and plot the dendrograms.
10.	Perform Random Forest classification on Pima-Indians diabetes dataset.

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

1.	Develop an appreciation for what is involved in learning models from supervised learning.
2.	Demonstrate the application of similarity and dissimilarity index.
3.	Apply association analysis on structured data.
4.	Apply different unsupervised learning techniques to solve the problem specification.
5.	Interpret methods of parametric and non-parametric methods on real time data analysis.

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**
IS2002-1.1	1	2							1	1		1	1	1
IS2002-1.2	2	3		3	1				1	1		1	3	2
IS2002-1.3	2	3		2	1				1	1		1	3	2
IS2002-1.4	2	3		2	1				1	1		1	3	2
IS2002-1.5	1	1							1	1		1	1	1

1: Low 2: Medium 3: High	
TEXTBOOKS:	
1.	C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
2.	Ethem Alpaydin, Introduction to Machine Learning, Second Edition, 2004.
REFERENCE BOOKS:	
1.	T. M. Mitchell, “Machine Learning”, McGraw Hill, 1997.
2.	R. O. Duda, P. E. Hart and D. G. Stork Pattern Classification, Wiley Publications, 2001.
3.	T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008.
4.	P. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge University Press, 2012.
5.	K. P. Murphy, “Machine Learning: A probabilistic perspective”, MIT Press, 2012.
6	M. Mohri, A. Rostamizadeh, and A. Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012.
7.	S. Russel and P. Norvig, “Artificial Intelligence: A Modern Approach”, Third Edition, Prentice Hall, 2009.

INFORMATION & NETWORK SECURITY

Course Code:	**IS4001-1**	**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	**IS3001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	To understand the fundamentals of Cryptography
2.	To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
3.	To understand the various key distribution and management schemes.
4.	To understand how to deploy encryption techniques to secure data in transit across data networks
5.	To design security applications in the field of Information technology

UNIT-I	15 Hours

Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad.
Block Ciphers and The Data Encryption Standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, DES, Block cipher design principles, number of rounds, design of function F, key schedule algorithm, AES algorithm introduction.
Public-Key Cryptography and RSA: Principles of Public-key cryptosystems. Public-key cryptosystems. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA.

UNIT-II	14 Hours

Other Public-Key Cryptosystems: Diffie-Hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, Elliptic curve cryptography, Analog of Diffie-Hellman key exchange, Elliptic curve encryption/decryption.
Key Management And Distribution: Symmetric key distribution using Symmetric encryption, Hierarchical key control, Decentralized key control, Symmetric key distribution, public key authority, public keys certificates, X- 509 certificates.
User Authentication: Remote user Authentication principles, Kerberos, Remote user Authentication using Asymmetric encryption, identity management.

UNIT-III	10 Hours

Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL. Cipher Suites, Secure Shell (SSH).
IP Security: IP Security overview, IPSec, Security associations, IP traffic processing, Encapsulating Security

payload, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes.

Suggested List of Experiments

1.	Implementation of Substitution and Transposition Techniques i. Caesar Cipher ii. Playfair Cipher iii. Hill Cipher iv. Vignere Cipher v. Rail Fence Cipher
2.	Implementation of Cryptographic Algorithms a. DES b. RSA Algorithm c. Diffie-Hellman Algorithm d. MD5 e. SHA-1
3.	Implement the SIGNATURE SCHEME - Digital Signature Standard
4.	Providing secure data storage, secure data transmission and creating digital signatures.
5.	Setup a Honey Pot and Monitor the Honeypot on Network.
6.	Installation of rootkits and study the variety of options.
7.	Perform wireless audit on an access point or a router and decrypt WEP and WPA (Net Stumbler).
8.	Demonstrate intrusion detection system.

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

1.	Comprehend the cryptography techniques.
2.	Apply the Knowledge of number theory in Public Key Crypto Systems.
3.	Identify the Key management issues and resolve it.
4.	Analyze the security issues in the network and solution for it.
5.	Apply security mechanisms using rigorous approaches.

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
IS4001-1.1	3	3	2											1
IS4001-1.2	3	3	3											2
IS4001-1.3	3	3												1
IS4001-1.4	3	3	2											2
IS4001-1.5	3	3												1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. William Stallings: Cryptography and Network Security, Pearson 6th Edition, 2013.

REFERENCE BOOKS:

1. V K Pachghare: Cryptography and Information Security, PHE, 2013.

E Books / MOOCs/ NPTEL

ETHICAL HACKING AND NETWORK DEFENCE

Course Code:	**IS3002-1**	**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	**CS1002-1, IS2001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	To understand the core concepts of Ethical Hacking.
2.	To understand how security vulnerabilities are exploited.
3.	To analyze the impact of security vulnerabilities in systems.
4.	To understand popular Network Défense solutions deployed at large organizations.
5.	To configure basic firewall and IDS solution.

UNIT-I

INTRODUCTION TO ETHICAL HACKING	**13 Hours**

Fundamentals of Ethical hacking, how organizations gain from Ethical Hacking, Typical Life Cycle of Ethical Hacking, Types of Ethical Hacking- Red, Blue and Purple Teaming, Fundamentals of Vulnerability Analysis and Penetration Testing, Threat Modeling and Attack Surface Identification, Life Cycle of Penetration Testing, Using Kali Linux, and other tools for a penetration testing Assignment.

UNIT-II

NETWORK SECURITY	**13 Hours**

Networking Primer-understanding Security aspect of OSI Model, Active and passive Network Attacks, Network Layer and Cryptography, Single Sign On (SSO), Email encryption: PGP, STARTTLS; IPSec, SSL3.0, TLS 1.2, Attacks on SSL/TLS: Drown attack, Poodle attack, and Secure HTTP, DNSSEC. ARP Cache poisoning, MAC flooding, Port Stealing, DHCP attacks, DNS based attacks, VLAN hopping, Man in the middle attacks. Web Application Security: Security threats, XSS, CSRF, SQL Injection attacks, RFI, DoS/DDoS.

UNIT-III

	14 Hours

Techniques for Network Intrusion Detection System: Snort, Signature-based and Anomaly-based detection; Firewalls: packet filters and stateful firewalls, application-aware firewalls, Proxies, NAT, VPN, Honeypots and Honeynets.

Suggested List of Experiments

1.	Study of different wireless network components and features of any one of the Mobile Security Apps.
2.	Study of the features of firewall in providing network security and to set Firewall Security in windows.
3.	Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)
4.	Study of different types of vulnerabilities for hacking a websites / Web Applications.
5.	Analysis the Security Vulnerabilities of E-commerce services.
6.	Analysis the security vulnerabilities of E-Mail Application
7.	Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars.
8.	Study of packet sniffer tools like wireshark, ethereal, tcpdump etc. Use the tools to do the following: a) Observer performance in promiscuous as well as non-promiscous mode. b) Show that packets can be traced based on different filters.
9.	Download and install nmap. Use it with different options to scan open ports,perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, etc.
10.	Use the Nessus tool to scan the network for vulnerabilities
11.	Implement a code to simulate buffer overflow attack.
12.	Use of iptables in linux to create firewalls.

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

1.	To understand how to find security vulnerabilities in given system.
2.	To suggest the remediation steps for identified security bugs.
3.	To perform VAPT task on given system and submit professional report.
4.	To deploy IDS system.
5.	To develop custom IDS signatures.

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
IS3002-1.1	2	2												1
IS3002-1.2	2	2												1

IS3002-1.3	2	2	3											2
IS3002-1.4	2	3												2
IS3002-1.5	2	2												2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws Book by Dafydd Stuttard and Marcus Pinto.
2.	Hacking: The Art of Exploitation Book by Jon Erickson.
3.	Hacking Exposed 7: Network Security Secrets and Solutions by Stuart McClure, Joel Scambray, George Kurtz.
4.	Snort Intrusion Detection and Prevention Toolkit by by Brian Caswell, Jay Beale, Andrew Baker.

REFERENCE BOOKS:

1.	Advanced Penetration Testing: Hacking the World's Most Secure Networks by Wil Allsopp
2.	Snort 2.1 Intrusion Detection, Second Edition by Brian Caswell, Jay Beale (2004), Publisher(s): Syngress

E Books / MOOCs/ NPTEL

Professional Core Courses (Lab)

UNIX SHELL & SYSTEM PROGRAMMING Lab

Course Code:	**IS1602-1**	**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	**NIL**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Execute programs written in C under UNIX environment.
2.	Demonstrate how to use the basic Bourne Shell commands like cat, grep, ls, more, ps, chmod etc.
3.	Study about simple filters, grep and sed filters.
4.	Implement the Unix system process environment.
5.	Understand the Unix kernel environment.

List of Experiments

1.	Basic Unix Commands, Simple Shell scripts 1. Illustrate the usage of Unix commands and vi editor concept. 2. Implement a shell program to find and display largest and smallest of three numbers
2.	Simple Shell scripts/Command Substitution 1. Find the number n is divisible by m or not using shell script. Where m and n are supplied as command line argument or read from key board interactively 2. Plan and implement a shell program to search a pattern in a file that will take both pattern and file name from the command line arguments.
3.	File attributes/expr command demonstration 1. Design a shell program that takes two file names, checks the permissions for these files are identical and if they are identical, output the common permissions; otherwise output each file name followed by its permissions. 2. Implement a shell program to display the length of the name and also display first three characters and last three characters in the name in two different lines if the name contains at least 6 characters.
4.	Arithmetic operators/Command Substitution 1. Write a shell program to implement simple calculator operations. 2. Design a Shell Program that takes the any number of arguments and print them in same order and in reverse order with suitable messages.
5.	String handling operations/Command Substitution 1. For the given path names (E.g., a/b,a/b/c), design a shell script to create all the components in that path names as directories. 2. Develop a shell script that performs following string handling operations i) Calculate the length of the string ii) locate a position of a character in a string iii) extract last three characters from string
6.	Command Substitution 1. For every filename, check whether file exists in the current directory or not and then convert its name to uppercase only if a file with new name doesn't exist using shell script. 2. Execution of exercise Shell scripts
7.	Process 1. C program to do the following: Using fork( ) create a child process. The child process prints its own process-id and id of its parent and then exits. The parent process waits for its child to finish (by executing the wait( )) and prints its own process-id and the id of its child process and then exits. 2. C program that creates a child process to read commands from the standard input and execute them (a minimal implementation of a shell - like program). You can assume that no arguments will be passed to the commands to be executed.
8.	Signal 1. Write a C Program to register signal handler for SIGINT and when it receives the signal, the program should print some information about the origin of the signal. 2. Write a C program which illustrates sending signal from one process to another by using kill

	API. Also check if the program has permission to send the signal or not.
9.	Write a C Program to register signal handler for SIGSTOP.
10.	AWK scripts Write a C Program to handle user defined signals.
11.	AWK scripts Write a C Program to create a Daemon process.
12.	Miscellaneous Exercise of shell programs, C programs on processes and signals

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

1.	Interpret Unix commands to get familiarized with Unix operating system.
2.	Develop and implement shell script file using UNIX commands.
3.	Apply the concept of file attributes and filters to understand about the file permissions and pattern matching.
4.	Design and implement signal functions.
5.	Develop and implement processes in the Unix environment.

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
IS1602-1.1	**3**											**1**		
IS1602-1.2	**2**	**1**	**2**	**2**								**2**		
IS1602-1.3	**2**	**1**	**2**	**2**								**2**		
IS1602-1.4	**2**	**1**	**2**	**2**								**2**		
IS1602-1.5	**2**	**1**	**2**	**2**								**2**		

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	"Unix and Shell Programming", M.G. Venkateshmurthy, Pearson Education, 2005.
2.	"UNIX and Shell Programming", Behrouz A. Forouzan and Richard F. Gilberg, Thomson 2005. (Chapters Appendix H,9).

E Resources

1.	For Introduction to Shell scripting https://swayam.gov.in/nd2_aic20_sp05/preview
2.	For Processes & Signals geekstuff.com

DATABASE APPLICATIONS Lab

Course Code:	**IS1601-1**	**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	**NIL**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Learn how to design ER and schema diagrams for the given database problems and understand the mapping structure of entity relationship to tables.
2.	Program SQL queries using Data Definition and Data Manipulation Languages.
3.	Program SQL queries through a variety of database problems.
4.	Understand the concept of stored procedures, triggers, and cursors in developing database applications.
5.	Make use of complex and advanced query concepts in the developments of real time application

	using the database.

List of Experiments

1	a) Creation of a schema diagram for Employee database b) Creation of an ER diagram for Employee Database c) Creation of Employee Database using DDL commands d) Querying of Employee Database using simple DML commands
2	a) Creation of a schema diagram for Insurance database b) Creation of an ER diagram for Insurance Database c) Creation of Insurance Database using DDL commands d) Querying of Insurance Database using DML commands
3	a) Creation of a schema diagram for Bank database b) Creation of an ER diagram for Bank Database c) Creation of Bank Database using DDL commands d) Querying of Bank Database using DML commands e) Querying of Student Database using complex/Advanced DML commands
4	a) Creation of a schema diagram for Movie database b) Creation of an ER diagram for Movie Database c) Creation of Movie Database using DDL commands d) Querying of Movie Database using DML commands e) Querying of Movie Database using complex/Advanced DML commands
5	a) Creation of a schema diagram for Student database b) Creation of an ER diagram for Student Database c) Creation of Student Database using DDL commands d) Querying of Student Database using simple DML commands e) Querying of Student Database using complex/Advanced DML commands

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

1.	Make use of ER diagrams concepts to design a database for a given real world scenarios.
2.	Make use of Schema diagrams concepts to design a database for a given real world scenarios.
3.	Analyse abstract problems and apply a combination of hardware and software to address problems. Implement database creation using Data Definition Language (DDL) concepts.
4.	Apply the DML (Data Manipulation Language) Concepts to query the Database.
5.	Apply the concepts of complex queries in database environment.

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
IS1601-1.1	1	2		2						1	1				1
IS1601-1.2	1	2		2						1	1				1
IS1601-1.3	2	2		2	2					1	1			3	2
IS1601-1.4	2	2		2	2					1	1				2
IS1601-1.5	2	2		2	2					1	1			2	2

1: Low 2: Medium 3: High

TEXT BOOKS:

1.	Database Systems Models, Languages, Design and Application Programming, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.

REFERENCE MATERIALS:

1.	Database System Concepts- Silberschatz, Korth and Sudharshan, Sixth Edition, Mc-Graw Hill, 2010

E Resources

1.	https://swayam.gov.in/nd1_noc19_cs46/preview , Database Management System, Swayam.
2.	https://www.coursera.org/learn/intro-sql, Introduction to Structured Query Language (SQL), coursera.
3.	https://www.coursera.org/projects/introduction-to-relational-database-and-sql, Introduction to Relational Database and SQL.

MOBILE APPLICATION DEVELOPMENT Lab			
Course Code:	**IS3603-1**	**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	**CS1002-1, CS2002-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Describe the architecture and overview of android.
2.	Develop a mobile application on Android Platform using UI components and Android Components.
3.	Develop applications supporting services and broadcast receivers.
4.	Manage the data handling of the app using databases, shared preferences.
5.	Support the application with the graphical features or animations and sensors.

List of Experiments

1.	Simple Program to display Hello World on App Screen and Looking into the res folder, Manifest.xml file, values folder and activity_main.xml file.
2.	Mobile Application to develop a simple Calculator, Application to generate a random color on each button click, Application to change background color using radio buttons.
3.	Mobile Application to toast the list of items checked, Application to change image in Image View on button click, Application to select date and time and display it using Date Picker and Time Picker**.**
4.	Implement option menu and context menu to perform mathematical operations, Application to dynamically and statically add items to a list.
5.	Mobile Application to demonstrate the activity life cycle by logging the activities in the LogCat, Application to demonstrate interaction between activities.
6.	Implement an AsyncTask to count from 1 to 100 in background and display the progress using progress bar, Implement the same using threads.
7.	Implement a service to play music in background. Demonstrate sending of SMS, Call, Email using Intent class. Demonstrate usage of Browser and Maps using Intent class.
8.	Implement broadcast receiver to read the battery percentage from cellphone and change background color based on level, Application to send SMS using SMS Manager, Application to read phone call state using Telephony APIs.
9.	Application to insert data entered by user into database and display the values in database (using SQLiteDatabase and DBHelper).
10.	Implement an application to store and retrieve data by using Shared Preference.
11.	Mobile Application to implement Android Graphics with different objects, Application to implement Android Animations – Fade, Rotate, zoom, blink.
12.	Mobile Application to capture image using Camera and set the image as background, Mobile Application to capture video and illustrate playback.
13.	Mobile Application to use Accelerometer and display coordinates, Application to use gyroscope and change Background color using sensor values.

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

1.	Explain the architecture, project structure for Android and demonstrate mobile applications with UI Elements
2.	Build Mobile applications using activities.
3.	Develop mobile applications using services and Broadcast receivers.
4.	Design Mobile Applications that support data handling with Shared Preferences and Databases
5.	Make use of graphical features, animations, multimedia and sensors in android 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
IS3603-1.1	1	1	2	2						1		1		
IS3603-1.2	1	2	3	3						1		1	2	1
IS3603-1.3	1	2	2	3						1		1	3	2
IS3603-1.4	1	2	3	3						1		2	3	2
IS3603-1.4	1	1	2	2						1		1	2	1

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Barry Burd, Android Application Development All in one for Dummies.
2.	Teach Yourself Android Application Development in 24 Hours, Publication: SAMS.

E Resources

1.	https://developer.android.com/training/index.html
2.	https://www.udacity.com/course/new-android-fundamentals--ud851
3.	https://www.tutorialspoint.com/android/index.htm
4.	https://www.javatpoint.com/android-tutorial
5.	https://developer.android.com/guide/
6.	https://www.udemy.com/course/learn-android-application-development-y/

C# AND .NET FRAMEWORK Lab

Course Code:	**IS3601-1**	**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	**CS1001-1, CS2002-1**		

Teaching Department: Information Science and Engineering

Course Objectives:

1.	To know the .NET framework and its entire architecture in action.
2.	To help the student develop Standalone and web applications.
3.	To aid the student in the rapid development of applications with respect to agile software development.

List of Experiments

Create a C# Console application given the following requirements.

a) Calculate Hypotenuse of triangle using dynamic initialization of variables.
b) Check whether the alphabet is a vowel or not.
c) Find out the given point set in the quadrant space.

Create a console application to perform the following operations using encapsulation features.

a) Take Student Input
b) Print student details
c) Edit student details

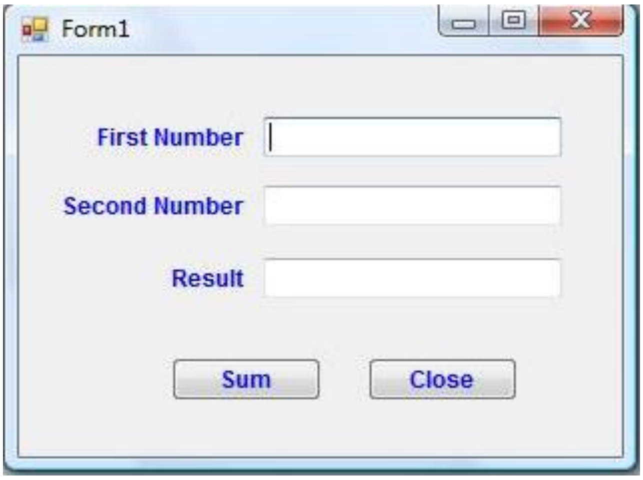
Also, encapsulate the following operations in a specific class. Use appropriate assumptions and details.

Develop a C# application to imbibe the following inheritance concepts related to object-oriented programming.
(a) Single Inheritance
(b) Multilevel Inheritance
(c) Multiple Inheritance

Create an application in C# to perform operator overloading given the following requirements.

a) Unary Operator.
b) Binary Operator.

Perform the aforementioned operations on a class caleed Point which has a three-dimensional data.

	Write a C# application to implement threading using inbuilt .NET framework classes. Also, do provide options for thread priority and other threading operations.
	Create a C# application to create a delegate and a event to implement the following. a. General template for performing mathematical operations using delegates. b. An event handler when an operation is performed.
	Create an application using Windows form given the following screenshot. Also provide required functionalities for all UI elements added. 
	Create a windows application to perform similar operations as given in **lab program No. 2** using User Interfaces.
	Create a Windows Application to recreate the classic notepad operation.
	Create a Windows application to perform basic database operations in ADO.NET environment.

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

1.	Display proficiency in C# by building stand-alone applications in the .NET framework using C#.
2.	Create distributed data-driven applications using the .NET Framework, C#, SQL Server and ADO.NET.
3.	Create web-based distributed applications using C#, ASP.NET, SQL Server and ADO.NET.
4.	Utilize DirectX libraries in the .NET environment to implement 2D and 3D animations and game-related graphic displays and audio.
5.	Utilize XML in the .NET environment to create Web Service-based applications and components.

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
IS3601-1.1		3	3		3			3			2		2	3
IS3601-1.1		3	3		3			3			2		3	3
IS3601-1.1		3	3		2			3			3		3	2
IS3601-1.1		3			3			2			2		3	1
IS3601-1.1		2	2		2			3			1		3	3

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	NET 4.0 Programming (6-in-1), Black Book, Kogent Learning Solutions Inc., Wiley- Dream Tech Press.
2.	Paul Deitel and Harvey Deitel: C# 2010 for Programmers, 4th Edition, Pearson Education.
3.	Andrew Trolsen: Pro C# 5.0 and the .NET 4.5 Framework, 6th Edition, Wiley-Appress.
4.	Herbert Schildt: Complete Reference C# 4.0, Tata McGraw Hill, 2010

E Resources

1.	https://www.w3schools.com/cs
2.	https://www.coursera.org/projects/buildingacalculatorinvisualstudio
3.	https://www.udemy.com/course/csharp-from-scratch/

INTERNET OF THINGS Lab

Course Code:	**IS3602-1**	**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	**CS1002-1, IS2101-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Assess the genesis and impact of IoT applications, architectures in real world.
2.	Illustrate diverse methods of deploying smart objects and connect them to network.
3.	Compare different Application protocols for IoT.
4.	Infer the role of Data Analytics and Security in IoT.
5.	Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

List of Experiments

1.	What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact (Chapter 1) Lab Experiment: Simple Blinking of Arduino and LED Blinking Arduino
2.	Convergence of IT and IoT, IoT Challenges 9Chapter 1), IoT Network Architecture and Design, Drivers behind New Network Architectures (Chapter 2) Lab Experiment: Arduino Button Based LED Blinking along with Counting number of times button Pressed
3.	Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack. (Chapter 2) Lab Experiment: Arduino Sense the Temperature using any Temperature Sensor
4.	Sensors, Actuators, and Smart Objects, Sensor Networks (chapter 3), Connecting Smart Objects Communications Criteria, IoT Access Technologies. (Chapter 4) Lab Experiment: Arduino read the serial Monitor and display value of a sensor
5.	IP as the IoT Network Layer, The Business Case for IP, The need for optimization (Chapter 5), Lab Experiment: Use Arduino to connect to the Internet using Emulated Platform
6.	IoT Application Transport Methods. Data and Analytics for IoT. (Chapter 6 and 7) Lab Experiment: Connect to cloud using Blynk Framework and Arduino + Sense the Temperature from the Arduino and display to the cloud.
7.	Edge Streaming Analytics, Network Analytics, Securing IoT (Chapter 7 and 8), A Brief History of IOT Security, and Common Challenges in OT Security. Lab Experiment: Control Arduino from the Blynk terminal and display the value entered from the cloud to the console
8.	Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary (Chapter 8) Lab Experiment: Using Blynk cloud display action-based Proximity Sensor.
9.	IoT Physical Devices and Endpoints - Arduino UNO, Introduction to Arduino, Arduino UNO. IoT Physical Devices and Endpoints - Raspberry Pi: (second text book Chapter 7) Lab Experiment: Using the Nodemcu and connecting to Wi-Fi
10.	Introduction to Raspberry Pi, About the Raspberry Pi Board: Hardware Layout (Second text book Chapter 8) LAB Experiment: Interfacing the Nodemcu with Cloud like Ubidots, Blynk, and Adafruit etc.
11.	Operating Systems on Raspberry Pi, Configuring Raspberry Pi, Programming Raspberry Pi with Python (Second Text book chapter 8) LAB Experiment: Measuring GPS coordinates from the Device and displaying it to Nodemcu.
12.	Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Arduino, Accessing Temperature from DS18B20 sensors. (Second text book Chapter9). Lab Experiment: Raspberry Pi introduction + Connecting Raspberry Pi connection to Internet.
13.	Remote access to Raspberry Pi, Smart and Connected Cities (Second text book Chapter 10) Lab Experiment: Connecting Raspberry Pi to other Edge devices for communication

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

1.	Compare and contrast the deployment of smart objects and the technologies to connect them to the network.
2.	Analyse the role of IoT protocols for efficient network communication.
3.	Apply different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.
4.	Apply the knowledge of installation of Operating systems on Raspberry PI and its configuration.
5.	Analyse the role of Smart cities and its importance with IoT.

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**
IS3602-1.1	2	3	2											2
IS3602-1.2	2	3	1									1		2
IS3602-1.3	2	3	3	2								2		3
IS3602-1.4	2	3	1											2
IS3602-1.5	2	2	1									1		1

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands - on- Approach)”, First Edition, VPT, 2014. (ISBN: 978-8173719547)
2.	Raj Kamal, “Internet of Things: Architecture and Design Principles”,1st Edition, McGraw-Hill Education, 2017. (ISBN: 978-9352605224)

E Resources

Professional Elective Courses (IT Management Stream)

INFORMATION STORAGE MANAGEMENT

Course Code:	**IS2201-1**	**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	**CS1002-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Describe about different types of computer storage and its working.
2.	Focus on the latest technologies which are used for data protection and storage.
3.	Analyze requirement and suggest appropriate storage technology to store the data.
4.	Use and compare different storage techniques and its pros and cons.
5.	How computer storage techniques have evolved.

UNIT-I	**15 Hours**

STORAGE SYSTEM: INTRODUCTION TO INFORMATION

Information Storage, Evolution of Storage and Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. **(T1: 1.1-1.4)**

DATA PROTECTION

RAID: RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares. **(T1: 3.1-3.7)**

INTELLIGENT STORAGE SYSTEMS

Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage Systems. **(T1: 4.1-4.3)**

STORAGE NETWORKING TECHNOLOGIES:

Direct-Attached Storage and Introduction to SCSI: Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces, Introduction to Parallel SCSI, SCSI Command Model**. (T2: 5.1-5.5)**

UNIT-II	**15Hours**

STORAGE NETWORKING TECHNOLOGIES: FIBRE CHANNEL STORAGE AREA NETWORKS

Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Fabric Services, Switched Fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN. **(T1: 5.1-5.11)**

NETWORK-ATTACHED STORAGE

General-Purpose Servers vs. NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operations, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance, File-Level Virtualization. **(T1: 7.1-7.9)**, **IP SAN:** iSCSI, FCIP. **(T1: 6.1-6.2)**

OBJECT-BASED AND UNIFIED STORAGE

Object-Based Storage Devices, Content-Addressed Storage, CAS Use Cases, Unified Storage. **(T1: 8.1-8.5)**

UNIT-III	**10 Hours**

BUSINESS CONTINUITY: INTRODUCTION TO BUSINESS CONTINUITY

Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. **(T1: 9.1-9.6)**

BACKUP AND RECOVERY

Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Targets. **(T1: 10.1-10.10)**

CLOUD COMPUTING

Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges, Cloud Adoption Considerations. **(T1: 13.1-13.8)**

SECURING THE STORAGE INFRASTRUCTURE

Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking. **(T1: 14.1-14.4)**

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

1.	Outline the computer storage techniques evolution.
2.	Explain the latest technologies of storage.
3.	Illustrate and compare storage techniques.
4.	Analyze requirements and suggest the appropriate storage technology.
5.	Apply the techniques to secure and protect the data.

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
IS2201-1.1	3	2												1
IS2201-1.2	3	2												2
IS2201-1.3	3	2	1											2
IS2201-1.4	3	2	1											2
IS2201-1.5	2	3												2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments, 2nd Edition, Published by John Wiley & Sons, Inc.
2. Information Storage and Management by EMC Education Services.

REFERENCE BOOKS:

1. Storage Networks Explained by Ulf Troppen, Rainer Erkens, Wolfgang Muller.
2. Storage Networks by Robert Spalding.

iOS APP DEVELOPMENT USING XCODE AND SWIFT

Course Code:	**IS3201-1**	**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	**CS1001-1, IS2001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	**Describe** the iOS interface builder and various UI elements.
2.	**Develop** basic iOS App using various UI elements of Interface
3.	**Understand** the core data structure, system utilities and application design patterns.
4.	**Build** iOS App with IBactions, tables, navigation, segues and transitions.
5.	**Develop** application to demonstrate networking, storing retrieving and modifying Data.

UNIT-I **15 Hours**

INTRODUCTION TO DEVELOPER TOOLS

Introduction to macOS; Introduction to XCode and Swift.; Introduction to Interface Builder; New project setup in Xcode – Using Templates, Creating Projects and Playground, and Workspaces; Interface Builder to design and create UI of your app – introduction to various UI elements of Interface Builder; Cloning Projects; iOS simulator.

INTRODUCTION TO iOS

App user interface designing – mobile UI Layout (Layout, View) UI Control (TextView, EditText, Button, ImageButton, ToggleButton, RadioGroup, RadioButton, CheckBox, ProgressBar Spinner,DayPicker,TimePicker), Draw-able, Menu(Option, Context, Popup).

UNIT-II **15 Hours**

CORE FOUNDATION, SYSTEM UTILITIES AND APPLICATION PATTERNS,

Loops and conditional statements, Array, Dictionaries, Data, String, Numbers etc; Classes and Structures; Handling JSON Working with Files, Date/Calendar utilities, Preferences; Model View Controller (MVC)

Design Pattern, IBOutlets, IBActions and linking various elements of UI, Subclassing and Delegation, Extensions and Protocols.

USER INTERFACE DEVELOPMENT

iOS User Interface (UI) design fundamentals iOS; The view hierarchy – Views, Windows; Navigation View and Tab Bars; Text and Web Views; Alert Views and Action Sheets; Multi-touch, taps and gestures; Table views – delegates and data sources, view styles, custom cells; UIPickerview and UIDatePicker; Autolayout and setting constraints; Storyboards – adding scenes, segues, transitions

UNIT-III	**10 Hours**

NETWORKING

Network frameworks to access data on the Internet; JSON Handling; NSDataTask, NSURLSession; Webviews.

CORE DATA

Overview of Core Data; Managed Objects; Persistent Store Coordinator; Entity Descriptions; Retrieving and Modifying Data.

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

1.	**Understand** the iOS developing tool like XCode and Swift, projects, playground and iOS Emulator.
2.	**Design** simple iOS app using the fundamental UI elements, Layout and Views.
3.	**Apply** the basic data structures, MVC design patterns, delegates, protocols and structures and classes to build more advanced iOS app.
4.	**Develop** apps that uses advanced UI components like tables, different views and layouts and multiple screens.
5.	**Apply** the networking APIs and database APIs to design Apps that work real-time data.

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
IS3201-1.1	3	3	3		1	1		2	2	1	2	1	2	3
IS3201-1.2	3	3	3		1	1		2	2	1	2	1	2	3
IS3201-1.3	3	3	3		1	1		2	2	1	2	1	2	3
IS3201-1.4	3	3	3		1	1		2	2	1	2	1	2	3
IS3201-1.5	3	3	3		1	1		2	2	1	2	1	2	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Matt Neuburg, "iOS 13 Programming Fundamentals with Swift: Swift, Xcode, and Cocoa" Basics 1st Edition
2.	Serhan Yamacli, "Beginner's Guide to iOS 13 App Development Using Swift 5.1: Xcode, Swift and App Design Fundamentals" 2019 edition.

REFERENCE BOOKS:

1.	Kevin J McNeish, "iOS App Development for Non-Programmers Series: The Series on How to Create iPhone & iPad Apps", 2012 Edition.
2.	Jesse Feiler, "iOS App Development for Dummies", 2014 Edition.

E Books / MOOCs/ NPTEL

1.	https://developer.apple.com/swift/
2.	https://developer.apple.com/videos/ https://code.tutsplus.com/series/learn-ios-sdk-development-from-scratch--mobile-14536
3.	https://www.coursera.org/courses?query=ios%20app%20development
4.	https://www.udemy.com/topic/ios-development/

ROBOTIC PROCESS AUTOMATION DESIGN & DEVELOPMENT

Course Code:	**IS3202-1**	**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	**CS1001-1, IS1103-1, CS2001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	To prepare students to be Junior RPA Developers
2.	Learn the basic concepts of Robotic Process Automation
3.	Develop familiarity and deep understanding of UiPath tools
4.	Develop the ability to independently design and create robots for business processes

UNIT-I | **15Hours**

RPA Basics

History of Automation; Story of Work; Introduction to RPA; RPA vs. Automation; RPA and AI; RPA and emerging ecosystem; Industries best suited for RPA; Processes that can be Automated.

Introduction to UiPath

UiPath and its products; Robots and their types; Studio Overview; Orchestrator; UiPath Studio Installation; The User Interface; Features of Studio - Managing Activities Packages, Managing Extensions, Reusing Automation Library, Version Control, Introduction to Automation Debugging, Activities Guide; Building Hello World Robot.

Variables and Arguments

Variables and its types; Variables Panel; Scope of Variable; Arguments; Arguments Panel; Argument Directions; Argument vs Variable.

UNIT-II

UI Automation & Selectors

UI interactions; Input actions and Input methods - Input actions: Click, Type Into, Send Hotkey - Input methods: Default, SendWindowMessages, Simulate Type/Click; Containers; Recording & its types; Selectors; Types of Selectors - Full and Partial, Containers and Partial Selectors, Dynamic Selectors, Wildcards in Selectors; UI Explorer; Anchors; Debugging selectors

Control Flow

Sequences; Control Flow and its types; Decision control – IF, Switch, IF vs Switch; Loops - Do While, While, For each; Other control flow activities – Delay, Break, Assign, Continue, Parallel; Flowcharts – Introduction, Decisions in flowcharts, Loops in flowcharts, Nesting flowcharts and sequences, Sequences vs. Flowcharts; Error handling – Errors, Exceptions, Error handling approach, Try Catch, Retry Scope, Global Exception Handler, Continue On Error, Best Practice for Error Handling.

Data Manipulation

Data Manipulation and Its Importance - Introduction & operations, Data conversion; String Manipulations - Introduction & methods, RegEx; DataTable Manipulations; Collection, Its Types and Manipulations; Lists; Dictionaries

UNIT-III | **10 Hours**

Automation Concepts and Techniques

Extraction and its techniques - Screen scraping, Data scraping, PDF Extraction; Automation techniques - Workbook and Excel automation (read/write); Email Automation

Orchestrator

Orchestrator Overview; Publishing a Robot to Orchestrator; Orchestrator Functionalities; Orchestrator User Interface; Categories of functionalities; Automations – Processes, Triggers, Queues, Transactions, Assets; Management – Folders, Users, Roles, Robots, Environments, Machines, Packages, Libraries; Monitoring – Robots, Jobs, Queues, Logs.

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

1.	Independently function as Junior RPA Developers
2.	Explain the basic concepts of Robotic Process Automation
3.	Apply UiPath tools for Robotic Process Automation
4.	Independently design and create robots for business processes
5.	Acquire skills required to pass UiPath RPA Associate Exam

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
IS3202-1.1	1								2					1
IS3202-1.2		2				1							1	
IS3202-1.3	2										1			2
IS3202-1.4			1				2						2	
IS3202-1.5				2					1					2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Power Point presentations from UiPath Academic Alliance program.

REFERENCE BOOKS:

1. Title: Learning Robotic Process Automation, Author: Alok Mani Tripath, Publisher: Packt Publishing Ltd., UK, 2018.

E Books / MOOCs/ NPTEL

1. https://academy.uipath.com/courses

TOTAL QUALITY MANAGEMENT FOR SUSTAINABLE GROWTH

Course Code:	**IS1201-1**	**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	**NIL**		

Teaching Department: Information science & Engineering

Course Objectives:

1.	To gain a thorough understanding of Quality and features of quality.
2.	To gain knowledge of various quality procedures.
3.	To explore the fundamentals of TQM tools
4.	To learn about the fundamental of quality audit.
5.	To learn about various statistical tools required to access quality.

UNIT-I

Introduction — **15 Hours**

Evolution of quality, Definition, Concept and Features of TQM, Eight building blocks of TQM. (T1:1,3)

TQM thinkers and Thought

Juran Trilogy, PDSA cycle, 5S, Kaizen, Crosby's theory on Quality Management, **Quality Performance Excellence Award-** Deming Application Award, European Quality Award, Malcolm Baldrige National Quality Award**.** (T2:5)

UNIT-II

TQM tools — **13 Hours**

Benchmarking: Definition, concepts, benefits, elements, reasons for benchmarking, process of benchmarking, FMEA, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept and need**.** (T2:7)

Six Sigma- Features of six sigma, Goals of six sigma, DMAIC, Six Sigma implementation. (T1:7)

Six Sigma

Features of six sigma, Goals of six sigma, DMAIC, Six Sigma implementation. (T1:7).

UNIT-III

Statistical Process Control — **12 Hours**

Central Tendency, The seven tools of quality, Normal curve, Control charts, Process Capability**.** (T2:15)

Quality Systems- ISO 9000, ISO 9000:2000, ISO 14000, other quality systems. (T1:1, T2:8)

Quality Systems

ISO 9000, ISO 9000:2000, ISO 14000, other quality systems. (T1:1, T2:8)

Introduction to Sustainable Development

Definitions and principles of Sustainable Development, History and emergence of the concept of Sustainable Development, Millennium Development Goals: Status (global and Indian), Impacts on approach to development policy and practice in India, future directions. (T3:1 and Class Slides)

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

1.	Understand the various approaches of TQM
2.	Identify and use appropriate tools and techniques for controlling, improving and measuring quality
3.	Analyse customer needs and perceptions of various tools utilization for quality improvement
4.	Apply statistical tools for continuous improvement of systems
5.	Apply the tools and technique for effective implementation of TQM

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
IS1201-1.1	1	2											1	2
IS1201-1.2	1	3											1	2
IS1201-1.3	1	3											1	2
IS1201-1.4	1	3											1	2
IS1201-1.5	1	3											1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Poornima M Charantimath, "Total Quality Management", Pearson Third Edition.
2. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint 2006.
3. Kirkby. J, O'Keefe P. and Timberlake, "Sustainable development" Earth Scan Publication, London, 1996.

REFERENCE BOOKS:

1. H.Lai, Lt. Gen ,Wiley Eastern Limited, 1990 , Total Quality Management.
2. Bounds Greg, McGraw, Beyond Total Quality Management.
3. Kanishka Bedi, Oxford Higher Education, Quality Management.
4. James R.Evans and Williuam M Lindsay, Managing for Quality and Performance Excellence, 9th edition, Publisher Cengage Learning.

E Books / MOOCs/ NPTEL

1. http://www.evans.swlearning.com
2. www.cengage.com/international

INNOVATION MANAGEMENT AND BUSINESS MODELS

Course Code:	**IS2301-1**	**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	**ME1654-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	To learn the basics and types of innovation, creativity
2.	To learn about the Design thinking and entrepreneurship
3.	To learn about business models
4.	To learn about incubation and markets
5.	To demonstrate innovation management and case studies.

UNIT-I	**15 Hours**

Innovation

Analyzing the Current Business Scenario, Innovation and Creativity- An Introduction, Innovation in Current Environment, Types of Innovation, School of Innovation.

Challenges of Innovation, Steps of Innovation Management, Idea Management System, Divergent V/s Convergent Thinking, Design Thinking and Entrepreneurship
Experimentation in Innovation Management, Idea Championship, Participation for Innovation, Co-creation for Innovation, Prototyping to Incubation.
Marketing of Innovation, Technology Innovation Process, Technological Innovation Management Planning, Technological Innovation Management Strategies, Technology Forecasting.

UNIT-II	**15 Hours**

Business Model
What is a Business Model, Who is an Entrepreneur, Social Entrepreneurship, Blue Ocean Strategy-I, Blue Ocean Strategy-II
Business Models and value proposition, Business Model Failure: Reasons and Remedies, Incubators: Business Vs Technology, Managing Investor for Innovation, Future markets and Innovation needs for India.
Exploration of business models for material efficiency services.
Case Studies

UNIT-III	**10 Hours**

Context and Pattern, SME'S strategic involvement in sustainable development
Management of Innovation, Innovation, Sustainability Innovation and Entrepreneurship, Innovation Sustainable Conditions, Innovation: Context and Pattern. Case Study of Patents

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

1.	Acquire Knowledge on Innovation concepts, challenges and management
2.	Understand the experimentation and marketing of innovation
3.	Acquire Knowledge on business models, entrepreneur and investors
4.	Analyse the business case studies
5.	Understand the management of innovation

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
IS2301-1.1	1	2								1				1
IS2301-1.2	1	2	2							3				3
IS2301-1.3	1	2	2							3				3
IS2301-1.4	1	2	2							3				1
IS2301-1.5	1	2								1				1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	8 Steps To Innovation: Going From Jugaad To Excellence- Book by Rishikesha T. Krishnan and Vinay Dabholkar
2.	Innovation and Entrepreneurship Book by Peter Drucker
3.	HBS series on Innovation and Entrepreneurship

REFERENCE BOOKS:

1.	Ries, Eric(2011), The lean Start-up: How constant innovation creates radically successful businesses, Penguin Books Limited.
2.	T. H. Byers, R. C. Dorf, A. Nelson, Technology Ventures: From Idea to Enterprise, McGraw Hill (2013) · Osterwalder, Alex and Pigneur, Yves (2010) Business Model Generation.
3.	Verstraete, T. and Laffitte, E.J. (2011). a Business Model of Entrepreneurship, Edward Elgar Publishing.
4.	Kelley, Tom (2011), The ten faces of innovation, Currency Doubleday.

E Books / MOOCs/ NPTEL

1.	Innovation, Business Models and Entrepreneurship, By Prof. Rajat Agrawal, Prof. Vinay Sharma | IIT Roorkee.

NOSQL DATABASE

Course Code:	**IS3301-1**	**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	**CS1001-1, CS2102-1**		

Teaching Department: Information Science and Engineering

Course Objectives:

1.	Understand the importance of NoSQL data management and compare with traditional relational database management system.
2.	Understand the CAP theorem and compare with ACID properties of traditional relational database management system.
3.	Understand the basics of MongoDB and Cassandra NoSQL database management systems.
4.	Develop queries to store and retrieve the data using MongoDB NoSQL database management systems.
5.	Develop queries to store and retrieve the data using Cassandra NoSQL database management systems.

UNIT-I — **15 Hours**

Introduction to NoSQL: Why NoSQL? Types of NoSQL databases, Distribution models: single server, sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication, Consistency: Update Consistency, Read Consistency, The CAP Theorem, MapReduce: Partitioning and Combining, Composing MapReduce calculations.

UNIT-II — **15 Hours**

Introduction to MongoDB: What is MongoDB? Why MongoDB?, JSON, Creating Unique Key, Storing Binary data, Terms used in RDMS and MongoDB, Data types in MongoDB, MongoDB Query Language: Insert method, Save method, Update method, Remove method, Find method, Dealing with Null values, Count, Limit, Sort, Skip, Arrays, Aggregate Functions.

UNIT-III — **10 Hours**

Introduction to Cassandra: Features of Cassandra, CQL data types, CRUD (Create, Update, Read and Delete) operations, Collections: Set collection, List collection, Map collection, Set and List, Map, Alter commands, Import and Export.

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

1.	Understand the importance of NoSQL data management and compare with traditional relational database management system.
2.	Understand the CAP theorem and compare with ACID properties of traditional relational database management system.
3.	Understand the basics of MongoDB and Cassandra NoSQL database management systems.
4.	Develop queries to store and retrieve the data using MongoDB NoSQL database management systems.
5.	Develop queries to store and retrieve the data using Cassandra NoSQL database management 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**
CS3301-1.1	3									1		1	3	
CS3301-1.2	3									1		1	3	
CS3301-1.3	3									1		1	3	

CS3301-1.4	3									1		1	3	
CS3301-1.5	3	2								1		1	3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Pramod J. Sadalage, Martin Fowler. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence". 1st Edition, Addison-Wesley,2012.
2.	Seema Acharya, Subhashini Chellappan, "Big Data Analytics", 1st Edition, Wiley, 2015.

REFERENCE BOOKS:

1.	Deepak Vohra, Nosql Web Development with Apache Cassandra, Cengage Learning, Inc; New edition, 2015.
2.	Doug Bierer, MongoDB 4 Quick Start Guide: Learn the skills you need to work with the world's most popular NoSQL database, Packt, 2018.

E Books / MOOCs/ NPTEL

1.	https://www.mongodb.com/nosql-explained
2.	https://cassandra.apache.org/_/index.html

SUPPLY CHAIN MANAGEMENT & ENTERPRISE RESOURCE PLANNING

Course Code:	**IS1301-1**	**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	**NIL**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Outline the concepts of a supply chain with various case studies and explain the strategic framework to analyze supply chains and their management.
2.	Illustrate the role of transportation and coordination in a supply chain with design and comparison of various transportation modes and coordination methodologies.
3.	Analyze the role of pricing and revenue management in a supply chain with key factors, tactics and get the idea of role of IT in a supply chain.
4.	Understand and Analyze ERP.
5.	Apply ERP to the Supply Chain Management.

UNIT-I | **15 Hours**

BUILDING A STRATEGIC FRAME WORK TO ANALYZE SUPPLY CHAINS [2nd Textbook]:
1st Chapter: 1.4: Supply chain stages and decision phases process view of a supply chain. **-1.5:** Supply chain flows. **1.6:** Examples of supply chains. **2.1:** Competitive and supply chain strategies. **2.2:** Achieving strategic fit. **2.3:** Expanding strategic scope. **3.2:** Drivers of supply chain performance. **3.3:** Framework for structuring drivers – **3.5:** Inventory, **3.6:** Transportation, **3.4:** Facilities, **3.7:** Information. Obstacles to achieving fit. Case discussions.
T2
TRANSPORTATION IN A SUPPLY CHAIN [2nd Textbook] 14th Chapter

14.1: Roles of transportation in a supply chain ,**14.2:** modes of transportation and their performance characteristics, **14.3:** transportation infrastructure and policies, **14.4:** design option for a transportation network, **14.5:** trade-offs in transportation design, **14.6:** tailored transportation, **14.7:** role of IT in transportation, **14.8:** risk management in transportation, Indian transportation system-in need of innovations to propel economic growth, **14.9:** making transportation decisions in practice.

UNIT-II | **14 Hours**

CORDINATION IN A SUPPLY CHAIN [2nd Textbook] 10th Chapter
10.1: Lack of supply chain coordination and bullwhip effect, **10.2:** the effect on performance of lack of coordination, **10.3:** Obstacles to coordination in supply chain, **10.4:**managerial levels to achieve coordination, building strategic partnerships and trusts within, **10.5:**continuous replenishment and vendor managed inventories, **10.6:**collaborative planning, forecasting and replenishment(CPFR), collaborative planning,

forecasting and replenishment-Indian experiences, the role of IT in coordination.

TOTAL DISTRIBUTION COST ANALYSIS

Total cost concept, principles of logistic costing, logistics and bottom line, logistics and shareholder value, customer profitability analysis, direct product profitability, cost drivers and activity-based costing.

UNIT-III	11 Hours

IT ENABLED SUPPLY CHAIN [2nd Textbook] 17th Chapter

17.1: Introduction, **17.2:** changing role of IT, IT solution options, Electronic Data Interchange (EDI)

ERP OVERVIEW [3rd Textbook] 1st Chapter

1.10: Benefits, **2nd Chapter 2.1:** business engineering, **2.7:** ERP and management concerns, **3rd Chapter 3.1:** Business Modeling for ERP. **4th Chapter 4.1:** ERP implementation, **4.3:** customization, **4.5:** post implementation options.

ERP AND COMPETITIVE ADVANTAGE 5th Chapter

Marketing of ERP, **6th Chapter** ERP domain: **6.5:** SAP, **6.4:** BAAN, **6.6:** SAP r/3, **6.2:** MGF/PRO, **6.3:** IFS/Avalon.

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

1.	Illustrate the supply chains in the real world and methodologies for the supply chain profitability.
2.	Demonstrate the relation between concepts and activities of the supply chain to actual organizations.
3.	Apply a good pricing and revenue management system for a successful supply chain.
4.	Explain the role of technology in logistics and supply chain management.
5.	Apply Information Technology and ERP in a supply chain.

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
IS1301-1.1	2	3											1	
IS1301-1.2	2	3											1	
IS1301-1.3	2	2	2										2	1
IS1301-1.4	2	2	2										3	1
IS1301-1.5	2	3											2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Martin Christopher, Logistics and supply chain management.
2.	Sunil Chopra, Peter Meindl, supply chain management strategy, planning, and operation, Pearson Education 2003.
3.	Vinod Kumar Garg, N.K. Venkatakrishnan, Enterprise Resource planning concepts and Practice, PHI 1999.

REFERENCE BOOKS:

E Books / MOOCs/ NPTEL

USER INTERFACE DESIGN

Course Code:	**IS2302-1**	**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	**CS1002-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	To study the concept of menus, windows, interfaces
2.	To study about user interface design, pitfalls, commandments of design and usability aspects.
3.	To study system menus and windows and layouts for effective communication.

4.	To study the psychology of users and their action.
5.	To study about constraints, discoverability of features, feedback system and detecting and reporting error.

UNIT-I

The User Interface-	**15 Hours**

Introduction, Overview, The importance of user interface Defining the user interface, The importance of Good design, benefits of good design, Introduction to graphical user interface, A brief history of screen design.

The User Interface Design process

Obstacles, Usability, Important human characteristics in design, Human considerations in Design, Business definition and requirement analysis.

UNIT-II	**15 Hours**

System menus

Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, Kinds of graphical menus.

Windows

Characteristics, Components of window, Window presentation styles, Types of window, Window management, Window operations, Characteristics of device based controls.

Screen based controls-

Operable control, Text control, Selection control Provide effective feedback and Guidance assistance, Organize and Layout Windows and pages

UNIT-III	**10 Hours**

The psychology of everyday actions:

How people do things: The gulfs of execution and evaluation, The seven stages of action, The seven stages of action and The three levels of processing, Seven fundamental design principles.

Four kinds of constraints: physical, cultural, semantic, and logical, constraints that force the desired behaviour, conventions the faucet: a case history of design, using sound as signifiers.

Human error? no, bad design

Understanding why there is error, two types of errors: slips and mistakes, social and institutional pressures, reporting error, detecting error, designing for error, design principles for dealing with error.

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

1.	Explain various Graphical User Interface design aspects & measures to improve them.
2.	Summarise the basic principles of user interface and design
3.	Outline the differences between usability and user experience and the need for human factors in design.
4.	Infer user-interface design process and introducing common design scenarios.
5.	To understand the user psychology and enunciate the design principles from psychological aspects.

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
IS2302-1.1	3	3							1	1		1	1	
IS2302-1.2	2	3							1	1		1	1	
IS2302-1.3	1	3	2						1	1		1	3	2
IS2302-1.4	1	3	2						1	1		1	3	2
IS2302-1.5		2	2						1	1		1	1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	The Essential Guide to User Interface Design, Wilbert O. Galitz, 3rd Edition, 2007, John Wiley & Sons, Inc., ISBN: 0470146222.
2.	The design of Everyday Things, Don Norman, 2013, Basic Books Publication, ISBN: 978-0-465-00394-5.

E Books / MOOCs/ NPTEL

1.	Coursera course: User Interface Design Specialization by Loren Terveen(16 weeks).

Professional Elective Courses (Software Engineering & Development Stream)

ADVANCED JAVA PROGRAMMING

Course Code:	**IS3211-1**	**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	**CS2002-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Develop networking Java applications.
2.	Apply the database concept for a Java database application.
3.	Design server-side web applications using Java Servlets.
4.	Develop server-side web applications using Java Server Pages.

UNIT-I — **15 Hours**

REVISIT TO OOP CONCEPTS:

Class, Object and Inheritance in Java. String buffer and string builders, Java beans, Introspection, Bean APIs, EJB concepts, Collection interfaces and Collection classes. FILE HANDLING: Serial Access Files, File Methods, Redirection, Command Line Parameters, Random Access Files.

UNIT-II — **15 Hours**

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, Scrollable Result Sets in JDBC 2.0, Modifying Databases via Java Methods.

NETWORK PROGRAMMING WITH JAVA:

Basic Concepts, Protocols and Terminology, Clients, Servers and Peers, Ports and Sockets, The Internet and IP Addresses, Internet Services, URLs and DNS, TCP, UDP. The Inet Address Class, Using Sockets (TCP and UDP).

UNIT-III — **10 Hours**

JAVA SERVLETS:

Benefits, A simple Java Servlet, Anatomy of a Java Servlet, Reading data from a client, Reading HTTP Request Headers, Sending data to a client, working with Cookies, Tracking Sessions. JAVA SERVER PAGES (JSP): JSP Tags, Form handling in JSP, User Sessions, Cookies, Session objects.

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

1.	Apply the knowledge of Java Programming to demonstrate the OOP Concepts.
2.	Demonstrate the file handling using JAVA.
3.	Develop Java Program to store and retrieve data from the database.
4.	Apply Java Programming to establish Network Connectivity also Demonstrate TCP and UDP sockets.
5.	Communicate and function effectively with Modern Engineering and IT.

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

CS3211-1.1	3	2											2	1
CS3211-1.2	2	3											2	2
CS3211-1.3	2	3											2	2
CS3211-1.4	3	3											2	2
CS3211-1.5	3	3											2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Herbert Schildt, "The Complete Reference Java by Seventh Edition", Tata McGraw-Hill, 2007
2.	Jan Graba, "An Introduction to Network Programming with Java", Springer Publications, 2007
3.	jim Keogh, "The Complete Reference J2EE", Tata McGraw-Hill, 2002.

REFERENCE BOOKS:

1.	H. M. Deitel, "Java – How to Program? ", Prentice Hall, 2004.

E Books / MOOCs/ NPTEL

1.	http://www.mindview.net/Books/TIJ
2.	http://docs.oracle.com/javase/specs/jls/se8/html/index.html

BUSINESS INTELLIGENCE AND ITS APPLICATIONS

Course Code:	**IS2212-1**	**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	**IS1103-1**		

Teaching Department: Information Science &Engineering

Course Objectives:

1.	Comprehend the need of BI for a business enterprise.
2.	Summarize the types of Digital data & its operation.
3.	To outline the Need & Significance of data warehouse in BI applications.
4.	Identify the types and step involved in ETL process.
5.	To understand the measurement concept to evaluate business performance and build enterprise reports.

UNIT-I — 15 Hours

BUSINESS VIEW OF INFORMATION TECHNOLOGY APPLICATIONS

Business Enterprise Organization, Its Functions, and Core Business Processes; Baldrige Business Excellence Framework; Key Purpose of Using IT in Business; The Connected World: Characteristics of Internet-ready IT Applications; Enterprise Applications (ERP/CRM, etc.) and Bespoke IT Applications; Information Users and Their Requirements; Case Studies **(T1: Ch-1.1 to 1.6)**

TYPES OF DIGITAL DATA

Introduction; Getting into "GoodLife" Database; Getting to Know Structured Data; Getting to Know Unstructured Data; Getting to Know Semi-Structured Data; Difference Between Semi-Structured and Structured Data. **(T1: Ch-2.1 to 2.6)**

INTRODUCTION TO OLTP AND OLAP

OLTP (On-Line Transaction Processing); OLAP (On-Line Analytical Processing); Different OLAP Architectures; OLTP and OLAP; Data Models for OLTP and OLAP; Role of OLAP Tools in the BI Architecture; Should OLAP be Performed Directly on Operational Databases? A Peek into the OLAP Operations on Multidimensional Data; Leveraging ERP Data Using Analytics

(T1: Ch-3.1 to 3.9)

UNIT-II — 15 Hours

GETTING STARTED WITH BUSINESS INTELLIGENCE

Using Analytical Information for Decision Support; Information Sources Before Dawn of BI? Business Intelligence (BI) Defined; Evolution of BI and Role of DSS, EIS, MIS, and Digital Dashboards; Need for BI at Virtually all Levels; BI for Past, Present, and Future; The BI Value Chain; Introduction to Business Analytics. **(T1: Ch-4.1 to 4.8)**

BI DEFINITIONS AND CONCEPTS

BI Component Framework; Who is BI for? BI Users; Business Intelligence Applications; BI Roles and Responsibilities; Best Practices in BI/DW; The Complete BI Professional; Popular BI Tools. **(T1: Ch-5.1 to 5.8)**

BASICS OF DATA INTEGRATION

Need for Data Warehouse; Definition of Data Warehouse; What is a Data Mart? What is Then an ODS? Ralph Kimball's Approach vs. W.H. Inmon's Approach; Goals of a Data Warehouse; What Constitutes a Data Warehouse? Extract, Transform, Load; What is Data Integration? Data Integration Technologies; Data Quality; Data Profiling. **(T1: Ch-6.1 to 6.12)**

MULTIDIMENSIONAL DATA MODELING

Introduction; Data Modeling Basics; Types of Data Model; Data Modeling Techniques; Fact Table; Dimension Table; Typical Dimensional Models; Dimensional Modeling Life Cycle.

(T1: Ch-7.1 to 7.8)

UNIT-III	**10 Hours**

MEASURES, METRICS, KPIS, AND PERFORMANCE MANAGEMENT

Understanding Measures and Performance; Measurement System Terminology; Navigating a Business Enterprise, Role of Metrics, and Metrics Supply Chain; "Fact-based Decision Making" and KPIs; KPI Usage in Companies; Where Do Business Metrics and KPIs Come From? Connecting the Dots: Measures to Business Decisions and Beyond.

(T1: Ch-8.1 to 8.7)

BASICS OF ENTERPRISE REPORTING

Reporting Perspectives Common to All Levels of Enterprise; Report Standardization and Presentation Practices; Enterprise Reporting Characteristics in OLAP World; Balanced Scorecard; Dashboards; How Do You Create Dashboards? Scorecards vs. Dashboards; The Buzz Behind Analysis. **(T1: Ch-9.1 to 9.8)**

BI ROAD AHEAD

Understanding BI and Mobility; BI and Cloud Computing; Business Intelligence for ERP Systems; Social CRM and BI. **(T1: Ch-10.1 to 10.4)**

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

1.	Interpret the business view of information technology applications
2.	Summarize the types of Digital data & its operation.
3.	Outline the Need & Significance of data warehouse in BI applications
4.	Explain the basics of data integration including data quality and data profiling and implement various data integration approaches
5.	Identify Key Performance Indicators, Business Metrics, Future of BI, creation of Enterprise Reports.

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
IS2212-1.1		2							1	1		1		1
IS2212-1.2	2	2			2				1	1		1		3
IS2212-1.3	2	2				2			1	1		1		3
IS2212-1.4	2	2				2			1	1		1		3
IS2211-1.5	2	2			2				1	1		1		2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Prasad RN, Seema Acharya: Fundamentals of Business Analytics, First Edition, Wiley India Pvt. Ltd.
2.	William H. Inmon: Building the Data Warehouse, 4th Edition, Wiley India Ed.
3.	Infosys Reference Book on Business Intelligence.

REFERENCE BOOKS:

1.	David Loshin: Business Intelligence, First Edition, Elsevier Science, 2003.
2.	Mike Biere: Business Intelligence for the Enterprise, First Edition, IBM Press, 2003.
3.	Larissa T. Moss and Shaku Atre: Business Intelligence Roadmap, Addison-Wesley Professional, 2003.

OBJECT ORIENTED MODELING AND DESIGN			
Course Code:	**IS2213-1**	**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	**IS1103-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Explain what is meant by object-oriented modeling. Apply object-oriented modeling techniques to the problem solving. Introduce various models that can be used to describe an object-oriented design.
2.	Show how the UML may be used to represent these models.
3.	Create class diagrams that model both the domain model and design model of a software system.
4.	Create interaction diagrams that model the dynamic aspects of a software system.
5.	Understand and analyse the basics of Design pattern.

UNIT-I — **15 Hours**

Introduction:

What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modeling history.

Modeling as Design Technique: Modeling; abstraction; The three models. Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips.

Advanced Class Modeling: Advanced object and class concepts; Association ends; N-ary associations; ***(Text Book-1: Chapter 1 to 4.3***)

Advanced Class Modeling: Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips.

State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior.

UNIT-II — **15 Hours**

Advanced State Modeling: Advanced State Modeling: Nested state, diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models

Interaction Modeling: Use case models; Sequence models; Activity models; Use case relationships; Procedural sequence models; Special constructs for activity models

(Text Book-1: Chapter 4.4,5,6 ,7)

Process Overview, System Conception: Development stages; Development life cycle, Devising a system concept; Elaborating a concept; Preparing a problem statement.

Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis.

Application Analysis: Application Analysis: Application interaction model; Application class model; Application state model; Adding operations.

(Text Book-1: Chapter 10,11,12, 13)

UNIT-III — **10 Hours**

System Design: Overview; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example.

Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Re-cursing downwards, Re-factoring; Design optimization; Reification of behavior; Adjustment of inheritance;

Organizing a class design; ATM example.
(Text Book-1: Chapter 14 and 15)

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

1.	Explain the importance of object orientation, modeling and design.
2.	Apply object-oriented techniques to design class and state models.
3.	Make use of UML for advanced state Modeling and interaction modeling.
4.	Apply domain analysis, system conception, application analysis to refine the model and design.
5.	Explain advanced concepts of object-oriented modeling 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
CS2213-1.1	1	2								1				1
CS2213-1.2	1	2	2							3				3
CS2213-1.3	1	2	2							3				3
CS2213-1.4	1	2	2							3				1
CS2213-1.5	1	2								1				1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Object-Oriented Modeling and Design with UML – Michael Blaha, James Rumbaugh, 2nd Edition, Pearson Education, 2005.

REFERENCE BOOKS:

1.	1. Rebecca Wirfs, Designing Object-oriented software, Prentice-Hall India, 1990.
2.	Martin. J and Odell J, Object-oriented methods: A foundation, Prentice-Hall, 1995.

E Books / MOOCs/ NPTEL

SOFTWARE TESTING

Course Code:	**IS2214-1**	**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	**IS1103-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Explain the concept of testing and the testing life cycle.
2.	Use the testing frameworks, process and test management to generate the test plans.
3.	Generate the test plans for a business.
4.	Illustrate the use of automation in testing.
5.	Perform defect management and data management.

UNIT-I **14 Hours**

INTRODUCTION TO TESTING – WHY AND WHAT:
Why is testing necessary? What is testing? Role of Tester, Testing and Quality, Overview of STLC
SOFTWARE TESTING LIFE CYCLE – V MODEL:
SDLC vs STLC, different stages in STLC, document templates generated in different phases of STLC, different levels of testing, different types of testing: Functional Testing, API Testing, Usability Testing, Exploratory Testing, Ad-hoc Testing. Static Testing**:** Static techniques, reviews, walkthroughs
BASICS OF TEST DESIGN TECHNIQUES:
Various test categories, test design techniques for different categories of tests. Designing test cases using MS-Excel.

UNIT-II **16 Hours**

TEST MANAGEMENT:
Documenting test plan and test case, effort estimation, configuration management, project progress management. Use of Testopia for test case documentation and test management.
DEFECT MANAGEMENT:
Test Execution, logging defects, defect lifecycle, fixing / closing defects. Use of Bugzilla for logging and tracing defects.
TEST DATA MANAGEMENT:
Test Data Management –Overview, Why Test Data Management, Test Data Types, Need for Test Data Setup, Test Data Setup Stages, Test data management Challenges. Creating sample test data using MS-Excel.

UNIT-III	10 Hours

BASICS OF AUTOMATION TESTING:
Introduction to automation testing, why automation, what to automate, tools available for automation testing.
BASICS OF AUTOMATION TESTING USING SELENIUM:
Introduction to Selenium, using Selenium IDE for automation testing, using Selenium Web driver for automation testing, understanding TestNG framework with Selenium Web driver for automation testing, Introduction to Maven automation tool.

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

1.	Apply the knowledge of engineering to understand the various terms and techniques used in testing domain.
2.	Identify the different phases of software testing life cycle and types of testing.
3.	Analyze test management and test data management processes.
4.	Analyze defect management life cycle and use open source tool for defect management.
5.	Design test case and formulate automation testing with demonstration of open source testing tool.

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
IS2214-1.1	2	3								1		1		1
IS2214-1.2	2	3								1		1		1
IS2214-1.3	2	3								1		1	2	3
IS2214-1.4	2	3								1		1	2	3
IS2214-1.5		2	3							1		1	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Rex Black, “Managing the Testing Process”,2nd edition, John Wiley & Sons, 2001
2.	Dorothy Graham, Erik van Veenendaal, Isabel Evans, Rex Black,” Foundations of software testing”, Cengage Learning EMEA, 2008.
3.	Elfriede Dustin, “Implementing Automated Software Testing: How to Save Time and Lower Costs While Raising Quality”, Addison-Wesley Professional,2009

REFERENCE BOOKS:

1.	Paul C. Jorgensen,” Software Testing, A Craftsman’s Approach”, Third Edition, Auerbach Publications, 2008.
2.	Mauro Pezze, Michal Young,” Software Testing and Analysis –Process”, Principles and Techniques, Wiley India, 2009.

E Books / MOOCs/ NPTEL

1.	https://www.softwaretestinghelp.com/selenium-tutorial-1/
2.	http://softwaretestingfundamentals.com/software-testing-methods/
3.	https://www.tutorialspoint.com/software_testing/software_testing_tutorial.pdf
4.	http://docs.seleniumhq.org/docs/
5.	http://www.seleniumhq.org/download/
6.	http://nptel.ac.in/courses/106105150/
7.	https://freevideolectures.com/course/3625/testing-with-selenium

AGILE TECHNOLOGY

Course Code:	**IS2311-1**	**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	**IS1103-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Explain the principles involved in agile technologies.
2.	Explain XP lifecycle.
3.	Understand concepts of XP practices, collaborating in agile methods.
4.	Understand concepts of releasing, planning and developing in agile methods.
5.	Explain the process of mastering agility.

UNIT-I — **15 Hours**

Why Agile?:

Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:** Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor

Understanding XP

The XP Lifecycle, The XP Team, XP Concepts, **Adopting XP**: Is XP Right for Us?, Go!, Assess Your Agility(T1:1,2,3,4)

UNIT-II — **15 Hours**

Practicing XP

Thinking: Pair Programming, Energized Work, Informative Workspace, RootCause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:** "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning**: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating**.** **Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing(T1:5,6,7,8,9)

UNIT-III — **09 Hours**

Mastering Agility: Values and Principles

Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People:** Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste:** Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput(T1:10,11,12,13)

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

1.	Explain XP Lifecycle.
2.	Illustrate the process of adopting XP.
3.	Interpret XP practices and explain collaborating in agile technologies.
4.	Demonstrate the process of releasing, planning and developing in agile technologies.
5.	Explain the concept of imroving the process, eliminate waste.

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
IS2311-1.1	1	2											1	2
IS2311-1.2	1	3											1	2
IS2311-1.3	1	3											1	2
IS2311-1.4	1	3											1	2
IS2311-1.5	1	3											1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. The Art of Agile Development James shore, Chromatic, O'Reilly 2007.

REFERENCE BOOKS:	
1.	Agile Software Development, Principles, Patterns, and Practices Robert C. Martin Prentice Hall 1st edition, 2002.
2.	Agile and Iterative Development A Manger's Guide Craig Larman Pearson Education First Edition, India, 2004.

FULL STACK DEVELOPMENT

Course Code:	**IS2312-1**	**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	**CS1002-1, IS1103-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Design static and modern web pages using HTML5, Cascading Style Sheets (CSS) and Bootstrap.
2.	Develop client-side validations using JavaScript.
3.	Develop the server-side script using PHP.
4.	Design the server-side database using MySQL
5.	Develop the interactive web application using NodeJS framework and

UNIT-I	**14 Hours**

BASICS OF HTML5, CSS AND JAVASCRIPT: Overview of HTML5, HTML5 elements, Introduction to CSS, Levels of style sheets, The Box Model, The basics of Javascript, General syntactic characteristics, Event Handling.

BOOTSTRAP:
What is Bootstrap? Why use Bootstrap? Where to get Bootstrap? Bootstrap CDN, First Web Page with Bootstrap, Bootstrap Grid system, Contextual Colors and Backgrounds, Bootstrap Tables, Bootstrap Images, Bootstrap Jumbotron and Page Header, Bootstrap Wells, Bootstrap Alerts, Bootstrap Buttons, Bootstrap Badges and Labels, Bootstrap Progress Bars, Bootstrap List Groups, List Group with Badges, Tabs, Tabs With Dropdown Menu, Pills, Bootstrap Navigation Bar, Bootstrap Forms, Bootstrap Form Inputs, Bootstrap Media Objects, Bootstrap Carousel Plugin.

UNIT-II	**13 Hours**

INTRODUCTION TO PHP:
Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, Operations and Expressions, Output, Control statements, Arrays,
Functions, Pattern Matching, Form handling, Files, Cookies, Session tracking, Database access with PHP and MySQL.

UNIT-III	**13 Hours**

NodeJS: Introduction to Node.js- Installing Node.js - Node.js Modules, Node.js File System, Node.js URL Module, Node.js NPM, Node.js Events, Node.js Upload Files, Node.js Email.
NodeJS MySQL - Create Database, Create Table, Insert into, select from, Where, Order by, Delete, Drop Table, Update, Limit, Join.
Introduction to Mongo DB- Node.js MongoDB, Create Database, Create Collection, Insert, Find, Query, Sort, Delete, Drop Collection, Update, Limit, Join.

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

1.	Describe the fundamental features of HTML5, CSS and Bootstrap and Design static web pages.
2.	Design and Implement the client-side validations using JavaScript.
3.	Illustrate the concept of PHP and Develop the server-side script using PHP.
4.	Design the server-side database using MySQL.
5.	Develop the interactive web application using NodeJS framework and MongoDB.

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
IS2312-1.1	1	2	3											3

IS2312-1.2	2	3												3
IS2312-1.3	2	3												3
IS2312-1.4	1	2	3											3
IS2312-1.5	1	2												3

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Robert W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson, 2014.
2.	Jake Spurlock, "Bootstrap-Responsive Web Development", O'Reilly publications, 2013.
3.	Ari Lerner, Ng-book, "The complete book on Angular JS", 2013.
4.	Chris Northwood, The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer Paperback – Import, 20 November 2018.
5.	David Herron, Node.js Web Development: Server-side web development made easy with Node 14 using practical examples, 5th Edition Edition, 2020
REFERENCE BOOKS:	
1.	M. Deitel, P.J. Deitel, A. B. Goldberg," Internet & World Wide Web: How to Program, 4e Paperback – 1 January 2009.
2.	Chris Bates,"Web Programming Building Internet Applications", Third Edition, Wiley India, 2006
E Books / MOOCs/ NPTEL	
1.	https://www.cs.uct.ac.za/mit_notes/web_programming.html
2.	http://www.multitech.ac.ug/uploads/IntroductiontoWebProgramming.pdf
3.	https://www.w3schools.com/php/
4.	https://www.w3schools.com/bootstrap/
5.	https://www.w3schools.com/nodejs/
6.	http://nptel.ac.in/courses/106106156/2
7.	https://www.coursera.org/learn/web-development
8.	https://www.coursera.org/learn/server-side-nodejs

HUMAN COMPUTER INTERACTION

Course Code:	**IS3313-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**39**	**CIE + SEE Marks**	**50+50**
Prerequisite	**IS2002-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	To learn the concepts of HCI.
2.	Study model-based design and evaluation.
3.	To understand guidelines in HCI.
4.	Explore various empirical methods, task models and architecture in HCI.
5.	Study and compare various case studies.

UNIT-I	**15 Hours**

Introduction: Course Learning Objectives and overview, Historical evolution of the field.
Interactive System Design: concept of usability -definition and elaboration, HCI and software engineering, GUI design and aesthetics, prototyping techniques.
Model-Based Design And Evaluation: Introduction to different types of models, GOMS family of models(KLMandCMN-GOMS),Fitt'slaw and Hick-Hyman's law, Model based design case studies.

UNIT-II	**16 Hours**

Guidelines In HCI: Shneiderman's eight golden rules, Norman's seven principles, Norman's model of interaction, Nielsen's ten heuristics with example of its use, Heuristic evaluation, Contextual inquiry, Cognitive walk-through.
Empirical research methods in HCI: Introduction (motivation, issues, research question formulation techniques), Experiment design and data analysis(with explanation of one-way ANOVA).

Task modeling and analysis: Introduction to formalism in dialog design, design using FSM (finite state machines), State charts and(classical) Petri Nets in dialog design.

UNIT-III	08 Hours

Cognitive architecture: Introduction to CA, CA types, relevance of CA in IS design, Model Human Processor (MHP).
Design-Case Studies: Case Study 1- Multi- Key press Hindi Text Input MethodonaMobilePhone, CaseStudy2-GUIdesignforamobilephone based Matrimonial application. Case Study 3 - Employment Information System for unorganised construction workers on a MobilePhone.

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

1.	Learn basics of HCI and different HCI models.
2.	Understand the research methods and the guidelines to be followed in designing HCI.
3.	Learn to design HCI 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
IS3313-1.1	3	2											2	
IS3313-1.2	2	3												2
IS3313-1.3	3	3											3	
IS3313-1.4	2	2											2	
IS3313-1.5	2	3											2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Jennifer Preece, Helen Sharp and Yvonne Rogers, Interaction design: Beyond Human-Computer Interaction, 4th edition Helen Sharp, John Wiley and Sons, 2015, ISBN: 978-1-119-02075-2.
2.	Ben Shneiderman and Catherine Plaisant, Designing the User Interface: Strategies for Effective Human-Computer Interaction, 6th Edition, Pearson, 2017.

REFERENCE BOOKS:

1.	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education, 2004.
2.	Brian Fling, “Mobile Design and Development”, First Edition, O’Reilly Media Inc., 2009.
3.	Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, O’Reilly, 2009.

E Books / MOOCs/ NPTEL

1.	nptel.ac.in/courses/106103115/

SOFTWARE ARCHITECTURE & DESIGN PATTERNS

Course Code:	**IS2314-1**	**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	**IS1103-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Outline the various architectural influences and its qualities on the organizational requirements.
2.	Make use of different case studies to critically evaluate the suitability of a software architecture.
3.	Develop the architecture using different architecture styles.
4.	Choose the different architectural pattern and design patterns to design the architecture that enhances the architectural capabilities.
5.	Document the software architecture to communicate the system evolution strategy to the stakeholder.

UNIT-I	15 Hours

INTRODUCTION:

The Architecture Business Cycle: Where do architectures come from? Software processes and the architecture business cycle; What makes a "good" architecture? What software architecture is and what it is not; Other points of view; Architectural patterns, reference models and reference architectures; Importance of software architecture; Architectural structures and views **(Text Book-1: Chapter 1: 1.1 ,1.2,1.3, Chapter 2: 2.1,2.2,2.3,2.4,2.5)**

QUALITY: Functionality and architecture; Architecture and quality attributes; System quality attributes; Quality attribute scenarios in practice; Other system quality attributes; Business qualities; Architecture qualities. Achieving Quality: Introducing tactics; Availability tactics; Modifiability tactics; Performance tactics; Security tactics; Testability tactics; Usability tactics.

(Text Book-1: Chapter 4: 4.1, 4.2,4.3,4.4,4.5,4.6,4.7, Chapter 5:5.1,5.2,5.3,5.4,5.5,5.6, 5.7).

UNIT-II	15 Hours

ARCHITECTURAL STYLES AND CASE STUDIES: Architectural styles; Pipes and filters; Data abstraction and object-oriented organization; Event-based, implicit invocation; Layered systems; Repositories; Interpreters; Process control; Other familiar architectures; Heterogeneous architectures. Case Study: Mobile robotics.

(Text Book-2: Chapter 2: 2.1, 2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10, Chapter 3:3.3)

ARCHITECTURAL PATTERNS: Introduction, Distributed Systems: Broker; Interactive Systems: MVC, Presentation-Abstraction-Control. Adaptable Systems: Microkernel.

(Text Book-2: Chapter 2: 2.1, 2.3,2.4,2.5)

UNIT-III	10 Hours

DESIGNING AND DOCUMENTING SOFTWARE ARCHITECTURE: Architecture in the life cycle; designing the architecture; Forming the team structure; Creating a skeletal system. Uses of architectural documentation; Views; choosing the relevant views; Documenting a view; Documentation across views.
(Text Book-1: Chapter 7: 7.1, 7.2,7.3,7.4, Chapter 9: 9.1,9.2,9.3,9.4,9.5)

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

1.	Identify the requirements which influence the architecture and development strategy.
2.	Analyze the architecture using different case studies and quality attributes.
3.	Recognize architecture styles to design the architecture.
4.	Apply different architecture patterns and design patterns to develop architecture that yields the system that has new organizational capabilities and requirements.
5.	Describe the different views to document the architecture.

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
IS2314-1.1	2	3											2	3
IS2314-1.2	1	2	3										2	3
IS2314-1.3	1	2												3
IS2314-1.4	1	2	3											3
IS2314-1.5	2	3												3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Len Bass, Paul Clements, Rick Kazman,"Software Architecture in Practice",Second Edition, Pearson Education, 2003.
2.	Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, "Pattern-Oriented Software Architecture", A System of Patterns -Volume 1, John Wiley and Sons, 2006.
3.	Mary Shaw and David Garlan, "Software Architecture-Perspectives on an Emerging Discipline",

	Prentice-Hall of India, 2007.
REFERENCE BOOKS:	
1.	E. Gamma, R. Helm, R. Johnson, J. Vlissides, "Design Patterns- Elements of Reusable Object-Oriented Software ", Addison- Wesley, 1995.
E Books / MOOCs/ NPTEL	
1.	http://www.hillside.net/patterns/
2.	https://www.cs.cmu.edu/afs/cs/project/vit/ftp/pdf/intro_softarch.pdf
3.	https://www.ics.uci.edu/~yuzok/software-architecture.html
4.	http://www.nptel.ac.in/syllabus/106104027/
5.	https://www.coursera.org/learn/software-architecture

Professional Elective Courses (Networks & Security Stream)

ADHOC WIRELESS NETWORKS

Course Code:	**IS4221-1**	**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	**IS3001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Understand the MAC layer functionalities of wireless networks.
2.	Understand the working of major MAC layer protocols for Adhoc wireless networks.
3.	Classify and distinguish Network layer protocols for Adhoc wireless networks.
4.	Identify the issues with TCP/IP Transport layer protocols with wireless networks. Study few solutions provided by Adhoc transport layer protocols.
5.	Identify security and QoS issues and challenges with Adhoc wireless networks.

UNIT-I — **15 Hours**

Review of Wireless Networks: IEEE Wireless Standard, Basic 802.11 MAC layer mechanisms, CSMA/CA mechanisms and other MAC layer functionalities.
Ad hoc Networks: Introduction, Issues in Ad Hoc wireless networks, Ad hoc wireless internet.
MAC Protocols for Ad hoc wireless Networks: Introduction, Issues in designing a MAC Protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks.
Classification of MAC Protocols: Contention based protocols: MACAW, FAMA busy tone protocols, receiver initiated protocol: MARCH. Contention based protocols with reservation mechanisms: DPRMA, HRMA, FPRP. Contention-based MAC protocols with scheduling mechanism: DPS&MA.
Routing protocols for Ad hoc wireless Networks: Introduction, Issues in designing a routing Protocol for Ad hoc wireless Networks, Classification of routing Protocols.

UNIT-II — **15 Hours**

Table drive routing protocol: DSDV, WRP, CGSR. On-demand routing protocol: DSR, AODV, LAR, FORP.
Hybrid routing protocol: CEDAR, ZRP. Hierarchical routing protocols: FSR. Metrics used by power aware routing protocols.
Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer Protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks: TCP-F, TCP with ELFN, TCP-BuS, ATCP, Split TCP. Other transport layer protocols for Ad hoc wireless Networks: ACTP, ATP.

UNIT-III — **09 Hours**

Security in wireless Ad hoc wireless Networks: Network Security requirements, Issues & Challenges in security provisioning, Network security attacks, Key Management, Secure routing in Ad hoc wireless Networks: SAR, SEAD, Security-Aware AODV.
Quality of service in Ad hoc wireless Networks: Introduction, Issues & challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions, MAC layer solutions, network layer solutions.

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

1.	Define the MAC layer functionalities of wireless networks.
2.	Define the working of major MAC layer protocols for ad hoc wireless networks

3.	Classify and distinguish Network layer protocols for ad hoc wireless networks.
4.	Identify the issues with TCP/IP Transport layer protocols with wireless networks and examine few solutions provided by ad hoc transport layer protocols.
5.	Identify security and QoS issues and challenges with ad hoc wireless networks.

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
IS4221-1.1	2	3								1		1		2
IS4221-1.2	2	3								1		1		2
IS4221-1.3	2	3								1		1		2
IS4221-1.4	2	3								1		1		2
IS4221-1.5	2	3								1		1		2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Siva Ram Murthy and B S Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols”, Second Edition, C. Pearson Education, 2005.

REFERENCE BOOKS:

1.	Prasant Mohapatra and Srikanth Krishnamurthy, “Ad Hoc Networks: Technologies and Protocols”, Springer Science, 2005.
2.	Subir Kumar Sarkar, T G Basavaraju and C Puttamadappa, “Ad Hoc Mobile Wireless Networks: Principles, Protocols, and Applications”, Auerbach Publications, 2007.
3.	SudipMisra, Isaac Woungang, Subhas Chandra Misra, “Guide to Wireless Ad Hoc Networks”, Springer-Verlag, 2009.
4.	Mohammad Ilyas, “The Handbook of Ad Hoc Wireless Networks”, Editor, CRC Press, 2003.
5.	C. K. Toh , ”Adhoc Mobile Wireless Networks: Protocols & Systems”, Prentice-Hall PTR, 2002.

E Books / MOOCs/ NPTEL

1.	https://onlinecourses.nptel.ac.in/noc17_cs07/preview

COMPUTING IN COMMUNICATION NETWORKS

Course Code:	**IS4222-1**	**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	**IS3001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Understand the need of computing in future communication networks.
2.	Learn the concepts like Network slicing, Mobile edge cloud and content distribution
3.	Learn enabling technologies like software defined networking and network function virtualization.
4.	Learn the importance of time sensitive networking
5.	Explore various networking tools

UNIT-I	**15 Hours**

On the need of computing in future communication networks

Evolution of communication networks: The telephone networks: circuit-switched, The Internet: packet-switched, The cellular communication networks

The 5G communication system: The 5G Atom core: use cases, First tier: the technical requirements, Second tier: the concepts, Third tier: the softwarization technologies, Fourth tier: innovation and novelties

Softwarization: the game changer for network operators [Chapter 1]

UNIT-II	15 Hours
Network slicing: Introduction, Network slice: concept and life cycle, Network slicing architectures: Single owner, single controller, Single owner, multiple tenants – SDN proxy, Multiple owners, tenants, Network slicing in 5G. Mobile edge cloud: Introduction, Concepts, Three Layer Architecture. Content distribution: Content delivery networks, content distribution, Request routing Software-defined networks: Introduction, SDN Architecture, SDN use cases Network function virtualization: Logic structure of NFV, two-layer SDN-NFV architecture	
UNIT-III	**10 Hours**
Integrating time-sensitive networking: Introduction to TSN, Time synchronization (IEEE 802.1AS), Packet shapers: Credit based shaper (IEEE 802.1Qav), Time aware shaper (IEEE 802.1Qbv) **Networking tools: Connectivity testing – ping, Basic network administration – iproute2** (ip addr, ip link, ip route), Traffic generation – iPerf, Process monitoring – htop, Network traffic manipulation – TC, Traffic monitoring – tcpdump/Wireshark	

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

1.	Understand the need of computing in future communication networks
2.	Learn the concepts like Network slicing, Mobile edge cloud and content distribution
3.	Learn enabling technologies like software defined networking and network function virtualization.
4.	Learn the importance of time sensitive networking
5.	Ability to learn various networking tools

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
IS4222-1.1	3	3	3						2	2	1	1		
IS4222-1.2	3	3	2	2					2	2	1	1		
IS4222-1.3	3	3	3	2	2		1	2	3	3	1	2		
IS4222-1.4	3	3	3	2	2	2	2		3	4	1	1		
IS4222-1.5	2	2	2	2							1	1		

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Computing in communication Networks: From Theory to Practice by Frank Fitzek, Fabrizio Granelli, Patrick Seeling, published in 2020 by academic press ISBN 13: 9780128204887.

REFERENCE BOOKS:

1.	Software-defined networking and security: from theory to practice
2.	CRC Press/Taylor & Francis Group , *Ankur, Huang, Dijiang, Pisharody, Sandeep*

E Books / MOOCs/ NPTEL

NETWORK ENGINEERING

Course Code:	**IS4223-1**	**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	**IS3001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Introduce the detailed aspects of TCP/IP stack optimizations.
2.	Explore different approaches to minimize end to end latency.
3.	Explain the importance of traffic control layer and queue disciplines.
4.	Introduce different types of congestion signaling mechanisms.
5.	Introduce the fundamentals of Data Center Networks and its performance issues.

UNIT-I	14 Hours

TCP/IP stack optimizations:
Optimizations proposed for improving the performance of TCP/IP: Building blocks of TCP and TCP Fast Open, Primer on Latency and Bandwidth: Busting the Myth, History of TCP/IP and Importance of Internet Standardization, Building Blocks of TCP and Slow Start Restart (SSR), TCP Window Scaling, Impact of TCP 3-way handshake and Slow Start on HTTP Traffic, TCP's AIMD Algorithm, Packet Loss Detection Techniques in TCP, TCP Tahoe and TCP Reno, Selective Acknowledgements (SACK) for TCP. [Chapter 5 to 8 from [Grigorik 2013]

UNIT-II	13 Hours

Loss Recovery Techniques in TCP: Rate Halving and PRR (Proportional Rate Reduction)
Introduction to Queue Management Algorithms: Random Early Detection (RED), Gentle RED, Nonlinear RED and Self Configuring RED, Adaptive RED
Congestion Signaling Mechanisms: Explicit Congestion Notification (ECN), ECN+, ECN+/Wait, ECN+/TryOnce and ABE. [Chapter 5 to 8 from [Grigorik 2013]]

UNIT-III	13 Hours

Active Queue Management: Controlled Delay (CoDel) Queue Discipline, Proportional Integral (PI) Controller and PI Controller Enhanced (PIE) queue disciplines.
Introduction to Data Center Networks, Data Center TCP (DCTCP): Differences between the Internet architecture and DCN architecture, Performance problems in DCNs and existing solutions such as Data Center TCP (DCTCP).

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

1.	Understand different approaches for TCP/IP optimizations.
2.	Ability to appreciate the importance of reducing latency for real time applications.
3.	Understand the working of Linux queue disciplines, and use them to reduce latency.
4.	Learn the different types of congestion signaling mechanisms.
5.	Ability to design and optimize networking protocols for Data Center Networks.

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
IS4223-1.1	3	3	3						2	2	1	1		
IS4223-1.2	3	3	2	2					2	2	1	1		
IS4223-1.3	3	3	3	2	2		1	2	3	3	1	2		
IS4223-1.4	3	3	3	2	2	2	2		3	4	1	1		
IS4223-1.5	3	3	2	2							1	1		

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	[Grigorik 2013] Grigorik, Ilya. High Performance Browser Networking: What every web developer should know about networking and web performance. " O'Reilly Media, Inc.", 2013.

REFERENCE BOOKS:

1.	[Kurose and Ross 2012] Kurose, James F. Computer networking: A top-down approach featuring the internet, 6/E. Pearson Education India, 2005.
2.	[Khan and Zomaya 2015] Khan, S. U., & Zomaya, A. Y. (Eds.). (2015). Handbook on Data Centers. Springer, 2015.
3.	[Peterson and Davis 2007] Peterson, L. L., & Davie, B. S. Computer networks: A Systems Approach. Elsevier, 2007.
4.	[Online Resources] Interactive animations, Video notes from Kurose and Ross 2012, Wireshark assignments, Presentation slides, interactive exercises from the following link: http://wps.pearsoned.com/ecs_kurose_compnetw_6/216/55463/14198700.cw/

E Books / MOOCs/ NPTEL

SOFTWARE DEFINED NETWORKS

Course Code:	**IS4224-1**	**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	**IS3001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Differentiate between traditional networks and software defined networks.
2.	Understand advanced and emerging networking technologies and Obtain skills to do advanced networking research and programming.
3.	Learn how to use software programs to perform varying and complex networking tasks.

UNIT-I — **15 Hours**

Introducing SDN: SDN Origins and Evolution – Introduction – Why SDN? Centralized and Distributed Control and Data Planes - The Genesis of SDN.
SDN Abstractions: How SDN Works - The Openflow Protocol - SDN Controllers: Introduction.

UNIT-II — **15 Hours**

SDN Abstractions Contd…
General Concepts - VMware - Nicira – VMware/Nicira – OpenFlow – Related - Mininet – NOX/POX - Trema - Ryu - Big Switch Networks/Floodlight - Layer 3 Centric - Plexxi - Cisco OnePK.
Programming SDN'S: Network Programmability - Network Function Virtualization - NetApp Development, Network Slicing.
SDN Applications and Use Cases

UNIT-III — **10 Hours**

SDN in the Data Center: SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System.
SDN's Future and Perspectives: SDN Open Source - SDN Futures - Final Thoughts and Conclusions.

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

1.	At the end of the course the student will be able to identify the role of Software Defined Networks and explain how SDN works.
2.	Understand the network abstraction and study the implementation & development of network programmability.
3.	Apply the SDN concept to the global environment and study the future of SDN.

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
IS4224-1.1	1	2												1
IS4224-1.2	2	2	3											2
IS4224-1.3	2	2	3											2
IS4224-1.4	1	3												
IS4224-1.5	1	2												

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Paul Goransson, Chuck Black: Software Defined Networks A Comprehensive Approach, Elsevier, 2014.

REFERENCE BOOKS:

1.	Thomas D. Nadeau & Ken Gray: SDN Software Defined Networks O'Reilly publishers, First edition,2013.

E Books / MOOCs/ NPTEL

1.	https://www.tutorialspoint.com/sdn/index.htm

2.	https://www.opennetworking.org
3.	http://www.nec-labs.com/~lume/sdn-reading-list.html

BLOCKCHAIN TECHNOLOGY

Course Code:	**IS3321-1**	**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	**CS1001-1, CS2002-1**		

Teaching Department: Information science & Engineering

Course Objectives:

1.	To provide conceptual knowledge of Block chain technology used to innovate and improve business processes
2.	To provide theoretical and practical solution of Block chain technology
3.	Identify the current and future trends in Block chain technology

UNIT-I — 15 Hours

INTRODUCTION

Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public v/s Private Block chain, Understanding crypto currency to Block chain, Permissioned model of Block chain, overview of security aspects of Block chain. (R1, R2, R3, R4)

BITCOIN AND BLOCK CHAIN

Creation of coins, Payments and double spending, Bitcoin scripts, Bitcoin P2P network, transaction in bitcoin network, Block mining, Block propagation and Block relay. (R5,R6,R7,R8)

WORKING WITH CONSENSUS IN BITCOIN

Distributed consensus in open environment, Consensus in Bitcoin network, Proof of Work (PoW)- basic introduction hash cash PoW, Bitcoin PoW, attacks on PoW, monopoly problem, proof of stake, proof of burn, and proof of elapsed time, the life of bitcoin miner, mining difficulty, mining pool. (R9,R10,R11,R12)

UNIT-II — 15 Hours

PERMISSIONED BLOCKCHAIN

Permission model and use cases, design issues for permissioned Block chains, execute contracts, state machine replication, overview of consensus models for permissioned Block chain – distributed consensus in closed environment, Paxos, RAFT consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak Pease, BFT algorithm, BFT over asynchronous system. (R13, R14, R15, R16, R17)

ENTERPRISE APPLICATION OF BLOCK CHAIN

Cross border payment, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled trade, We trade-Trade finance network, supply chain financing, identity on Block chain.(R18, R19,R20,R21)

UNIT-III — 10 Hours

BLOCK CHAIN APPLICATION DEVELOPMENT

Hyperledger fabric – architecture, fabric details and Channels, Fabric – Membership and Identity Management, Identities and Policies, Membership and Access Control, Writing smart contract using Ethereum.(R24,R25,R26,R27,R28)

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

1.	Explain the Blockchain Technology and its application in Crypto currency
2.	Make use of the bitcoin protocols for mining and select the optimal solution
3.	Identify the types of Blockchain protocols for permissioned and permission less environment
4.	Apply the blockchain protocols for enterprise applications
5.	Analyze the Blockchain based solutions and write smart contracts using solidity in Hyperledger Fabric and Ethereum Framework

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
IS3321-1.1	3	3								1		1		1
IS3321-1.2	2	3	3							1		1		2

IS3321-1.3	2	3	3							1		1		2
IS3321-1.4	2	2	3							1		1		2
IS3321-1.5	2	2	3							1		1		2

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Melanie Swan “Block Chain: Blue Print for a New Economy”, O’Reilly, 2015.
2.	Josh Thompsons, “The Block Chain for a Beginners – Guide To Block chain technology and Leveraging Block Chain Programming”.
3.	Daniel Dreschers “, Block Chain Basics”, A press; 1st edition 2017.
4.	Anhul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, New Delhi
	Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology and Decentralization, Smart Contracts Explained” Packt Publishing.

E Books / MOOCs/ NPTEL

1.	R1: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=5&lesson=9
2.	R2: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=5&lesson=10
3.	R3: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=5&lesson=11
4.	R4: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=5&lesson=13
5.	R5: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=6&lesson=14

INTRUSION DETECTION SYSTEM

Course Code:	**IS4321-1**	**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	**CS1002-1, IS3001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	To become familiar with the basics of Intrusion Detection system.
2.	To learn concepts of network Intrusion Detection systems.
3.	To gain the knowledge of Snort rules and Procedures.
4.	To acquire knowledge of securing databases.

UNIT-I — **15 Hours**

[1st Main Textbook]

Chapter 2: History of Intrusion detection, Audit, Concept and **2.1**- definition, Internal and external threats to data, attacks, **2.3** - need and types of IDS, **2.3.7** - Information sources, **2.3.7.2** - Host based information sources, **2.3.7.1**- Network based information sources.
Intrusion Prevention Systems, Network IDs protocol-based IDs, Hybrid IDs, Analysis schemes, thinking about intrusion, A model for intrusion analysis, techniques.

UNIT-II — **15 Hours**

[1st Reference book]

Chapter 1: Introduction to Snort, **Chapter 2: 2.1** - Snort Installation Scenarios, **2.2**- Installing Snort, **2.3** - Running Snort on Multiple Network Interfaces, **2.4** - Snort Command Line Options, **2.5**- Step-By-Step Procedure to Compile and Install Snort, **2.6** - Location of Snort Files, **2.7** - Snort Modes, **2.8** - Snort Alert Modes.
Chapter 3: Working with Snort Rules, **3.5** - Rule Headers, **3.6** - Rule Options, **3.7** - The Snort Configuration File etc. **Chapter 4:** Plugins, Preprocessors and Output Modules. **Chapter 5:** Using Snort with MySQL **Chapter 6:** Using ACID and SnortSnarf with Snort.

UNIT-III — **10 Hours**

[2nd Reference book]

Chapter 8 : Securing database-to-database communications : **8.1** - Monitor and limit outbound communications , **8.2** - Secure database links and watch for link-based elevated privileges, **8.3** - Protect link usernames and passwords, **8.4** - Monitor usage of database links, **8.5** - Secure replication mechanisms, **8.6** - Map and secure all data sources and sinks, **Chapter 9:** Trojans : **9.1** - The four types of database Trojans, **9.2** - Baseline calls to stored procedures and take action on Divergence, **9.3** - Control creation of and changes to procedures and triggers, **9.4** - Watch for changes to run-as privileges, **9.5** - Closely monitor developer activity on production environments, **9.6** - Monitor creation of traces and event monitors, **9.7** - Monitor and audit job creation and scheduling, **9.8** - Be wary of SQL attachments in e-mails.

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

1.	Comprehend the basics of Intrusion Detection System and classify different types of intrusion detection systems
2.	Comprehend the basics of Intrusion Detection System.
3.	Explain the concept on Snort rules.
4.	Develop the Snort tools for attacking scenarios.
5.	Illustrate the knowledge on different types of database 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
IS4321-1.1	2	3												
IS3321-1.2	2	3												
IS4321-1.3	2	2											1	
IS4321-1.4	2	2	3										2	
IS4321-1.5	3	3											1	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Rebecca Gurley Base "Intrusion Detection" MacMillan Technology Series (MTP Series) ISBN 1578701856, 9781578701858.

REFERENCE BOOKS:

1. Rafeeq Rehman "Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID", Prentice Hall PTR, 2003 ISBN 0-13-140733-3.
2. RonBen Natan, Implementing Database Security and Auditing, Elsevier, Indian reprint, ISBN: 9781555583347.

E Books / MOOCs/ NPTEL

1. https://wanguolin.github.io/assets/cryptography_and_network_security.pdf
2. https://www.wileyindia.com/cryptography-and security.html
3. http://nptel.ac.in/courses/106105031/
4. https://www.mooc-list.com/tags/cybersecurity

WIRELESS NETWORKS AND MOBILE COMPUTING

Course Code:	**IS4322-1**	**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	**CS1002-1, IS3001-1**		

Teaching Department: Information Science and Engineering

Course Objectives:

1.	Outline the concept of mobility with wireless networks.
2.	Explore the mechanisms adopted in mobile channel allocation.
3.	Examine the context, architecture and design elements of application in mobile environment.
4.	Understand the parameters that impact user experience in the mobile interfaces.
5.	Identify the scenarios when a handover takes place.

UNIT-I — **15 Hours**

Introduction to mobile computing: Mobile Technologies, Anatomy of a Mobile Device, Survey of Mobile Devices Applications of Mobile Computing **Types of Mobility**: Mobility in cellular based wireless network: channel allocation, interferences, handoffs and location management. IP mobility: Mobile IP and IDMP.

UNIT-II — **15 Hours**

Impacts of mobility and portability in computational model and algorithms for mobile environment: Disconnected operation. Analysis of algorithms and termination detection.

Data delivery models: push and pull. Data dissemination in wireless channels.

Broadcast disks. Effects of caching.

Application Design: Context, Information Architecture, Design Elements, Mobile Web vs Native Applications.
The User Experience: The Small Screen Problem, The Unified Look and Feel Paradigm, The iPhone Human Interface Guidelines, The Blackberry User Interface Guidelines, Common User Interface Guidelines.

UNIT-III	**10 Hours**

Mobile Databases and Handover Management: Indexing in Air, Mobile Databases and transaction. Handover management, location management, registration, tunneling and encapsulation, route optimization, dynamic host configuration.

Logical mobility: Migrating processes, mobile agents.
Upcoming Technologies: Convergence of Media and Communication Devices, Security Issues. Next era: Cloud Computing.

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

1.	Learn the computing concepts of mobile networking.
2.	Identify basic protocols of mobile networks.
3.	Explain the computing concepts of mobile networks.
4.	Know to perform performance comparison of mobile networks.

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
IS4322-1.1	2	3												
IS4322-1.2	2	3												
IS4322-1.3	2	2											1	
IS4322-1.4	2	2	3										2	
IS4322-1.5	3	3											1	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Kumkum Garg, Mobile Computing, First Edition, Pearson Education, 2010.
2.	Rajkamal, Mobile Computing, Second Edition, Oxford University Press, 2012.

REFERENCE BOOKS:

1.	T. Mikkonen, Programming Mobile Devices: An Introduction for Practitioners, Wiley, 2007.
2.	S. Hashimi, S. Komatineni, D. MacLean, Pro Android 2, Apress (2010).
3.	D. Mark and J. LaMarche, Beginning iPhone 3 Development: Exploring the iPhone SDK, Apress (2009).
4.	A. Rizk, Beginning BlackBerry Development, Apress, (2009).

E Books / MOOCs/ NPTEL

1.	-----------------

WIRELESS SENSOR NETWORKS

Course Code:	**IS4323-1**	**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	IS3001-1

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Identify basic architecture of wireless sensor network.
2.	Analyze the issues related to communication in wireless sensor network.
3.	Identify the current and future trends in wireless sensor networks.

UNIT-I	13 Hours

Introduction, Overview and Applications of Wireless Sensor Networks Introduction, Basic overview of the Technology, Applications of Wireless Sensor Networks: Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology.

Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends

UNIT-II	13 Hours

MAC Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study.

Routing Protocols for Wireless Sensor Networks: Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs.

UNIT-III	13 Hours

Transport Control and Middleware for Wireless Sensor Networks: Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols. Middleware for Wireless

Sensor Networks: Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware.

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

1.	Comprehend the architecture and applications of Wireless Networks.
2.	Analyze the MAC and Routing Protocols in Wireless Sensor Networks.
3.	Identify the Transport Control and Middleware issues for Wireless Sensor Networks.

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
IS4323-1.1	2													
IS4323-1.2	3	3												2
IS4323-1.3	2	1												1
IS4323-1.4	2													
IS4323-1.5	3	3												2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, “Wireless Sensor Networks: Technology, Protocols and Applications, WILEY, Second Edition (Indian) , 2014

2. Feng Zhao, Leonidas Guibas, “Wireless Sensor Network”, Elsevier, 1st Ed. 2004 (ISBN: 13- 978-1-55860-914-3)

REFERENCE BOOKS:

1. Holger Kerl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Network”, John Wiley and Sons, 2005 (ISBN: 978-0-470-09511-9)

2. Raghavendra, Cauligi S, Sivalingam, Krishna M., Zanti Taieb, “Wireless Sensor Network”, Springer 1st Ed. 2004 (ISBN: 978-4020-7883-5).

3. B. Krishnamachari, “Networking Wireless Sensors”, Cambridge University Press.

4. N. P. Mahalik, “Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications” Springer Verlag.

5. Ian F. Akyildiz, Mehmet Can Vuran "Wireless Sensor Networks", Wiley 2010

6.	Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

Professional Elective Courses (Data Science & Machine Intelligence Stream)

ARTIFICIAL INTELLIGENCE

Course Code:	**IS2231-1**	**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	**MA1002-1, MA1007-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Understand the history of artificial intelligence (AI) and its foundation.
2.	Learn principles of AI in problem solving, Inference, perception, knowledge representation.
3.	Explain various applications of AI techniques in intelligent agents, artificial neural networks and other machine learning models.
4.	Developing simple applications in an AI language, expert system shell or data mining tool.
5.	Find current scope and limitations, and societal implications of AI.

UNIT-I — **15 Hours**

Introduction: what is AI, Acting Humanly: The Turing Test approach, Thinking Humanly: The cognitive modelling approach, Thinking rationally: The laws of thought approach, Acting Rationally: The rational agent approach. The state of art.
Intelligent Agents: Agents and Environments, Good behaviour: The concept of rationality, The nature of environments, properties of task environments, Structure of Agents: Agent Programs, Types of agent programs. **Solving Problems by Searching:** Problem solving Agents, well defined problems and solutions, formulating problems, Example problems: Toy problems: Vacuum world, 8-Queen’s problem, Real world problem: Airline Route finding problem.
Searching for solutions: Infrastructure for search algorithms, measuring problem solving performance, Uninformed search strategies: Breadth first search, Cost search, Depth first search, Informed search strategies: Greedy best search, A* algorithms, Heuristic functions.

UNIT-II — **15 Hours**

Quantifying Uncertainty: Acting under uncertainty, summarizing uncertainty, Uncertainty and rational decisions, Basic probability notation, what probabilities are about. The language of propositions in probability assertions, Inference using full joint distribution, Bayes’ rule and its use, Applying Bayes’ rule for simple use case.
Probability Reasoning Over time: Time and Uncertainty, States and observations, Transition and Sensor models, Inference in temporal models, Smoothing, Hidden Markov model, Simplified matrix algorithms, Hidden Markov model: Localization, Kalman Filter basics.
Reinforcement Learning: Introduction, Passive reinforcement learning, Generalization in reinforcement learning, Applications of reinforcement learning.

UNIT-III — **10 Hours**

Q-Learning Intuition: Plan of attack, Bellman Equation, The Plan, Markov Decision Process, Policy vs Plan, Adding Living penalty, Temporal Difference
Artificial Neural Networks: Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptron: Representational power of perceptron, The perceptron training rule, gradient

descent and delta rule

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), agent and its foundation.
2.	Interpret the basic principles of AI in solutions that require problem solving using searching.
3.	Understand the various applications of AI techniques in quantifying uncertainty and probability reasoning.
4.	Developing simple applications in an AI language, using reinforcement learning.
5.	Describe the concepts of q-learning intuition and Artificial neural networks.

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
IS2231-1.1	2													
IS2231-1.2	2	3											1	1
IS2231-1.3	3	3											1	1
IS2231-1.4	3	3											2	2
IS2231-1.5	3	3		3									2	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Stuart Russel and Peter Norvig, "Artificial Intelligence A Modern Approach", Pearson 3rd Edition, 2016.
2.	Introduction to Data Mining-Pang-NingTan, Michael Steinbach,Vipin Kumar, Pearson Education, 2007.

REFERENCE BOOKS:

1.	DAN W PATTERSON," Introduction to Artificial Intelligence and Expert Systems", PEARSON, 1st edition 2015.
2.	Tom. M. Mitchel, "Machine Learning", McGraw Higher Ed, 1st edition 2013.
3.	Elaine Rich, "Artificial Intelligence", Mc Graw Hill 3rd Edition, 2017.
4.	Er. Rajiv Chopra, "Artificial Intelligence – A practical approach", Chand publication, 1st edition 2012. https://www.javatpoint.com/reinforcement-learning
5.	Data Mining–Concepts and Techniques-Jiawei Han and Micheline Kamber, 2ndEdition, Morgan Kaufmann, 2006.
6.	Insight into Data Mining–Theory and Practice- K.P.Soman, Shyam Diwakar, V.Ajay, PHI, 2006.

E Books / MOOCs/ NPTEL

BIO INFORMATICS

Course Code:	**IS2232-1**	**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	**BT1001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Understand the basic concepts of Bioinformatics and its significance in Biological data analysis.
2.	Explain about the methods to characterise and manage the different types of Biological data.
3.	Understand the basics of sequence alignment and analysis.
4.	Overview about biological macromolecular structures and structure prediction methods.

UNIT-I — **15 Hours**

Bioinformatics and Computational Biology, Nature & Scope of Bioinformatics. The central dogma of molecular biology and bio-sequences associated with it, RNA classification –coding and non-coding RNA- mRNA, tRNA, miRNA and sRNA, RNAi. DNA and RNA structure – Nucleic Acid structure and function,

Genetic Code, Genes and Evolution
Importance of databases- Biological databases-primary sequence databases, Composite sequence databases- Secondary databases- nucleic acid sequence databases - Protein sequence data bases - structure databases, Types of databases, Data retrieval tools - Entrez

UNIT-II	**15 Hours**

Sequence alignment – local/global, pairwise sequence alignment, scoring methods. Needleman and Wunsch algorithm, global and local alignments. Multiple sequence alignment. Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series, principles based on which these matrices are derived. Differences between distance & similarity matrix.
Introduction, Advantages, Phylogenetic Trees, Tree topologies, Methods for phylogenetic analysis- Distance Matrix methods, Character based methods. HMM (Hidden Markov Model): Introduction to HMM, Forward algorithm, Viterbi algorithm, applications in Bioinformatics.

UNIT-III	**10 Hours**

General introduction to Gene expression in prokaryotes and eukaryotes

Protein and RNA structure Prediction: Predicting RNA secondary structure - Nussinov Algorithm, Energy minimization methods - Zuker Algorithm. Amino Acids, Polypeptide Composition, Protein Structures, Algorithm for protein folding, Structure prediction.

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

1.	Understand the concepts of bioinformatics.
2.	Identify different types of biological sequence.
3.	Analyze multiple sequences and find conserved regions.
4.	Understand RNA and Protein folding.

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
IS2232-1.1	2	2							2	1		1	2	1
IS2232-1.2	2	2							2	1		1	2	1
IS2232-1.3	2	2							2	1		1	3	2
IS2232-1.4	2	2							2	1		1	2	1
IS2232-1.5	2	2							2	1		1	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	S C Rastogi, N Mendiratta and P Rastogi, " Bioinformatics: Methods and Applications", New Delhi, 2015.
2.	D E Krane and M L Raymer, Fundamental Concepts of Bioinformatics, 2006.

REFERENCE BOOKS:

1.	Andreas D.Baxevanis, B F Francis Ouellette, "Bioinformatics - A Practical Guide to the Analysis of Genes and Proteins", Third Edition.
2.	Neil C Jones and Pavel A Pevzner, An Introduction to Bioinformatics Algorithms, MIT press, 2004.

E Books / MOOCs/ NPTEL

FUNDAMENTALS OF IMAGE PROCESSING

Course Code:	**IS3233-1**	**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	**MA2005-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Outline the theory behind the basics of digital image processing, the relation between the components of image processing system.

2.	Make use of Electromagnetic Spectrum, find the equivalence between pixels.
3.	Make use of Homomorphic Filtering and how to simplify Detection of Discontinuities.
4.	Get the idea of Models Elements of Information, find the equivalence between Dilation and Erosion, Opening and Closing, and identify the Hit-or-Miss Transformation.
5.	Tell how Components of an Image Processing System works, their design, and get the feeling of Histogram Processing.

UNIT-I	**15 Hours**

INTRODUCTION

What Is Digital Image Processing? Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. (1.1 - 1.4)

Digital Image Fundamentals - Elements of Visual Perception, Brightness Adaptation and Discrimination (2.1), Light and the Electromagnetic Spectrum (2.2), Image Sensing and Acquisition, Image Sampling and Quantization (2.3-2.4)), Some Basic Relationships between Pixels. (2.5))

Image Enhancement in the Spatial Domain - Background, Some Basic Gray Level Transformations, Histogram Processing. (3.1-3.3)

Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. (3.4-3.7)

Image Enhancement in the Frequency Domain- Background, Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters. (4.1-4.3

UNIT-II	**15 Hours**

Sharpening Frequency Domain Filters, Homomorphic Filtering. (4.4-4.5)

Image Segmentation- Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds, the Use of Motion in Segmentation. (10.1-10.6)

IMAGE COMPRESSION

Fundamentals Image Compression, Models Elements of Information, Theory Error-Free Compression, Lossy Compression (8.1-8.5), Image Compression Standards. (8.6 only JPEG)

UNIT-III	**09Hours**

MORPHOLOGICAL IMAGE PROCESSING

Preliminaries, Dilation and Erosion, Opening and Closing, the Hit-or-Miss Transformation Some Basic, Morphological Algorithms. (9.1-9.5)

COLOR IMAGE PROCESSING

Color Fundamentals, Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression. (6.1-6.9) Introduction to wavelet-based processing. (7.1)

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

1.	Apply Image Sampling and Quantization techniques
2.	illustrate an equivalence between Light and the Electromagnetic Spectrum, and prove Some Basic Relationships between Pixels.
3.	Design and apply Smoothing Spatial Filters, Sharpening Spatial Filters
4.	Explain Image Compression Standard
5.	Summarize the concept of Morphological and color Image Processing.

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
IS3233-1.1	2	2							2	1		1	2	1
IS3233-1.2	2	2							2	1		1	2	1
IS3233-1.3	2	2							2	1		1	3	2
IS3233-1.4	2	2							2	1		1	2	1
IS3233-1.5	2	2							2	1		1	2	1

1: Low 2: Medium 3: High

TEXTBOOK:

1.	1. Rafel C Gonzalez and Richard E Woods, “Digital Image Processing”, Pearson Education, 2nd Edition, 2003.
REFERENCE BOOKS:	
1.	1. Anil K Jain, “Fundamentals of Digital Image Processing”, Prentice-Hall of India Pvt. Ltd., 1997.
2.	2. Milan Sonka, Vaclav Hlavac and Roger Boyle, “Image Processing, Analysis and Machine Vision”, Thomson Learning, Brooks/Cole, 2nd Ed. 2001.
3.	3. B. Chanda, D Dutta Majumder, “Digital Image Processing and Analysis”, Prentice-Hall, India, 2002.
4.	4. The Scientist and Engineers Guide to Digital Signal Processing – by Steven W. Mith, 2nd Edition, 1999, California Technical Publishing.
E Books / MOOCs/ NPTEL	
1.	1. https://www.coursera.org/learn/digital
2.	2. http://nptel.ac.in/courses/106105032/
3.	3. http://nptel.ac.in/courses/106105032/

INTRODUCTION TO DRONES

Course Code:	**IS1231-1**	**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: Information science and Engineering

Course Objectives:

1.	Understand the structure of unmanned aerial vehicles.
2.	Understand different drone parts and their contribution for successful flight operation.
3.	Understand different types of drone circuits /electronic parts.
4.	Learn the criterion for the selection of various drone materials.
5.	Understand the Concept of Surveying.

UNIT-I	**15 Hours**
Overview and background. Definitions. history of UAVsc. Classifications of UAVsi. Scale lift generation method contemporary applications, military. government. civil societal impact and future outlook. operational considerations. liability / legal issues. insurance. ethical implications. human factors	
UNIT-II	
Introduction to Drone Technology, Drone design and fabrication, Drone programming, Drone flying and operation, Drone accessories, Drone maintenance, Safety and Regulations, Drone commercial applications	**15 Hours**
UNIT-III	
Case studies in the drone industry to show the potential for boosting entrepreneurial spirit, Drone technology and entrepreneurship, Drone Technology as a tool for social inclusion, Future of drones	**10 Hours**

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

1.	Understand drone concepts and terminology.
2.	Describe the steps for drone design.
3.	Understand the technical characteristics
4.	Describe the process for drone fabrication
5.	Describe the algorithm for drone programming

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

IS3208-1.1	2	2							2	1		1	2	1
IS3208-1.2	2	2							2	1		1	2	1
IS3208-1.3	2	2							2	1		1	3	2
IS3208-1.4	2	2							2	1		1	2	1
IS3208-1.5	2	2							2	1		1	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Theory, Design, and Applications of Unmanned Aerial Vehicles- by A. R. Jha., 2016

REFERENCE BOOKS:

1. Handbook of Unmanned Aerial Vehicles- Editors: Valavanis, K., Vachtsevanos, George J. (Eds.), 2014

E Books / MOOCs/ NPTEL

DATA MINING

Course Code:	**IS3331-1**	**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	**IS2102-1, MA2001-1**		

Teaching Department: Information Science &Engineering

Course Objectives:

1.	Define multi-dimensional data models.
2.	Identify data mining problems and implement the data warehouse.
3.	Explain rules related to association, classification and clustering analysis.
4.	Compare and contrast between different classification and clustering algorithms

UNIT-I	**16 Hours**
INTRODUCTION TO DATA MINING – Why Data Mining? What is Data Mining? What kind of data can be mined? What kinds of patterns can be mined? Issues in data mining. **GETTING TO KNOW YOUR DATA**: Data Objects and Attribute Types, Basic Statistical Descriptions of Data (2.2.1,2.2.2), Measuring Data Similarity and Dissimilarity. **DATA PREPROCESSING**: Data Pre-processing: An Overview, Data Cleaning, Data integration, Data Reduction (3.4.1,3.4.6,3.4.7,3.4.8), Data transformation and Discretization (3.5.1,3.5.2,3.5.3). **MINING FREQUENT PATTERNS: Associations and Correlations** - Basic Concepts, Frequent Item-set Mining Methods (6.2.1, 6.2.2, 6.2.4) – Apriori Algorithm, Generating Association rules from frequent item-sets. A Pattern growth approach for mining frequent item-sets, Which Patterns are interesting? (6.3.1, 6.3.2)	

UNIT-II	**14Hours**
CLASSIFICATION: BASIC CONCEPTS: Basic Concepts, Decision tree induction (8.2.1,8.2.2), Bayes Classification methods (8.3.1,8.3.2) Rule based classification (8.4.1,8.4.2,8.4.3- Rule Induction Using a Sequential Covering Algorithm), Model evaluation and selection (8.5.1).	

UNIT-III	
CLUSTER ANALYSIS: **Basic concepts and methods-** Cluster Analysis (10.1.1, 10.1.2,10.1.3), Partitioning methods (10.2.1,10.2.2), Hierarchical methods (10.3.1,10.3.2), Evaluation of clustering.	**09 Hours**

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

1.	Explain the functionalities, interesting patterns and kind of data for data mining & the need of pre-processing of data.
2.	To identify frequent patterns and develop the association's rules.
3.	Apply classification algorithms like Decision tree and Bayesian classification to classify the data.

4.	Experiment with rule-based classification method to classify the data.
5.	Apply partitional clustering and Hierarchical clustering methods to cluster the data and outline the evaluation of clustering methods.

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
IS3331-1.1	2	2								1		1		
IS3331-1.2	2	2		2						1		1		2
IS3331-1.3	2	2		2						1		1		2
IS3331-1.4	2	2		3						1		1		2
IS3331-1.5	3	3		2						1		1		3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Jiawei Han and Micheline Kamber, "Data Mining – Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers.

REFERENCE BOOKS:

1.	1. M. H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education. 2001.
2.	2. D. Hand, H. Mannila and P. Smyth, "Principles of Data Mining", Prentice-Hall. 2001.
3.	3. I. H. Witten and E. Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann. 2000.

E Books / MOOCs/ NPTEL

DEEP LEARNING

Course Code:	**IS3332-1**	**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	**IS2002-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Summarize the principles and building blocks of Deep Neural networks.
2.	Understand the structure and working of Autoencoders and Restricted Boltzmann Machines.
3.	Understand the structure and working of Convolutional Neural Networks and Recurrent Neural Networks.
4.	Learn the basics of Deep Reinforcement Learning and Generative Adversarial Networks.
5.	Summarize the need and techniques for regularization and optimization in deep learning.

UNIT-I

Foundations of Neural Network and Deep Learning
Neural Networks, Training Neural Networks, Activation Functions, Loss Functions, Hyperparameters.
(Textbook 3: Chapter 2)
Deep Learning Introduction: Historical trends in Deep Learning, Challenges motivating deep learning. **(Textbook 2: 1,5.11)**
Common Neural Architectures: Shallow models, RBF networks, RBM, CNN, Hierarchical Feature Engineering and Pretrained Models.
(Textbook 1: 1.6)
Autoencoders
Basic Principles, Nonlinear activations, Deep autoencoders, Application outlier detection, Sparse feature learning.
(Textbook 1: 2.5.1 to 2.5.5)

15 Hours

Restricted Boltzmann Machines Introduction, Hopfield Networks, Boltzmann Machine, RBM, Stacking RBM. **(Textbook 1: 6.1 to 6.4, 6.7)**	
UNIT-II	
Convolutional Neural Networks Introduction, basic structure, Training CNN, Case study: Alexnet, VGG, GoogleNet, ResNet, Applications. **Recurrent Neural Networks** Introduction, Architecture, Challenges, Echo-State Networks, LSTM, GRU, Applications. **Deep Reinforcement Learning** Introduction, Stateless Algorithms, Basic framework of Reinforcement learning. **General Adversarial Networks** Training GAN, comparison with variation autoencoder, using GAN to generate image data, CGAN. **Limitations of Neural Networks** An aspirational goal: One Shot Learning, Energy Efficient Learning. **(Textbook 1:7.1 to 7.7, 8.1 to 8.4, 8.6,9.1 to 9.3,10.4,10.6)**	**16 Hours**
UNIT-III	
Regularization and Optimization for Deep Learning Models Regularization: Parameter Norm Penalties, Dataset Augmentation, Multi-task Learning, Early Stopping, Parameter typing and parameter sharing, sparse representation, ensemble methods**,** Dropout**. (Textbook2: 7.1,7.4,7.7,7.8,7.9,7.10,7.11,7.12)** Optimization: How learning differs from pure optimization, challenges in neural network optimization, Basic algorithms. (**Textbook2: 8.1,8.2,8.3)**	**09 Hours**

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

1.	Summarize the basics of Neural Networks and Deep Learning Models.
2.	Outline the principles, applications of Autoencoders and Restricted Boltzmann Machines.
3.	Identify the use and application of Convolutional Neural Networks and Recurrent Neural Networks.
4.	Summarize the concepts of Deep Reinforcement learning and GANs.
5.	Explain the need of regularization and optimization in deep learning.

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
IS3332-1.1	3	2											1	1
IS3332-1.2	3	2	2	2									1	1
IS3332-1.3	3	2	2	2	1								3	3
IS3332-1.4	3	3	2	2									1	1
IS3332-1.5	3	3	2	2									2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Charu C Agarval, “Neural Networks and Deep Learning", Springer International Publishing AG, part of Springer Nature 2018
2.	Ian Goodfellow, Y. Bengio and A. Courville, "Deep Learning", MIT Press, 2016.
3.	Josh Patterson, Adam Gibson, ”Deep Learning A Practitioners’ Approach”, O’Reilly, First Edition.

REFERENCE BOOKS:

1.	Michael A. Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015
2.	Li Deng and Dong Yu, "Deep Learning: Methods and Applications", 2013

E Books / MOOCs/ NPTEL

GAME THEORY AND APPLICATIONS

Course Code:	**IS3333-1**	**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	**MA1002-1, MA1007-1, MA2005-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Understand what is a “game” and its components.
2.	Transform an economic relationship between two or more parties into a “game”
3.	Understand equilibrium concept for games with different information structures.
4.	Evaluate the predictions made by applying game theory concepts.

UNIT-I — **15 Hours**

INTRODUCTION; STRATEGIC GAMES

What is game theory? Four elements, Classification of games, The theory of rational choice; Interacting decision makers, Strategic games; Example: The prisoner’s dilemma; Nash equilibrium; Examples of Nash equilibrium; Best- response functions; Dominated actions; Equilibrium in a single population: symmetric games and symmetric equilibria, Interpretation of Nash Equilibrium

MIXED STRATEGY EQUILIBRIUM
Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Finding mixed strategy by graphical met
hod; Finding mixed strategy by analyzing subset of all actions; Dominated actions; Pure equilibria when randomization is allowed, examples; The formation of players beliefs; Eliminating dominated actions, Median Voter theorem.

UNIT-II — **16 Hours**

EXTENSIVE GAMES

Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding subgame perfect equilibria of finite horizon games.

EXTENSIONS Allowing for simultaneous moves, examples, Discussion: subgame perfect equilibrium and backward induction.

STRICTLY COMPETITIVE GAMES AND MAXIMIZATION

Maximization and Nash equilibrium; Strictly Competitive Games; Maximization and Nash equilibrium in strictly competitive games

RATIONALIZABILITY
Iterated elimination of strictly dominated actions; Iterated elimination of weakly dominated actions; Dominance solvability.

UNIT-III — **08 Hours**

APPLICATIONS OF GAME THEORY

Assumptions and issues in Game theory, Mechanism design problem and examples, game theory and cryptography, game theory and wireless Adhoc networks, game theory and network security, Pareto optimal, Selfish routing, Correlated equilibrium

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

1.	Understand the Architecture of Games
2.	Analyze the Architecture of Game Playing, Apply the use of Equilibrium in Games

3.	Apply the Concepts of Game Theory

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
IS3333-1.1	2	2											2	
IS3333-1.2	3	2	3											3
IS3333-1.3	2	3											1	
IS3333-1.4	1	2												2
IS3333-1.5	2	2												2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Martin Osborne: An introduction to game theory, Oxford University Press, Indian Edition, 2004.
2. An Introduction to Game Theory: Strategy, Joel Watson, W W Norton and Company. Algorithmic Game Theory, Noam Nisan, Tim Roughgarden, Eva Tardos, Vijay V Vazirani, Cambridge University Press.

REFERENCE BOOKS:

1. Roger B Myerson: Game theory: Analysis of Conflict, Harvard University Press, 1997.

E Books / MOOCs/ NPTEL

SOCIAL AND WEB ANALYTICS

Course Code:	**IS3334-1**	**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	**IS2002-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Understand social media, web and social media analytics, and their potential impact.
2.	Determine how to Leverage social media for better services and Understand usability metrics, web and social media metrics
3.	Use various data sources and collect data relating to the metrics and key performance indicators
4.	Identify key performance indicators for a given goal, identify data relating to the metrics and key performance indicators
5.	Use ready-made web analytics tools (Google Analytics) and be able to understand a statistical programming language (R), also use its graphical development environment (Deduce) for data exploration and analysis.

UNIT-I	**15 Hours**

Introduction to web and social analytics: Overview of web & social media (Web sites, web apps, mobile apps and social media), Impact of social media on business, Social media environment, How to leverage social media for better services, Usability, user experience, customer experience, customer sentiments, web marketing, conversion rates, ROI, brand reputation, competitive advantages.

Need of using analytics, Web analytics technical requirements., current analytics platforms, Open Source vs licensed platform, choosing right specifications & optimal solution, Web analytics and a Web analytics 2.0 framework (clickstream, multiple outcomes Relevant Data And its Collection using statistical Programming language R.:Data (Structured data, unstructured data, metadata, Big Data and Linked Data), Participating with people centric approach, Data analysis basics (types of data, metrics and data, descriptive statistics, comparing, Basic overview of R:R-Data Types, R- Decision Making, R-Loops, R-functions, R-Strings, Arrays, R-Lists, R-Data Frame, R-CSV Files, R- Pie Charts, R-Bar charts, R-Barplots. Basic Text Mining in R and word cloud.

UNIT-II	15 Hours

Kpi/Metrics: Understand the discipline of social analytics, Aligning social objectives with business goals, Identify common social business objectives, developing KPIs; Standard vs Critical metrics. PULSE metrics (Page views, Uptime, Latency, Seven-day active users) on business and technical Issues, HEART metrics (Happiness, Engagement, Adoption, Retention, and Task success) on user behaviour issues; Bounce rate, exit rate, conversion rate, engagement, strategically aligned KPIs, Measuring Macro & micro conversions, On-site web analytics, off-site web analytics, the goal- signal-metric process. Case study on Ready-made tools for Web and social media analytics (Key Google Analytics metrics, dashboard, social reports, Tableau Public and KNIME

Mining Twitter: Exploring Trending Topics, Discovering What People Are Talking About, and More: Why Is Twitter All the Rage?, Exploring Twitter's API, Fundamental Twitter Terminology, Creating a Twitter API Connection, Exploring Trending Topics, Searching for Tweets, Analyzing the 140 Character, Extracting Tweet Entities, Analyzing Tweets and Tweet Entities with Frequency Analysis, Computing the Lexical Diversity of Tweets, Examining Patterns in Retweets, Visualizing Frequency Data with Histograms.

Mining Facebook: Analysing Fan Pages, Examining Friendships, and More: Overview, Exploring Facebook's Social Graph API, Understanding the Social Graph API, Understanding the Open Graph Protocol, Analyzing Social Graph Connections, Analyzing Facebook Pages, Examining Friendships.

UNIT-III	10 Hours

Data Mining in Social Media: Introduction, Data Mining in a Nutshell, Social Media, Motivations for Data Mining in Social Media, Data Mining Methods for Social Media, Data Representation, Data Mining - A Process, Social Networking Sites: Illustrative Examples, The Blogosphere: Illustrative Examples, Related Efforts, Ethnography and Netnography, Event Maps

Text Mining in Social Networks

Introduction, Keyword Search, Query Semantics and Answer Ranking, Keyword search over XML and relational data, Keyword search over graph data, Classification Algorithms, Clustering Algorithms, Transfer Learning in Heterogeneous Networks

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

1.	Understand social media, web and social media analytics, and their potential impact.
2.	Identify and explain ready-made web analytics tools (Google Analytics) and able to understand a statistical programming language (R).
3.	Identify key performance indicators for a given goal, identify data relating to the metrics and key performance indicators.
4.	Determine how twitter mining can be done for better services.
5.	Explain text mining and data mining in social networks.

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
IS3334-1.1	2	2											2	
IS3334-1.2	3	2	3											3
IS3334-1.3	2	3											1	
IS3334-1.4	1	2												2
IS3334-1.5	2	2												2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Matthew A. Russell," Mining of Social web, O′Reilly", Second Edition, ISBN-13: 978- 1449367619, 2013.
2.	Charu C Agarwal, "Social Network Data Analytics", Springer; October 2014.
REFERENCE BOOKS:	
1.	Hand, Mannila, and Smyth, "Principles of Data Mining", Cambridge, MA: MIT Press, ISBN: 026208290X, 2001.
2.	Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity", John Wiley &Sons; Pap/Cdr Edition, 2009.
3.	Tom Tullis, Bill Albert, "Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics", First Edition, Morgan Kaufmann ,2008.
4.	Jim Sterne, Social Media Metrics: "How to Measure and Optimize Your Marketing Investment", John Wiley & Sons ,2010.
5.	Brian Clifton, "Advanced Web Metrics with Google Analytics", Third Edition, John Wiley & Sons ,2012.
E Books / MOOCs/ NPTEL	
1.	http://www.webpages.uidaho.edu/~stevel/504/Mining-the-Social-Web-2nd-Edition.pdf
2.	Stanford: http://library.stanford.edu/projects/r
3.	http://nptel.ac.in/courses/106106146/21#watch
4.	https://www.coursera.org/learn/social-media-data-analytics

Professional Elective Courses (General Stream)

CLOUD COMPUTING

Course Code:	**IS3241-1**	**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	**CS1002-1, IS2001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Explain the technology and principals involved in building a cloud environment.
2.	Understand concepts of virtualization and cloud architecture.
3.	Choose appropriate cloud model for a given application.
4.	Understand advanced topics in cloud.
5.	Use simulators and tools to understand working of cloud environment.

UNIT-I — **15 Hours**

Introduction Cloud computing at a glance Historical development (T1: 1.1,1.2) **Principles of Parallel and Distributed Computing** Eras of computing Parallel vs distributed computing Elements of parallel computing Elements of distributed computing Technologies for distributed computing (T1: 2.1, 2.2, 2.3, 2.4, 2.5) **Virtualization** Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization. (T1: 3.1, 3.2, 3.3, 3.4, 3.5)

UNIT-II — **15 Hours**

Cloud Computing Architecture Introduction, The cloud reference model, Types of clouds, Economics of the cloud, Open challenges (T1: 4.1, 4.2, 4.3, 4.4, 4.5) **Cloud Platforms in Industry** Amazon web services, Google AppEngine, Microsoft Azure (T1: 9.1, 9.2, 9.3) **Cloud Applications** Scientific applications, Business and consumer applications (T1: 10.1, 10.2)

UNIT-III — **10 Hours**

Advanced Topics in Cloud Computing: Energy efficiency in clouds, Market-based management of clouds, Federated clouds/Inter Cloud, Third-party cloud services, (T1: 11.1, 11.2, 11.3, 11.4) Introduction to Software Defined Networks (R1), Network Function Virtualization. (R2) Introduction to Microservices in cloud (R3), Fog Computing (R4. R5).

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

1.	Explain the concepts and terminologies of cloud computing.
2.	Illustrate virtualization, cloud frameworks and technologies.
3.	Interpret appropriate cloud model for a given application.
4.	Explain energy efficiency and basics of software defined networks in cloud.
5.	Explain micro services and fog computing.

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
IS3241-1.1	1	2											1	2
IS3241-1.2	1	3											1	2
IS3241-1.3	1	3											1	2
IS3241-1.4	1	3											1	2
IS3241-1.5	1	3											1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Buyya, R., Vecchiola, C. and Selvi, S.T., 2013. "*Mastering cloud computing: foundations and* applications programming", Newnes.

REFERENCE BOOKS:

1. https://www.opennetworking.org/images/stories/downloads/sdn-resources/technical-reports/SDN-architecture-overview-1.0.pdf

2. https://web.archive.org/web/20161128071647/https://portal.etsi.org/NFV/NFV_White_ Paper.pdf

3.	https://tsh.io/state-of-microservices-2020-by-tsh.pdf
4.	https://www.cisco.com/c/dam/en_us/solutions/trends/iot/docs/computing-overview.pdf
5.	Mahmud, Redowan, Ramamohanarao Kotagiri, and Rajkumar Buyya. "Fog computing: A taxonomy, survey and future directions." In *Internet of everything*, pp. 103-130. Springer, Singapore, 2018.
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/106105167/
2.	https://www.coursera.org/learn/cloud-computing-basics

GRAPHICS AND ANIMATION

Course Code:	**IS3242-1**	**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	**MA1007-1, CS2001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Illustrate geometric transformations on objects.
2.	Infer the representation of viewing, Color and Illumination models in graphic
3.	Illustrate interactive computer graphics using OpenGL
4.	Able to understand the concept of animation and Image storage

UNIT-I

Introduction to Graphics and OpenGL	**13 Hours**

Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging Systems; The synthetic camera model; Graphics architectures; Programmable Pipelines; Performance Characteristics, Graphics Programming: The Sierpinski gasket; Programming Two Dimensional Applications, Basic Implementation Strategies; Four major tasks, Hidden Surface Removal; Antialiasing.

The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three-dimensional gasket; Plotting Implicit Functions.

INPUT AND INTERACTION	**02 Hours**

Interaction; Input devices; Clients and Servers; Display Lists; Display Lists and Modeling; Programming Event Driven Input; Menus; Picking;

UNIT-II

Geometric Objects and Transformations	**04Hours**

Geometric Objects and Transformations: Scalars, Points, and Vectors; Three - dimensional Primitives; Coordinate Systems and Frames; Modeling a Colored Cube; Affine Transformations; Rotation, Translation and Scaling; Transformation in Homogeneous Coordinates; Concatenation of Transformations. A Geometric Interpretation of Homogeneous Coordinates, The Window-to-Viewport Transformations

VIEWING	**03Hours**

Classical and computer viewing; Viewing with a Computer; Positioning of the camera; Simple projections; Projections in OpenGL; Interactive Mesh Displays; Parallel - projection matrices; Perspective - projection matrices; Projections and Shadows.

Visible-Surface Determination & Plane Curves and Surfaces	**08 Hours**

Techniques for efficient Visible-Surface Algorithms, Categories of algorithms, Back face removal, The Z-Buffer Algorithm, Scan-line method, Painter's algorithms (depth sorting), Area sub-division method, BSP trees, Visible-Surface Ray Tracing, comparison of the methods.

Curve Representation, Nonparametric Curves, Parametric Curves, Parametric Representation of a Circle, Parametric Representation of an Ellipse, Parametric Representation of a Parabola, Representation of Space Curves, Cubic Splines, Bezier Curves, B-spline Curves, , Quadric Surfaces. Bezier Surfaces.

UNIT-III

LIGHTING AND SHADING	**05 Hours**

Light and Matter; Light Sources; The Phong Lighting model; Computation of vectors; Polygonal Shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global Illumination. Implementation: Clipping: Line - segment clipping, Rasterization: Bresenham's Algorithm, Polygon Rasterization.

Computer Animation and Image Manipulation and Storage	**05 Hours**
Computer Animation: Principles of Animation, Key framing, Deformations, Character Animation, Physics-Based Animation, Procedural Techniques, Groups of Objects. **Image Manipulation and Storage:** What is an Image? Digital image file formats, Image compression standard – JPEG, Image Processing - Digital image enhancement, contrast stretching, Histogram Equalization, smoothing and median Filtering.	

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

1.	Explain the concepts of the graphics system and its implementation strategies.
2.	Apply basic transformations on objects using OpenGL
3.	Demonstrate the viewing and projection matrices.
4.	Apply light materials to illuminate model for rendering 3D Objects.
5.	Able to understand the computer animation and different image manipulation and storage.

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
IS3242-1.1	2													
IS3242-1.2	2													
IS3242-1.3	2	2											2	
IS3242-1.4	2	2											2	
IS3242-1.5	2	1											2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Edward Angel: Interactive Computer Graphics A Top Down Approach with OpenGL, 5th Edition, Pearson Education, 2008.
2.	Computer Graphics - Principles and Practice, J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Pearson,2nd Edition.
3.	Principles of Interactive Computer Graphics, William M. Newman and Robert F. Sproull, TMH, 2nd Edition.

REFERENCE BOOKS:

1.	Donald Hearn and Pauline Baker: Computer Graphics OpenGL Version, 3rd Edition, Pearson Education, 2004.
2.	2. F.S. Hill Jr.: Computer Graphics Using OpenGL, 3rd Edition, PHI, 2009.
3.	Fundamentals of Computer Graphics, Steve Marschner, Peter Shirley, CRC press, 4th Edition,1996.
4.	Mathematical Elements for CG, D. F. Rogers, J. A. Adams, TMH 2nd Edition.

MULTICORE ARCHITECTURE AND PROGRAMMING

Course Code:	**IS3243-1**	**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	**CS1001-1, IS2101-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Outline the principles of multi-core design and performance measurement
2.	Illustrate the concept of parallelization and develop parallel programs
3.	Identify the hurdles of parallelization and determine ways to handle these issues
4.	Analyse the process of code optimization
5.	Recognize the need and usage of multi-threading tools

UNIT-I	**15 Hours**
CONCEPTS AND DESIGN OF PARALLEL AND THREAD PROGRAMMING: Definition of thread and process, Parallel programming models, Parallel Programming constructs:	

Synchronization, Deadlock, Critical sections.
THREAD PROGRAMMING: Parallel programming using POSIX APIs, OpenMP- Directives, clauses, and environment variables. Introduction to intel TBB, Thread- Safeness, Cache related issues. ***(Text Book-1: chapter 1, chapter 2)***

UNIT-II	**15 Hours**

PARALLEL PROGRAMMING WITH DISTRIBUTED MEMORY PARALLEL COMPUTERS:
MPI Model: Collective communication, Data decomposition, Communicators and topologies, point-to-point communication, MPI Library, Programs using MPI.
MULTITHREADED PROGRAM DEBUGGING:
Benchmarks and other performance analysis tools, VTune Performance Analyzer, Thread Checker. Thread Profiler, hotspots, performance issues in algorithms, branch misprediction, cache organization, cache loads, efficiency, hardware and software prefetch. ***(Text Book-1: chapter 4, chapter 5, chapter 6)***

UNIT-III	**10 Hours**

COMPILER OPTIMIZATIONS AND PARALLEL ALGORITHMS:

Compilers for High performance Computing, compiler optimization, code and loop optimization, scalar and vector processing, temporal and spatial locality-matrix multiplication example. OS support to multi-core architectures. Parallel algorithms study and analysis - The Sieve of Eratosthenes, Floyd's algorithm, Matrix-Vector multiplication, Monte Carlo methods, Matrix Multiplication, Parallel Quicksort Algorithm. ***(Text Book-1: Chapter 8, Text Book-2: chapter 2, 3, and 4)***.

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

1.	Describe the multi-core architecture and motivation behind it.
2.	Design and develop parallel program on shared memory parallel computers using Pthreads API and OpenMP.
3.	Design and develop parallel program on distributed memory parallel computers using MPI.
4.	Analyse the performance of multithreaded programs using performance analysis tools.
5.	Apply compiler optimization techniques for parallel programs.

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
CS3243-1.1	2	3							1	1		1	3	
CS3243-1.2			3						1	1		1		3
CS3243-1.3			3						1	1		1		3
CS3243-1.4				3					1	1		1	3	
CS3243-1.5				3					1	1		1	3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Shameem Akhter and Jason Roberts," Multicore programming- Increasing performance through software multithreading", Intel press, 2013.
2.	Richard Gerber, Aart J.C.Bik, Kevin B.Smith, Xinmin Tian,"The software optimization cookbook",High performance Recipes for IA-32 Platforms,Intel press, 2005.

REFERENCE BOOKS:

1.	Steven S.Muchnick, Morgan Kaufman,"Advanced Compiler Design Implementation", Publishing 2000.

E Books / MOOCs/ NPTEL	
1.	www. tutorials on introduction to parallel computing
2.	http://www.cs.cmu.edu/afs/cs/user/fp/www/courses/15213-s07/lectures/27- multicore.pdf
3.	www.openmp.org for OpenMP
4.	http://nptel.ac.in/courses/106104025/2
5.	https://www.mooc-list.com/tags/parallel-programming

MULTIMEDIA PROCESSING

Course Code:	**IS3244-1**	**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	**MA2005-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Get the key concepts in current multimedia technology.
2.	Summarize the representation of text, images, audio and video.
3.	Classify and develop various compression techniques for text, images, audio and video.
4.	Analyze and evaluate the strengths and limitations of various audio and video codecs.
5.	Design codecs using the best techniques of compression, encoding and decoding.

UNIT-I — **15 Hours**

Multimedia Communications: Introduction to Multimedia Systems and Processing, multimedia information representation, multimedia networks, multimedia applications, network QoS and application QoS.
Information Representation: text, images, audio and video,
Text compression: Text compression principles, Lossless compression, Lossy compression, static coding, dynamic coding, Static Huffman Coding, Dynamic Huffman coding, Arithmetic coding, Lempel – Ziv coding, Lempel – Ziv Welsh coding.
transform encoding, entropy encoding, differential encoding, **Image compression:** GIF format, TIFF format, digital Pictures, Raster scan principles, JPEG.

UNIT-II — **15 Hours**

Audio: Types, Audio compression: PCM, Adaptive PCM, Adaptive Differential PCM, Adaptive predictive coding, Linear predictive coding, code excited LPC, perceptual coding, MPEG audio coders, Dolby Audio coders
Video: broadcast TV, color signals, NTSC, PAL, Digital formats: 4:2:2, 4:2:0, HDTV format, SIF, CIF, QCIF, PC video.
Video compression: video compression principles, frame types, motion estimation and compensation, encoding of frames, implementation issues.

UNIT-III — **10 Hours**

Video compression standards: H.261, H.263, MPEG 1, MPEG 2, MPEG 4 (scene composition, coder, decoders), MPEG 7, MPEG 21 multimedia framework.

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

1.	Describe how text, audio, image and video information can be represented digitally in a computer, so that it can be processed, transmitted and stored efficiently.
2.	Able to differentiate and design lossless and lossy compression techniques.
3.	Analyze and evaluate the possibility and limitations of multimedia data compression.
4.	Evaluate the audio coding techniques including predictive coding and more advanced techniques based around LPC and others.
5.	Apply various compressions, encoding and decoding techniques to solve the real problems in multimedia processing and adopt the best methods.

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
IS3244-1.1	2	3							1	1		1	3	
IS3244-1.2			3						1	1		1		3
IS3244-1.3			3						1	1		1		3
IS3244-1.4				3					1	1		1	3	
IS3244-1.5				3					1	1		1	3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols And Standards", Pearson education, 2001.
2.	K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2004.

REFERENCE BOOKS:

1.	Raif steinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and Applications",Pearson education, 2002.
2.	John Billamil, Louis Molina, "Multimedia: An Introduction", PHI, 2002.

E Books / MOOCs/ NPTEL

1.	NPTEL materials on multimedia processing, IIT Kharagpur: http://nptel.iitk.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Multimedia %20Processing/New_index1.html

AI AND ML IN HEALTHCARE

Course Code:	IS3341-1	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	IS2002-1		

Teaching Department: Information science & Engineering

Course Objectives:

1.	To understand the terminology and classifications of AI and ML.
2.	To understand how different ML algorithms work, including supervised, unsupervised, and semi-supervised algorithms.
3.	To appreciate the role of AI/ML in predictive analytics in healthcare, using real world examples.
4.	To appreciate the role of AI/ML in automated imaging interpretation in healthcare.

UNIT-I	15 Hours

Why we need AI in healthcare, Opportunities of AI in Health care, Challenges of AI in Healthcare, towards dehumoning healthcare. Data available from healthcare system, Clinical Data, Clinical data mining, Analysis of clinical Data, Analysis of ready datasets from patient time line

UNIT-II	15 Hours

Machine learning and deep learning for healthcare, AI for disease diagnosis, prediction
NLP and Data analytics in Healthcare, Integrating AI to hospital management System

UNIT-III	10 Hours

Case study on several applications of classification. Segmentation: (brain tumor liver, cancer cells etc), image (CT scan X-ray), patient data(text).

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

1.	Understand need of AI for healthcare
2.	Understand various algorithms used for analysis and diagnosis
3.	Understand the various applications which require AI

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
IS3341-1.1	1	2							1	1		1	1	1

IS3341-1.2	2	3		3	1				1	1		1	3	2
IS3341-1.3	2	3		2	1				1	1		1	3	2
IS3341-1.4	2	3		2	1				1	1		1	3	2
IS3341-1.5	1	1							1	1		1	1	1

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	"Artificial Intelligence and Data Mining in Healthcare", springer, 2020.
2.	"Healthcare and Artificial Intelligence", Springer, 2020.
REFERENCE BOOKS:	

E Books / MOOCs/ NPTEL	

COMPUTER VISION

Course Code:	IS3342-1	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	CS1001-1, CS2001-1		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Understand the goal and scope of computer vision
2.	Learn the basics of image and image formation in computers.
3.	Learn about camera projections and viewing in computer vision
4.	Learn the basics of image segmentation and feature tracking.
5.	Understand and learn the principles of object detection and recognition in computer vision.

UNIT-I	15 Hours
Introduction: Introduction to Computer Vision:	
Goal, areas, Human Vision, Segmentation, Perception, Semantic information, Special effects, Modelling, Applications; Linear Algebra: Vectors & matrices, Transformation matrices, Matrix inverse, Matrix rank, SVD.	
Pixels, Features, and Cameras: Pixels and Filters:	
Images as functions, Linear Systems (filters), Convolution & Correlation. Edge detection: Simple, Canny, RANSAC; Feature detector: Local invariant, Harris, DOG, SIFT;	
UNIT-II	15 Hours
Camera and Camera model:	
Pinhole Cameras, Cameras & lenses, Projection matrix, Intrinsic parameters, Extrinsic parameters; Stereo Vision: Epipolar geometry, Parallel images, Images rectification, Solving correspondence problem, Active Stereo Vision System. Regions of Images, and Segmentation: Basic Concepts of Segmentation: Gestalt theory; Agglomerative, K-means & Mean-shift Clustering; Optical flow, Feature tracking, Applications;	
Regions of Images, and Segmentation:	
Basic Concepts of Segmentation: Gestalt theory; Agglomerative, K-means & Mean-shift Clustering; Optical flow, Feature tracking, Applications;	
UNIT-III	10 Hours
Advanced Image Parsing Topic and Applications:	
Binary, Image Matting; Figure-ground Segmentation Using Clustering Algorithms.	
Recognizing Faces and Objects:	
Basic Concepts in Recognition & its pipeline, Nearest Neighbour Match; PCA and Eigenfaces; Tracking Millions of People: Detection, Tracklet Generation & Association.	
Course Outcomes: At the end of the course student will be able to	

1.	Outline Application of image processing
2.	Explain edge detection and feature description techniques.
3.	Summarise camera projections
4.	Apply image segmentation and feature tracking.to video streams
5.	Apply the techniques of recognizing faces and objects to photo frames

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
IS3342-1.1	1	3							1	1		1	1	1
IS3342-1.2	1	3							1	1		1	1	1
IS3342-1.3	2	2							1	1		1	1	2
IS3342-1.4	2	2							1	1		1	2	2
IS3342-1.5	1	3							1	1		1	3	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Computer Vision: Algorithms and Applications, Richard Szeliski, Microsoft Research, Electronic draft (2010).
2.	Multiple View Geometry in Computer Vision, Hartley & Zisserman, Cambridge University Press; 2 edition (2004).
3.	Computer Vision: A Modern Approach, David A. Forsyth& Jean Ponce, Prentice Hall; 2 edition (2011).

REFERENCE BOOKS:

1.	Introductory computer vision and image processing, Low, Adrian; McGraw-Hill, Edition-1991.
2.	Digital image processing, Gonzalez, Rafael C. and Richard E. Woods; Addison- Wesley, Edition: 3rd, Year:1998.
3.	Machine vision, Jain, Ramesh and Rangachar Kasturi and Brian G. Schunck; McGraw-Hill, Edition-1995.

E Books / MOOCs/ NPTEL

1.	Youtube channel: First Principles of Computer Vision
2.	Coursera: First Principles of Computer Vision specialisation
3.	Nptel course: https://nptel.ac.in/courses/106105216 (12 weeks)

OPERATIONS RESEARCH

Course Code:	IS3343-1	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	MA2005-1		

Teaching Department: Information Science &Engineering

Course Objectives:

1.	Describe the scope and limitations of OR methods and outline the role of OR techniques in supporting the decisions.
2.	Explain the concept of Linear Programming Model (LPM) and formulate Linear Programming problems.
3.	Describe the various methods like Simplex Method, revised simplex Method, Big M Method, Two Phase Method, Dual Simplex Method and duality theory and use it on Linear Programming Problems.
4.	Describe the formulation of Transportation problems, different methods in Transportation problems like North West Corner Rule, Row minima method, Column minima method, Matrix minima method, Vogel's approximation method, U-V method and use those methods on the respective real-world problems.
5.	Describe the formulation of Assignment problems, use Hungarian method in Assignment problems,

	CPM and PERT (project management techniques) and use it on the respective real-world problems.

UNIT-I	15 Hours

INTRODUCTION
Introduction to OR, nature and meaning, applications, modeling in OR, phases of OR study
LINEAR PROGRAMMING
Introduction to Linear Programming through an example, graphical method, formulation of LP model from practical problems, assumptions and properties of linear programming, simplex method, Big M method, 2 phase method, Revised simplex method,
Duality theory, Primal and dual relationship.
(Text Book-1: Chapter 2,3,5,6,7,8)

UNIT-II	15 Hours

TRANSPORATION PROBLEMS
Transportation problems, methods to find initial feasible solution and modification to obtain optimal solution (Degeneracy in transportation problems, unbalanced transportation problems.
ASSIGNMENT PROBLEM
Mathematical formulation of an assignment problem, unbalanced assignment problem, Travelling Salesman Problem (TSP), Hungarian method.(Text Book-1: Chapter 15,16)

UNIT-III	10 Hours

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

1.	Describe the basics of OR, modelling and applications of OR and the linear programming model.
2.	Construct linear programming problem and apply methods like Simplex method, revised simplex method, Big M method, 2 phase method and Dual simplex method to solve the different use cases of linear programming problem.
3.	Apply the North West Corner Rule, Row minima method, Column minima method, Matrix minima method, Vogel's approximation method and U-V method to solve the Transportation Problems.
4.	Apply the Hungarian method to solve the Assignment Problems and Travelling Salesman Problems.
5.	Apply the CPM and PERT project management techniques on the respective use cases to solve the problems related to the use cases.

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
IS3343-1.1	3												3	
IS3343-1.2	2	3											3	
IS3343-1.3	2	3											3	
IS3343-1.4	2	3											3	
IS3343-1.5	2	3											3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Operations Research, S. D. Sharma, 17th Revised edition,2014.

REFERENCE BOOKS:

1.	Operations Research,Er. Premkumar Gupta,Dr. D.S. Hira, 4th edition, 2015.
2.	Introduction to Operations Research - A Computer Oriented Algorithmic Approach, Gillelt B G, McGraw Hill, 2008.
3.	Operations Research – An introduction, Hamdy A Taha, PHI, 8th edition, 2007.

E Books / MOOCs/ NPTEL

1.	https://www.tutorialspoint.com/linear_programming/index.asp
2.	https://www.cs.toronto.edu/~stacho/public/IEOR4004-notes1.pdf
3.	http://people.brunel.ac.uk/~mastjjb/jeb/or/contents.html
4.	Fundamentals of Operations Research IIT Madras Course, Prof. G. Srinivasan: https://swayam.gov.in/

VIRTUAL REALITY

Course Code:	IS3344-1	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	CS1001-1, IS2101-1		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	To understand concepts of Virtual Reality & geometric modeling
2.	To study about Virtual environment
3.	To develop Virtual Hardwares and Softwares and Virtual Reality applications

UNIT-I	13 Hours

INTRODUCTION TO VIRTUAL REALITY

Virtual Reality & Virtual Environment : Introduction – Computer graphics – Real time computer graphics – Flight Simulation – Virtual environments –requirement – benefits of virtual reality- Historical development of VR : Introduction – Scientific Landmark -3D Computer Graphics :Introduction – The Virtual world space – positioning the virtual observer – the perspective projection – human vision – stereo perspective projection – 3D clipping – Color theory – Simple 3D modeling Illumination models – Reflection models – Shading algorithms- Radiosity – Hidden Surface Removal – Realism-Stereographic image. (T1)

GEOMETRIC MODELLING

Geometric Modeling: Introduction – From 2D to 3D – 3D space curves – 3D boundary representation - Geometrical Transformations: Introduction – Frames of reference – Modeling transformations – Instances – Picking – Flying – Scaling the VE – Collision detection - A Generic VR system: Introduction – The virtual environment – the Computer environment – VR Technology – Model of interaction. (T1)
VR Systems.

UNIT-II	13Hours

VIRTUAL ENVIRONMENT

Animating the Virtual Environment: Introduction – The dynamics of numbers – Linear and Non-linear interpolation - The animation of objects – linear and non- linear translation - shape & object inbetweening – free from deformation – particle system- Physical Simulation: Introduction – Objects falling in a gravitational field– Rotating wheels – Elastic collisions – projectiles – simple pendulum – springs – Flight dynamics of an aircraft.(T1)

UNIT-III	13Hours

VR HARDWARES & SOFTWARES

Human factors: Introduction – the eye - the ear- the somatic senses - VR Hardware: Introduction – sensor hardware – Head-coupled displays –Acoustic hardware – Integrated VR systems-VR Software: Introduction – Modeling virtual world –Physical simulation- VR toolkits – Introduction to VRML. (T1)

VR APPLICATION

Virtual Reality Applications: Introduction – Engineering – Entertainment – Science – Training – The Future: Introduction – Virtual environments – modes of interaction. (T1)

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

1.	Explain the concepts of virtual reality in real-time applications
2.	Illustrate the concepts of geometric modelling for object transformations
3.	Apply the concepts of animation and simulation in developing a tool for virtual environment
4.	Select appropriate hardware and software for interacting with VR systems.
5.	Develop applications of VR toolkits for modelling virtual world simulators.

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
IS3344-1.1	2													
IS3344-1.2	2	2												
IS3344-1.3	2	2											1	
IS3344-1.4	1				2									

IS3344-1.5	2	2											2	

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.
REFERENCE BOOKS:	
1.	Adams, “Visualizations of Virtual Reality”, Tata McGraw Hill, 2000.
2.	Grigore C. Burdea, Philippe Coiffet , “Virtual Reality Technology”, Wiley Interscience, 2nd Edition, 2006.
3.	William R. Sherman, Alan B. Craig, “Understanding Virtual Reality: Interface, Application, and Design”, Morgan Kaufmann, 2008.
E Books / MOOCs/ NPTEL	
1.	www.vresources.org.
2.	www.vrac.iastate.edu.
3.	www.w3.org/MarkUp/VRML

Programme Specific Ability Enhancement Courses

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 iferent 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 technique
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/

BASICS OF R PROGRAMMING

Course Code	**IS2651-1**	**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**
Prerequisite	**CS1001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Explain the concepts of data mining and types of Analytics
2.	Illustrate the use of different datamining algorithm
3.	Describe the basic concepts of R programming
4.	Apply the Data visualization concepts using R programs

5.	Get the idea of lookup functions and Pivot Tables and Illustrate the use of Data validation and Data Visualization.

List of Experiments

Unit-I	**15 Hours**

R Programming Basics: Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Array, understanding and manipulating data structures, Matrix, Vectors, Factors, Functions.
Reading in data, more built-in functions, what is a working directory, R Projects, libraries, How to get help, Naming things and coding style.
Data Frames, Functions, R packages, Data Reshaping. **Data Visualization using R:** Reading and getting data into R (External Data): Using CSV files, Excel files.
Working with R Charts and Graphs: Histograms, making plots, Box plots, Bar Charts, Line Graphs, Scatter plots, Pie Charts.
Dealing with dates and times, making your own functions, Vectorization: loops, More ways to iterate.

Unit-II	**10 Hours**

Descriptive Statistics: Data Range, tidy data, tidyverse, Frequencies, Mode, Mean and Median: Mean Applying Trim Option, Applying NA Option, Median - Mode - Standard Deviation – Correlation - Spotting Problems in Data with Visualization: visually Checking Distributions for a single Variable.
Regression: Linear Regression, Multiple regression.

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

1.	**Outline** the R basics and **Demonstrate** how to install and use RStudio
2.	**Describe** Variables and Data Types, Control Structures, the use of data structure and loop functions
3.	**Apply** various concepts, R packages and **Develop** Simple programs using R.
4.	**Understand** the R Data Visualization concept and **apply** R programming in plotting various Charts and Graphs.
5.	**Analyse** data and **apply** regression techinques on data using R

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
IS2651-1.1	2	2												2	
IS2651-1.2	2	3												2	
IS2651-1.3	2	2	3											2	
IS2651-1.4	2	2	3											3	
IS2651-1.5	2	2	3											2	

1: Low 2: Medium 3: High

TEXT BOOKS:

1.	Tilman M. Davies, "The Book of R: A First Course in Programming and Statis-tics", No Starch Press; 1st edition ,2016.
2.	Introduction to Linear Regression Analysis by Douglas C. Montgomery, Eliz-abeth A. Peck, G. Geoffrey Vining (Wiley).
3.	Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017, ISBN: 978-93-5260-455-5.
4.	Seema Acharya, Data Analytics using R, McGrawHill Education (India), 2018, ISBN: 978-93-5260-524-8.

REFERENCE MATERIALS:

1.	Andrie de Vries and Joris Meys. "R For Dummies", 2nd Edition, John Wiley & Sons; 2nd Edition, 2015.
2.	Hadley Wickham, Garrett Grolemund, "R for data science: Import, Tidy, Transform, Visualize, And Model Data", O′Reilly; 1st edition, 2017.
3.	Linear Models and Generalizations - Least Squares and Alternatives by C.R. Rao, H. Toutenburg, Shalabh, and C. Heumann (Springer, 2008)
4.	Tilman M. Davies, "The Book of R: A First Course in Programming and Statistics", No Starch Press; 1st edition,2016.
5.	Jiawei Han, MichelineKamber, Jian Pei (2012), Data Mining: Concepts and Techniques,

	3rdedition, Elsevier, United States of America.AndrewOleksy, Data Science with R: A Step by Step Guide With Visual Illustrations & Examples,
E Resources	
1.	Peng, R.D. (2020). R Programming for Data Science.
2.	https://bookdown.org/rdpeng/rprogdatascience/
3.	Phillips, N.D. (2018). YaRrr, The Pirate's Guide to R.
4.	https://bookdown.org/ndphillips/YaRrr/
5.	Mahoney, M. (2019). Introduction to Data Exploration and Analysis with R.
6.	https://bookdown.org/mikemahoney218/IDEAR/

ANGULAR AND REACT JS

Course Code:	**IS2652-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CS1001-1**		

Teaching Department: Information Science & Engineering

UNIT-I	**10 Hours**
INTRODUCTION TO ANGULARJS	
AngularJS Overview, AngularJS MVC Architecture, AngularJS Expressions, Numbers, Strings, Objects, Arrays, AngularJS Modules, AngularJS Directives, AngularJS Model, Data Binding, AngularJS Controllers, Repeating HTML Elements, AngularJS Scope, AngularJS Filters, AngularJS Services.	
UNIT-II	**15Hours**
INTRODUCTION TO REACTJS	
Introduction to ReactJS, ReactJS vs AngularJS, Pros and Cons of ReactJS, React Components, React Class, React State, React Props, React Constructor, React Forms, React Events, React List, React Keys, React Fragments.	
INTRODUCTION TO REACT ES6, REACT JSX AND REACTDOM	
ES6 Variables and Arrays, ES6 Classes, ES6 Modules, React Elements as JSX, JSX Attributes, JSX Styling, Expression in JSX, Introduction to ReactDOM, Introduction to Babel.	

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

1.	**Describe** the fundamental features of AngularJS and **Apply** the usage of AngularJS components.
2.	**Design and implement** AngularJS script at the client side.
3.	**Illustrate** ReactJS concept, **explain** the concept of class, list, constructs and forms in ReactJS.
4.	**Discuss** client-side rendering of ReactJS, **demonstrate** implementation of ReactJS script at client side
5.	**Explain** the features of React ES6, React JSX And ReactDOM and **demonstrate** the use of React ES6, React JSX And ReactDOM.

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
IS2652-1.1	2		3											3
IS2652-1.2	2		3											3
IS2652-1.3	2													3
IS2652-1.4	2		3											3
IS2652-1.5	2		3											3

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Ari Lerner, Ng-book, "The complete book on Angular JS", 2013.
REFERENCE BOOKS:	
1.	M. Deitel, P.J. Deitel, A. B. Goldberg, "Internet & World Wide Web How to Program", Third Edition, Pearson education, 2004.
2.	Chris Bates,"Web Programming Building Internet Applications", Third Edition, Wiley India, 2006.
E Books / MOOCs/ NPTEL	
1.	https://www.tutorialspoint.com/reactjs/index.htmww.tutorialspoint.com/android/index.htm
2.	https://www.tutorialspoint.com/angularjs/index.htm
3.	https://www.w3schools.com/REACT/DEFAULT.ASP
4.	https://www.w3schools.com/angular/
5.	https://www.coursera.org/specializations/full-stack-mobile-app-development
6.	https://www.coursera.org/learn/single-page-web-apps-with-angularjs
7.	https://www.coursera.org/learn/front-end-react

PROFESSIONAL ETHICS

Course Code	**IS1651-1**	**Course Type**	**HU**
Teaching Hours/Week (L: T: P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Understand the human values, work ethics, and accept challenges in workplace.
2.	To communicate about the need for education for life.
3.	Impart the knowledge on safety. Risk and responsibilities.
4.	Understand human rights, protection of intellectual property and global issues.
5.	To get an awareness of corporate ethics and social responsibility.

Unit - I	**10 Hours**

Professional Ethics

Objectives of the study, Morals, Values, Ethics, Integrity, Work Ethics, Virtues, Valuing Time, Empathy, Self Confidence, Challenges in work Place, Spirituality, Yoga for Professional Excellence and Stress Management.

Unit - II	**15 Hours**

Safety, Responsibility and Rights:

Safety and Risk, Risk analysis, Assessment of Safety and Risk, Safe Exit, Risk benefit analysis, Collegiality and Loyalty, Collective Bargaining, Confidentiality, Conflicts of Interest, Occupational Crimes.

Human Rights:

Employee Rights, (Right to privacy, Right to choose outside activities, Right to due Process from Employer, Right to equal opportunity, Non-discrimination)

Global Issues

Globalization, Multinational Corporations, Environmental Ethics, Computer Ethics, Engineers as Advisors in planning and Policy Making, Moral leadership, Codes of Ethics, Ethics and Codes of Ethics of Business in MNC, Corporate Social Responsibility.

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

1.	Adopt and practice the human values, work ethics, respect to others and stress management in personal and professional life.
2.	Develop a universal approach to value and skill education by understanding reality and holistic perspective.

3.	Assess safety, risk, confidentiality and occupational crimes.
4.	Aware of human rights.
5.	Comprehend planning, policy making and corporate social responsibilities.

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
IS1651-1.1	3			2		3	1	1	1					
IS1651-1.2				2	3			2	1					
IS1651-1.3	2					3								
IS1651-1.4				2		3	1							
IS1651-1.5	1				2			2	1					

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	Human values by A. N. Tripaty New Age International publishers 2003.
2.	A Text book on Professional Ethics and Human Values by R. S. Naagarazan, 2nd Edition New Age International Publishers.
3.	Foundation of Ethics and Management by B.P, Banerjee. Excel Books.

REFERENCE MATERIALS:

1.	Science and Humanism by P. L. Dhar and R. R. Gaur Commonwealth Publishers.
2.	Business Ethics by B. A. Karunakara Reddy, Pushpa N and Archana. Vision Book House.
3.	Human Capital Management by Chandrasekhar, Gurumurthy, Mahesh and Nagarthna M Malagi Phoenix Publishing House.

RESEARCH METHODOLOGY

Course Code:	**HU1010-1**	**Course Type:**	**AEC**
Teaching Hours/Week (L: T: P: S):	**2:0:0:0**	**Credits:**	**02**
Total Teaching Hours:	**30**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Respective Department

Course Objectives:

1.	Understand Research Formulation and Design
2.	Inculcate the ability to collect Data and its analysis
3.	Enhance knowledge of Soft Computing
4.	Comprehend Research Ethics and the art of publishing
5.	Develop Interpretative Skills and write reports

UNIT-I

Research Formulation and Design — **6 Hours**

Motivation and Objectives – Research methods vis-a-vis Methodology. Types of research – Descriptive vis-a-vis Analytical, Applied vis-a-vis Fundamental, Quantitative vis-a-vis Qualitative, Conceptual vis-a-vis Empirical, concept of applied and basic research process, Criteria of good research.

Defining and formulating the research problem, Selecting the problem, Importance of Literature Review, Literature Review - Primary and Secondary sources, reviews, monograph, patents, research databases, Web as a source, Critical literature review, Identifying gap areas from Literature Review, Development of working hypothesis.

Data Collection and Analysis — **6 Hours**

Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with statically package (Sigma STAT, SPSS for student t-test, ANOVA, etc.), hypothesis testing.

UNIT-II

Soft Computing	**6 Hours**
Computer and its role in research, Use of statistical software SPSS, GRETL in research. Introduction to evolutionary algorithms - Fundamentals of Genetic algorithms, Simulated Annealing, Neural Network based optimization, Optimization of fuzzy systems.	
Research Ethics and Scholarly Publishing	**6 Hours**
Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility, and accountability	

UNIT-III

Interpretation and Report Writing	**3 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.	Formulate and design the research problem.
2.	Interpret and Analyze the Data for research.
3.	Identify and interpret the Data with Soft Computing.
4.	Apply research ethics and develop the art of publishing.
5.	Integrate interpretative skills and write reports.

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
HU1010-1.1	-	-	-	-	-	-	-	-	-	2	-	3	-	-
HU1010-1.2	-	-	-	-	-	-	-	-	-	3	-	3	-	-
HU1010-1.3	-	-	-	-	-	-	-	-	-	3	-	3	-	-
HU1010-1.4	-	-	-	-	-	-	-	-	2	2	-	2	-	-
HU1010-1.5	-	-	-	-	-	-	-	-	1	2	-	2	-	-

1: Low 2: Medium 3: High

REFERENCES:

1. Garg, B.L., Karadia, R., Agarwal, F., & Agarwal, “An introduction to Research Methodology”, RBSA Publishers, 2002.
2. Wadehra, B.L., “Law relating to patents, trademarks, copyright designs and geographical indications” Universal Law Publishing, 2000.
3. Kothari, C.R., “Research Methodology: Methods and Techniques”, New Age International, 1990.
4. Trochim, W.M.K. “Research Methods: the concise knowledge base”, Atomic Dog Publishing, 2005.
5. Sinha, S.C., & Dhiman, A.K., “Research Methodology”, EssEss Publications. (2 volumes), 2002.
6. Satarkar, S.V., “Intellectual property rights and copyright”, EssEss Publications, 2000.
7. Coley, S.M., & Scheinberg, C.A. “Proposal Writing”, Sage Publications, 1990.
8. Day, R.A. “How to Write and Publish a Scientific Paper”, Cambridge University Press, 1992.
9. Anthony, M., Graziano, A.M., & Raulin, M.L., “Research Methods: A Process of Inquiry”, Allyn and Bacon, 2009.

TECHNICAL CONTENT WRITING

Course Code	**IS2653-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**1:0:2:0**	**Credits**	**02**
Total Teaching Hours	**15+0+26+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**HU1001-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Understand the importance of English in the fields of science and engineering.

2.	Understand common problems associated with using technical vocabulary in specialist fields.
3.	Use effective strategies to learn technical vocabulary in specialist fields.
4.	Use text analysis tools to identify differences in the audience, purpose, structure, style, and presentation of technical texts in different fields.
5.	Identify the structure of technical research papers in specialist fields.
6.	Understand research journal Call for Papers and Instructions for Authors.

List of Activities

1	Introduction to Technical Writing Review of Technical Writing 1: What is research/How do you structure a research paper
2	Introduction to Literature Review
3	Introduction to text analysis tools: analyzing research paper biographies
4	First steps in text analysis: creating vocabulary lists, searching for words, phrases, and grammar patterns. Building a corpus of research papers.
5	Writing a research paper proposal: brainstorming topics, narrowing the scope, finalizing the decision.
6	Writing a research paper title: keywords, noun phrases, and prepositions
7	Writing a research paper introduction (1): characteristic features and structure of introductions
8	Writing a research paper introduction (2): explaining the situation, describing problems/limitations, describing the response
9	Writing a research paper methods section: explaining methods and processes
10	Writing a research paper results section: deciding the type of visual aid, explaining figures and tables.
11	Writing a research paper discussion/conclusion section: summarizing results, adjusting the strength of interpretations using hedging with chapters
12	Writing a thesis using research chapters

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

1.	Understand to write Literature review
2.	Understand to write Technical Abstract
3.	Understand to write Science and Technology Research Paper
4.	Understand to write Science and Technology Thesis
5.	Understand to write Science and Technology Presentations

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**
IS2653-1.1	1	-	-	-	3	-	-	-	-	-	-	-			
IS2653-1.2	1	-	-	-	3	-	-	-	-	-	-	-			
IS2653-1.3	1	-	-	-	3	-	-	-	-	-	-	-			
IS2653-1.4	1	-	-	-	3	-	-	-	-	-	-	-			
IS2653-1.5	1	-	-	-	3	-	-	-	-	-	-	-			

1: Low 2: Medium 3: High

E Resources

1.	https://www.prismnet.com/~hcexres/textbook/acctoc.html

Humanities & Management Courses

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**

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 — **09 Hours**

Personality Traits

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 — **09 Hours**

Social Behaviour and Cultural Etiquette

Time Management, Personal Grooming, Making Small Talk, Customs & Manners.

Professional Presentation Techniques

Formal Presentation, Sensitivity towards multi-cultural workspaces.

UNIT-III — **08 Hours**

Job-Related Communication

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.

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 — 06 Hours

Need, Basic Guidelines, Content and Process for Value Education

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 — 06 Hours

Understanding Harmony in the Human Being, Family and Society

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 — 03 Hours

Whole existence as Coexistence: Implications of the above Holistic Understanding of Harmony and Professional Ethics

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"

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	**39**	**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.

FINANCIAL MANAGEMENT			
Course Code:	**MG1002-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**39**	**CIE + SEE Marks**	**50+50**

Teaching Department: Any

Course Objectives:

1.	Develop basic financial management knowledge essential to make a managerial career in professional life.
2.	Impart some of the crucial and basic skills required to work in the area of budgeting, investment and financial decision making.
3.	Enable in making a right decisions on selection of projects for investment.
4.	Understand the basics of finance and financial markets, project evaluation and selection.

UNIT-I

Time Value of Money	**15 Hours**

Financial Management: Concepts and Meaning – Introduction to Finance; Objectives of Financial Management; Profit Maximization; EVA; Changing Role of Financial Managers.
Time Value of Money: Techniques and Applications of Compounding and Discounting.

UNIT-II

Capital Budgeting and Working Capital	**15 Hours**

Capital Budgeting (Investment Evaluation Techniques): Payback Period Method; Present Worth Method; Annual Worth Method; Profitability index method; Estimation of IRR.
Cost of Capital: Sources of various Types of Capital; Cost of Debenture Capital; Cost of Preferential Capital; Cost of Term Loans; Cost of Equity Capital.
Working Capital: Factors influencing Working Capital Requirements.

UNIT-III

Inventory Management and Break Even Analysis	**9 Hours**

Inventory Management: Techniques of Inventory Management and Control – EOQ, ABC Analysis, Just-in-Time (JIT) System
Break Even Analysis: Estimation of Break-Even Point and Values.

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

1.	Describe the basic financial management skills required for a professional.
2.	Explain techniques and applications of compounding and discounting and calculate compounded/discounted amount for the given proposal.
3.	Evaluate the given investment option by capital budgeting techniques.
4.	Describe the basics of cost of capital and working capital. Determine the cost of capital for the given investment option.
5.	Describe the basics of inventory management and calculate the economic order quantity and reorder point for the given conditions. Calculate breakeven point for the given manufacturing setup.

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
MG1002-1.1	3	-	-	-	-	-	-	-	1	1	-	1	-	-	-
MG1002-1.2	1	3	-	-	-	-	-	-	1	1	-	1	-	-	-
MG1002-1.3	2	3	-	-	-	-	-	-	1	1	-	1	-	-	-
MG1002-1.4	2	3	-	-	-	-	-	-	1	1	-	1	-	-	-
MG1002-1.5	1	3	-	-	-	-	-	-	1	1	-	1	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	M Y Khan, P K Jain , "Financial Management – Text, Problems & Cases",7th Edition, 2015; McGraw Hill Education (India) Pvt. Ltd, New Delhi.
2.	I M Pandey, "Financial Management", 11th Edition, 2015; Vikas Publishing House Pvt. Ltd. (UP) India.
3.	James L. Riggs, David D. Bedworth and Sabah U. Randhawa, "Engineering Economics", 4th Edition, Tata McGraw Hill Edition.
REFERENCE BOOKS:	
1.	Prasanna Chandra, "Financial Management", 6th Edition, 2004; Tata McGraw Hill Publishing Company Ltd, New Delhi.
2.	S. D. Sharma, "Operation Research" , Kedar Nath Ram Nath Publishers, 2015.

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: Information Science & 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→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 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

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

06 Hours

2. ಕೀರ್ತನೆಗಳು: ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ - ಪುರಂದರದಾಸ 3. ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳುಮನವೆ - ಕನಕದಾಸ 4. ತತ್ವಪದಗಳು: ಸಾವಿರ ಕೊಡಗಳಸುಟ್ಟು - ಶಿಶುನಾಳಷಂಥಷರೀಫ 5. ಶಿವಯೋಗಿ: ಬಾಲಲೀಲಾ ಮಹಾಂತ ಶಿವಯೋಗಿ 6. ಜನಪದಗೀತೆ: ಬೀಸುವಪದ, ಬಡವರಿಗೆ ಸಾವ ಕೊಡಬೇಡ	
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 ಎಂ ವಿಶ್ವೇಶ್ವರಯ್ಯ - ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ: ಎ ಎನ್ಮೂರ್ತಿ ರಾವ್ 2. ಯುಗಾದಿ: ವಸುಧೇಂದ್ರ 3. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ. ಚಿ. ಬೋರಲಿಂಗಯ್ಯ	**06 Hours**
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→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													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, ೨೦೦೮, 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

1	Personal Pronouns, Possessive Forms, Interrogative words	**06 Hours**
2	Possessive forms of nouns, Dubitive question and Relative nouns	
3	Qualitative, Quantitative and Colour Adjectives, Numerals	
4	Predictive Forms, Locative Case	
5	Dative Cases, and Numerals	
6	Ordinal numerals and Plural markers	
7	Defective / Negative Verbs and Colour Adjectives	
8	Permission, Commands, encouraging and Urging words (Imperative words and sentences)	
9	Accusative Cases and Potential Forms used in General Communication	
10	Helping Verbs “iru and iralla”, Corresponding Future and Negation Verbs	
11	Comparative, Relationship, Identification and Negation Words	
12	Different types of forms of Tense, Time and Verbs	
13	Formation of Past, Future and Present Tense Sentences with Verb Forms	
14	Karnataka State and General Information about the State	
15	Kannada Language and Literature	
16	Do's and Don'ts in Learning a Language	

UNIT – II

Kannada Language Script Part – 1	**06 Hours**

UNIT – III	
Kannada Vocabulary List & Kannada Words in Conversation	**03Hours**

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 (೨೦೧೬).
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, ೨೦೦೬, ಭಾಷಾ ಪ್ರಕಾಶನ, ಮೈಸೂರು.
8.	ಕಾನೂನು ಪದಕೋಶ (ಪರಿಷ್ಕೃತ) ಕನ್ನಡ- ಇಂಗ್ಲಿಷ್, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂಗಳೂರು.

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.

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.

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

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→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 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.
5. Narayanan, P., “IPR”, Eastern Law House Private Ltd, 2017.

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

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

2. 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
UC1001-1.1	**3**	**1**	-	-	**1**	-	-	-	**2**	**3**	**1**	-	-	-	-
UC1001-1.2	**3**	**1**	-	-	**1**	-	-	-	**2**	**3**	**1**	-	-	-	-
UC1001-1.3	**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**	**Course Type**	**UCC**
Teaching Hours/Week (L: T: P: S)	**09**	**Credits**	**10**
Total Teaching Hours:52	-	**CIE + SEE Marks**	**100+100**
Prerequisite			

Course Objectives:

1.	The student should complete a project using the knowledge gathered from the courses successfully completed.
2.	Conceptual development of a new idea in the field of Information Science and Engineering.

Students will carry out a detailed project in Computing either singly or in small groups to show case the extent of knowledge gained during the regular classes in the relevant and useful applications on the subject of electronic circuits, systems, using either or both hardware and software.
It is recommended that a group of 3-4 students be guided by one faculty member during this period.

Assessment Details (both CIE and SEE)

CIE procedure for project phase II is same as that of project phase I

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.	Design and model a system based on the requirements; implement, test and analyse the performance of the system.
2.	Record and document the work done.

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**
UC3001-1.1	3	2	2	3	3	2	2	2	3	1	3	3	3	3	3
UC3001-1.2	1	1	1	1	1	1	1	1	3	3	1	3	3	3	3

1: Low 2: Medium 3: High

Open Elective Courses

LIST OF OPEN ELECTIVES			
Sl No.	**Department**	**Course Codes**	**Open Elective Courses**
1	BT	BT1501-1	Bio Fuel Engineering
2	BT	BT1502-1	Solid Waste Management
3	CS	CS2501-1	Fundamentals of AI and ML
4	CS	CS2502-1	Introduction to Data Structures
5	CV	CV2501-1	Disaster Management
6	CV	CV2502-1	Environmental Hygiene, Sanitation and Waste Management
7	CV	CV2503-1	Environmental Impact Assessment
8	CV	CV2504-1	Introduction to Geoinformatics
9	CY	CY2501-1	Corrosion Science (Only for CV and ME)
10	CY	CY2502-1	Natural Products Chemistry (Only For BT)
11	EC	EC1501-1	Artificial Neural Network Systems
12	EC	EC1502-1	Introduction to MATLAB Programming: A Hands-on Approach (only for CV and BT)
13	EC	EC1503-1	Robotics
14	EC	EC2501-1	Consumer Electronics
15	EC	EC2502-1	PCB Design and Fabrication
16	EC	EC2503-1	Space Technology and Applications
17	EE	EE2501-1	Battery Management System
18	EE	EE2502-1	Biomedical Instrumentation
19	EE	EE2503-1	Electric Vehicle Technology
20	EE	EE2504-1	Fundamentals of PLC and its applications
21	EE	EE2505-1	Motors and Motor Control Circuits
22	EE	EE2506-1	Non-Conventional Energy sources
23	HU	HU1501-1	Elements of Yoga
24	HU	HU1502-1	Intellectual Property Rights
25	HU	HU1503-1	Introduction to German Language
26	HU	HU1504-1	Introduction to Japanese Language
27	HU	HU1505-1	National Cadet Corps: Organization, Functions & Capabilities
28	HU	HU1506-1	Overview of Indian Culture
29	HU	HU1507-1	Philosophy
30	HU	HU1508-1	Principles of Physical Education
31	HU	HU1509-1	Indian Culture – Dance *
32	HU	HU1510-1	Indian Culture – Music *
33	HU	HU1511-1	Engineering Ethics *
34	HU	HU1512-1	Art of Communication and Interpersonal Skills*
35	HU	HU2501-1	Common sense and Critical Thinking
36	HU	HU2502-1	Linguistics & Language Technology
37	IS	IS2501-1	Introduction to Cyber Security (except EC, EE, AM, AD, CC, CS, IS)
38	IS	IS2502-1	Python Application Programming
39	IS	IS2503-1	Software Engineering Practices
40	IS	IS2504-1	Web technologies
41	MA	MA1501-1	Graph Theory (for BT, CV, EC, EE, ME and RI)
42	MA	MA1502-1	Number Theory
43	MA	MA3501-1	Linear Algebra (for BT, CV, EE, ME and RI)

44	ME	ME1501-1	Automotive Engineering
45	ME	ME1502-1	Industrial Pollution Control
46	ME	ME1503-1	Sustainable Development Goals
47	ME	ME1504-1	Technology Innovation
48	MG	MG1501-1	Human Resource Management
49	MG	MG1502-1	Management Accounting and Control Systems
50	MG	MG1503-1	Operations and Quality Management
51	MG	MG1504-1	Organizational Behaviour
52	MG	MG1505-1	Taxation for Engineers
53	MG	MG1506-1	Working Capital Management
54	PH	PH2501-1	Nanotechnology
55	PH	PH2502-1	Optoelectronic Devices (EC, EE, CSE, ISE, AM and CC branches)
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)

*** For students admitted under Twinning Program**

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

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.

SOLID 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 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

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
BT1502-1.1	1	-	-	-	-	-	-	-	1	-	-	-
BT1502-1.2	1	1	-	-	-	1	1	-	1	-	-	-
BT1502-1.3	-	2	-	-	-	-	-	-	1	-	-	-
BT1502-1.4	-	2	-	-	-	1	1	-	1	-	-	-

BT1502-1.5	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	**CS1002-1**		

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

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

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

Outcomes												
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

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

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://www.sulabhinternational.org
3.	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

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

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

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

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

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. garwal, "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

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

	Starting MATLAB and familiarization with its user interface, syntax and semantics, ways in which MATLAB provides help, create plots in MATLAB.
	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.
	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.
	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
	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.
	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.
	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.

	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.
	Reading an image, saving, basic manipulation of images, arithmetic operations
	Pre-processing – conversion of color image to gray scale image, decomposition of color images to single color component image.
	Histogram processing.
	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

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

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

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

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

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

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

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:

	Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, "Bio-Medical Instrumentation and Measurements", II edition, Pearson Education, 2002.
	R. S. Khandpur, "Handbook of Bio-Medical instrumentation", Tata McGraw Hill Publishing CoLtd., 2003.
	J. Webster, "Medical Instrumentation", John Wiley & Sons, 1995.
	L. A. Geddes and L. E. Baker, "Principles of Applied Bio-Medical Instrumentation", John Wiley & Sons, 1975.
	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

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
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	
	Introduction to Mechanics | Coursera
	Electric Vehicles - Part 1 - Course (nptel.ac.in)
	NPTEL: Electrical Engineering - Introduction to Hybrid and Electric Vehicles
	Hybrid Vehicles (edX) | MOOC List (mooc-list.com)
	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

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	
	https://library.automationdirect.com/category/product/programmable-control/
	https://www.coursera.org/lecture/intelligent-machining/programmable-logic-controllers-plc-fGz3r
	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

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

1.	https://www.coursera.org/learn/motors-circuits-design
2.	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

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12

↓ Course Outcomes												
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

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

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

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

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

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

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

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

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

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

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

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 and to understand the security threat
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 Cyber Security — **15 Hours**

Concepts of Cyber Security, Formal Methods of Security Validation, CIA framework-Confidentiality, Integrity and Authenticity, Threat modelling, Domains of cyber security, Security attacks, Security services, Security Mechanisms, Fundamental security design principles, Types of Cyber Threat.

UNIT-II

Tools and methods used in Cybercrime — **14 Hours**

Introduction, Proxy Servers and Anonymizers, Intruders and Hackers, Insider threats, Cybercrimes. Network Threats: Active/ Passive – Interference – Interception –Impersonation – Worms –Virus – Spam's – Ad ware - Spy ware – Trojans and covert channels –Backdoors – Bots – IP, Spoofing - ARP spoofing - Session Hijacking, Introduction to Phishing, Identity Theft (ID Theft).

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.

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

1.	Comprehend the Cybercrime and its origin
2.	Analyse Security Threat Management and understand the security elements.
3.	Apply tools and methods used in Cyber crimes
4.	Analyse Phishing and ID Theft
5.	Comprehend Digital Forensics

Course Outcomes Mapping with Program Outcomes

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.	William Stallings, “Cryptography and Network Security: Principles and Practice”, Pearson Education, 2006.
2.	Swiderski, Frank and Syndex, “Threat Modeling”, Microsoft Press, 2004.
3.	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.
3.	Santosh B. J., K. V. S. S. S. S. Sairam, Shubham Kumar, Chandu Jagan Sekhar M, “Information and Cyber Security”, Scientific International Publishing House, ISBN- 978-93-5625-694-1.

PYTHON APPLICATION 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	**CS1002-1**		

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

Functions, Classes and OOP — **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-II

Lists, Tuples, and Dictionaries — **14 Hours**

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.

File Handling: Reading From Text Files, Writing to Text Files, Working with Excel Sheets ,CSV, PDF, Word,

UNIT-III

Essential Python Libraries — **11 Hours**

Working with SciPy, Numpy, Matplotlib, Pandas.

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

Program Outcomes→ ↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
IS2502-1.1	2	-	-	-	2	-	-	-	-	-	-	3
IS2502-1.2	2	-	-	-	2	-	-	-	-	-	-	3
IS2502-1.3	2	-	-	-	2	-	-	-	-	-	1	3
IS2502-1.4	-	-	-	-	-	-	-	-	-	-	-	-
IS2502-1.5	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Kenneth A. Lambert, "The Fundamentals of Python: First Programs", 2011, Cengage Learning, ISBN: 978-1111822705.

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	**CS1002-1**		

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

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	**CS1002-1**		

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

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

Graphs and Graph Models, digraphs, Konigsberg bridge problem. Special Types of Graphs: Subgraphs-spanning and induced subgraphs, complete graph, Bipartite Graphs. Isomorphism of graphs. Complement of a graph and its properties.
Connectivity-point and line connectivity. Trees and its properties.
Euler and Hamilton 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.	
Matrix 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

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, V Edition-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

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

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

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

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

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

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

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

Course Outcomes Mapping with Program Outcomes

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

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.

Course Outcomes Mapping with Program Outcomes

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.

Course Outcomes Mapping with Program Outcomes

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.

Course Outcomes Mapping with Program Outcomes

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.

Course Outcomes Mapping with Program Outcomes

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.

ENGINEERING ECONOMICS & FINANCIAL MANAGEMENT

Course Code:	**MG1507-1**	**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.	Analyse the time value of money.
2.	Evaluate the worth of creations, by comparing the alternatives visa, vis the cost (cost- benefit analysis).
3.	Take decisions with the limited resources, the relevant course of action, with the help of suitable tools.
4.	Determine the depreciated values of assets and also cost involved in each operation, a product should undergo with an aim to fix suitable selling price for the products.
5.	Know the fundamentals of Financial Management.

UNIT-I

Fundamental economic concepts	**07 Hours**
Consumer goods, Producer goods, Factors of production, Economy of organization, Demand theory, Law of demand, Exceptions to law of demand, Law of supply, Determinants of supply, Law of increasing returns and law of diminishing returns(No exercises)	
Interest	**07 Hours**
Rate of interest, Determining rate of interest, Time value of money, Simple interest, Compound interest, Nominal and effective interest rate, Equivalence involving interest, Interest formulae [single payment, uniform series and arithmetic gradient only], problems using interest formulae [discrete compounding only].	

UNIT II

Economic Analysis of Alternatives	**09 Hours**
Analysis based on: Present Worth [equal life and unequal life situations], Future Worth, Equivalent Annual Worth, Exercises. Analysis based on Rate of Return, Exercises.	
Depreciation	**04 Hours**
Causes of depreciation, Depletion, Methods of depreciation [Straight line, Declining balance, Double declining	

balance] Exercises.

Estimating and Costing	03 Hours
Components of cost [Material cost, Labour cost, Overhead expenses, Prime cost, Factory cost, Total cost], Determination of selling price of a product, Exercises.	

UNIT III

Financial management	05 Hours
Terminologies used in accounting, Journal and ledger, Profit and loss statement, Balance sheet, Understanding basic financial ratios, Simple exercises.	
Working Capital Management	**05 Hours**
Factors influencing working capital requirement, determination of operating cycle and working capital. **Capital Budgeting:** Risk analysis in Capital Budgeting	

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

1.	Explain the fundamental economic concepts.
2.	Use simple interest and compound interest to determine compounded and discounted amount.
3.	Compare the alternatives using Present Worth, Equivalent Annual Worth, Future Worth and IRR methods.
4.	Calculate the depreciated amount of a given assets using Straight line, Declining balance, Double declining g balance method. Estimate the selling price of given product.
5.	Prepare Balance Sheet & Profit and Loss account for given data of a firm. Estimate working capital. Explain capital budgeting.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MG1507-1.1	3	1	-	-	-	1	-	-	1	1	-	1
MG1507-1.2	2	3	-	-	-	1	-	-	1	1	-	1
MG1507-1.3	2	3	-	-	-	1	-	-	1	1	-	1
MG1507-1.4	2	3	-	-	-	1	-	-	1	1	-	1
MG1507-1.5	2	3	-	-	-	1	-	-	1	1	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Riggs J.L., "Engineering Economics", 4th edition, Tata McGraw-Hill, 2004.
2.	Banga and Sharma, "Mechanical Estimating and Costing", 16th edition, Khanna Publishers, 2012.
3.	I M Pandey, "Financial Management", Vikas Publishing House, 2002.

REFERENCE BOOKS:

1.	E Paul Degarmo, "Engineering Economy", Macmillan Publishing, 2001.
2.	Gerald J Thuesen & W J Fabrycky, "Engineering Economy", Prentice Hall of India, 9th ed.
3.	Tarachand, "Engineering Economics", Nemchand & Bros, 1996.

E Books / MOOCs/ NPTEL

1.	http://nptel.ac.in/courses/112107209/

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

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

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

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

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

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

VOCATIONAL EDUCATION COURSES

PYTHON PROGRAMMING FUNDAMENTALS

Course Code:	**IS1551-1**	**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**
Prerequisite	**NIL**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Construct python programs using data types and looping.
2.	Make use of python operators for manipulating lists, dictionaries and files.
3.	Design function based Python programs.
4.	Implement list, tuple related programs in Python.
5.	Write string handling programs in python

List of Experiments

1.	Experiments related to basic operation, data types and variables.
2.	Experiments related to operations of Lists, tuples and dictionaries.
3.	Experiments on writing functions and parameter passing.
4.	Experiments related to working with strings.
5.	Experiments related to file handling.

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

1.	Experiment with the basics of python programming like data types and looping
2.	Experiment string manipulation operators in programming
3.	Apply the Python operators for manipulating lists, dictionaries and files
4.	Design functions in python for modular programming
5.	Perform operations on string

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
IS1551-1.1	1	2	1	2	-	-	2	-	-	-	-	2	-	1
IS1551-1.2	-	2	-	-	-	1	-	-	-	-	-	1	-	2
IS1551-1.3	1	-	-	-	-	-	-	-	-	-	-	1	-	-
IS1551-1.4	-	1	-	2	-	1	-	-	-	-	-	1	-	-
IS1551-1.5	-	-	1	3	-	-	2	-	-	-	1	2	-	2

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Kenneth A. Lambert, "The Fundamentals of Python: First Programs", Cengage Learning, 2011.
2.	Magnus Lie Hetland, "Beginning Python from Novice to Professional", Second Edition, Apress, 2009.
3.	Mark Summerfield, "Programming in Python 3 - A Complete Introduction to the Python Language", Second Edition, Addison-Wesley, 2009.
4.	Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 2013.