Regulations and Curriculum for

Bachelor of Technology (B.Tech.)
in
Artificial Intelligence and Machine Learning

Version 2023.02

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 2023-24

NITTE
(Deemed to be University)

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

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

MISSION

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

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

Effective from

Academic Year

2023 – 2024

Curriculum for Acquiring Professional Skills (CAPS)

With Scheme of Teaching & Examination

REGULATIONS: 2023

COMMON TO ALL
B.Tech. DEGREE PROGRAMS
CHOICE BASED CREDIT SYSTEM
(CBCS)

Version 2023.02

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 interdisciplinary 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 projects.
7. Importance is given to creativity, innovation, and development of entrepreneurship skills.

Key Information

Program Title	Bachelor of Technology Abbreviated as B.Tech. Artificial Intelligence and Machine Learning
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	14ENGR02D2
Revision version	2023.02 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 Artificial Intelligence and Machine Learning and approved by the Academic Council.
Effective from	09-03-2024
Approvals	• Approved in the 54th Academic Council meeting of NITTE (Deemed to be University), held on 24.06.2023 and vide Notification of Ref: N(DU)/REG/AC-NMAMIT/2022-23/1264 dated 18.07.2023. • Approved in the 56th Academic Council meeting of NITTE (Deemed to be University), held on 23.02.2024 and vide Notification Ref: N(DU)/REG/AC-NMAMIT/2023-24/925 dated 09.03.2024.
Program offered at	NMAM Institute of Technology, Off -Campus Centre, Nitte, 574110, Karkala Taluk
Grievance and dispute resolution	All disputes arising from this set of regulations shall be addressed to the Board of Management. The decision of the Board of Management is final and binding on all parties concerned. Further, any legal disputes arising out of this set of regulations shall be limited to jurisdiction of Courts of Mangalore only

CONTENTS

PREAMBLE

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

The Bachelor of Technology (B. Tech.) Programs focus on Pursuing Excellence, Empowering people, and Partnering in Community Development. Out of fourteen 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), Robotics & Artificial Intelligence (RI), Computer Science & Engineering - Cyber Security (CB), Electronics Engineering - VLSI Design and Technology (VT), and Electronics & Communication - Advanced Communication Technology (AC), all seven eligible UG Programs i.e., BT, CS, CV, EC, EE, IS and ME are accredited by NBA, New Delhi under Tier - I category till 30th June 2025.

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

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

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

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

Efforts have been made to make the syllabus compliant with international professional societies.
As part of providing quality engineering education, at NMAMIT, Nitte, it has initiated the Choice Based Credit System (CBCS) into its academic curriculum. By this, the students can register for courses of their choice and alter the pace of learning within the broad framework of academic courses and credit requirements. CBCS allows students to plan for their academic load and alter it as they progress in learning. Students also have the option of choosing courses from a pool of courses within each classification. Ample options are given to choose interdisciplinary courses

from other programs which will help the student to develop additional skills. Slow learners will also be benefitted since important courses are offered in all semesters. This arrangement helps the students to re-register and clear the backlog courses in the subsequent semester. Suitable provisions are made for fast learners to associate them with research activities of faculty members and contribute to research beyond the working hours.

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

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

REGULATIONS

COMMON TO ALL B.Tech. (CBCS) DEGREE PROGRAMS OF NITTE (Deemed to be University)

1. INTRODUCTION

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

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

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

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

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

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

2. ELIGIBILITY FOR ADMISSION

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

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

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

2.1 Qualifications from foreign countries

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

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

3.1 Program paths, exit options.

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

- **Its mandatory to earn 10 credits through internship/Training/Specialized courses before the award of Qualification 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	(BT)
ii)	Computer Science & Engineering	(CS)
iii)	Computer Science & Engineering (Cyber Security)	(CB)
iv)	Civil Engineering	(CV)
v)	Electronics & Communication Engineering	(EC)
vi)	Electronics Engineering (VLSI Design and Technology)	(VT)
vii)	Electronics & Communication (Advanced Communication Technology)	(AC)
viii)	Electrical & Electronics Engineering	(EE)
ix)	Information Science & Engineering	(IS)
x)	Mechanical Engineering	(ME)
xi)	Artificial Intelligence and Machine Learning	(AM)
xii)	Computer and Communication Engineering	(CC)
xiii)	Robotics and Artificial Intelligence	(RI)
xiv)	Artificial Intelligence and Data Science	(AD)
Other teaching departments are –		
i)	Chemistry	(CY)
ii)	Humanities	(HU)
iii)	Management and Social Sciences	(MG)
iv)	Mathematics	(MA)
v)	Physics	(PH)

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

5. CREDIT SYSTEM

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

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

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

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

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

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

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

Lecture / Tutorials / Practical:

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

For example,

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

Example:

An LTP-C of 2-2-2-4 means 2 instructional units based on classroom lecture (L), one instructional unit of the tutorial (T), and one laboratory (P) based instructional unit all delivered during a calendar week and repeated for the entire duration of the semester to earn 4 credits (C) after passing the course.

- As advised by the faculty advisor, a student may register, between a minimum of **16 credits and up to a maximum of 28 credits.**

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

6. REGISTRATION

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

a. 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 for 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

a. 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).

b. 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.

c. 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 to fulfill 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		

a. 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 /II 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	MAT	3	0	0	3	50	50	100	3
2	BSC	PH1004-1	Quantum Computing and Modern Physics	PHY	3	0	2	3	50	50	100	4
3	ESC	CS1005-1	Introduction to Python Programming	CS	2	0	2	3	50	50	100	3
4	ESC	EC1001-1	Basic Electronics	EC	3	0	0	3	50	50	100	3
5	ETC	IS1101-1	Fundamentals of Cyber Security	CS	3	0	0	3	50	50	100	3
6	AEC	CS1651-1	IT Skills	Any Dept.	1	0	2	3	50	50	100	2
7	MNC	CV1002-1	Environmental Studies	CV	1	0	0	-	50	-	50	0
8	BSC	MA1006 – 1	Mathematics with MATLAB	MAT	0	0	2	-	50	-	50	1
TOTAL					**16**	**0**	**8**	**18**	**400**	**300**	**700**	**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

I/II 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	MA1007 – 1	Discrete Mathematics and Transform Techniques	MAT	4	0	0	3	50	50	100	4
2	BSC	CY1003-1	Materials Chemistry for Computer Systems	CHE	3	0	2	3	50	50	100	4
3	ESC	EC1002-1	Applied Digital Logic Design	EC	2	0	2	3	50	50	100	3
4	PLC	CS1004-1	Introduction to C Programming	CS	2	0	2	3	50	50	100	3
5	ESC	EE1001-2	Basic Electrical Engineering	EE	2	0	2	3	50	50	100	3
6	HSMC	HU1001-1	Technical English	HU	1	0	2	3	50	50	100	2
7	AEC	BT1651-1	Biology for Engineers	BT	1	0	0	1	50	50	100	1
8	ESC	ME1004-1	Engineering Visualization	ME	0	0	2	0	50	0	50	1
9	MNC	HU1002-1	Constitution of India	HU	1	0	0	-	50	-	50	0
TOTAL					**16**	**0**	**12**	**19**	**450**	**350**	**800**	**21**

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

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	AM	3	0	2	0	03	50	50	100	4
3	IPCC	CS2002-1	Object Oriented Programming	AM	3	0	2	0	03	50	50	100	4
4	PCC	AM2101-1	Modern Computer Architecture	AM	3	0	0	0	03	50	50	100	3
5	PCC	AM1104-1	Introduction to Machine Learning	AM	3	0	0	√	03	50	50	100	3
6	PCC	AM1602-1	Data Science & Machine Learning Lab	AM	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													
10	MNC	MA1012-1	Bridge Course – Calculus and 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/ Drawing	PBL	Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1	BSC	MA2005-1	Linear Algebra and It's Applications	MA	3	0	0	0	03	50	50	100	3
2	IPCC	CS3004-1	Design and Analysis of Algorithms	AM	3	0	2	0	03	50	50	100	4
3	IPCC	AM2001-1	Advanced Machine Learning	AM	3	0	2	0	03	50	50	100	4
4	PCC	CS2102-1	Database Management Systems	AM	3	0	0	√	03	50	50	100	3
5	PCC	AM2102-1	Operating Systems Essentials	AM	3	0	0	0	03	50	50	100	3
6	PCC	AM2601-1	Mobile Application Development	AM	0	0	2	0	03	50	50	100	1
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/AM	1	0	0	0	01	50	50	100	1
9	VEC	AMx5xx-1	Department Specific Vocational Education Course	AM	0	0	2	0	03	50	50	100	1
10	UCC	UC1001-1	Internship – I (Activity based Internship)	AM	Mandatory Intra Institutional Activity based Internship of 2 weeks duration (80 - 90 h) to be completed during the vacations of I & II Semesters. Lateral entry students have to complete the Internship - I during the vacation of III semester					100	-	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													
11	MNC	MA1014-1	Bridge Course – Discrete Math and 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/ Drawing	PBL	Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1	IPCC	AM3004-1	Neural Networks and Deep Learning	AM	3	0	2	0	3	50	50	100	4
2	IPCC	AM3003-1	Natural Language Processing	AM	3	0	2	0	3	50	50	100	4
3	PCC	AM1101-1	Artificial Intelligence	AM	3	0	0	0	3	50	50	100	3
4	PCC	AM2602-1	Projects in Internet of Things	AM	0	0	2	0	3	50	50	100	1
5	PEC	AMxxxx-x	Professional Elective – I (Group 1)	AM	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	AM	1	0	2	0	3	50	50	100	2
		HU1010-1	Research Methodology	Any Dept.	2	0	0	0					
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	AM	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/ Drawing	PBL	Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1	IPCC	AM3002-1	Computer Vision	AM	3	0	2	0	3	50	50	100	4
2	PCC	AM3101-1	Data Networking and Communication Systems	AM	3	0	0	0	3	50	50	100	3
3	PCC	AM1601-1	Angular and ReactJS Lab	AM	0	0	2	0	3	50	50	100	1
4	PEC	AMxxxx-x	Professional Elective – II (Group 1)	AM	3	0	0	0	3	50	50	100	3
5	PEC	AMxxxx-x	Professional Elective – III (Group 2)	AM	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	Any Dept.	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
Data and Visual Analytics in AI 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 Lecture	Tutorial	Practical/ Drawing	PBL	Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1	IPCC	AM3001-1	AI and ML in Healthcare	AM	3	0	2	0	3	50	50	100	4
2	PCC	AM4601-1	Generative AI and Large Language Models Lab	AM	0	0	2	0	3	50	50	100	1
3	PEC	AMxxxx-x	Professional Elective – IV (Group 1)	AM	3	0	0	0	3	50	50	100	3
4	PEC	AMxxxx-x	Professional Elective – V (Group 2)	AM	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	Any Dept	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	AM	-	-	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

a. 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.**

b. 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.

c. Project viva-voce examination shall be conducted individually.

8.6 ELECTIVES

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

b. 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).

c. 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.

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

b. **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.

c. **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.

d. **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.

e. 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.

f. 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.

a. Absolute Grading – Letter Grade and its range

The grade point scale for absolute grading

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

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

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

b. **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.

c. 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.

a. 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.

b. **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:
   i) Illness or accident, which disabled him/her from attending SEE.
   ii) A calamity in the family at the time of SEE required the student to be away from the College.
   iii) 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.
   iv) 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.

c. **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

d. **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

a. 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.

b. 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.

c. 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.

d. 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.

e. 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 the timetable for the summer semester well in advance.

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

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

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

i. 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

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

12. EVALUATION OF PERFORMANCE

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

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

CGPA is computed as follows:

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

13. COMMUNICATION OF GRADES

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

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

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

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

14.3 A Student shall be declared fail if he/she

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

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

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

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

a. 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.**

b. 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.

c. 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 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	≥ 70%	First class with Distinction
≥ 6.00	≥ 60%	First Class
5.0 ≥ CGPA <6.00	50≥ 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.

a. 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

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

b. 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 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 Mechanical Engineering

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

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

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

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

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

8. Credit

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

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

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

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

10. Choice-based credit system (CBCS)

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

11. Course Registration

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

12. Learning outcomes

a. Program Outcomes (PO) - Statements defining the skills, knowledge, and attitude that graduates of a program will be able to demonstrate upon completing the program.

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

c. Attainment of POs-COs is mapped to the POs such that attaining the course outcomes leads to the attainment of program outcomes.

13. Evaluation

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

13.1 Continuous Internal Evaluation (CIE)

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

13.2 Semester End Evaluation (SEE)

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

14. Grading

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

15. Semester Grade Point Average (SGPA)

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

16. Cumulative Grade Point Average (CGPA)

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

17. Academic Bank of Credits (ABC)

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

APPENDIX-B

Evaluation Guidelines

CIE and SEE details for various types of courses

1. Theory: PCC/IPCC/PEC/OEC

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

1.2. Continuous internal evaluation (CIE):

1.2.1. CIE (PCC/PEC/OEC)

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

1.2.2 CIE (IPCC/PBL)

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

1.2.3 Semester End Evaluation (SEE): 3 Hours Duration

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

1.2.4 CIE & SEE for various types of courses

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

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

2 Laboratory/Practical Course

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

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

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

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

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

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

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

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

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

3. Internship and Evaluation

3.1 Introduction

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

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

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

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

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

Following are the intended objectives of internship training.

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

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

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

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

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

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

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

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

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

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

(xi) Expose the students to future employers.

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

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

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

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

- A minimum of 20 credits of Internship/ Entrepreneurial activities / Project work/ Seminar and Inter/ Intra Institutional Training may be counted towards B. Tech. degree program
- Here, 1 credit is equivalent to a minimum of 40-45 hours of work. Therefore, a full-time intern is expected to spend 40 - 45 hours per week on Internship, Training, Project work, Seminar activities, etc. This will result in about 800 to 900 hours of total internship and project duration for the B. Tech program.
- To derive the benefits of an internship, it is introduced in two/ three stages of the B.Tech. program.
- Internships may be full-time or part-time; they are full-time during the summer vacation and part-time during the academic session. The curriculum is flexible to adjust internship duration. Therefore, opportunities must be provided for experiences that cannot be

anticipated when planning the course.

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

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

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

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

During the summer vacation after the 4th/ 6th semester, students are ready for industrial experience. Therefore, they may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry.

3.3 Internship Supervision

i) The internship shall be carried out under the supervision of a faculty mentor. The faculty mentor/guide should,
ii) Serve as a teacher, mentor, trainer, critic, leader, and boss.
iii) Provide sufficient time to guide the interns. (Interns are students or a trainee who does a job to gain work experience)
iv) Play a vital role, along with the Training and Placement Officer, in providing internship opportunities for the students.
v) Exhibit qualities such as leadership, strong communication skills, and patience.
vi) Provide a letter of recommendation in due consultation with students and the industrial organization (if possible) where the internship is intended to be carried out, endorsed by the authority (Principal/Institution Internship Coordinator).

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

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

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

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

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

3.4 Internship-I (Activity based Internship)

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

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

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

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

3.4.1 List of proposed activities

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

3.5 Documents to be submitted by Students for Internship Evaluation

3.5.1 Student’s Diary

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

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

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

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

3.5.2 Internship report

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

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

Procedure for the Evaluation of Internship-I

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

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

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

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

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

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

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

3.6.1 Innovation

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

3.6.2 Entrepreneurship

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

3.6.3 Incubation Center

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

3.6.4 Startup

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

An entity shall be considered a Startup

i) Up to ten years from the date of incorporation/ registration, if it is incorporated as a private limited company (as defined in the Companies Act, 2013) or registered as a partnership firm (registered under section 59 of the Partnership Act, 1932) or a limited liability partnership (under the Limited Liability Partnership Act, 2008) in India.
ii) Turnover of the entity for any of the financial years since incorporation/ registration has not exceeded one hundred crore rupees.
iii) The entity is working towards innovation, development, or improvement of products or processes, or services, or if it is a scalable business model with a high potential for employment generation or wealth creation.
iv) Provided that an entity formed by splitting up or reconstruction of an existing business shall not be considered a Startup.

3.6.5 Societal (Social) related activities

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

i) (Swachch Bharat: Swachh Bharat Mission, Swachh Bharat Abhiyan, or Clean India Mission is a country-wide campaign to eliminate open defecation and improve solid waste management.
ii) Accessible India: Accessible India Campaign or Sugamya Bharat Abhiyan is a program to serve the differently able community of the country.
iii) Digital India: A campaign to ensure the Government's services are made available to citizens electronically by improved online infrastructure and by increasing Internet connectivity or making the country digitally empowered in the field of technology.
iv) Beti Bachao and Beti Padhao: A campaign of the Government of India that aims to generate awareness and improve the efficiency of welfare services intended for girls in India.
v) Environment and Energy Conservation and Education, legal aid, consumer protection, and allied field including Indian Red Cross Society, National Cadet Corps, Bharat Scouts, and Guides.

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

vi) PO-6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
vii) PO-7: Environment and Sustainability: Understand the impact of the professional engineering solution in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development. The long-term goal under Societal (social work) related activities, particularly in a rural area, results in a rural internship. In urban areas, the student may adopt slum/ economically weaker section areas for short duration social internship to uplift the living conditions.

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

3.6.6 Places for Innovation/Entrepreneurial Activities

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

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

3.6.7 Industrial Internships

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

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

3.6.7.1 Industry Internship Benefits

i) Have ample opportunities to attend seminars, symposiums, workshops, etc. This in turn provides an opportunity to establish rapports with professionals and pioneers in their respective fields for further growth.
ii) Have wide scope to publish paper/s in journals.
iii) Good recommendation letter/s that increase the prospectus for further internships, higher studies, and placements.
iv) Helps to acquire team spirit, motivated acts, techniques to resolve conflicts, etc.
v) Helps to develop a lot of leadership skills.
vi) Increases the prospect of placement in the same concern, provided the intern has exhibited a clear understanding of basics and completed the internship.
vii) Fosters to substantiate the issues with facts and figures.

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

3.6.8 Assessment Rubrics for Innovation / entrepreneurship/ Societal Internship Activities

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

Table – B3 Innovation/entrepreneurship/ Societal Internship Activities and Assessment Rubrics
Scheduled during the intervening period of IV & V semester and VI & VII Sem
(Prescribed Period 08 weeks: Credits 08)

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

3.7 Research Internships / Extended Industry Internships

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

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

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

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

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

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

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

3.7.8 Necessary Skills for Research Internship and Industrial Internship

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

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

3.7.9 Responsibilities of an Intern

Interns,

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

3.7.10 Research internship Outcomes

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

3.7.11 Research internships Benefits

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

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

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

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

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

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

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

4.6 Continuous Internal Evaluation (CIE)

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

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

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

4.7 Recommendation letter

The guide must state whether the intern,

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

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

4.8 Assessment of CIE marks

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

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

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

4.9 Assessment of SEE marks

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

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

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

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

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

NITTE (Deemed to be University) | 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

B.Tech. Syllabus

Effective from

Academic Year

2023 – 2024

Curriculum for Acquiring Professional Skills (CAPS)

With Scheme of Teaching & Examination

VISION

To be a center of excellence in Artificial Intelligence and Machine Learning Engineering education and research, to produce comprehensively trained, technically skilled, ethically strong, innovative engineers to excel globally, take future challenges and contribute to social welfare.

MISSION:

- To provide excellent academic environment to students for continuous improvement in Computer Science, Artificial Intelligence and Machine learning specialization by imparting education with innovation, skills, and positive attitude to make them competent engineers and leaders to solve the real-world problems to inculcate values of professional ethics, leadership qualities and lifelong learning.
- To strengthen the industry partnership for collaborative work and prepare graduates in cutting edge Artificial Intelligence technologies in par with industrial standards by undertaking collaborative projects which offer opportunities for long term interaction between academia and industry.
- To inculcate research, ethical values, professionalism, lifelong learning to make them globally competent and socially committed.
- To provide resources that contribute to congenial learning environment and encourage students to pursue higher education and take competitive exams.

Program Educational Objectives (PEOs)

After few years of graduation, the graduates of B. E in **Artificial Intelligence & Machine Learning** will:

1. Demonstrate technical skills, competency in computer science, artificial intelligence and machine learning and exhibit team management capability with effective communication and responsibility in their career.
2. Emerge as engineering professionals, innovators or entrepreneurs engaged in technology deployment and support the growth of economy of a country with a lifelong learning attitude.
3. Use basic science and engineering ideas to carry out research, pursue higher studies in the multidisciplinary areas to address the basic needs of the society.

Program Outcomes (POs):

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. 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.

4. 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.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

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.

7. 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.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. 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.

11. 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.

12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

1. Gain both theoretical and practical knowledge of human cognition, Artificial Intelligence, Machine Learning, Deep learning and data engineering for designing intelligent systems.
2. Apply computational knowledge, tools, techniques and project development skills to provide innovative solutions for social wellbeing.

Course Numbering Scheme

Branch Code		**Course Level**	**Course Code**			**Separator**	**Version**
Letter	**Letter**	**Number**	**Number**	**Number**	**Number**	**-**	**Number**
Branch Code	ME is 2 Letter code for the Department of Mechanical 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.

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	MAT	3	0	0	3	50	50	100	3
2	BSC	PH1004-1	Quantum Computing and Modern Physics	PHY	3	0	2	3	50	50	100	4
3	ESC	CS1005-1	Introduction to Python Programming	CS	2	0	2	3	50	50	100	3
4	ESC	EC1001-1	Basic Electronics	EC	3	0	0	3	50	50	100	3
5	ETC	IS1101-1	Fundamentals of Cyber Security	CS	3	0	0	3	50	50	100	3
6	AEC	CS1651-1	IT Skills	Any Dep	1	0	2	3	50	50	100	2
7	MNC	CV1002-1	Environmental Studies	CV	1	0	0	-	50	-	50	0
8	BSC	MA1006 - 1	Mathematics with MATLAB	MAT	0	0	2	-	50	-	50	1
TOTAL					**16**	**0**	**8**	**18**	**400**	**300**	**700**	**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

II 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	MA1007 – 1	Discrete Mathematics and Transform Techniques	MAT	4	0	0	3	50	50	100	4
2	BSC	CY1003-1	Materials Chemistry for Computer Systems	CHE	3	0	2	3	50	50	100	4
3	ESC	EC1002-1	Applied Digital Logic Design	EC	2	0	2	3	50	50	100	3
4	PLC	CS1004-1	Introduction to C Programming	CS	2	0	2	3	50	50	100	3
5	ESC	EE1001-2	Basic Electrical Engineering	EE	2	0	2	3	50	50	100	3
6	HSMC	HU1001-1	Technical English	Any Dept.	1	0	2	3	50	50	100	2
7	AEC	BT1651-1	Biology for Engineers	BT	1	0	0	1	50	50	100	1
8	ESC	ME1004-1	Engineering Visualization	ME	0	0	2	0	50	0	50	1
9	MNC	HU1002-1	Constitution of India	HU	1	0	0	-	50	-	50	0
TOTAL					**16**	**0**	**12**	**19**	**450**	**350**	**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	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

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's theorem (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 irrrotational 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

Mode of Teaching and Learning:

Class room teaching.
Use of mathematical softwares (such as MATLAB, MATHEMATICA, SAGE, ETC.) as teaching aid.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and of Semester End Exam (SEE) is 50%. The student must obtain a minimum of 40% marks, individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this, grades will be awarded

Continuous Internal Evaluation:

1.	Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2.	The class teacher must decide the topics for closed book test and Written Quiz. The methods of CIE for the subject must be announced at the beginning of the course.

Semester End Examination:

There will be **8** questions of **20** marks each in the question paper categorized into **3 Units** as per the syllabi & contact hours. The student will have to answer **5** full questions, selecting **2** full questions each from **Unit - I** & **Unit – II** and **1** full question from **Unit – III**.

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/*

QUANTUM COMPUTING AND MODERN PHYSICS

Course Code:	**PH1004 -1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L:T:P: S):	**2:2:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Physics

Course Objectives:

1.	To study the principles of quantum mechanics and its application in quantum computing
2.	To study the concepts of semiconductors and semiconductor devices
3.	To study the properties of superconductors and their applications
4.	To understand the principle, working and applications of lasers.
5.	To understand the principle, working and applications of optical fibers.

UNIT-I

Quantum Computing **15 Hours**

Fundamentals of Quantum Mechanics:

Introduction to Quantum mechanics. Fundamental postulates of QM: Representation of states, dynamical variables - Adjoint of an operator. Eigen value problem - degeneracy. Eigenvalues and Eigenfunctions. Completeness and normalization of eigen functions. Closure. Physical interpretation of Eigen values, Eigen functions and expansion coefficients

Matrix formulation of quantum mechanics.

Matrix formalism of quantum mechanics: Linear vector spaces - orthogonality and linear independence, bases and dimensions, completeness, Hilbert's spaces. Hermitian operators. Bra and Ket notations for vectors. Representation theory, Schwartz inequality.

Dirac representation and matrix operations:

Matrix representation of 0 and 1 States, Identity Operator I, Applying I to$|0\rangle$and $|1\rangle$ states, Pauli Matrices and its operations on $|0\rangle$and $|1\rangle$states, Explanation of i) Conjugate of a matrix and ii) Transpose of a matrix. Unitary matrix U, Examples: Row and Column Matrices and their multiplication (Inner Product), Probability, and Quantum Superposition, normalization rule. Orthogonality, Orthonormality. Numerical Problems

Principles of Quantum Information & Quantum Computing:

Introduction to Quantum Computing, Moore's law & its end, Differences between Classical & Quantum computing. Concept of qubit and its properties. Representation of qubit by Bloch sphere. Single and Two qubits. Extension to N qubits.

Quantum Gates: Single Qubit Gates: Quantum Not Gate, Pauli – X, Y and Z Gates, Hadamard Gate, Phase Gate (or S Gate), T Gate

UNIT-II

Electrical Properties of Materials: 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. **p-n junction:** Junction formation, Unbiased and biased p-n junction, Devices: LED, Photodiode and solar cell.

Electrical Properties of Materials: Superconductors **4 Hours**

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

UNIT-III

Photonics: Lasers **05 Hours**

Introduction to lasers, Characteristics of LASER, Interaction of radiation with matter, Einstein's coefficients, Requisites of a Laser System. Conditions for Laser action. Principle, Construction and

Working of Nd:YAG laser and Semiconductor laser. Application of Lasers in Bar code scanner and Laser Printer. Numerical Problems.

Photonics: Optical Fibers	**05 Hours**

Introduction to optical fibers, Principle of Optical Fibers (TIR), Propagation mechanism in optical fibers - Angle of Acceptance and Numerical Aperture(N.A.), Expression for NA, Fractional Index Change, Modes of Propagation, Number of Modes and V Number, Types of Optical Fibers, Attenuation and Mention of Expression for Attenuation coefficient, Attenuation Spectrum of an Optical Fiber- Optical Windows. Discussion of Block Diagram of Point-to-Point Communication, Intensity based Fiber Optic Displacement Sensor, Merits and Demerits, Numerical problems.

List of Experiments

1.	Energy gap of a semiconductor by four-probe technique.
2.	Hall effect
3.	I-V characteristics of Zener diode
4.	Dielectric constant by charging and discharging of a capacitor.
5.	Solar cell characteristics.
6.	Semiconductor laser - Determination of wavelength by diffraction.
7.	Determination of acceptance angle and numerical aperture of the given Optical Fiber.
8.	Photo electric effect – Determination of the work function of the material of the emitter of a photocell.
9.	Photo-Diode characteristics
10.	LED characteristics and determination of Planck’s Constant using LEDs.

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

1.	**Describe** the fundamental principles of the Quantum Mechanics and quantum computing
2.	**Summarize** the properties of semiconductors and the working principles of semiconductor devices.
3.	**Summarize** the essential properties of superconductors and its applications.
4.	**Describe** the principles of LASERS and their relevant applications.
5.	**Describe** the principles of Optical fibers and their relevant 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															
PH1004-1.1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
PH1004-1.2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
PH1004-1.3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
PH1004-1.4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
PH1004-1.5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Parag K Lala, “Quantum Computing – A Beginner’s Introduction”, Indian Edition, McGraw Hill, Reprint 2020.
2.	B. G. Streetmann, “Solid State Electronic devices”, 6th edition, Prentice Hall India Learning Private Limited.
3.	A. Ghatak, “Optics”, Tata McGraw Hill Pub., 5th Edition, 2012.

REFERENCE BOOKS:

1.	Michael A. Nielsen & Isaac L. Chuang, “Quantum Computation and Quantum Information”, Cambridge Universities Press, 2010 Edition.
2.	Vishal Sahani, “Quantum Computing”, McGraw Hill Education, 2007 Edition.
3.	Maria Luisa Dalla Chiara, Roberto Giuntini, Roberto Leporini, Giuseppe Sergioli, “Quantum Computation and Logic: How Quantum Computers Have Inspired Logical

	Investigations", Trendsin Logic, Volume 48, Springer.
4.	Gupta and Kumar, "Solid State Physics", K. Nath & Co., Meerut.
5.	A. J. Dekker, "Electrical Engineering Materials", Prentice Hall India Pub., New Delhi, Reprint 2011.
6.	S. O. Pillai, "Solid State Physics", New Age International Private Limited, 8th Edition, 2018.
7.	M. Ali. Omar, "Elements of Solid State Physics: Principles and Applications", Pearson Publishers.
8.	Arthur Beiser, "Concepts of Modern Physics", Tata McGraw Hill Education Private Limited, Special Indian Edition, 2009.
9.	Kenneth Krane, "Modern Physics", Wiley International, 3rd Edition, 2012.
10.	Michael Tinkham, "Introduction to Superconductivity", II Edition, McGraw Hill, INC
E Books / MOOCs/ NPTEL/ Web links	
1.	LASER: https://www.youtube.com/watch?v=WgzynezPiyc
2.	Superconductivity : https://www.youtube.com/watch?v=MT5Xl5ppn48
3.	Optical Fiber : https://www.youtube.com/watch?v=N_kA8EpCUQo
4.	Quantum Mechanics : https://www.youtube.com/watch?v=p7bzE1E5PMY&t=136s
5.	Quantum Computing : https://www.youtube.com/watch?v=jHoEjvuPoB8
6.	Quantum Computing :https://www.youtube.com/watch?v=ZuvCUU2jD30
7.	Physics of Animation : https://www.youtube.com/watch?v=kj1kaA_8Fu4
8.	Statistical Physics Simulation : https://phet.colorado.edu/sims/html/plinko-probability/latest/plinkoprobability_en.html
9.	NPTEL Supercoductivity:https://archive.nptel.ac.in/courses/115/103/115103108/
10.	NPTEL Quantum Computing : https://archive.nptel.ac.in/courses/115/101/115101092
11.	Virtual LAB :https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
12.	Virtual LAB : https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning	
1.	http://nptel.ac.in
2.	https://swayam.gov.in
3.	https://virtuallabs.merlot.org/vl_physics.html
4.	https://phet.colorado.edu
5.	https://www.myphysicslab.com

INTRODUCTION TO PYTHON PROGRAMMING

Course Code:	**CS1005-1**	**Course Type:**	**PLC**
Teaching Hours/Week (L: T: P: S):	**2:0:2**	**Credits:**	**03**
Total Teaching Hours:	**25**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Computer 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.	Design list, tuple related programs in Python.
5.	Write string handling programs in python.

UNIT-I

Introduction | **10 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 python, basic syntax, interactive shell, editing, saving, and running a script.
The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages;
Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit evaluation

UNIT-II

Data structure and function | **10 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.
FUNCTIONS
Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Recursive functions, Lambda functions.
Introduction to Object oriented concepts – Class, object and member function

UNIT-III

Strings and text files | **06 Hours**

STRING MANIPULATIONS: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa, Binary, octal, hexadecimal numbers
Manipulating files and directories, text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).

Suggested 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	3
CS1005-1.1	1	2	1	2	-	-	2	-	-	-	-	2	-	1	1
CS1005-1.2	-	2	-	-	-	1	-	-	-	-	-	1	-	2	-
CS1005-1.3	1	-	-	-	-	-	-	-	-	-	-	1	-	-	1
CS1005-1.4	-	1	-	2	-	1	-	-	-	-	-	1	-	-	-
CS1005-1.5	-	-	1	3	-	-	2	-	-	-	1	2	-	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

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.

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 — **07 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 — **08 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

FUNDAMENTALS OF CYBER SECURITY

Course Code:	**IS1101-1**	**Course Type:**	**ETC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Define the area of cybercrime and forensics.
2.	Explain the motive and causes for cybercrime, detection, and handling.
3.	Investigate Areas affected by cybercrime.
4.	Illustrate tools used in cyber forensic

UNIT-I

Introduction to Cybercrime — **15 Hours**

Cybercrime - Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cyber Crimes. [T1: 1.1-1.5]

Cyber offenses: How Criminals Plan Them

How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing. [T1: 2.1-2.8]

Mobile and Wireless Devices

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops. [T1: 3.1-3.12]

UNIT-II

Tools and methods used in Cybercrime — **14 Hours**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. [T1: 4.1-4.12]

Phishing and Identity Theft

Introduction to Phishing, Identity Theft (ID Theft). [T1: 5.1-5.3]

UNIT-III

Understanding Computer Forensics — **11 Hours**

Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics. [T1: 7.1-7.19]

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

1.	Comprehend the Cybercrime and its origin

2.	Analyse the cybercrimes in mobile and wireless devices
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 & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
IS1101-1.1	2	-	-	-	-	1	-	3	-	-	-	-	-	-	-
IS1101-1.2	-	3	-	1	-	2	-	-	2	-	-	-	-	-	-
IS1101-1.3	-	3	2	-	-	-	-	-	-	-	-	-	-	-	-
IS1101-1.4	2	-	-	-	-	2	-	-	-	-	-	-	-	-	-
IS1101-1.5	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013.

REFERENCE BOOKS:

1.	Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions", John Wiley & Sons, Inc, ISBN: 978 -1-118 -84965 -1, 2014.
2.	James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials", CRC Press, 15-Dec 2010. Anti- Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw-Hill.
3.	Mr. Santosh BJ, Dr. K.V. S.S.S.S. Sairam, Mr. Shubham Kumar, Mr. Chandu Jagan Sekhar M, "Information and Cyber Security", Scientific International Publishing House, ISBN- 978-93-5625-694-1.

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

Mathematics with MATLAB

Course Code:	**MA1006-1**	**Course Type**	**B.Sc.**
Teaching Hours/Week (L: T: P: S)	**0:0:2:0**	**Credits**	**01**
Total Teaching Hours	**0+0+26+0**	**CIE Marks**	**100**
Prerequisite	**MA1002-1**		

Teaching Department: Mathematics

Course Objectives:

1. Understand the use of the basic operators, some built-in functions of MATLAB.
2. Create and work with arrays
3. Create and display simple plots
4. Solve by Symbolic and Numerical computation techniques

List of Experiments

1 Introduction to MATLAB: Basic Operators: Arithmetic, Logical and Relational operators. Elementary math functions such as algebraic, trigonometric, logarithmic, exponential functions, Conditions and Loops.
2 Symbolic Computation, plotting curves, surfaces and vector fields.
3 Differentiation of composite and implicit functions.
4 Taylor’s/ Maclaurin’s series expansion of a function of single variable.
5 Computation of partial derivatives and Jacobians
6 Evaluation of double/triple integrals with constant/variable limits.
7 Computation of angle between (a) radius vector and tangent; (b) two curves
8 Computation of radius of curvature
9 Computation and visualization of (a) gradient of a scalar function; (b) divergence and curl of a vector function
10 Solution (with solution curve) of first order ordinary differential equation
11 Solution (with solution curve) of second and higher order linear differential equation with constant coefficients

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

1. Write and compile simple MATLAB codes. Implement basic operators and conditions and loops effectively.
2. Construct MATLAB programs gradually for the mathematics concept they are studying In theory.
3. Appreciate the pictorial representation of the mathematics concept.

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**
MA1006-1-1.1	3	2		-	-	-	-	-	-	-	-	-	-	-	-
MA1006-1-1.2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-

MA1006-1-1.3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:	
1.	Rudra Pratap, “MATLAB”, OXFORD University press, 2010
2.	Dorothy C. Attaway Ph.D, A practical introduction to prog. And problem solving , 5th edition

E Resources	
1.	https://www.mathworks.com › matlab › matlab_prog
2.	https://www.coursera.org/specializations/mathematics-engineers
3.	https://www.coursera.org/specializations/matlab-programming-engineers-scientists
4.	https://www.coursera.org/learn/matlab

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DISCRETE MATHEMATICS AND TRANSFORM TECHNIQUES

Course Code:	**MA1007 - 1**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P: S):	**4:0:0:0**	**Credits:**	**04**
Total Teaching Hours:	**50+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

Logics	**8 Hours**

Propositional logic, logical operations, Rules of inference, Predicates calculus. Methods of Proof: Direct, Indirect and Proof by Contradiction and Contrapositive. Proofs by Mathematical Induction (both weak and strong inductions).

UNIT-II

Set Theory And Graph Theory **11 Hours**

Relations- Relations and Digraphs, Properties of Relations, Equivalence Relations, Transitive Closure and Warshall's Algorithm.

Functions- permutations functions, functions for computer science.

Graphs: Basic terminologies, simple graphs, complete graphs, bipartite graphs. Adjacency matrices, incidence matrices and graph isomorphism. Connectivity- vertex and edge connectivity. Euler and Hamiltonian graphs and their applications. Planar graphs, graph coloring and their applications.

UNIT-III

Numerical Methods **11 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.

UNIT-IV

Fourier Series and Fourier Transform **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.

UNIT-V

Z-Transforms **10 Hours**

Z-transforms of standard functions, Bilateral Z- Transform. ROC, linearity, Time shift, Convolution, Scaling & Differentiation in Z-Domain, Time reversal property, Initial and Final Value Theorems.

Inverse Z-transform: Partial Fraction Method, Power series/ division method, Contour integral Method.

Unilateral Z-Transform: Properties, Solution of difference equations.

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

1.	Establish by deduction the validity of an argument using inference rules.
2.	Represent a relation in terms of matrix and digraph, apply permutation functions for encoding and decoding simple text massages. 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 and partial differential equations.
4.	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.
5.	Apply the concepts of Z- 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
MA1007 - 1.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1007 - 1.2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1007 - 1.3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1007 - 1.4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1007 - 1.5	3	2	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

Mode of Teaching and Learning:

Class room teaching.

Use of mathematical softwares (such as MATLAB, MATHEMATICA, SAGE, ETC.) as teaching aid.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and of Semester End Exam (SEE) is 50%. The student must obtain a minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this, grades will be awarded.

Continuous Internal Evaluation:

1.	Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2.	The class teacher must decide the topics for closed book test and Written Quiz. The methods of CIE for the subject must be announced at the beginning of the course.

Semester End Examination:

There will be **8** questions of **20** marks each in the question paper categorized into **3 Units** as per the syllabi & contact hours. The student will have to answer **5** full questions, selecting **2** full questions each from **Unit - I** & **Unit – II** and **1** full question from **Unit – III**.

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.
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)

MATERIALS CHEMISTRY FOR COMPUTER SYSTEMS

Course Code:	**CY1003-1**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T:P: S):	**2:2:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Chemistry

Course Objectives:

1.	To enable students to acquire knowledge on principles of chemistry for engineering applications.
2.	To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
3.	To provide students with a solid foundation in analytical reasoning required to solve societal problems.

UNIT-I

Electrode & Energy Systems	8 Hours

Electrode System: Introduction to galvanic cell. Reference electrode - Introduction, calomel electrode – construction, working and applications. Concentration cell –Definition, construction, working, and numerical problems. Ion selective electrode–definition, construction, and advantages of glass electrode, determination of pH using glass electrode.

Energy Systems: Introduction to batteries, construction, working and applications of Lithium ion, and Sodium ion batteries. Fuel cells, Construction, working and applications of methanol-oxygen fuel cell.

Polymers & Analytical Techniques	07 Hours

Polymers: Introduction, Molecular weight –Number average, weight average and numerical problems. Preparation, properties, and commercial applications of carbon fibre. Conducting polymers– synthesis and conducting mechanism of polyaniline and commercial applications.

Analytical Techniques: Principle and instrumentation of Conductometry; its application in the estimation of weak acid and strong acid. Principle and instrumentation of Potentiometry; its application in the estimation of iron.

UNIT-II

Sensors and PCB	07 Hours

Sensors: Introduction, working, principle and applications of Conductometric sensors, Electrochemical sensors, Thermometric sensors (Flame photometry) and Optical sensors(colorimetry). Sensors for the measurement of dissolved oxygen (DO). Electrochemical sensors for pharmaceuticals.

Electrochemical gas sensors for SOx and NOx. Disposable sensors in the detection of biomolecules and pesticides.

Printed Circuit Boards: Electroless plating – Introduction, Electroless plating of copper in the manufacture of double-sided PCB and its applications.

Memory Devices and Display Systems	08 Hours

Memory Devices: Introduction, Basic concepts of electronic memory, History of organic/polymer electronic memory devices, Classification of electronic memory device, types of organic memory devices (organic molecules, polymeric materials, organic-inorganic hybrid materials).

Display Systems: Photoactive and electroactive materials, Nanomaterials and organic materials used in optoelectronic devices. Liquid crystals (LC's)- Introduction, types, properties and applications in Liquid Crystal Displays (LCD's)- Electro-optic effect, Properties, and application of Organic Light Emitting Diodes (OLED's) and Quantum Light Emitting Diodes (QLED's), Light emitting electrochemical cells.

UNIT-III

E-Waste Management & Green Fuels	10 Hours

E-Waste: Introduction, sources of e-waste, Composition, Characteristics, and Need of e-waste management. Toxic materials used in manufacturing electronic and electrical products, health hazards due to exposure to e-waste. Recycling and Recovery: Different approaches of recycling (separation, thermal treatments, hydrometallurgical extraction, pyrometallurgical methods, direct recycling). Extraction of gold from E-waste. Role of stake holders in environmental management of e-waste (producers, consumers, recyclers, and statutory bodies).

Green Fuels: Introduction, construction and working of solar photovoltaic cell, advantages, and disadvantages. Generation of energy (green hydrogen) by electrolysis of water and its advantages.

Suggested List of Experiments

1. Determination of strength of an acid in Pb-acid battery (Demonstration).
2. Determination of Total Hardness of a sample of water using disodium salt of EDTA.
3. Estimation of iron in TMT bar by diphenyl amine/external indicator method.
4. Synthesis of polyurethane (Demonstration).
5. Conductometric estimation of strong acid with standard NaOH solution.
6. Potentiometric estimation of FAS using standard $K_2Cr_2O_7$solution.
7. Determination of pKa of vinegar using pH sensor (Glass electrode).
8. Determination of the viscosity coefficient of a given liquid using Ostwald’s viscometer.
9. Estimation of Copper present in electroplating effluent by optical sensor (colorimetry).
10. Colorimetric determination of iron.
11. Conductometric estimation of a weak acid using standard NaOH solution.
12. Estimation of Sodium present in soil/effluent sample using flame photometer.
13. Synthesis of biodiesel (Demonstration).
14. Synthesis of Iron-oxide Nano particles (Demonstration).

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

1. Identify the terms processes involved in scientific and engineering and applications.
2. Explain the phenomena of chemistry to describe the methods of engineering processes.
3. Solve the problems in chemistry that are pertinent in engineering applications.
4. Apply the basic concepts of chemistry to explain the chemical properties and processes.
5. Analyze properties and multi processes associated with chemical substances in disciplinary situations.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
CY1003-1.1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CY1003-1.2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CY1003-1.3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CY1003-1.4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CY1003-1.5	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. P. C. Jain & Monica Jain, “Engineering Chemistry”, Dhanpat Rai Publications, New Delhi, 2015.
2. R. V. Gadag and Nityananda Shetty, “A Text Book of Engineering Chemistry”, 2nd Edition, I. K. International Publishing house, 2016.
3. S. S. Dara & S. S. Umare, “A Textbook of Engineering Chemistry”, 12th Edition, S. Chand & Company Ltd., 2011.

REFERENCE BOOKS:

1. Baskar, “Wiley Engineering Chemistry”, 2nd Edition, Wiley India Pvt. Ltd, New Delhi, 2013.
2. Satya Prakash & Manisha Agrawal, “Engineering Chemistry”, Khanna Book Publishing, Delhi.
3. Bahl & Tuli, “Essentials of Physical Chemistry”, S. Chand Publishing.
4. Sunita Rattan, “Applied Chemistry”, Kataria.
5. D. Grour Krishana, “Engineering Chemistry – I”, Vikas Publishing.
6. F. W. Billmeyer, “Text Book of Polymer Science”, John Wiley & Sons, 4th Edition, 1999.
7. G. A. Ozin & A. C. Arsenault, “Nanotechnology A Chemical Approach to Nanomaterials”, RSC

	Publishing, 2005.
8	Kirby W. Beard, “Linden's Handbook of Batteries”, Fifth Edition, Mc GrawHill, 2019.
9	Takatoshi Tsujimura, “OLED Display Fundamentals and Applications”, Wiley–Blackwell, 2012.
10	MaxLu, Francois Beguin, Elzbieta Frackowiak, “Super capacitors: Materials, Systems, and Applications”, Wiley-VCH;1stedition, 2013.
11	H. Panda, “Handbook on Electroplating with Manufacture of Electro-chemicals”, ASIAPACIFIC BUSINESS PRESS Inc., 2017.
12	Sudharani, “Laboratory manual in Engineering Chemistry”, Dhanpat Rai Publishing Company, New Delhi.
13	“Expanding the Vision of Sensor Materials”, National Research Council 1995, Washington, DC: The National Academies Press. doi:10.17226/4782.
14	Mahesh B and Roopa Shree B, “Engineering Chemistry”, Sunstar Publisher, Bengaluru, ISBN978-93-85155-70-3, 2022
15	F. H. Froes,et al., “High Performance Metallic Materials for Cost Sensitive Applications”, John Wiley & Sons, 2010.
16	K. R. Mahadik and L. Satyanarayana, “Instrumental Methods of Analysis”, Nirali Prakashan, 2020.
17	Douglas A. Skoog, F. James Holler, Stanley R. Crouch, “Principles of Instrumental Analysis”, Seventh Edition, Cengage Learning, 2020.
18	V R Gowariker, N V Viswanathan, Jayadev, Sreedhar, “Polymer Science”, NewageInt. Publishers, 4th Edition, 2021.
19	Hari Singh, “Nanostructure materials and nanotechnology”, Nalwa, Academic press, 1st Edition, 2002.
20	O. G. Palanna, “Engineering Chemistry”, Tata McGraw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
E Books / MOOCs/ NPTEL	
1.	http://libgen.rs/ • https://nptel.ac.in/downloads/122101001/
2.	https://nptel.ac.in/courses/104/103/104103019/ • https://ndl.iitkgp.ac.in/.
3.	https://www.youtube.com/watch?v=faESCxAWR9k

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:	**25+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	To understand the basics of Number Systems, Logic Gates and Boolean Functions.
2.	To understand simplification of the Boolean Equations using Boolean Algebra, Karnaugh Maps and QM method.
3.	To design combinational Logic Circuits like Adders/Subtractors, Binary Comparators, Decoders, Encoders, and Multiplexers.
4.	To understand the operation of Flip-Flops, Master-Slave Flip-Flops and Conversion of Flip Flops.
5.	To design Shift Registers and Counters.

UNIT-I

Fundamentals of Digital Design — **10 Hours**

Difference between Analog and Digital Signals, Number Systems: Decimal, Binary, Octal and Hexadecimal. Binary Addition and Subtraction, Digital Logic Gates, Boolean Algebra, Boolean Functions: Canonical Forms, Completely and Incompletely Specified Functions, Simplification of Boolean Functions using Boolean Algebra, Karnaugh Map and Quine-McCluskey Method, Realization of Boolean functions using Basic Gates and Universal Gates.

UNIT-II

Combinational Logic and Sequential Logic Circuits — **10 Hours**

Introduction to Combinational Logic Circuits, Half/Full Adders/Subtractors, Parallel Adders/Subtractors, Binary Comparators, Decoders, Encoders, Multiplexers.

Basic Bistable Element, SR Flip-Flop, D Flip Flop, JK Flip Flop, T Flip Flop, Master Slave JK Flip Flop, Characteristic Equations, Conversion of Flip Flops.

UNIT-III

Applications of Flip Flops — **05 Hours**

Design of Shift Register using D- flip flop, Design of Counters: Asynchronous counters using T-flip flop, Synchronous Counters using D-flip flop and T 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.
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; Analyze Boolean functions.
2.	Simplify the logic expressions using Boolean Algebra or K-Map or QM Method; Realize the logic expressions using Basic/Universal Gates.
3.	Analyze and Design different Combinational Logic Circuits such as Adders, Subtractors, Binary Comparators, Decoders, Encoders and Multiplexers.
4.	Describe the operation of Flip Flops, Mater-Slave Flip Flops and Conversion of Flip Flops.
5.	Make use of Flip Flops to design Shift Registers and 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

INTRODUCTION TO C PROGRAMMING

Course Code:	**CS1004-1**	**Course Type:**	**PLC**
Teaching Hours/Week (L: T: P: S):	**2:0:2**	**Credits:**	**03**
Total Teaching Hours:	**25+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Computer Science & Engineering

Course Objectives:

1.	Make students learn the basics of C programming language including the basic data types, Operators and Evaluating expressions in C.
2.	Apply the concepts of decision making and looping in problem solving to demonstrate its usage using simple programs.
3.	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.
4.	Demonstrate the usage of Strings and Structures
5.	Demonstrate the usage of Pointers, and File handling that are essential for understanding the concepts with simple examples.

UNIT-I

Introduction To C Programming Language	**10 Hours**

Basic C DataTypes, operators, Operator precedence, Arithmetic expressions and type conversion.

Decision Making and Branching:

Decision making with if statement, Nesting of if…else statements, ternary operator, 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.

UNIT-II

Arrays	**10 Hours**

Arrays (1-D, 2-D) Initialization and Declaration.

User-Defined Functions

Argument Passing – call by value, call by reference, Category of Functions. Managing Command line arguments

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

Strings

Declaring and Initializing strings, String manipulation functions.

UNIT-III

Structures	**06 Hours**

Structures and Unions: Usage and nesting, Array of Structures

Pointers and File Handling:

Accessing of variables using Pointers, array of pointers
Basic file operations: Open, Close, Read, Write, Append and concatenate

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 using string manipulation functions.
6.	Write a C program to input N real numbers in 1-D array. Compute mean, variance and Standard Deviation. [Mean= sum/N, Variance = Σ (Xi-mean) 2 /N, STD Deviation= √variance.]
7.	Write a C program to read N integers into an array A and find the sum of elements using pointers.
8.	Write a C program to copy contents of one file to another file.

PART B

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.
9.	Write a program to demonstrate the use of pointers and files.

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

1.	Describe the basics of C and the process of problem-solving aspects using algorithmic solution for a given problem. Apply the knowledge of expression solving to evaluate simple expressions and input/output statements to develop a C program.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→													**PSO↓**

↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CS1004-1.1	3	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CS1004-1.2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CS1004-1.3	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CS1004-1.4	2	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CS1004-1.5	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:	**EE1001-2**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P: S):	**1:2:2:0**	**Credits:**	**03**
Total Teaching Hours:	**15+30+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 fundamental concepts in EV, basic converters and special motors, electrical wiring protective devices and safety measures

UNIT-I

Circuit Fundamentals **04 Hours**

Introduction to DC circuits, Basic nodal and mesh analysis excited by independent DC voltage sources, Power and Energy.

11 Hours

AC Fundamentals: 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: Analysis of R, L, C, R-L, R-C and R-L-C series. 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 wattmeter.

UNIT-II

DC Machines — **05 Hours**

Faradays Laws, self and mutually induced emfs. 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.

Single-Phase Transformers — **05 Hours**

Necessity of transformer, Principle of operation. Types of Transformers, Emf equation, losses, efficiency, problems on emf equation and efficiency, Autotransformer, Applications.

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

UNIT-III

Electric Vehicles — **06 Hours**

Fundamentals, Block diagram of EV and its components. Motors used in EV – BLDC, Permanent Magnet Synchronous Machine (PMSM) -Working principle

SMPS: Concept of step up and step-down converter (Basic equation and Block diagram representation), Applications. Block diagram of UPS and applications.

Domestic Wiring — **04 Hours**

Types of wiring. Two-way and Three-way control of lamp. Elementary discussion on Circuit protective devices: Fuse and Miniature Circuit Breaker (MCB’s).

Personal safety measures: Electric Shock and Precautions against shock. Potential between neutral and ground. Necessity of Earthing, Earthing types- 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. Voltage and Current relationships of three phase star/delta circuits.
5. Measurement of three-phase power using two wattmeter method
6. Load test on a single-phase Transformer.
7. Speed load characteristic of a 3-phase Induction Motor.
8. Time characteristic of fuse

Demonstration Experiments

1. Demonstration of fuse, MCB by creating a fault.
2. Two-way and Three-way Control of lamp and formation of truth table.
3. Demonstration of cut out sections of electrical machines (DC machines, Induction machines and Synchronous machines).
4. Demonstration of EV and its Components.

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

1. Analyze the DC Circuits using mesh & node methods to compute power and energy.
2. Analyze voltage & current phasor relationships in single phase & three phase AC circuits to compute circuit parameters.
3. Describe the fundamentals of electromagnetism, construction, operating principle of DC & Induction motor to study performance characteristics.

4.	Apply principle of single-phase transformer to compute transformer efficiency.
5.	Describe fundamental concepts in EV, converters, domestic wiring, protection and safety 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
EE1001-2.1	2	3	-	-	-	-	-	-	-	-	-	-	-	-
EE1001-2.2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
EE1001-2.3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
EE1001-2.4	2	3	-	-	-	-	-	-	-	-	-	-	-	-
EE1001-2.5	2	3	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. S. K. Sahdev, “Basic Electrical Engineering (with Lab Manual)”, January 2022
3. Lecture Notes on Basic Electrical Engineering, Department of E&E, NMAMIT, Nitte. (New version)
4. Hughes, Edward, “Electrical Technology”, Pearson Education Publications, 10th Edition, 2010.
5. A. Chakarbarti, M. L. Soni and P. V. Gupta, U. S. Bhatnagar, “Power system engineering”, Gagan Kanur, Dhanapat Rai and Co Pvt. Ltd, 2013.

REFERENCE BOOKS:

1. Vincent Del Toro, “Electrical Engineering Fundamentals”, 2nd Edition, Pearson, 2015.
2. H. Cotton, “Electrical Technology”, CBS, 7th Edition, 2005.
3. A. Mittle and V. N. Mittle, “Basic Electrical Engineering”, Tata McGraw Hill, 2005.
4. Debashisha Jena, “Basic Electrical Engineering”, Wiley India Private Limited, 2012.
5. M.V. Deshpande, “Elements of Power Station Design”, 1st edition, PHI learning, 2009.

E Books / MOOCs/ NPTEL

1. http://nptel.ac.in/downloads/108105053/
2. http://www.textbooksonline.tn.nic.in/books/11/stdxi-voc-ema-em-1.pdf
3. Basic Electrical Technology Lectures by Dr. L Umanand Department of Power Electronics Group, CEDT IISC Bangalore available at http://www.nptelvideos.in/2012/11/basic-elerical-technology.html

IT SKILLS

Course Code:	CS1651-1	**Course Type:**	**AEC**
Teaching Hours/Week (L: T: P: S):	**1:0:2**	**Credits:**	**02**
Total Teaching Hours:	**13+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 effective static web pages.
3.	Describe the basic concepts of Cloud.
4.	Analyse data using Microsoft Excel.
5.	Create interactive gaming applications through Scratch coding.

Suggested List of Experiments

9.	**Design and create simple game using MIT-scratch/Code.org** • Design and create catch game using MIT scratch coding. • Design and create a Jumping game using MIT scratch coding. • Design and create pong game using MIT scratch coding.
10.	**Design and create simple android applications using MIT app inventor.** • Create an application to display a “Hello, World!” message on screen. Application should also display the current time and date. • Implement an application to change the background colour and image of the screen. • Create a simple calculator which can perform basic arithmetic operations like addition, subtraction, multiplication, or division depending upon the user input. • Build a bouncing ball app or make a ball bounce around on the screen (on a Canvas). • Write an application to send SMS using MIT app inventor and also implement a text-to-speech application by passing text from the user.
11.	**HTML and CSS** HTML: Basic Tags - paragraph, headings, Hyperlinks, image, tables, HTML forms.
12.	HTML Lists: Unordered Lists, Ordered Lists and Definition list.
13.	Create a form for a survey on the topic of your choice. Include a variety of answer options, including text fields, dropdowns, radio buttons, checkboxes, and a submit button. Use CSS to improve the look of your form.
14.	Design and create web page for a travel book /recipe book with more than 3 pages, add table to list places /recipes (iframe, hyperlink)
15.	**Create user account and demonstrate use of Google drive, Google docs, Google Form.** • Upload and share any files and folders in google drive using different file permissions. • Creation of google forms for applications such as a registration form, feedback form,quiz etc. • Creation of google docs with citation from websites.
16.	**Data Analysis using Microsoft Excel.** • Basic Excel Formulas: Concatenate(),Len(),Days(), Net workdays(), Count(), Counta(), If(), Iferror(), Find(), Search(),Left(), Right() and Rank(). • Conditional Math: Learn to use SUMIF(), SUMIFS(), AVERAGE(), AVERAGEIF(), AVERAGEIFS(), COUNTIF(), COUNTIFS() to add cells only when certain conditions are met.

- VLOOKUP with Approximate or Exact Match: Learn to use VLOOKUP to find an approximate or exact match and return the corresponding value, work with INDEX, MATCH, and HLOOKUP as alternatives to the VLOOKUP function.
- Conditional Formatting: Apply the different rules to the values of the cell in sheets to carry out the analysis of data.
- Optimizing Data: Sorting, Filtering, Excel PivotTables
- Data Validation: Use Data Validation to ensure that users enter valid data in input cells, o restrict users' ability to enter invalid data in cells by providing them with a drop-down list of valid options.
- Data Visualization in Excel-Charts by generating various types of charts.

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

1.	Develop Gaming Applications using Scratch Coding.
2.	Understand the basics of Android Programming.
3.	Design attractive and effective Static Web pages.
4.	Analyse the basic concepts of Cloud.
5.	Utilize Microsoft Excel to conduct 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	3
CS1651-1.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CS1651-1.2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CS1651-1.3	3	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)

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*BiologyforEngineers*,PHIlearningPrintBookISBN:9789391818142eBook 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.andSimmons,C.A.*Introductorybiomechanics*-Fromcellstoorganisms.Cambridge

	University Press,2012

ENGINEERING VISUALIZATION

Course Code:	**ME1004-1**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T: P):	**0:0:2**	**Credits:**	**01**
Total Teaching Hours:	**26**	**CIE + SEE Marks:**	**50+50**

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 position 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

02 Hours

Chapter 1: Orthographic Projection: Introduction to orthographic projection, Quadrants, principal planes, principal views, Difference between First angle and third angle projection, Dimensioning, Conventions employed for drawing.

06 Hours

Chapter 2: Projection of plane surface: 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)

UNIT-II

06 Hours

Chapter 3: Projection of Solids: Prisms, Pyramids, Cones and Cylinders in simple position (Resting on HP with inclination to HP and VP, true length with true inclination only)
Orthographic projection of simple machine components using their isometric projection.

UNIT-III

06 Hours

Chapter 4: Development of Lateral surfaces of solids: Right regular Prisms, Pyramids, Cylinders and cones (with single section plane)

06 Hours

Chapter 5: Isometric projection: 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 for a given position using Solid Edge software.
2. Draw the orthographic projections of a solids and simple machine parts for a given position using Solid Edge software.
3. 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**
ME1004-1.1	3	1	-	-	-	-	-	-	1	1	-	2	2	1
ME1004-1.2	3	1	-	-	-	-	-	-	1	1	-	2	2	1
ME1004-1.3	3	1	-	-	-	-	-	-	1	1	-	2	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	N. D. Bhat & V. M. Panchal, Pramod R. Ingle, “Engineering Drawing”, 53rd Edition, Charotar Publishing House, Gujarat, 2014.
2.	K. R. Gopalakrishna, “Engineering Drawing”, Subhas publishers, Bangalore , 32nd Edition, 2012.
REFERENCE BOOKS	
1.	“A Primer on computer aided Engineering Drawing”, VTU, Belgaum, 8thedition, 2011.
2.	Shah, “Engineering Drawing and Computer Graphics”, Pearson, 2010.
3.	Agarwal & Agarwal, “Engineering Graphics”, TMH, Second edition, 2013.
4.	P. S. Gill, “A Text book of Engineering Graphics and Drafting”, 11th Edition, S. K. Kataria & sons, New Delhi, 2009.

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.

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

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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).

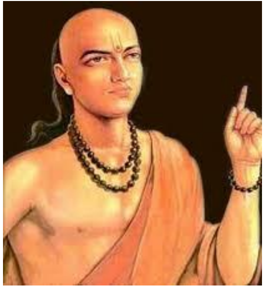
MATHEMATICS

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.

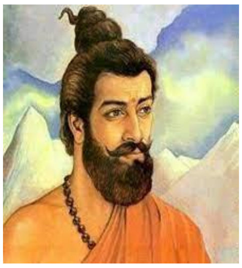
Thus, the Physics though has many branches and uses many other branches of science and philosophy, in the past and the present, its aim is to understand the whole universe which is nothing but matter and energy which is seen or unseen.

CHEMISTRY

ANCIENT SEERS OF INDIA – CHEMISTRY

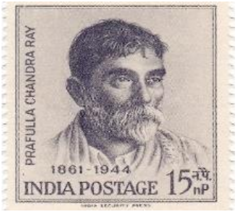
In ancient India, chemistry was called **Rasayan Shastra, Rasa-Vidya, Rasatantra and Rasakriya** all of which roughly mean '***Science of Liquids***'. There also existed chemical laboratories which were called **Rasakriya-nagaram**/**Rasakriya-shala**, which literally mean '***School where liquids are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

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



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

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



Prafulla Chandra Ray (1861-1944), an Indian chemist, is often referred to as the Father of Chemistry in India. He received his BS in 1882 and his PhD in 1887 from University of Edinburgh. In 1896, he announced a major discovery of a new compound, mercurous nitrite. Today's Science and Technology has been greatly inspired by the contributions of these wise seers. Indians have continued to show their global impact in the Field of Science.

In the 21^{st} century, biochemist **Har Gobind Khorana** won the Nobel Prize (1968) for demonstrating how the nucleotides in nucleic acids control the synthesis of proteins.
Thus, the seers of ancient India have contributed significantly in the development of Modern Chemistry.

BIOTECHNOLOGY

Biology for Engineers

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

COMPUTER, 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 **$ax^2 + bx + c = 0, a \neq 0$** 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 ज़(Gnya)=5 च(Cha)=6 छ(Cha)=7 ज(Ja)=8 झ(Ja)=9 अ(Nya)=0. The modern **Hasing technique in computing system** which is resembling was then being used in the **Indian Katapayadi system**. For example, the hashing number based on Katapayadi system would be as follows for '**Gurudev'**
Gu=Ga(is the consonant)=3, Ru=Ra(is the consonant)=2, De=Da(is the consonant)=8 Va=Va(is the consonant)=4, So Gurudeva = 4823.
In the recent decades, following are the few of the major contributors to the computing world:

1. In 1996 the USB port invented by the **Ajay Bhatt,** an Indian at Intel Oregon which involved low level **programs delt with embedded C Language** to perform flexible IO transfer and opened up an area to use plug-and-play devices efficiently.
2. The Pentium chip invented by **Vinod Dham,** that **made C compiler to speed up the program execution** and do well with **GUI applications (both System and User Level) that are wiritten in C language.**
3. **Amit Singhal** is an Indian who rewrote (search engine in 2001) the **google algorithm** (C language coding embedded with Assembly Language service routins in Windows and Unix/Linux). Then on the Google processes over 40,000 search queries every second on average which translates to over **3.5 billion searches per day** and **1.2 trillion searches per year** worldwide.

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

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

ELECTRONICS AND COMMUNICATION ENGINEERING

The idea of a holistic approach to engineering design and education has been envisioned to meet the perceived and emerging needs for innovation in the 21st century. Many engineering educators, practicing engineers and engineering students have already recognized the gaps and areas of potential improvements in the knowledge acquisition process implemented in current engineering degree programs when compared to current societal and technological issues and developments.
Society and humanity have progressed drastically over the past few generations. Engineers as a network of professional problem solvers have been heavily involved in these global communities and the engineering profession is evolving from one that focuses on targeted, isolated issues, to one that embraces challenges that incorporate physical, economic, environmental, and humanitarian aspects.
Currently, engineering students are required to take classes on ethics, liberal studies and technology and society courses, however engineering students are not prefaced with the importance of rounding out their education with these topics, and while social issues are discussed, they are not related to engineering specifically. That being said, explicitly linking the technical aspects of engineering to society is paramount in training effective problem solvers for the 21st century.

With some exposure to multi-disciplinary, inter-disciplinary and trans-disciplinary approaches to engineering and design, students will be better prepared for their future careers in industry or research fields.

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

- students will be inspired and driven to seek opportunities in engineering for environmental, social, medical, and human development/poverty issues.
- students will be able to identify the issues that are emerging from new technology, how to mitigate the negative aspects and reduce the amount of impact, while leveraging the positive outcomes.
- students will have respect and knowledge of the importance of ethics and policy matters in the field of engineering and be able to determine between unethical and an ethical situation in a proactive manner.

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

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

ELECTRICAL AND ELECTRONICS ENGINEERING

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

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

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

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

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

MECHANICAL ENGINEERING

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

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

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

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

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

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

CIVIL ENGINEERING

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

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

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

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

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

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

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

- Rama was the world's first king to build a bridge across the sea. But he did not do it on his own. He sought the help of a great engineer called Nala according to Valmiki Ramayana. Any wise man will seek local knowledge when he ventures into new places. Nala knew the shallow areas across the sea in and around Tamilnadu. American space agency NASA also confirmed that there was a bridge through the satellite pictures. Any wise engineer will use such naturally elevated areas instead of deep waters to build a bridge.
- Bageeratha changed the course of the mighty river Ganges. The vast forest areas of modern Bihar, Uttar Pradesh, and West Bengal were made into fertile lands by his marvelous engineering feat. In those days very few people lived in those jungles. Puranas say that Bageeratha did penance for several thousand years to do this that too 'standing in one foot'. This is a phrase Indians use very often. Even the great Tamil poet Tiruvalluvar uses the simile of Stork that stands in one foot to catch a fish. This is the hidden language to say that he tried for a very long time with focused attention.
- Vedic Saint Agasthya discovered the land route to South India via Vindhyas. The Puranas say that he "subdued the arrogance of the hills", this is hidden language. Till Agastya's this great discovery kings and travellers used

only sea routes. Since they knew the secret of monsoon winds they can travel to West Bengal or Maharashtra from Sri Lanka in a few months' time.

- Uparichara Vasu, an ancient king made mountain passes for the benefit of land travellers. He was a Vasu king ruling over the Chedi kingdom. Mahabharata says that he kicked the Kolahal Mountain which was blocking the flow of the Shaktimati River. This is a hidden language to say that he diverted the river for irrigation by cutting the hills.
- In short Bageerathan, Agastya, and Uparichara Vasu are the earliest engineers who built dams across the rivers. But unlike modern engineers, they did not use cement or mortar but they used the hills themselves. To avoid the force they made checks and balances. They use a hidden language saying that Shiva bore the force when Ganga came down from heaven.
- Parasuraman retrieved a lot of lands and gave it to Indians. A Pandya king called Nilam Tharu Vil Nediyon built sea walls to prevent the sea from invading the land.
- Balraman always travelled with an axe to clear the forests and make them cultivable. He was a great agriculturist. When Krishna spent most of his time in politics, his brother Balarama did constructive work.
- The Mohanjodaro, created 3000 years ago, is considered as a wonderful piece of civil engineering. Found in archaeological excavations even the ruins prove that this town was well settled and its buildings and roads – all were made using symmetry and geometrical measurements. The roads found in this city were straight and were made from east to west and north to south and surprisingly they were at an angle of 90 degrees from each other. Buildings were also constructed in proportion. The intersection of the corners, the heights of the walls was equal. The city had public buildings, gardens, a restaurant, a large public bath as well as residential buildings. There was a provision for bathroom, living room etc in the residential buildings. The public buildings were 11.82m long, 7.01m wide and 2.44m high, and there were two streams of water. The building material and bricks of the walls were coated with a substance on which there was no effect of water. Archaeological research shows that people living here were well-versed in the construction techniques.
- Indus Valley Cities such as Harappa, Mohanjadaro, Lothal, Dholavira, Kalibangan need no new interpretations. The well-laid cities with uniform brick structures, Great Bath, most hygienic drainage systems, grain storage barns, and wells are all already well known to the world.
- Dwarka, also known as Lord Krishna's city, also narrates a similar story. Dr S R Rao discovered Dwarka in the archaeological excavation and found that the ancient city (Dwarka Nagar) was well built and settled. There was a wall around the city. The stones used for the construction of buildings did not erode despite the fact that the city was very close to the sea. Two-storey buildings, roads and water system are also found in the city. Copper, bronze and some alloys with zinc mixed up to 34 percent have also been found during the excavation. The size of columns, windows, etc reveals that they were designed with a complete mathematical precision.
- South Indian Tamil saint Appar always travelled with a pickaxe to clear the bushes from the temple towers. He simply followed Balarama. Great Chola king Karikalan built a dam across river Cauvery in Kal Anai. The Grand Anicut was an engineering wonder of ancient Tamils. It was built around the 1st century AD. Big temples of India, the number of which runs into thousands, stand as monumental proof for the engineering skills of Indians. Mamallapuram and other Pallavacave temples are well-known milestones in Indian architecture.
- The Group of Monuments at Hampi are also recognized as a UNESCO World Heritage Site. The Vittala temple—the stone chariot – is the most iconic symbol of Hampi. The Virupaksha Temple at Hampi was built in the seventh century by the Chalukya rulers.

Virupaksha and Vithala Temple in Hampi

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Scheme & Syllabus for
B. Tech. (Artificial Intelligence and Machine Learning)

HIGHER SEMESTER COURSES

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
2023-24

III SEMESTER													
Sl. No.	**Course and Course code**		**Course Title**	**Teaching Dept.**	**Teaching Hours/Week**				**Examination**				**Cr**
					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	AM	3	0	2	0	03	50	50	100	4
3.	IPCC	CS2002-1	Object Oriented Programming	AM	3	0	2	0	03	50	50	100	4
4.	PCC	AM2101-1	Modern Computer Architecture	AM	3	0	0	0	03	50	50	100	3
5.	PCC	AM1104-1	Introduction to Machine Learning	AM	3	0	0	√	03	50	50	100	3
6.	PCC	AM1602-1	Data Science & Machine Learning Lab	AM	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													
10	MNC	MA1012-1	Bridge Course – Calculus and 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/ Drawing**	**PBL**	**Duration in hr**	**CIE Marks**	**SEE Marks**	**Total Marks**		
					L	**T**	**P**	**J**						
1.	BSC	MA2005-1	Linear Algebra and It's Applications	MA	3	0	0	0	03	50	50	100		3
2.	IPCC	CS3004-1	Design and Analysis of Algorithms	AM	3	0	2	0	03	50	50	100		4
3.	IPCC	AM2001-1	Advanced Machine Learning	AM	3	0	2	0	03	50	50	100		4
4.	PCC	CS2102-1	Database Management Systems	AM	3	0	0	√	03	50	50	100		3
5.	PCC	AM2102-1	Operating Systems Essentials	AM	3	0	0	0	03	50	50	100		3
6.	PCC	AM2601-1	Mobile Application Development	AM	0	0	2	0	03	50	50	100		1
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/AM	1	0	0	0	01	50	50	100		1
9.	VEC	AMx5xx-1	Department Specific Vocational Education Course	AM	0	0	2	0	03	50	50	100		1
10.	UCC	UC1001-1	Internship – I (Activity based Internship)	AM	Mandatory Intra Institutional Activity based Internship of 2 weeks duration (80 - 90 h) to be completed during the vacations of I & II Semesters. Lateral entry students have to complete the Internship - I during the vacation of III semester					100	-	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												
11	MNC	MA1014-1	Bridge Course – Discrete Math and 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/ Drawing	PBL	Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1.	IPCC	AM3004-1	Neural Networks and Deep Learning	AM	3	0	2	0	3	50	50	100	4
2.	IPCC	AM3003-1	Natural Language Processing	AM	3	0	2	0	3	50	50	100	4
3.	PCC	AM1101-1	Artificial Intelligence	AM	3	0	0	0	3	50	50	100	3
4.	PCC	AM2602-1	Projects in Internet of Things	AM	0	0	2	0	3	50	50	100	1
5.	PEC	AMxxxx-x	Professional Elective – I (Group 1)	AM	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	AM	1	0	2	0	3	50	50	100	2
		HU1010-1	Research Methodology	Any Dept.	2	0	0	0					
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	AM	1	0	0	0	-	50	-	50	1
TOTAL					**16/17**	**0**	**6/8**	**-**	**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/ Drawing**	**PBL**	**Duration in hr**	**CIE Marks**	**SEE Marks**	**Total Marks**		
					L	**T**	**P**	**J**						
1.	IPCC	AM3002-1	Computer Vision	AM	3	0	2	0	3	50	50	100		4
2.	PCC	AM3101-1	Data Networking and Communication Systems	AM	3	0	0	0	3	50	50	100		3
3.	PCC	AM1601-1	Angular and ReactJS Lab	AM	0	0	2	0	3	50	50	100		1
4.	PEC	AMxxxx-x	Professional Elective – II (Group 1)	AM	3	0	0	0	3	50	50	100		3
5.	PEC	AMxxxx-x	Professional Elective – III (Group 2)	AM	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	Any Dept.	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**

Note: AM1104-1 - Introduction to Machine Learning, AM2001-1 - Advanced Machine Learning, AM1101-1 - Artificial Intelligence, AM3004-1 - Neural Networks and Deep Learning, AM3003-1 - Natural Language Processing, AM3002-1 – Computer Vision. These subjects are empowered by AI for youth Intel Readiness Program and Dell Technologies. The students are required to complete the social impact projects on the above-mentioned subjects. Final evaluation will be done by Intel Trained Faculty and members of Intel readiness Program. On successful completion of projects students will be awarded with Intel certificate.

VII 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.	IPCC	AM3001-1	AI and ML in Healthcare	AM	3	0	2	0	3	50	50	100	4
2.	PCC	AM4601-1	Robotic Process Automation Lab	AM	0	0	2	0	3	50	50	100	1
3.	PEC	AMxxxx-x	Professional Elective – IV (Group 1)	AM	3	0	0	0	3	50	50	100	3
4.	PEC	AMxxxx-x	Professional Elective – V (Group 2)	AM	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	Any Dept	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	AM	-	-	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**

NMAM Institute of Technology, Nitte

An off-Campus Institution of
NITTE (DEEMED TO BE UNIVERSITY) MANGALORE
B.Tech. (AI&ML): Scheme of Teaching and Examinations 2023-27
Outcome Based Education (OBE)and Flexible Choice Based Credit System (FCBCS)
(Effective from the academic year 2023-24)

Program Specific Ability Enhancement Courses [AEC]	
Course Code	**Course Title**
ME1014-1	Research Methodology
AM1651-1	Programming in C++ with Examples
AM1653-1	Unix Shell and System Programming
AM4651-1	Introduction and practices of drones
AM1652-1	Programming in JAVA

VOCATION EDUCATION COURSE	
Course Code	**Course Title**
AM1551-1	Python Programming with Data Science
AM1552-1	Data And Visual Analytics in AI
AM1553-1	Unix Shell programming

List of Professional Elective Courses [PEC]			
Group-1		**Group-2**	
Stream 1: Computational Fundamentals Electives			
Code	**Title**	**Code**	**Title**
AM2201-1	Software Engineering and Project Management	AM1301-1	Internet and Web Programming
AM3201-1	Cloud Computing	AM2301-1	Advanced Java Programming
AM3202-1	Compiler Design	AM2302-1	Angular and ReactJS
AM3203-1	Micro controllers and embedded systems	AM3301-1	Full Stack Development
AM3204-1	NoSQL Database	AM3302-1	Semantic Web
AM3205-1	Theory of Computation	AM3303-1	Operation Research
AM3206-1	Advanced Unix Programming		
Stream 2: Computer Networking Technologies and Cyber Security Electives			
AM4211-1	Software Defined Networks	AM3311-1	Cryptography and Cyber Security
AM4212-1	Wireless Sensor Networks	AM3312-1	Cyber Security and Cyber Laws
Stream 3: Machine Learning and Data Science Electives			
AM1221-1	Introduction to Data Science	AM1321-1	R Programming
AM2221-1	Empowering with Artificial Intelligence	AM2321-1	Introduction to Drones
AM3221-1	Data Mining	AM3321-1	Augmented and Virtual Reality
AM3222-1	Human Computer Interaction	AM3322-1	Big Data Analytics
AM3223-1	Optimization Techniques in Machine Learning	AM3323-1	Social and Web Analytics
AM3224-1	Pattern Recognition	AM3324-1	Text Mining
AM3225-1	Reinforcement Learning	AM3325-1	Web Applications using ML
AM3226-1	Soft computing	AM3326-1	Empowering with AI
Stream 4: Applied Computational Electives			
AM2231-1	Fundamentals of Image Processing	AM3331-1	Autonomous Systems

AM3231-1	Bio Informatics	AM3332-1	Business Intelligence and its Applications
AM3232-1	Game theory and applications	AM3333-1	User Interface Design
AM3233-1	Multimedia Processing	AM4331-1	Blockchain Technology
AM3234-1	Nature Inspired Computing	AM4332-1	Multicore Architecture and Programming
AM3235-1	Speech Processing	AM4333-1	Prompt Engineering
AM3236-1	Generative Adversarial Networks		

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	**39**	**CIE + SEE Marks**	**50+50**

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
4.	Understand the concept of correlation, correlation coefficient, Regression, and concept of Principle of least squares for curve fitting and regression lines.
5.	Describe the theory of stochastic processes, Compute probabilities of transition especially for Markov processes

Prerequisite	**MA1002-1**

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.	Able to apply the central limit theorem to sampling distribution. Translate real-world problems into probability models.

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

Mode of Teaching and Learning:

Classroom teaching.

Use of mathematical softwares (such as MATLAB, MATHEMATICA, SAGE, R, ETC.) as teaching aid.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and of Semester End Exam (SEE) is 50%. The student must obtain a minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this, grades will be awarded.

Continuous Internal Evaluation:

1.	Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2.	The class teacher must decide the topics for closed book test and Written Quiz. The methods of CIE for the subject must be announced at the beginning of the course.

Semester End Examination:

1.	There will be **8** questions of **20** marks each in the question paper categorized into **3 Units** as per the syllabi & contact hours. The student will have to answer **5** full questions, selecting **2** full questions each from **Unit - I** & **Unit – II** and **1** full question from **Unit – III**.

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, NewDelhi,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 IT'S APPLICATION

Course Code:	**MA2005-1**	**Course Type**	**BSC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mathematics

Course Objectives:

1.	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.

Prerequisites: MA1002-1 , MA1007-1

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 values and eigen vectors of square matrices. Diagonalization.

UNIT-II

Vector Space **15 Hours**

Vector spaces, subspaces, bases and dimension, coordinates, row space, column space and null space.

Linear Transformations

Linear transformations, algebra of linear transformations, representation of transformations by matrices, isomorphism, Range and Null space of a linear transformation. Rank – nullity theorem (Without Proof). 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 eigen vectors and eigenvalues and perform diagonalization of matrices
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
MA2006-1.1	3	1												
MA2006-1.2	2	3												
MA2006-1.3	2	1												
MA2006-1.4	2	2												
MA2006-1.5	3	2												

1: Low 2: Medium 3: High

Mode of Teaching and Learning:

Class room teaching.

Use of mathematical software (such as MATLAB, MATHEMATICA, SAGE, ETC.) as teaching aid.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and of Semester End Exam (SEE) is 50%. The student must obtain a minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this, grades will be awarded.

Continuous Internal Evaluation:

1.	Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2.	The class teacher must decide the topics for closed book test and Written Quiz. The methods of CIE for the subject must be announced at the beginning of the course.

Semester End Examination:

There will be **8** questions of **20** marks each in the question paper categorized into **3 Units** as per the syllabi & contact hours. The student will have to answer **5** full questions, selecting **2** full questions each from **Unit - I** & **Unit – II** and **1** full question from **Unit – III**.

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

Bridge Courses for Lateral Entry Students

Calculus & Differential Equations
(Common to AM\CC\CS\IS\DS\RI)

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**	**CIE + SEE Marks:**	**100+00**

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:
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

DIFFERENTIAL CALCULUS	**07 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 (No Derivation). Taylor’s theorem for functions of single variable. Mean value theorems.	
PARTIAL DIFFERENTIATION	**08 Hours**
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	**07 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	**08 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. 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.	

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
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", Khanna Publications, 43rd Edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition (Reprint), 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 MATHEMATICS & NUMERICAL METHODS (COMMON TO AM\CC\CS\IS\DS\RI)

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**	**CIE + SEE Marks:**	**100+00**

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:

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	**07 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	**08 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.

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
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”, Khanna Publications, 43rd Edition, 2015.
2.	Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley and Sons, 10th Edition (Reprint), 2016.
REFERENCE BOOKS:	
1.	T. Veerarajan, “Engineering Mathematics”, McGraw-Hill, New Delhi, 2008.
2.	B. V. Ramana, “Higher Engineering Mathematics”, Tata Mc Graw –Hill, New Delhi,2010.

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**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Outline the concepts of data structures, types, operations, structures, pointers and implement pointers, structures, and pointer to structures
2.	Implement linear data structures stacks, queues, and usage of stacks in various applications.
3.	Implement the operations of singly linked lists and circular linked lists, doubly linked list and circular doubly lists.
4.	Identify and differentiate different types of binary trees and binary search trees data Structures and implement them.
5.	Illustrate and classify threaded binary trees, expression trees, AVL trees, BTrees, B+ tree and techniques of hashing.

Prerequisite	CS1001-1- Problem-Solving through Programming

UNIT-I

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

15 Hours

UNIT-II

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, Linked Stack and Queues, Header Nodes, Representation of Linked list using arrays. Circular Linked List, Doubly Linked List and Circular doubly Link list : Representation and Operations

15 Hours

UNIT-III

Non linear 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
Non linear Data structures – Graphs:
Representation of graphs: Definition, types and terminology, Matrix representation, Adjacency list chain and sequential representation.

10 Hours

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 queues.
6. The 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 and pointers using that knowledge and design the programs using 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 singly linked lists, circular linked lists and doubly linked list.
5. Implement and apply the concept of 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	3
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, YedidyahLangsam& Moshe J. Augenstein, "Data Structures using C", Pearson Education/PHI, 2009.
2. Ellis Horowitz and SartajSahni, "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, ReemaThareja, 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+26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CS1001-1 / CS1004-1**		

Teaching Department: Computer 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.

Exception Handling – Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, multiple catch Clauses, Nested try statements, throw, and throws, finally.

(Textbook 1, Chapter – 6-10)

UNIT-II

MULTITHREAD PROGRAMMING: **15 Hours**

Multithreaded Programming – The Java Thread Model, The Main Thread, creating a Thread, Creating Multiple Threads, Using is Alive () and join (), Thread Priorities.

Autoboxing – in Methods, in Expressions, with Boolean and Character Values

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.

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 –11, 12, 22, 29, 30) (Textbook 2-Chapter 4)

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)

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,SThamarasiselvi, 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**

Teaching Department: Artificial Intelligence Machine Learning

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.

Prerequisite	CS2001-1- Data Structures**,** CS1001-1- Problem-Solving through Programming

UNIT-I	
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 Basic efficiency classes, Mathematical Analysis of Non-recursive and Recursive Algorithms, **(Text Book-1: Chapter 2: 2.1 to 2.4)** **BRUTE FORCE:** Background, Selection Sort and Bubble sort, Sequential search and Brute-Force String Matching algorithms with complexity analysis, Exhaustive search **(Text Book-1: Chapter 3: 3.1, 3.2,3.4)** **DIVIDE AND CONQUER:** General Method, Merge sort, Quick sort, Binary Search algorithms with Complexity analysis **(Text Book-1: Chapter 4: 4.1 to 4.3)**	**15 Hours**
UNIT-II	
DECREASE & CONQUER: General method, Insertion Sort algorithm, **Graph algorithms:** Depth First Search, Breadth First Search, Topological Sorting with complexity analysis **TRANSFORM AND CONQUER:** General method, **Balanced Search Trees:** AVL trees, 2-3 trees, Heaps and Heap sort algorithms with complexity analysis **TIME AND SPACE TRADEOFFS:** Sorting by counting, Input Enhancement in String Matching: Horspool's algorithm and analysis **(Text Book-1: Chapter 5: 5.1 to 5.3, Chapter 6: 6.3 to 6.4, Chapter 7:7.1, 7.2)** **DYNAMIC PROGRAMMING:** General method, The Floyd-Warshall Algorithm, The Knapsack problem and memory function with complexity study **(Text Book-1: Chapter 8: 8.2 and 8.4).**	**15 Hours**
UNIT-III	
GREEDY TECHNIQUE: General method of Greedy technique, **Minimum Spanning Trees:** Prim's Algorithm, Kruskal's Algorithm, Single-Source Shortest Paths using Dijkstra's Algorithm, Huffman Trees **(Text Book-1: Chapter 9: 9.1 to 9.4)** The Bellman-Ford algorithm, **(Text Book-2: Chapter 24: 24.1).** **BACKTRACKING:** General method, State space trees and algorithms for N-Queens problem, Subset-sum problem **(Text Book-1: Chapter 12: 12.1 selected topics**) **BRANCH AND BOUND:** General method, Solving job Assignment Problem ,Travelling Salesman problem, Knapsack Problem using branch and bound method **(Text Book-1: Chapter 12: 12.2**) P,NP and NP Complete Problems (**Text Book-1: Chapter 11: 11.3)**	**10 Hours**

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

ADVANCED MACHINE LEARNING

Course Code:	**AM2001-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L: T: P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Implement advanced model tuning and pre-processing.
2.	Describe shallow algorithms and feature selection methodologies.
3.	Understand web scrapping using BeautifulSoup and web crawling techniques.
4.	Develop advanced scrapping using APIs and Pillow library.
5.	Implement vision techniques on images.

Prerequisite	AM1104-1-Introduction to Machine Learning

UNIT-I

Model tuning: Data cleaning, handling text and categorical attributes: auto encoding, label encoding, custom transformers, feature scaling, transformation pipelines, cross-validation, Tuning a model: Grid Search, Randomized Search, Ensemble methods. **Shallow algorithms:** Logistic regression, Estimating Probabilities, Training and cost function, Decision boundaries, SoftMax regression. Non-linear SVM classification: Polynomial kernel, adding similarity feature, Gaussian RBF Kernel, SVM Regression **Feature extraction and feature selection:** Types of feature selection, mutual information for feature selection, Goodman-Kruskal score, Laplacian score, Hybrid genetic algorithm for feature selection, ranking for feature selection: Feature selection based on optimization formulation.	**15 Hours**

UNIT-II

Experience on data Collection and preprocessing **Web scrapping and its analysis:** An introduction to BeautifulSoup, find() and find_all() with BeautifulSoup, other BeautifulSoup objects, Navigating Trees, Regular expressions Writing web crawlers: Traversing a single domain, Crawling an entire site, crawling across the internet, web crawling models: planning and defining objects, dealing with different website layouts, structuring crawlers, crawling sites through search, crawling sites through links **Advanced scrapping:** writing a simple scraper, spidering with rules, creating items, outputting items, the item pipeline, Document encoding, text encoding and global internet, crawling through APIs: HTTP methods and APIs, Parsing JSON, Overview of libraries: PillowProcessing well formatted text, adjusting images automatically, scrapping text from images on websites, Reading captchas and training Tesseract **Intel AI for Youth: Module 22**	**15 Hours**

UNIT-III

Acquire – AI for Computer Vision **Computer vision:** Basic image handling and processing: The python Imaging Library (PIL), Matplotlib, NumPy-Array image representation, Grey-level transforms, Image	**10 Hours**

resizing, PCA of images, Image De-noising, Haris-corner detector, finding corresponding points between images, SIFT-Scale invariant feature transform, Matching geotagged images

Intel AI for Youth: Module 14

Suggested List of Experiments

Implementation of following machine learning algorithms in various projects using Python:

1.	Classification and regression algorithms.
2.	Artificial Neural Network (with back-propagation)
3.	Decision Trees
4.	Random Forest.
5.	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets
6.	Apply K-means clustering algorithm on the given dataset
7.	Use Random Forest algorithm to generate the classification and confusion matrix
8.	Usage of ensemble methods in machine learning
9.	Understand the concept of SVM with simple kernel for the given dataset
10.	Features scaling technique using standardization and normalization
11.	Logistic regression using ML
12.	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
13.	Implement and demonstrate 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.
	PART-B
1.	Mini project on ML concepts

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

1.	Implement hyperparameter tuning and pre-processing techniques and cross validation
2.	Describe Logistic regression and SVM kernels and feature selection methodologies
3.	Apply web scrapping using BeautifulSoup and web crawling techniques
4.	Implement advanced scrapping using APIs and Pillow library
5.	Describe vision techniques on images and usage of different vision libraries

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
AM2001-1.1	3	2	3	2	2								2	
AM2001-1.2	3	2	3	3	2								2	
AM2001-1.3	3	2	3	3	2								2	
AM2001-1.4	3	3	3	2	2								2	
AM2001-1.5	3	3	3										2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Hands-on Machine learning with Scikit-Learn, Keras and TensorFlow, concepts tools and techniques to build intelligent systems, by Aurelien Geron, 2nd Edition, 2019, Published by O'Reilly Media, Inc
2. Introduction to pattern recognition and machine learning, M Narasimha Murthy, Der V Susheela Devi, 2015
3. Web scrapping with python-collecting more data from the modern web, Ryan Mitchell,2018, 2nd Edition, Published by O'Reilly Media, Inc.
4. Programming computer vision with python, Jan Erik Solem, June 2012, Published by O'Reilly Media, Inc.
5. Intel AI for Youth: Module 14 and 22

REFERENCE BOOKS:

1. Fundamentals of deep learning, Nikhil Buduma, Nicholas Locascio, 2017

2.	Deep Learning (Adaptive Computation and Machine Learning series), Ian Goodfellow, YoshuaBengio, Aaron Couville-2016
E Books / MOOCs/ NPTEL	
1.	Introduction to computer vision: https://nptel.ac.in/courses/106105216
2.	https://www.mygreatlearning.com/academy/learn-for-free/courses/web-scraping-with-python

NEURAL NETWORKS AND DEEP LEARNING

Course Code:	**AM3004-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L:T:P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Understand the neural network and artificial neurons.
2.	Learn about how to train neural networks with different optimizers.
3.	Describe the operation of deep convolutional neural networks.
4.	Outline the concepts Recurrent neural networks.
5.	Learn about performance metric and different applications of neural networks.

Prerequisite	AM2001-1-Advanced Machine Learning

UNIT-I

Acquire – AI fundamentals (Neural Networks)

Introduction to artificial neural networks: From biological to artificial neurons, the perceptron, Multilayer perceptron, Activation Functions and types, Feed forward neural networks, Back propagation algorithm, Fine tuning neural network hyperparameters: Number of hidden layers, number of neurons per hidden layer, learning rate, batch size and other hyperparameters.

Training deep neural networks: Vanishing Gradient problems Exploding gradient problem, Glorot and He Initialization, Batch normalization, Gradient clipping

Optimizers: Gradient descent, stochastic gradient descent, mini-batch stochastic gradient descent, AdaGrade optimizers, AdaDelta optimizers, learning rate scheduling, avoiding overfitting through regularization, L1 and L2 regularization, Drop-out layers

Intel AI for Youth: Module 9

15 Hours

UNIT-II

Acquire – Domain Specific Concepts (Neural Networks)

15 Hours

Convolutional Neural Networks: The convolution operation, motivation, Padding in convolution network, Operation of CNN, Max pooling in CNN, Data augmentation, Variants of the basic convolution function, Structured Outputs, Data types, Efficient convolution algorithms

Sequence modeling: Recurrent and Recursive Nets: Unfolding computational graphs, Recurrent neural networks, Bidirectional RNNS, Encoder-Decoder Sequence to Sequence Architecture, Deep Recurrent networks, Recursive neural networks, LSTM Recurrent neural network, optimization for long term dependencies learning in CNN.

Intel AI for Youth: Module 14

UNIT-III

10 Hours

Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data,

Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications.

Tutorial: How-to setup GPU Accelerated TensorFlow & Keras on Windows 10 with Anaconda 3
https://medium.com/@martin.berger/how-to-setup-gpu-accelerated-tensorflow-keras-on-windows-10-with-anaconda-3-bf844a720aa3

Tutorial: Setup for Deep Learning with GPU on Your Local Laptop
https://medium.com/analytics-vidhya/setup-for-deep-learning-with-gpu-on-your-local-laptop-3ab29eae68f2

Suggested List of Experiments

1.	Train a Deep learning model to classify a given image using pre trained model
2.	Object detection using Convolution Neural Network
3.	Recommendation system from sales data using Deep Learning
4.	Improve the Deep learning model by tuning hyper parameters
5.	Perform Sentiment Analysis in network graph using RNN 6. Image generation using GAN
8.	Feedforward Networks for Handwritten Digit Recognition
9.	Sequence Labelling with Deep Recurrent Networks
10.	Image Classification with Deep Convolutional Networks

GPU based programs

1.	Dynamic Product Review Analysis using neural networks GPU based performance prediction
2.	Live Customer Feedback analysis and its optimization using GPU based systems

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

1.	Describe the concepts of perceptron, neurons, back propagation algorithm.
2.	Implement neural networks with different optimizers and loss function calculation.
3.	Analyze the operations involved in deep convolution neural networks.
4.	Apply the concepts sequence modeling using Recurrent neural networks.
5.	Describe the performance metric and different applications of 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
AM3004-1.1	3	2	2	2	1								1	
AM3004-1.2	3	3	2	2	1								1	
AM3004-1.3	3	2	2	2	1								3	
AM3004-1.4	3	3	2	3	2								3	
AM3004-1.5	3	2	2										1	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Hands-on-machine learning with Scikit-Learn, Keras and Tensorflow Concepts, tools and Techniques to build Intelligent Systems, Aurélien Géron, 2nd edition, 2019.
2.	Deep Learning (Adaptive Computation and Machine Learning series), Ian Goodfellow,

	YoshuaBengio, Aaron Couville-2016
3.	**Intel AI for Youth: Module 9 and 14**
REFERENCE BOOKS:	
1.	Fundamentals of deep learning, Nikhil Buduma, Nicholas Locascio, 2017
2.	Deep Learning (Adaptive Computation and Machine Learning series), Ian Goodfellow, YoshuaBengio, Aaron Couville-2016
3.	Introduction to pattern recognition and machine learning, M Narasimha Murthy, Der V Susheela Devi, 2015
4.	Neural Networks Design, M T Hagan, H B Demoth, M Beale, 2002, Thomson Learning, ISBN-10: 0-9717321-1-6/ ISBN-13: 978-0-9717321-1-7
E Books / MOOCs/ NPTEL	
1.	deeplearning.net
2.	deeplearning.stanford.edu
3.	deeplearning.cs.toronto.edu
4.	https://www.coursera.org/specializations/deep-learning
5.	Deep Learning, Self-Taught Learning and Unsupervised Feature Learning by Andrew Ng

NATURAL LANGUAGE PROCESSING

Course Code:	**AM3003-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L:T:P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Analyze language and the tools available for processing the text.
2.	Efficiently analyse the large collections of text.
3.	Discuss how word level language is generated.
4.	Understand the syntactic analysis of the given words and sentences.
5.	Outline and understand design features of information retrieval.

UNIT-I

Prerequisite	AM2001-1-Advanced Machine Learning

Acquire -Domain Specific Concepts (Natural Language Processing)

Overview and Language Modeling:

Overview: Definition, Origins of NLP, Language and Knowledge-Levels, Role of grammar in language processing, Transformational grammar, Challenges of NLP, Applications of NLP, Information retrieval.

Language Modeling: Various Grammar based Language Models Generative grammars, Hierarchical grammar, Paninian Framework, Karaka Theory.

15 Hours

Statistical Language Model- n-gram model, Add-one Smoothing, Good-Turing Smoothing, Caching Techniques.

Intel AI for Youth: Module 15

UNIT-II

Experience - Classification of Natural Language Processing — **15 Hours**

Word Level and Syntactic Analysis:

Word Level Analysis: Regular Expressions- Introduction, Finite State Automata Morphological parsing, Spelling Error Detection and Correction, Word and word classes, Part-of Speech Tagging-Rule based, Stochastic and hybrid taggers.

Syntactic Analysis: Introduction, Context-Free Grammar, Constituency. Parsing-Top-down Parsing, Bottom-up Parsing, A-basic Top-down Parser, Early Parser.

Natural Language Understanding (NLU):

Definition, Approaches in NLU, Comparison between NLP and NLU , Approaches of machine translation in NLU

Intel AI for Youth: Module 22 and 23

UNIT-III

Information Retrieval and Lexical Resources: — **10 Hours**

Information Retrieval: Design features of Information Retrieval Systems, Classical, Non classical, Alternative models of Information Retrieval.

Lexical Resources: Word Net, Frame Net, Stemmers, POS Tagger.

Tutorial: Hugging Face

Suggested List of Experiments

1. Implement program to perform automatic word analysis.

2. Implement program to perform word generation.

3. Implement programs related to morphology, N-Grams, N-Grams Smoothing.

4. Implementation of Hidden Markov Models.

5. Program to build POS Tagger, Chunker.

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

1. Understand and analyse the natural language text.

2. Acquaint with the tools, techniques, resources, applications and challenges in NLP

3. Learn natural language processing with manual and automated approaches.

4. Learn syntactic analysis for natural language processing.

5. Design different models of information retrieval 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**
AM3003-1.1	3	2											2	
AM3003-1.2	3	2	2										2	
AM3003-1.3	3	2	2										2	
AM3003-1.4	3	2	2										2	
AM3003-1.5	3	2	2										2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

2. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction

	to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, Prentice Hall, 2008.
3.	Intel AI for Youth: Module 15 ,22 and 23
REFERENCE BOOKS:	
1.	NLP: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, Prentice Hall, 2016.
2.	Natural Language understanding by James Allen, Pearson Education, 2002.
3.	Meaning and Grammar by G. Chirchia and S. McConnell Ginet, MIT Press, 1990.
4.	An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition by Daniel Jurafsky and James H. Martin, Pearson Education, 2006.
E Books / MOOCs/ NPTEL	
1.	https://www.coursera.org/specializations/natural-language-processing
2.	https://en.wikipedia.org/wiki/Natural-language_understanding

COMPUTER VISION

Course Code:	**AM3002-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:2:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Learn the basics of computer vision elements
2.	Describe the process of image segmentation
3.	Illustrate different preprocessing methodologies
4.	Describe transfer learning and embedding techniques
5.	Demonstrate cloud API and Edge computing concepts

Prerequisite	AM2001-1-Advanced Machine Learning.

UNIT-I

Acquire – Domain Specific Concepts (AI for Computer Vision) **Introduction to Computer Vision:** What is computer vision? Computer vision applications, Vision types. **Machine Learning models for Vision:** A dataset for machine learning perception, reading image dataset, Visualizing image dataset, A Linear model using Keras, Neural networks using keras **Image Vision:** Pretrained model, transfer learning, Modular architectures **Image classification with keras:** Introducing keras, predicting an images's category, Investigating model: ImageNet Dataset, Model Zoos, Class Activation Maps **Object Detection and Image Segmentation:** Object Detection, YOLO, RetinaNet, Segmentation: Mask R-CNN and instance segmentation, U net and semantic segmentation	**15 Hours**

Creating Vision Datasets: Collecting images, photographs, imaging, Data Types: channels, Geospatial Data, Audio and Video, Manual Labelling: Muli label, Object Detection, Labeling at Scale, Automated Labeling

Intel AI for Youth: Module 14

UNIT-II

Experience – Basic Techniques in Computer Vision **16 Hours**

Preprocessing: Reasons for preprocessing, Shape transformation, Data Quality Transformation, Size and Resolution: Using Keras Preproceesing Layers, Data , Augmentation: Spatial Transformations, Color Distortion, Information Dropping, Formatting input images

Training Pipeline: Efficient Ingestion, Storing Data Efficiently, Reading Data in Parallel, Maximizing GPU Utilization

Building custom classifier in keras with transfer learning: Build the data pipeline, Data augmentation, Train the model, Analyzing results

Building a reverse image search engine: Understanding embeddings:
Image similarity, Feature extraction, similarity search, Visualizing image clusters with t-SNE, Improving the speed of similarity search, Scaling similarity search with approximate nearest neighbors, Improving accuracy with fine-tuning

Tutorial: Case studies on Flickr, Pinterest, Spotify, Image captioning

Intel AI for Youth: Module 19 and 20.

UNIT-III

Experience – Types of inference Modules : Intel AI for Youth **09 Hours**

Cloud APIs for Computer Vision: The landscape of visual Recognition APIs, Clarifai, Microsoft cognitive services, Google Cloud Vision, IBM Watson Visual Recognition. Getting up and running with cloud APIs, Training our custom classifier. Performance tuning for cloud APIs: Effect of Resizing on image labelling APIs, Effect of Compression on Image Labelling APIs, Effect of compression on OCR APIs, Effect of Resizing on OCR APIs

Google Cloud ML Engine: Pros of using cloud ML Engine, Cons of using Cloud ML Engine, Building classification API, TensorFlow Serving, KubeFlow: Pipelines, Fairing. Edge ML: Constraints and Optimizations, Tensoflow Lite, Running tensorflow lite, Processing the Image Buffer, Federated Learning

Tutorial: Different Tools and Frameworks which operate on EdgeML (Example: OpenVINO and NCS2)

Intel AI for Youth : Module 21

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

1.	Learn the basics of computer vision elements
2.	Describe the process of image segmentation
3.	Illustrate different preprocessing methodologies
4.	Describe transfer learning and embedding techniques
5.	Demonstrate cloud API and Edge computing concepts

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**
AM3232-1.1	1	2		2										

AM3232-1.2	1	2		2										
AM3232-1.3	1	2		2										
AM3232-1.4	1	2		2										
AM3232-1.5	1	2		2										

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Anirudh Koul, Siddha Ganju and Meher Kasam,Practical Deep Learning for Cloud, Mobile, and Edge: Real world AI and Computer Vision Projects using Python, Keras and Tensorflow, Oreilly publications, 2019
2.	Valliappa Lakshmanan, Martin Gorner & Ryan Gillard, Practical Machine Learning for Computer Vision: End to end machine learning for images, 2021, Oreilly publications
3.	Intel AI for Youth :Module 14 , 19 20 and 21.

REFERENCE BOOKS:

1.	Machine vision, Jain, Ramesh and Rangachar Kasturi and BrianG. Schunck; McGraw-Hill,Edition-1995
2.	Introductory computer vision and image processing, Low, Adrian; McGraw-Hill,Edition-1991.
3.	Digital image processing, Gonzalez, Rafael C. and Richard E. Woods; Addison-Wesley, Edition: 3rd,Year:1998.

E Books / MOOCs/ NPTEL

1.	https://onlinecourses.nptel.ac.in/noc21_ee23/preview
2.	https://onlinecourses.nptel.ac.in/noc19_cs58/preview
3.	https://www.coursera.org/learn/introduction-computer-vision-watson-opencv

AI AND ML IN HEALTHCARE

Course Code:	**AM3001-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L:T:P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Outline how AI is transforming the practice of medicine.
2.	Understand different evaluation models.
3.	Understand image classification technique.
4.	Analyze the use knowledge-based techniques in AI.
5.	Apply Fuzzy Logic and Genetic Algorithm in disease prediction.

Prerequisite	AM1101-1- Artificial Intelligence, AM2001-1-Advanced Machine Learning

UNIT-I

AI and ML in Health care Introduction, History of AI, Clinical Application of AI, AI technologies used in healthcare, AI-based healthcare system vs. Traditional healthcare system, Advantage of AI in health care, Use of AI in Health care, Roles of AI in Health, Challenges for AI in Healthcare Associate features of machine learning for healthcare structure, Pillars of machine learning for healthcare. **Artificial Intelligence Disease Diagnosis** Framework for AI in disease detection modelling , Medical imaging for diseases diagnosis ,	**15 Hours**

Symptoms of diseases and challenges to diagnostics, diseases with their sign and indications for events , Medical imaging types , Healthcare applications and their purpose , Use of AI in Diagnosis of Alzheimer's disease , Use of AI in Diabetes detection , Use of AI in Heart disease diagnosis , Use of AI in Hypertension disease detection , Use of AI in Cancer disease detection Cross Validation , The train , test and validation split , Evidence-Based Medicine, Automated Machine Learning for Health care. **Clinical information System** Introduction to clinical information systems, contemporary issues in healthcare, workflow and related tools for workflow design, electronic health records databases, Healthcare IT & portable technology **Evaluating models** Sensitivity, Specificity, and Evaluation Metrics, Accuracy in terms of conditional probability, Confusion matrix, ROC and AUC curve and Threshold.	
UNIT-II	
Image Classification: What Is Image Classification? Image Processing, Purpose of Image processing, Phases of image processing, Steps in Image Classification, Image Classification Techniques, Maximum likelihood, Minimum-distance, Principal components, so cluster, Parallel piped, Mahala Nobis Distance, Application of Image Processing, Resolving Class imbalance Problem, SNOMED-CT: Classification of Conditions , The CAESAR-ALE Framework , Generating Perceptual-Gestural Sequences : Traces Merging and Somatization , Traces Enrichment , **Image segmentation on MRI images** Introduction, segmentation methods: Region Based Segmentation, Thresholding, Region growing, Region growing, Classification methods, boundary-based methods, Parametric deformable model, non-Parametric deformable model Medical, Hybrid methods, Level set methods, Graph cut method. Model Development and Workflow, Parameters and Hyperparameters, Hyper parameter Tuning, Multivariate Testing. **Knowledge Represent** Knowledge-Based Agent in Artificial intelligence , The architecture of knowledge-based agent , Inference system , Operations Performed by KBA , A generic knowledge-based agent , Various levels of knowledge-based agent , Approaches to designing a knowledge-based agent , What is knowledge representation , What to Represent , Types of knowledge , The relation between knowledge and intelligence , AI knowledge cycle , Approaches to knowledge representation , Requirements for knowledge Representation system , Techniques of knowledge representation, Bayesian Belief Network in artificial intelligence.	**15 Hours**
UNIT-III	
Use of Fuzzy System in AI Introduction, Fuzzy System history**,** Fuzzification, Defuzzification, Architecture of Fuzzy System, Member function, Advantages and Disadvantages of fuzzy logics. **Introduction to Genetic Algorithm** Introduction, Advantages of Gas, Limitations of Gas, Basic Terminology, Basic Structure, Algorithm of Genetic Algorithm, Classes of Search Techniques, Working Mechanism of Genetic Algorithms, The Genetic Algorithm Cycle of Reproduction, Two Armed and K – Armed Bandit Problem, Case study of Predicting Heart disease and kidney disease using Genetic Algorithm.	**10 Hours**

Suggested List of Experiments

1.	Hands on with building and training a model for medical image diagnosis.
2.	Hands on with medical image segmentation (2D U-Net and 3D U-Net Data augmentation)
3.	Hands on with linear prognosis models for liver and heart diseases.
4.	Hands on with tree-based prognosis models and computing accuracy.
5.	Hands on building a risk model based on prognosis models.

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

1.	Understand how AI can be applied to diagnosis of diseases.
2.	Describe different evaluation models.

3.	Outline different Image Processing Technique.
3.	Analyse how to apply knowledge-based techniques to AI.
4.	Demonstrate the use of Genetic and Fuzzy logic in 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**
AM3001-1.1	3	2			2								2	
AM3001-1.2	3	2			2								2	
AM3001-1.3	3	2			2								2	
AM3001-1.4	3	2			2								2	
AM3001-1.5	3	2			2								2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again, Eric Topol, Basic Books, 1st edition 2019.
2.	Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes, Arjun Panesar, Apress, 1st ed. Edition, 2019.

REFERENCE BOOKS:

1.	“Healthcare and Artificial Intelligence”, Springer, 2020.

E Books / MOOCs/ NPTEL

1.	https://www.coursera.org/learn/ai-for-medical-diagnosis
2.	https://www.coursera.org/learn/ai-for-medical-prognosis#syllabus
3.	https://www.coursera.org/learn/ai-for-medical-treatment#syllabus

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Professional Core Courses (Theory)

MODERN COMPUTER ARCHITECTURE

Course Code:	**AM2101-1**	**Course Type**	**PCC**
Teaching Hours/Week (L:T:P:S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Students should be able to understand basic principles of Computer Systems.
2.	They should be able to understand interconnection through Bus, Execution of Instructions and working of ALU.
3.	Students should understand basic processing units, how parallelism is implemented to boost the performance.
4.	Students are to be introduced to various parallel architectures.
5.	They should be capable understanding I/O system operations and using high performance computing architecture.

Prerequisite	LD, CPP

UNIT-I

Organization and Architecture, Structure and Function. **Computer Evolution and Performance:** A Brief History of Computers, Designing for Performance, The Evolution of the Intel x86 Architecture (Textbook 3: W.S, Chapter 1, 2). **Computer Components, Computer Function:** Instruction Fetch and Execute Interrupts, I/O Function, Interconnection Structures. **Bus Interconnection:** Bus Structure, Multiple-Bus Hierarchies, Elements of Bus` Design. **PCI:** Bus Structure, PCI Commands, Data Transfers, Arbitration (Textbook 3: W.S, Chapter 3). **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Stacks and Queues (Textbook 1: Hamacher, Chapter 2) **Arithmetic:** Addition and subtraction of signed numbers, Design of Fast adder, carry look ahead addition**,** Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations on numbers in IEEE format (Textbook 1: Hamacher, Chapter 6). **Tutorial:** Visualization of Logic Gates, Boolean Functions, Multiplexers, Encoders, Decoders using Xilinks/Verilog.	**15 Hours**

UNIT-II

Basic Processing Unit: Basic Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Single Bus Organization, Multiple Bus Organization, Hard-wired Control, Micro programmed Control Queues (Textbook 1: Hamacher, Chapter 7). **Pipelining:** Memory technologies, hierarchical memory systems, Role of cache memory, the locality principle and caching, direct mapped caches, block size, cache conflicts, associative caches, write strategies, advanced optimizations, pipeline performance, Data hazards: Operand forwarding, Handling data hazard in software, Instruction Hazards: Unconditional branches, Conditional branches, prediction, structural hazards. control hazards, basic superscalar architecture basics (Textbook 1: Hamacher, Chapter 8). **Instruction level parallelism and Super Scalar Processors:** Overview, Design Issues (Textbook 3: W.S, Chapter 14). **Parallel Computer Architecture:**On-Chip Parallelism, Coprocessors, Shared Memory Multicomputer, Message Passing Multicomputer, Grid Computing, (Textbook 4: Tenenbaum, Chapter 8).	**15 Hours**

Tutorial: Basic assembly program structure, working of few assembly codes like adding two numbers, sum of “N” Numbers etc. using MASM or TASM assembler.

UNIT-III

Input/Output Systems: Introduction, I/O and Performance, AMDAHL’s Law, I/O Architectures, Data Transmission Modes, Direct Memory Access (DMA).: Textbook 2: Linda, Chapter 7).

High Performance Computing (HPC):
HPC Architecture, Parallel Processing, Parallel Memory Models, Data vs. Task Parallelism, High Throughput Computing, Vectorization, Multithreading.

High Performance Computing with CUDA:
CUDA programming model, Basic principles of CUDA programming, Concepts of threads and blocks, GPU and CPU data exchange

10 Hours

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

1.	Understand different computer architectures and their applications.
2.	Implement machine instructions and its functions.
3.	Analyse fundamental concepts of instruction execution and Pipelining.
4.	Realize parallel computer architecture and instruction level parallelism.
5.	Understand high-performance computing with CUDA.

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
AM2101-1.1	2			1										
AM2101-1.2	2			2										
AM2101-1.3	2			2										
AM2101-1.4	2			2										
AM2101-1.5	2			2										

1: Low 2: Medium 3: High

TEXTBOOKS:

1	Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Tata McGraw Hill, Fifth Edition, 2008
2	Linda Null, Julia Lobur, “The Essentials of Computer Organization and Architecture”
3	William Stallings, “Computer Organization and Architecture – Designing for Performance”, Pearson Education, Ninth Edition, 2012
4	Andrew A Tenenbaum, Todd Austin, Structured Computer Organization, 6th edition – Pearson, 2013

REFERENCE BOOKS:

1.	David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software interface”, Elsevier, Third Edition, 2005
2.	Parallel Computer Architecture: A Hardware/Software Approach David Culler and J.P. Singh with Anoop Gupta, Morgan Kaufmann, 1998.
3.	John P. Hayes, “Computer Architecture and Organization”, Tata McGraw Hill, Third illustrated Edition, 2007.

E Books / MOOCs/ NPTEL

1.	https://onlinecourses.nptel.ac.in/noc20_cs41/preview
2.	https://www.coursera.org/learn/introduction-high-performance-computing#syllabus

INTRODUCTION TO MACHINE LEARNING			
Course Code:	**AM1104-1**	**Course Type**	**PCC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Learn the fundamentals of machine learning and data preprocessing.
2.	Outline the concepts of decision tree, rule based and nearest neighbor classification techniques.
3.	Understand the concepts of Bayesian classifiers, and association analysis
4.	Describe unsupervised learning techniques with example
5.	Understand dimensionality reduction techniques

Prerequisite	NIL

UNIT-I	
Acquire Machine Learning Fundamentals **Introduction to machine learning:** What is machine learning? Examples of machine learning applications: Learning associations, Classification, Regression, Unsupervised learning, Reinforcement learning **Data preprocessing**: Types of data, attributes and measurements, types of datasets, Data quality, Aggregation, Sampling, Dimensionality reduction, Feature subset selection, Feature creation, Discretization and binarization, variable transformation **Supervised learning algorithms I:** **Decision tree induction**, Preliminaries, general approach to solving a classification problem how a decision tree works, how to build a decision tree, methods for expressing attribute test conditions measures for selecting the best split, algorithm for decision tree induction. **Nearest-Neighbour classifier:** Algorithm, characteristics of nearest neighbour classifier **Intel AI for Youth : Module 6, 7, 8**	**15 Hours**
UNIT-II	
Acquire Domain Specific Concepts **Bayesian classifiers:** Bayes theorem, using bayes theorem for classification, Naïve bayes classifier, Bayes error rate **Support vector machine:** Maximum margin hyperplanes, Linear SVM: separatable case **Association Analysis:** Frequent itemset generation, The Apriori principle, candidate generation and pruning, Support counting, Rule generation: Confidence based pruning, Rule generation in apriori algorithm **Regression:** Simple linear regression, least square method, analysing regression errors, analysing goodness of fit, multivariate regression. **Unsupervised learning algorithms** **Cluster analysis:** What is cluster analysis? Different types of clustering, different types of clusters **K-means clustering:** The basic K-means algorithm, K-means additional issues, Bisecting K-means, K-means and different types of clusters **Agglomerative Hierarchical clustering:** Algorithm, specific techniques, key issues in hierarchical clustering **DBSCAN:** Density centre-based approach, DBSCAN algorithm. **Intel AI for Youth : Module 13**	**15 Hours**
UNIT-III	
Module Evaluation : Intel AI for Youth	**10 Hours**

Dimensionality Reduction: Introduction, Subset selection, Principal component analysis, Feature embedding, factor analysis, singular value decomposition and matrix factorization, multi-dimensional scaling

Ensemble methods: Rationale for ensemble method, methods for constructing an ensemble classifier, Bias-variance decomposition, Bagging, Boosting, Random forests, Empirical comparison among ensemble methods, class imbalance problem, Receiver operating curve (ROC curve).

Intel AI for Youth : module 9

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

1.	Describe the machine learning techniques and its types.
2.	Analysis of association techniques using machine learning algorithm.
3.	Apply different classification techniques on real time data.
4.	Apply different types of clustering techniques.
5.	Understand evaluation measures, dimensionality reduction 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**
AM1104-1.1	3	2	2		2								3	
AM1104-1.2	3	2	2		2								3	
AM1104-1.3	3	2	2		2								3	
AM1104-1.4	3	2	2		2								3	
AM1104-1.5	3	2	2		2								3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Ethem Alpaydin, Introduction to Machine Learning, Second Edition, 2014.

2. Introduction to Data Mining-Pang-NingTan, Michael Steinbach, Vipin Kumar, Pearson Education, 2009.

3. Intel AI for Youth: Module 9 and 13

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.

E Books / MOOCs/ NPTEL

1. https://www.javatpoint.com/machine-learning - Introduction to machine learning

2. https://onlinecourses.nptel.ac.in/noc22_cs29/preview- NPTEL course on introduction to machine learning.

3. https://www.javatpoint.com/birch-in-data-mining - BIRCH clustering algorithm

DATABASE MANAGEMENT SYSTEMS

Course Code:	**CS2102-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CS1002-1**		

Teaching Department: Artificial Intelligence Machine Learning

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, Database System Concepts	**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 and Relational Calculus: 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 ER- to-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 Relatinal 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 Datastructures, Comparision 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. Understan 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, RamezElmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database Management Systems, Raghu Ramakrishnan,Johannes Gehrke, Indian Edition, Mc Graw Hill Education.

REFERENCE BOOKS:

1. Database Systems: Models, Languages, Design and Application Programming, RamezElmasri and Shamkant B. Navathe, 6th Edition, 2017, Pearson.
2. Database System Concepts, SilberschatzKorth and Sudharshan, 6thEdition, 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 ESSENTIALS

Course Code:	**AM2102-1**	**Course Type**	**PCC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

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 analyse 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 introducing to Virtualization and Cloud.

Prerequisite CS1001-1-Problem-Solving through Programming

UNIT-I	
INTRODUCTION: What Is An Operating System? History of Operating Systems, Computer Hardware Review, The Operating System Types, Operating System Concepts, System Calls, Operating System Structure. **(Text 1: Chapter 1).** **PROCESSES AND THREADS:** Processes, Threads, Inter process Communication (IPC), Classical IPC Problems. **(Text 1: Chapter 2).** **CPU SCHEDULING:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling. **(Text 2: Chapter 5).** **INTERPROCESS COMMUNICATION:** Race Conditions, Critical Regions, Mutual Exclusion with Busy Waiting, Sleep and Wakeup, Semaphores, Mutexes, Monitors, Message Passing, Shared Memory. **(Text 1: Chapter 2/ Text 2: Chapter 6).**	**15 Hours**
UNIT-II	
DEADLOCKS: System model; Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, avoidance, detection, and recovery from deadlock. (**Text 2: Chapter 8)** **MAIN MEMORY:** Paging, Structure of page table, Swapping. (**Text 2: Chapter 9)** **VIRTUAL MEMORY:** Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing, Allocating Kernel Memory. (**Text 2: Chapter 10)**	**15 Hours**
UNIT-III	
FILE-SYSTEM INTERFACE: Access Methods, Directory Structure, Protection. **FILE-SYSTEM IMPLEMENTATION:** Directory Implementation, Allocation Methods, Free-Space Management. (**Text 2: Chapter 13 & 14)** **VIRTUALIZATION AND THE CLOUD** **REQUIREMENTS FOR VIRTUALIZATION:** TYPE 1 AND TYPE 2 HYPERVISORS, **TECHNIQUES FOR EFFICIENT VIRTUALIZATION:** Virtualizing the Unvirtualizable, The Cost of Virtualization, Are Hypervisors Microkernels Done Right? Memory Virtualization, I/O Virtualization, Virtual Appliances, Virtual Machines on Multicore CPUs, Licensing Issues. **CLOUDS:** Clouds as a Service, Virtual Machine Migration, Checkpointing. **CASE STUDY:** VMWARE- The Early History of VMware, VMware Workstation. **(Text 1: Chapter 7/ Text 2: Chapter 18).**	**10 Hours**

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

1. Recognize the structural components of operating system
2. Demonstrate the creation and termination of the processes, threads and CPU scheduling algorithms.
3. Illustrate critical section problem and demonstrate the Peterson's solution. Investigate the Deadlock condition and determine the solution to prevent and 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 file system concepts, directory implementation and know the Virtualization and Cloud.

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**
AM2102-1.1	2		1											2
AM2102-1.2	2		2											2
AM2102-1.3	2		3											2
AM2102-1.4	2		1											2
AM2102-1.5	2		3											2

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Modern Operating Systems, 4th ed, by Andrew S. Tanenbaum, Herbert Bos, Prentice Hall, 2015.
2.	Operating System Concepts, Abraham Silberschatz, Greg Gagne, Peter B. Galvin, 10th Edition, John Wiley & Sons, 2018, ISBN: 9781119320913.
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/

ARTIFICIAL INTELLIGENCE

Course Code:	**AM1101-1**	**Course Type**	**PCC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Students will learn the basic concepts and techniques of Artificial Intelligence. They should be able to develop AI algorithms for solving practical problems.

Prerequisite	NIL

UNIT-I

Inspire Module: Intel AI for youth

Artificial Intelligence and its applications, Artificial Intelligence Techniques, Level of models, criteria of success, Intelligent Agents, Nature of Agents, Learning Agents. AI Techniques, advantages, and limitations of AI, Impact and Examples of AI, Application domains of AI. The AI Ladder - The Journey for Adopting AI Successfully, Advice for a career in AI, Hotbeds of AI Innovation.

Problem solving techniques.

State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, Constraint satisfaction problem, Mean-end analysis, Min-Max Search, Alpha-Beta Pruning, Additional refinements, Iterative Deepening.

15 Hours

UNIT-II

15 Hours

Logic

Propositional logic, predicate logic, Resolution, Resolution in proportional logic and predicate logic, Clause form, unification algorithm,

Knowledge Representation schemes and reasoning

Mapping between facts and representations, Approaches to knowledge representation, procedural vs declarative knowledge, Forward vs. Backward reasoning, Matching, conflict resolution, Nonmonotonic reasoning, Default reasoning, statistical reasoning, fuzzy logic Weak and Strong filler structures, semantic nets, frame, conceptual dependency, scripts.

UNIT-III

Planning The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning	**10 Hours**

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

1.	Understand the basic concepts and techniques of Artificial Intelligence.
2.	Apply AI algorithms for solving practical problems
3.	Describe human intelligence, intelligent system and AI
4.	Apply basics of Fuzzy logic and neural networks.
5.	Explain Expert System and implementation

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**
AM1101-1.1	2			2			3						2	
AM1101-1.2	3			3			2						3	
AM1101-1.3	3			2			1						2	
AM1101-1.4	2			1			1						3	
AM1101-1.5	1			2			1						2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	A Classical Approach to Artificial Intelligence, M.C. Trivedi, Khanna Book Publishing, 2019.
2.	Artificial Intelligence: A modern approach by Stuart Russel, Pearson Education, 2010.
3.	Intel AI for Youth Module 0 ,1 , 2 ,3 ,4 ,5

REFERENCE BOOKS:

1.	Artificial Intelligence by Rich and Knight, The McGraw Hill, 2017
2.	Artificial Intelligence: A new synthesis by Nils and Nilson, Elsevier, 1997.
3.	Artificial Intelligence by Luger, Pearson Education, 2002.
4.	Artificial Intelligence by Padhy, Oxford Press, 2005.

E Books / MOOCs/ NPTEL

1.	https://www.edx.org/course/artificial-intelligence-ai
2.	https://www.udemy.com/course/artificial-intelligence-az/

DATA NETWORKING AND COMMUNICATION SYSTEMS

Course Code:	**AM3101-1**	**Course Type:**	**PCC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Outline the concepts of basic data communications and networking.

2.	Get the idea of signal transmission.
3.	Understand the basic of data link layer functionalities and protocols.
4.	Study the importance of network layer and differentiate various routing algorithms
5.	Acquire the knowledge of working of transport layer, its protocols and some application layer protocols.

Prerequisite AM2102-1-Operating Systems Essentials

UNIT-I

Introduction to data communications: Components, Networks, Network Types, Protocol Layering, TCP/IP Protocol Suite, The OSI Model. (Chapter 1)
Physical Layer: Signals, Signal Impairment, Digital Transmission, Analog Transmission, Multiplexing. (Chapter 2)
Data-Link Layer: **Data-link control:** Framing, Error Control.
Media Access Protocols: Carrier Sense Multiple Access, CSMA/CD. Link-Layer Addressing: Three Types of Addresses (Chapter 3)
Local Area Networks: Ethernet, Standard Ethernet Frame Format. (Chapter 4)

15 Hours

UNIT-II

15 Hours

Network Layer: Data Transfer: Services, Packet Switching, Performance, IPv4: IPv4 Addressing, Main and Auxiliary Protocols. IPv6: IPv6 Addressing, The IPv6 Protocol. (Chapter 7)
Network Layer: Routing of Packets: General Idea, Least-Cost Routing, Routing Algorithms: Distance-Vector Routing, Link-State Routing, Path-Vector Routing, OSPF, BGP4, Multicast Routing: Unicasting, Multicasting, Distance Vector Multicast Routing Protocol. IGMP. (Chapter 8)

UNIT-III

10 Hours

Transport Layer: Transport-Layer Services, Transport-Layer Protocols, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Stream Control Transmission Protocol (SCTP). (Chapter 9)
Application Layer: Introduction, Client/Server Paradigm, Standard Applications. (Chapter 10)

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

1.	Describe the basics of Data Communication and understand the working of signals in physical layer.
2.	Understand the working of data link layer, the protocols and differentiate the types of LAN.
3.	Comprehend the basic data transfer in network layer.
4.	Distinguish between various routing algorithms.
5.	Portray the transport layer protocols and the list some of the services in application layer.

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**	
AM3101-1.1	1	2												2	
AM3101-1.2	3	1												2	
AM3101-1.3	3	2												2	
AM3101-1.4	3	2												2	
AM3101-1.5	3	2												2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Data Communications and Networking with TCP/IP Protocol Suite, Behrouz A. Forouzan, 6th Edition, 2022, McGraw Hill, ISBN 978-1-26-436335-3.

REFERENCE BOOKS:

1. Computer Networks by Andrew S. Tanenbaum (Fifth Edition), Pearson Education.
2. Data Communication and Networking by Behrouz A. Forouzan (Fifth Edition), Tata McGraw

	Hill.
3.	Computer Networking. A Top-down Approach, James F. Kurose, Keith W. Ross, Pearson, ISBN: 1292153598, 2017.
4.	Data and Computer Communications, 10th Edition, William Stallings, Pearson Education, 2013, ISBN: 0133506487,9780133506488.
5.	Data and Computer Communication, 8th Edition, William Stallings, Prentice Hall, 0132433109, 2007.
6.	An Introduction to Computer Networks, Peter L Dordal, Open Book, http://intronetworks.cs.luc.edu/ 2020.
7.	William A. Shay, “Understanding Data Communications and Networks”, 2nd Edition, Thomson.
E Books / MOOCs/ NPTEL	
1.	https://onlinecourses.nptel.ac.in/noc22_ee61/preview
2.	https://archive.nptel.ac.in/courses/106/105/106105080/
3.	https://www.digimat.in/nptel/courses/video/106105183/L01.html

Professional Core Courses (Lab)

DATA SCIENCE & MACHINE LEARNING LAB

Course Code:	**AM1602-1**	**Course Type:**	**PCC Lab**
Teaching Hours/Week (L:T:P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Apply the basics of Excel
2.	Analysis the data using Pivot Tables and Lookup Values
3.	Describe the basic machine learning
4.	Apply the concepts of ML to handle missing value

5.	Explain the concepts of machine learning to predict the different values.

Prerequisite	NIL

Following Topics Can be Covered

1) Creating Worksheet
2) Lookup
3) Pivot table
4) Operation on strings
5) operating on Date format
6) Formatting the cells
7) Classification and Regression Algorithm
8) Handling missing values
9) Normalization techniques in Machine Learning

List of Experiments

	PART A
1.	Create a worksheet to use some basic excel function
2.	Create a worksheet to analysis the call statistics of a company
3.	Create a worksheet to calculate employees payroll
4.	Create a worksheet to calculate the Commission for sales
5.	Create a worksheet to calculate the monthly quarterly and yearly sales
6.	Create a worksheet to compare the sales of each sheet
7.	Create a worksheet to store the students data and calculate the grade
8.	Create a worksheet to calculate employees annual increment based on age and current salary
9.	Create a student database to demonstrate the use of vlookup
10.	Create employees database to maintain the employees details and calculate net salary and total deduction.
11.	Create a university database to store students mark and perform result analysis
	PART B
1.	Predict the car sale price using suitable algorithm . Handle the missing values and use label encoding technique to encode the categorical data
2.	Apply the Decision tree classifier to iris data and find the accuracy of the model
3.	Predict the salary of a person using linear Regression technique and plot the graph for training and testing.
4.	Use standard scaler and KNN method to find the purchase details of customer.
5.	Predict the company profit using suitable model and encode the categorical data using Label encoding technique
6.	Apply the fraud detection for the credit card data and display the confusion matrix and classification report and apply the under sampling technique and compare the performance
7.	Apply the fraud detection for the credit card data and display the confusion matrix and classification report and apply the over sampling technique and compare the performance
8.	Predict the company profit using suitable model and encode the categorical data using Label encoding technique.

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

1.	Acquire the knowledge of data analysis and carry out the data analysis process.
2.	Practice out quick data analysis, extracting data values from text.
3.	Demonstrate the export of data to excel, PivotTable
4.	Describe to handle missing data.
5.	Apply the concepts of machine learning to predict the different model values.

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**

AM1602-1.1		3	3				3						3	
AM1602-1.2		3	3				3						3	
AM1602-1.3		3	3				3						3	
AM1602-1.4		3	3				3						3	
AM1602-1.5		2	2				2						3	

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	https://onlinecourses.nptel.ac.in/noc21_ma35/preview
2.	https://onlinecourses.nptel.ac.in/noc21_cs69/preview
3.	https://archive.nptel.ac.in/noc/courses/noc21/SEM1/noc21-ma35/

E Resources

1.	https://www.analyticsvidhya.com/blog/2016/02/complete-tutorial-learn-data-science-scratch/
2.	https://crd230.github.io/lab1.html
3.	https://r4ds.had.co.nz/introduction.html

MOBILE APPLICATION DEVELOPMENT

Course Code:	**AM2601-1**	**Course Type:**	**PCC Lab**
Teaching Hours/Week (L:T:P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

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.

Prerequisite	CS2002-1

List of Experiments

	First Week: Android Overview (T1 – 1.5), Setting up development Environment, Hello World Example, Traversing an Android App Project Structure, Installing and running App Devices (T1 – 2.2, 2.3, 2.4, 2.7) Lab Experiment: 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
	Second Week: App User Interface – UI Resources (Layout, View), UI Elements (Button, TextView, EditText, RadioButton, RadioGroup) (T1 – 4.1, 4.2, 4.3, 4.4, 4.5) Lab Experiment: 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
	Third Week: UI Elements – ImageView, CheckBox, DatePicker, TimePicker (T1 – 4.4, 4.5) Lab Experiment: 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
	Fourth Week: UI Elements – Spinner, List View, Options Menu, Context Menu (T1 – 4.4, 4.5) Lab Experiment: Implement option menu and context menu to perform mathematical operations, Application to dynamically and statically add items to a list
	Fifth Week: Activity – States and Life cycle, Interaction among Activities (T1 - 4.6, 4.7) Lab Experiment: Mobile Application to demonstrate the activity life cycle by logging the activities in the Logcat, Application to demonstrate interaction between activities
	Sixth Week: Threads and AsyncTask, UI Elements – ProgressBar (T1 – 5.1, 5.2, 5.3, 5.4) Lab Experiment: Implement an AsyncTask to count from 1 to 100 in background and display the progress using progress bar, Implement the same using threads
	Seventh Week: Service, Notifications, Intents – Implicit and Explicit Intents (T1 – 5.5, 5.6) Lab Experiment: Implement a service to play music in background, Demonstrate Call, demonstrate usage of Browser and Maps using Intent class
	Eighth Week: Broadcast Receivers, Telephony and SMS (T1 - 5.8, 5.9, 5.10) Lab Experiment: 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
	Ninth Week: Mobile Databases – SQLite (T1 – 6.5) Lab Experiment: Application to insert data entered by user into database and display the values in database (using SQLiteDatabase and DBHelper)
	Tenth Week: Shared Preferences, Content Providers (T1 – 6.3, 6.6) Lab Experiment: Implement an application to store and retrieve data by using Shared Preference.
	Eleventh Week: Android Animation, Text to Speech (T1 – 7.3) Lab Experiment: Application to implement Android Animations – Fade, Rotate, zoom, blink, implement application to convert text to speech.
	Twelfth Week: Audio, Video, Images (T1 –8.2, 8.3) Lab Experiment: Mobile Application to capture image using Camera and set the image as background, Mobile Application to capture video.
	Thirteenth Week: Sensors in Android, Android Sensor Framework, Motion Sensors - Accelerometer and Gyroscope (T1 – 10.2, 10.3, 10.4) Lab Experiment: Mobile Application to use Accelerometer and display coordinates, Application to use gyroscope and change Background color using sensor values.
Following experiments can be considered for practice purpose	
PART A	

<table>
<tr><td></td><td>Design four checkboxes namely any four food items and one button. Find total amount of food items selected in Toast message after clicking the button.</td></tr>
<tr><td></td><td>Design simple calculator application that performs basic arithmetic operations. Use ADD, SUB, MUL, DIV buttons to perform operations, CLEAR button to reset the fields, and edit text widgets for reading operands, displaying result value.</td></tr>
<tr><td></td><td>Create an application which generates a random color on each click.</td></tr>
<tr><td></td><td>Implement the options menu concept in the application to choose between two activities (Give appropriate titles to activities).</td></tr>
<tr><td></td><td>Implement context menu concept in application to change the background color.</td></tr>
<tr><td></td><td>Design an application to send SMS using Intent class.</td></tr>
<tr><td></td><td>Design a phone call application that takes a phone number from the user.</td></tr>
<tr><td></td><td>Write an application to toast your joining date and course selected for engineering using a Date picker and List view/Spinner.</td></tr>
<tr><td></td><td>Write an application to make a dialogue box to confirm the change of background color or image.</td></tr>
<tr><td></td><td>Design an application that captures the image using a camera and set the captured image as the background for your application.</td></tr>
<tr><td colspan="2">PART B</td></tr>
<tr><td></td><td>Implement a service concept to play the music in the background for long duration and perform a foreground job.</td></tr>
<tr><td></td><td>Implement an AsyncTask to count from 1 to 1000 in the background and the display the progress using progress bar on the screen.</td></tr>
<tr><td></td><td>Implement broadcast receiver to carry out the of following:
Read battery charge of your mobile, display it using progress bar and change the background color as given in table.
<table>
<tr><th><u>Color</u></th><th><u>Battery Charge</u></th></tr>
<tr><td>Red</td><td>0% To 20%</td></tr>
<tr><td>Blue</td><td>21% To 60%</td></tr>
<tr><td>Green</td><td>61% To 100%</td></tr>
</table>
</td></tr>
<tr><td></td><td>Write an application to insert the data entered by a user into a database and display all the values in database.</td></tr>
<tr><td></td><td>Write an application to search for a given USN from a student database and call to that student.</td></tr>
<tr><td></td><td>Design a simple resume builder application using two activities that take basic information namely Name, Email Id, Mobile No, Gender, Qualification, and Profile Picture from the user. Use appropriate text widgets for (Name, Email Id, Mobile No, Qualification), radio buttons for gender, Imageview for the profile picture.</td></tr>
<tr><td></td><td>Write an application that creates a notification message that will launch another activity after clicking on it.</td></tr>
<tr><td></td><td>Implement web view concept in application that contains two activities and opens default web page/user entered web page.</td></tr>
<tr><td></td><td>Implement an application to store and retrieve data by using shared preference. (Include save, delete and retrieve operations)</td></tr>
<tr><td></td><td>Implement the following animation concept
i. Blink
ii. Move the image object
iii. Rotate.
iv. Zoom in and Out</td></tr>
<tr><td colspan="2">Course Outcomes: At the end of the course student will be able to</td></tr>
</table>

1.	Explain the architecture, project structure for Android and demonstrate mobile applications with UI Elements
2.	Build Mobile applications using activities.
3.	Implement mobile applications using services and Broadcast receivers.
4.	Implement Mobile Applications that supports 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**
AM2601-1.1				1		2	2						1	
AM2601-1.2				3		3	3						3	
AM2601-1.3				3		3	3						3	
AM2601-1.4				3		3	3						3	
AM2601-1.5				3		2	2						3	

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Anubhav Paradhan, Anil V Deshpande, Mobile apps Development, 1st Edition, Publication: Wiley, 2014.
2.	Barry Burd, Android Application Development All in one for Dummies
3.	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/

PROJECTS IN INTERNET OF THINGS

Course Code:	**AM2602-1**	**Course Type:**	**PCC Lab**
Teaching Hours/Week (L:T:P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Learn the IoT hardware and software requirements
2.	Understand the IoT logical and physical design concepts
3.	Develop Raspberry Pi based IoT Projects and Arduino based IoT Projects
4.	Understand the usage of thing speak cloud.

Prerequisite NIL

List of Experiments

	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
	To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
	To interface DHT11 sensor with Arduino/Raspberry Pi and write a programe to print temperature and humidity readings.
	To interface motor using relay with Arduino/Raspberry Pi and write a programe to turn ON motor when push button is pressed.
	TO interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when ‘1’/’0’ is received from smartphone using Bluetooth.
	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.

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

1.	Identify the IoT hardware and software requirements
2.	Describe IoT logical and physical design concepts
3.	Implement Arduino based IoT Projects
4.	Implement Raspberry Pi based IoT Projects
5.	Implement the usage of thingspeak cloud.

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**
AM2602-1.1	2		2	2									3	
AM2602-1.2	2		2	2									3	
AM2602-1.3	3		3	3									3	
AM2602-1.4	3		3	3									3	
AM2602-1.5	3		3	3									3	

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	ArshdeepBahga, Vijay Madisetti, “Internet of Things: A Hands-On Approach, Vijay Madisetti”, 2014.
2.	Donald Norris, “The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black”, 1st Edition, McGraw Hill, 2015.
1.	https://onlinecourses.nptel.ac.in/noc22_cs53/preview
2.	https://onlinecourses.nptel.ac.in/noc21_ee85/preview
3.	https://archive.nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/

ANGULAR AND REACTJS LAB

Course Code:	**AM1601-1**	**Course Type:**	**PCC Lab**
Teaching Hours/Week (L:T:P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Learn Basics of html tags,frames,forms
2.	Understand the basics of CSS, Javascript,XML
3.	Implementation using AngularJS
4.	Implement using ReactJS to develop the applications

Prerequisite	**CS1001**

List of Experiments

1.	Implement Basic Html Tags
2.	Implement Table Tags a. Implement Frames
3.	Design a Form in Html a. Validation of Form Using JavaScript
4.	Implement Various Types of CSS
5.	Display Various Forms of XML Document a. Raw XML ii. XML with CSS iii .XML using XSLT
6.	Using ReactJS Implement a. Selecting Element, Getting Values, Setting Values. b. Events
7.	Using Angular JS Implement a. Input Validation b. Backend Building

PART-A

1.	Write a reactjs program to create a search filter
2.	Write a reactjs program to create a simple counter
3.	Write a reactjs program to display the lists
4.	Creating an accordion that toggles text content on click of the accordion header using React State and conditional rendering.
5.	Create an image slide, where users can view multiple images with next/previous buttons using reactjs
6.	Extracting text from the text input as it changes using AngularJS
7.	Adding entries to a list using forms and ng-submit using AngularJS
8.	Enumerating objects - countries and their populations Using AngularJS
9.	Sorting table columns interactively Using AngularJS

PART-B

1.	Write a React code to display a checklist with multiple options that can select and the selected options are dynamically displayed on the screen.
2.	Create a React code for simple login form where the user login by entering their username and password. The form inputs are validated to check if correct information is entered and the error messages are the validation fails. The login form is hidden and the “Welcome, ${name}” message is shown when the user login is successful.
3.	Create a React code to collect data from rest API using fetch() in JavaScript combined with

useEffect() to load the content on page render.

4. Create a React code to develop a multipage application with navigation for Home, About and Blog pages. The route-based component rendering is implemented using the "react-dom" npm package to allow users to navigate to different pages and render the component with respect to the route

5. Write a angularJS code to implement currency converter

6. Display the data in the form of table using angularJS

7. Write angularjs to create a form and submit the form and display the details.

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

1. Design and understand static web pages using HTML5 and Cascading Style Sheets (CSS), XML.

2. Develop client side validations using JavaScript.

3. Understand the basics of AngularJS

4. Develop interactive AngularJS script at the client side.

5. Understand the basics of ReactJS

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
AM1601-1.1	3		2	2										2
AM1601-1.2	3		3	3										3
AM1601-1.3	3		2	2										2
AM1601-1.4	3		3	3										3
AM1601-1.5	3		2	2										2

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. https://www.fullstacklabs.co/blog/angular-to-react-part-one

2. https://www.xenonstack.com/blog/react-learning-path

E Resources

1. https://www.udemy.com/course/angular-5/?LSNPUBID=JVFxdTr9V80&ranEAID=JVFxdTr9V80&ranMID=39197 &ranSiteID=JVFxdTr9V804ViYyNt.AAsnhH6rk2znyg&utm_medium=udemyads&utm_source=aff-campaign

2. https://www.udemy.com/course/react-fundamentals/?LSNPUBID=JVFxdTr9V80&ranEAID=JVFxdTr9V80&ranMID=39197 &ranSiteID=JVFxdTr9V80-ZuCzBfGb54dhnTrbB9SlEg&utm_medium=udemyads&utm_source=aff-campaign

GENERATIVE AI AND LARGE LANGUAGE MODELS LAB

Course Code:	**AM4601-1**	**Course Type:**	**PCC Lab**
Teaching Hours/Week (L:T:P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Introduce students to the basic concepts of generative adversarial networks
2.	Familiarize students with popular types of GAN and its implementation on different case studies
3.	Enable students to understand the concept of large language model and its training process
4.	Guide students in creating different scenario based large language model with langchain framework

Prerequisite: **AM3004-1, AM3003-1**

List of Experiments

PART-A

1.	Implement simple GAN on the given dataset with TensorFlow GPU based
2.	Implementation of conditional GAN on the given dataset
3.	Implement Deep Convolutional GAN with TensorFlow for generating higher resolution images
4.	Implement a Pix2Pix model for image-to-image translation with paired data.
5.	Implement a GAN-based anomaly detection model.

PART-B

1.	Develop a model that can effectively detect and understand sarcasm and irony in text, addressing the challenges posed by nuanced language.
2.	Build a system for detecting anomalous patterns in text, which can be applied to identify unusual events or fraudulent activities in various domains.
3.	Explore methods for zero-shot learning in text classification, where a model can classify samples from classes it has never seen during training.
4.	Develop a system that incorporates user input to co-create narratives, allowing users to interactively shape the direction of a generated story.
5.	Create a sentiment analysis model that can effectively analyze sentiment in multilingual text, considering the nuances of different languages.

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

1.	Understanding of what is GenAI and its usage in different fields of artificial neural networks
2.	Familiarize yourself with popular GAN models and understand its implementation
3.	Describe the lanchain framework and implement simple commands to get familiarize
4.	Implement scenario based case studies using large language models
5.	Analyze different large language models new generation GenAI, APIs and Multimodal GenAI

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
AM4601-1.1	3	2	2	2										2
AM4601-1.2	3	2	3	3										3

AM4601-1.3	3	2	2	2										2
AM4601-1.4	3	2	3	3										3
AM4601-1.5	3	2	2	2										2

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Generative Adversarial Networks with Python: Deep Learning Generative Models for Image Synthesis and Image Translation by
2.	Jason Brownlee, machine learning mastery, 2019 Generative Deep learning: Teaching machines to Paint, Write, Compose and Play by David Foster, Oreilly Publications, 2019
3.	Quick Start Guide to Large Language Models: Strategies and Best Practices for using ChatGPT and Other LLMs" by Sinan Ozdemir, O'reilly publications, October 2023
4.	Introduction to Transformers for NLP: With the Hugging Face Library and Models to Solve Problems" by Shashak mohan Jain, O'reilly publications, October 2022

E Resources

1.	Large Language Model: https://www.geeksforgeeks.org/large-language-model-llm/
2.	Large Language Model: https://developers.google.com/machine-learning/resources/intro-llms
3.	GAN: https://www.datacamp.com/tutorial/generative-adversarial-networks

Professional Elective Courses (PEC)

Professional Elective Courses
Stream 1
Computational Fundamentals
(Group-1)

SOFTWARE ENGINEERING AND PROJECT MANAGEMENT

Course Code:	**AM2201-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

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.

Prerequisite	**CS1002-1**

UNIT-I

Introduction — **15 Hours**

Introduction:
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**

System Models:
Context models, Interaction models, Structural models, Behavioral models.

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**

Project Management:
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. Recognize 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	3
AM2202-1.1		3	1					2					1	2	

AM2202-1.2	1	3	1										1	2	
AM2202-1.3	1	1	3										2	3	
AM2202-1.4	1	3	2										1	2	
AM2202-1.5	1	2	2										1	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

CLOUD COMPUTING

Course Code:	**AM3201-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

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

Prerequisite	**NIL**

UNIT-I

Introduction	**15 Hours**

Eras of computing, Parallel vs. Distributed Computing, Elements of Parallel Computing- (What is parallel computing , hardware architecture for Parallel processing, approaches to parallel programming, levels of parallelism, Laws of caution). Elements of Distributed Computing- (General concepts and definitions, components of a distributed system, Architectural styles for distributed computing, models for inter-process communication, Technologies for distributed computing-Remote procedure call, Service oriented computing).

Cloud computing Architecture: - Introduction, Cloud reference models- (Architecture, Infrastructure/Hardware as a service, Platform as a service, Software as a service), Types of cloud – (Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds), Economics of cloud, Open challenges

UNIT-II

Cloud Computing Architecture	**15 Hours**

Virtualization: – Introduction, characteristics of virtualized environments, taxonomy of virtualization technique- (execution of virtualization, other types of virtualization-Compute, Storage, Network, Desktop, Application). Virtualization and cloud computing, Pros and Cons of virtualization, Technology examples- XEN, VMware, Microsoft Hyper-V.

Security Concerns, Risk Issues:- Cloud Computing- Security Concerns. A Closer Examination: Virtualization, A Closer Examination: Provisioning.

Securing the Cloud: Key Strategies and Best Practices: - Overall Strategy: Effectively Managing Risk-Risk Management: Stages and Activities. Overview of Security Controls, Cloud Security Controls Must Meet Your Needs, NIST Definitions for Security Controls, Unclassified Models, Classified Model The Cloud Security Alliance Approach. The Limits of Security Controls - Security Exposure Will Vary over Time, Exploits Don’t Play Fair. Best Practices: Best Practices for Cloud Computing- First Principals, Best Practices across the Cloud Community . Other Best Practices for Cloud Computing- Cloud Service Consumers, Cloud Service Providers. Security Monitoring.

UNIT-III

Advanced Topics in Cloud Computing	**10 Hours**

The Purpose of Security Monitoring, Transforming an Event Stream, The Need for C.I.A. in Security Monitoring, the Opportunity for MaaS.

Case studies: Public cloud- AWS, Windows Azure, Google App Engine. Private Cloud- Open stack, Eucalyptus

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

1. Define the concept of cloud computing business need and various networking methods.
2. Express the infrastructure management for cloud environment.
3. Practice the Virtualization at all levels using technology XEN, Vmware, Microsoft Hyper-v.
4. Explain the security concepts in cloud computing and securing the cloud.
5. Practice the case studies of public cloud such as AWS, Google App Engine and private cloud such as Open Stack.

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
AM3201-1.1	1	2											1	2	
AM3201-1.2	1	3											1	2	
AM3201-1.3	1	3											1	2	
AM3201-1.4	1	3											1	2	
AM3201-1.5	1	3											1	2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Buyya, Rajkumar, Christian Vecchiola and Thamarai Selvi, "Mastering Cloud Computing Fundamentals and Applications Programming", McGraw Hill, 2013.
2. G, Somasundarm and Alok Srivatsa, "Information Storage and Managemnt.", EMC Education Services, Wiley Publishing Inc., 2009.
3. Sitaram, Dinakar and Geetha Manjunath,"Moving to the Cloud - Developing Apps in the World of Cloud Computing " ,Elsevier, 2012.
4. Sosinsky, Barrie,"Cloud Computing Bible.", Wiley India Pvt. Ltd , 2013.
5. Winkler, Vic(J.R), "Securing the Cloud - Cloud Computer Security Techniques and Tactics.",Elsevier Inc, 2012

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, Rama mohana rao 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

COMPILER DESIGN

Course Code:	**AM3202-1**	**Course Type:**	**PEC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

Course Objectives:

1.	Outline lexical analysis, use of regular expressions, transition diagrams, scanner-generator tools and context-free grammar.
2.	Get the idea of major parsing techniques top-down (recursive-descent, LL(1)) and Bottom up parsers.
3.	Discuss LR parsers using items sets and parsing tables.
4.	Make use of the principal ideas in syntax-directed definitions, syntax-directed translations and intermediate code representations for assignment statements and Boolean expressions.
5.	Describe how to construct the basic blocks from intermediate code, code optimization techniques and code generation algorithm.

Prerequisite	NIL

UNIT-I

Introduction: A Simple Compiler, The Phases of a Compiler. **Lexical Analysis:** Lexical Analysis, Input Buffering, Specifications of Tokens, Recognition of Tokens, A Language for Specifying Lexical Analyzer, LEX programming. **Syntax Analysis:** Context-free Grammars, ambiguity **Syntax Analysis:** The Role of the Parser, Top-down Parsing: No recursive Predictive parsing, LL (1) grammars, Bottom-up Parsing: shift- reduce conflicts.	**15 Hours**

UNIT-II

Syntax Analysis: Introduction to LR Parsers –Simple LR (SLR), LR (0) item set, LR (1) item set, Canonical LR (CLR), Look Ahead LR (LALR) Parsers, YACC programming. **Syntax-Directed Definitions** Constructions of Syntax Trees, Bottom-up Evaluation of S-attributed definitions, L-attributed definitions. **Intermediate Code Generation:** Intermediate Languages, Assignments, Boolean Expressions	**15 Hours**

UNIT-III

Code generation Target Machine, Basic blocks and Flow graphs, Next-use information, A Simple Code Generator, Register Allocation and Assignment, The DAG representation of Basic Blocks Introduction, The Principle of Optimization, Optimization of Basic Blocks, Loops in flow graphs.	**10 Hours**

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

1.	Explain the various phases of compiler. Build the regular expressions and transition diagrams by applying the knowledge of finite automata. Develop and Implement tokenizer using high level programming language and LEX Tool
2.	Develop top down parsers by applying the knowledge of context free grammar and parsing algorithms.
3.	Construct LR item sets by applying the knowledge of Closure and Go to functions. Make use of SLR, CLR and LALR parsing tables to parse the language constructs. Design and Implement parser using high level programming language and YACC Tool.
4.	Illustrate Syntax-Directed translation scheme for engineering problems. Apply three address code representations to generate an intermediate code for assignment statement and Boolean expressions.
5.	Build a code generator for the intermediate code by applying the knowledge of Basic blocks, address, register descriptors and next use information. Apply code optimization techniques to optimize the target code.

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
AM3202-1.1	1	2	3		3				1			1	1	3	
AM3202-1.2	1	2	3		3				1			1	1	3	
AM3202-1.3	1	2	3		3				1			1	1	3	
AM3202-1.4	1	2	3		1				1			1	1	3	
AM3202-1.5	1	2	3		1				1			1	1	3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. " Compilers- Principles, Techniques and Tools", Addison-Wesley, Second edition, 2007.

REFERENCE BOOKS:

1. Andrew W Apple, "Modern Compiler Implementation in C", Cambridge University Press, 1997.

2. Kenneth C Louden, "Compiler Construction Principles &Practice",Thomson Education, 1997.

3. John R. Levine, Tony Mason, Doug Brown, "LEX and YACC",
O'Reilly Publication,1999.

E Books / MOOCs/ NPTEL

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

2. http://hjemmesider.diku.dk/~torbenm/Basics/basics_lulu2.pdf

3.	http://cnp3book.info.ucl.ac.be/2nd/cnp3bis.pdf
4.	http://www.nptelvideos.in/2012/11/compiler-design.html

MICRO CONTROLLERS AND EMBEDDED SYSTEMS

Course Code:	**AM3203-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Explain the concepts and principles of Embedded system design.
2.	Identify basic building blocks of an embedded system.
3.	Assess the benefits of Intel Atom based embedded system in terms of power consumption.
4.	Analyze features of various RTOS
5.	Use Intel Atom boards in typical design of systems
6.	Compare various shared data handling techniques

Prerequisite	AM2101-1- Modern Computer Architecture

UNIT-I	
Embedded system definition, characteristics, design metrics; Processor, IC and design technologies; Embedded system examples, Digital Camera building blocks, Combinational and sequential building blocks. Use of DSP Processors, SoCs and Microcontrollers in embedded systems. Overview of 8051 microcontroller. Timers, ADCs, Keypad controllers, LCD controllers, stepper motor and DC motor control, Custom Single Purpose processor design examples: GCD Generator, 4-bit multiplier, Communication bridge. Memory – Composing memory, memory hierarchy and Cache memory, interfacing-Serial, Parallel and Wireless Protocols.	**15 Hours**
UNIT-II	
Introduction to Real – Time Operating Systems, features, Examples of RTOS, typical RTOS functions. Interrupt handling and latency, Shared data problems, Tasks and Task States, Task scheduling, Inter-task communication and synchronization, Semaphores, Message Queues, Mailboxes and Pipes, Reentrant functions, Typical software architectures, Embedded Software development and testing tools, JTAG debugger, typical system boot flow diagram. Intel ATOM Processor Architecture, Platform architecture and Micro architecture details.	**15 Hours**
UNIT-III	
Overview of Assembly language programming of ATOM Processor, Low power issues of ATOM processor, ATOM processor series.Intel ATOM Processor kit details, I/O options available, Keyboard and Mouse interface, GPS, GSM and RFID interface – Hands On, Overview of Device drivers.	**10 Hours**

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

1.	Identify basic building blocks of embedded systems.
2.	Explain General purpose processor and the purpose of peripherals.

3.	Illustrate the uses of RTOS
4.	Explain different features of real time operating systems.
5.	Design an embedded system using Intel Atom boards.

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**
AM3203-1.1	2	1												1
AM3203-1.2	2	1												1
AM3203-1.3	2	1												1
AM3203-1.4	2	1												1
AM3203-1.5	2	2												1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Frank Vahid and Tony Givargis, "Embedded Systems Design – A unified Hardware/Software Introduction", John Wiley, 2002 (Chapter 1, 2, 4).
2.	David E.Simon, "An Embedded Software Primer", Pearson Education Asia, First Indian Reprint 2000. (Chapter 6,7, 8, 9).
3.	Kenneth Ayala, "8051 Microcontroller Architecture, Programming and Applications", West publishing, 1991 (Selected chapters on Architecture of 8051).

REFERENCE BOOKS:

1.	Lori Matassa and Max Domeika, "Break away with Intel Atom Processors: A guide to Architecture Migration", Intel Press, 2010 (Chapter 3, selected topics of Chapter 4 & 5)
2.	Peter Barry, Patrik Crowley, "Modern Embedded Computing", Morgn Kaufmann publishers, ISBN: 978-0-12-391490-3 2012.

E Books / MOOCs/ NPTEL

1.	https://www.intel.com/content/www/us/en/products/processors/atom.html
2.	https://en.wikipedia.org/wiki/Embedded_system

NoSQL DATABASE

Course Code:	**AM3204-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3-0-0-0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

Course Objectives:
The primary Course Learning Objective is to Prepare the background in abstraction, notation and critical thinking of mathematics related to computer science.

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.

Prerequisite	CS2102-1- Database Management Systems.

UNIT-I

Introduction to NoSQL	**15 Hours**

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

Introduction to MongoDB	**15 Hours**

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

Introduction to Cassandra	**10 Hours**

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**
AM3204-1.1	3									1		1	3	
AM3204-1.2	3									1		1	3	
AM3204-1.3	3									1		1	3	
AM3204-1.4	3									1		1	3	
AM3204-1.5	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

THEORY OF COMPUTATION

Course Code:	**AM3205-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Outline the theory behind the basic design of machines, the relation between formal languages and programming languages, and their applications.
2.	Make use of regular expressions, find the equivalence between finite automata and regular languages, and identify non-regular languages.
3.	Design context-free grammars along with simplification of grammars.
4.	Get the idea of designing pushdown automata, find the equivalence between context-free languages and pushdown automata, and identify non-context-free languages.
5.	Tell how Turing machines solve any computational process carried by present day computers, their design, and get the feeling of undecidability concept.

Prerequisite	**CS1002-1**

UNIT-I

Automata:	**15 Hours**

Automata:
Why study automata theory, Central concepts of automata theory.
Finite Automata:
Deterministic Finite automata, Nondeterministic finite automata, An application: Text search, Finite automata with epsilon-transitions.
Regular Expressions and Languages:
Regular expressions, Finite automata and Regular expressions, Applications of regular expressions.
Properties of regular languages:
Proving languages not to be regular.
(Textbook-1: Chapter 1: 1.1, 1.5; Chapter 2: 2.1 to 2.5; Chapter 3: 3.1, 3.2.2, 3.2.3, 3.3; Chapter 4: 4.1)

UNIT-II

Properties of regular languages:	**15 Hours**

Properties of regular languages:
Closure properties of regular languages, Equivalence and minimization of automata.
Context-free grammars and languages:
Context free grammars – Examples and Definitions, More Examples, Derivation Trees and Ambiguity, Unambiguous CFG for algebraic expressions.

Pushdown automata
Definition of the Pushdown Automata, Language accepted by a PDA.
(Textbook-1: Chapter 4: 4.2, 4.4; Chapter 6: 6.1, 6.2.1, 6.2.2; Text Book-2: Chapter 6: 6.1, 6.2, 6.4, 6.5)

UNIT-III

Properties of context-free languages:	**10 Hours**

Properties of context-free languages:

Normal forms for CFGs.

Turing machines:

The Turing machine, Extensions to the Basic Turing Machines.

(Textbook-1: Chapter 7: 7.1; Chapter 8: 8.2, 8.4)

Recursively enumerable languages

Recursively enumerable languages and Recursive, The Chomsky hierarchy.

(Textbook-2: Chapter 10: 10.1, 10.4)

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

1. Outline the fundamental understanding of the core concepts in automata theory and formal languages and its applications. Discover finite automata for different language classes. Apply the procedure to convert deterministic finite automata to non-deterministic finite automata.

2. Find the regular expression for a given language and illustrate equivalence between finite automata and regular languages. Show the properties of regular languages and minimize the given finite automata.

3. Discover context-free grammars for different language classes. Demonstrate the ambiguity and unambiguous grammars.

4. Discover Pushdown automata for different language classes.

5. Translate the context-free grammars from one form to another. Discover Turing machines for different language classes. Explain the class of languages and their relationship.

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
AM3205-1.1	2	2	3						1				3		
AM3205-1.2	2	3											2		
AM3205-1.3	2	2	3						1				3		
AM3205-1.4	2	2	3						1				3		
AM3205-1.5	2	2	3						1				3		

1: Low 2: Medium 3: High

TEXTBOOKS:

1. J.P. Hopcroft, Rajeev Motwani, and J.D. Ullman, “Introduction to Automata Theory, Languages and Computation”, Third Edition, Pearson Education 2012.

2. John C Martin, “Introduction to languages and The Theory of Computation”, Third Edition, Tata McGraw Hill, 2008.

REFERENCE BOOKS:

1. Peter Linz, “An Introduction to formal languages and Automata”, Fourth Edition, Narosa Publishing House, 2011.

2. Michael Sipser, “Introduction to the Theory of Computation”, Third Edition, MIT Press, 2014.

E Books / MOOCs/ NPTEL

1. https://www.eecs.wsu.edu/~ananth/CptS317/Lectures/index.htm

2. https://www.cs.virginia.edu/~robins/Sipser_2006_Second_Edition_Problems.pdf

3. http://infocat.ucpel.tche.br/disc/lfa/docs/IAT.pdf

4. http://nptel.ac.in/courses/106106049/

5. http://aduni.org/courses/theory/index.php?view=cw

6. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-045j-automata-computability-and-complexity-spring-2011/lecture-note*s/

<table>
<tr><th colspan="5">ADVANCED UNIX PROGRAMMING</th></tr>
<tr><td>Course Code:</td><td>AM3206-1</td><td>Course Type</td><td colspan="2">PEC</td></tr>
<tr><td>Teaching Hours/Week (L: T: P: S)</td><td>3:0:0:0</td><td>Credits</td><td colspan="2">03</td></tr>
<tr><td>Total Teaching Hours</td><td>40</td><td>CIE + SEE Marks</td><td colspan="2">50+50</td></tr>
<tr><td colspan="5">Credits – 3</td></tr>
<tr><td colspan="4">Unit I</td><td>Contact Hours</td></tr>
<tr><td colspan="4">The POSIX standards. File types. General File APIs, File handling programs, Makefile-introduction, creation and execution of make file.The Process: Introduction,Mechanism for creating process. The UNIX Kernel support for process. The environment of a unix process: Introduction, main function, Process Termination, Command line arguments, Environment List, Memory layout of a C program,Memory allocation, Environment variables, functions.</td><td>15</td></tr>
<tr><td colspan="4">Unit II</td><td></td></tr>
<tr><td colspan="4">Setjmp and longjmp functions, getrlimit, setrlimit Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, Wait3, wait4 functions, Race conditions, exec functions, Interpreter files, System Function.Signals: The Unix Kernel Support for signals, Signal, Signal mask, Sigaction,The SIGCHLD Signal and waitpid functions,The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers. Daemon processes: Introduction, Daemon Characteristics, and Coding Rules.</td><td>16</td></tr>
<tr><td colspan="4">Unit III</td><td></td></tr>
<tr><td colspan="4">Interprocess communications: Overview of IPC Methods, Pipes, popen, Pclose functions, FIFOs, SOCKETS: Introduction, functions, Client/Server Message Handling Example.</td><td>08</td></tr>
<tr><td colspan="4">Course Outcomes:
1. Applyvarious file APIs for developing the file handling programs that can work on UNIX platform.
2. Illustratethe representation of a process and its environment in UNIX and design programs that can use various process APIs for creating and handing the processes in UNIX.
3. Demonstratethe concept of signal and signal handling methods. Usethe signal handling APIs for developing programs to handle operating system issues in UNIX platform.
4. Describe the concepts of demon process and inter process communication, design programs to demonstrate the working of inter process communication using suitable APIs of UNIX for achieving the computer communication.</td><td></td></tr>
<tr><td colspan="4">Textbooks:
1.Terrence Chan, “UNIX System Programming Using C++”, Prentice Hall India, 1999. (Chapters 1, 5, 6, 7, 8, 9, 10)
2.W.Richard Stevens,” Advanced Programming in the UNIX Environment”, Addison –Wesley/PHI, 2013. (Chapters 7, 8, 9, 13, 14, 15)
3.Sumitaba Das, “UNIX-Concepts and Applications”, Fourth Edition, Tata McGraw Hill, 2006. (Chapter 9).</td><td></td></tr>
<tr><td colspan="4">Reference Book:
1. Maurice.J.Bach,”The Design of the Unix Operating System”, Pearson Education /Prentice Hall of India, First Edition, 1986
2. Uresh Vahalia,” UNIX Internals, Pearson Education”, ASIA, 2001</td><td></td></tr>
</table>

3. R. Stones, N. Matthew, “Beginning Linux Programming”, Wrox publication, Fourth Edition,2007	

Professional Elective Courses
Stream 1
Computational Fundamentals
(Group-2)

INTERNET AND WEB PROGRAMMING

Course Code:	**AM1301-1**	**Course Type:**	**PEC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

Course Objectives:

1.	Gain exposure to a basic website repository, including its directory structure and HTML document contents.
2.	Learn the basics of PHP, Javascript and JSX
2.	Configure in-line, internal, and external CSS stylesheets.
3.	Configure your website to track page views and user events.

Prerequisite NIL

UNIT-I

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.	**13 Hours**

UNIT-II

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	**13 Hours**

UNIT-III

What is Node JS?, Advantages of Node JS, Node JS HTTP Module, File System Module, Node js Events: The Event Emitter Object, Upload Files, Send an Email, Nosql database: Introduction to MongoDB, Creating a Database, Insert, Find, Sort, Delete, Drop Collection	**14 Hours**

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**	**3**
AM1301-1.1	1	2	1	2			2					2		1	
AM1301-1.2	1	2				1						1			
AM1301-1.3			1	3			1				1	2		2	
AM1301-1.4		2										2			
AM1301-1.5		2										2			

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 https://www.udemy.com/course/react-the-complete-2021-guide-with-nodejs-and-mongo-db/

ADVANCED JAVA PROGRAMMING

Course Code:	**AM2301-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

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.

Prerequisite	CS2002-1-Object Oriented Programming.

UNIT-I

Revisit To OOP Concepts	**15 Hours**

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

Java data base connectivity (JDBC):	**15 Hours**

The Vendor Variation Problem, SQL and Versions of JDBC, Creating an ODBC Data Source, Simple Database Access, Modifying the Database Contents, Transactions , Metadata, Scrollable Result SetsinJDBC2.0, 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

Java servlets	**09 Hours**

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
AM2301-1.1	3	2											2	1
AM2301-1.2	2	3											2	2
AM2301-1.3	2	3											2	2
AM2301-1.4	3	3											2	2
AM2301-1.5	3	3											2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	HerbertSchildt,“TheCompleteReferenceJavabySeventhEdition”,TataMcGraw-Hill,2007
2.	JanGraba,“AnIntroductiontoNetworkProgrammingwithJava”,SpringerPublications, 2007
3.	**jimKeogh,“TheCompleteReferenceJ2EE”,TataMcGraw-Hill,2002.**

REFERENCE BOOKS:

1.	H.M.Deitel,”Java –How to Program? ”,PrenticeHall,2004.

E Books / MOOCs/ NPTEL

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

ANGULAR AND REACTJS

Course Code:	**AM2302-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Understand the basics of HTML, HTML5 and its attributes. Javascript.
2.	Learn and implement JavaScript Language programming concepts and techniques.
3.	Understand the architecture and basics of AngularJS
4.	Develop interactive AngularJS script at the clientside and its services.
5.	Understand the basics of ReactJS, React Forms, React Events, React List, React Keys and React Fragments.

Prerequisite	**CS1002-1**

UNIT-I

15 Hours

HTML5:
Overview of HTML5, New features in HTML5, Removed elements from HTML, HTML5 Semantic elements, HTML5 input types, HTML5 new form elements and attributes, HTML5 Video and Audio.

THE BASICS OF JAVASCRIPT:
Overview, Object orientation and JavaScript, General syntactic characteristics, Primitives, Operations, and Expressions, Screen output and keyboard input, control statements, Object creation and modification, Arrays, Functions, Constructors, Patterns matching using Regular Expressions, Errors in Scripts.

JAVASCRIPT AND XHTML DOCUMENTS:
The JavaScript Execution Environment, The Document object model, Element access in JavaScript, Events and Event handling, Handling events from Body elements, Handling events from Button elements, Handling events from Text Box and Password elements, The DOM 2 Event Model, The navigator Object.

UNIT-II

Introduction to Angularjs — **15 Hours**

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-III

Introduction to Reactjs — **09 Hours**

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.

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

1.	Design static web pages using HTML5 and Cascading Style Sheets (CSS).
2.	Develop client side validations using JavaScript.
3.	Understand the basics of AngularJS.
4.	Develop interactive AngularJS script at the clientside.
5.	Understand the basics of ReactJS.

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
AM2302-1.1	3	3		3	2								3	
AM2302-1.2	3	2		2	2								2	
AM2302-1.3	3	2		2	2								3	
AM2302-1.4	3	2		2	2								3	
AM2302-1.5	3	2		2	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-ResponsiveWebDevelopment‖,O‘Reilly publications,2013.

REFERENCE BOOKS:

1.	Ari Lerner, Ng-book, ―The complete book on Angular JS‖,2013.

E Books / MOOCs/ NPTEL

1.	https://www.coursera.org/learn/angular
2.	https://nptel.ac.in/courses/106105084

FULL STACK DEVELOPMENT

Course Code:	**AM3301-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

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 MongoDB.

Prerequisite	**CS1002-1**

UNIT-I

Basics of HTML5, CSS and Javascript	**15 Hours**

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

Introduction to PHP	**15 Hours**

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

NodeJS	**10 Hours**

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→ **↓ Course Outcomes**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
													1	**2**
AM3301-1.1	1	2	3											3
AM3301-1.2	2	3												3
AM3301-1.3	2	3												3
AM3301-1.4	1	2	3											3
AM3301-1.5	1	2												3

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Robert W. Sebesta, “Programming the World Wide Web”, Fourth Edition, Pearson, 2014.

Jake Spurlock, “Bootstrap-Responsive Web Development”, O’Reilly publications, 2013.

2. Ari Lerner, Ng-book, “The complete book on Angular JS”, 2013.

3. 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.

4. 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/

SEMANTIC WEB

Course Code:	**AM3302-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1. To learn Web Intelligence, Knowledge Representation for the Semantic Web

2. To examine Ontology Engineering

3. To understand Semantic Web Applications, Services and Technology

4. To learn Social Network Analysis and semantic web

Prerequisite **CS1002-1**

UNIT-I

Web Intelligence: Thinking and Intelligent Web Applications, The Information **15 Hours**

Age,The World Wide Web, Limitations of Today’s Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Semantic Road Map, Logic on the semantic Web.

Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XMLSchema.

UNIT-II

15 Hours

Ontology Engineering: Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

Semantic Web Applications, Services and Technology: Semantic Web applications and services, Semantic Search, e-learning

UNIT-III

10 Hours

Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods,

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

1.	To understand Web Intelligence
2.	To learn Knowledge Representation for the Semantic Web
3.	To analyze Ontology Engineering
4.	To learn Semantic Web Applications, Services and Technology
5.	To examine Social Network Analysis and semantic web

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
AM3302-1.1	2	2										3		
AM3302-1.2	2	3										2		
AM3302-1.3	2	3										1		
AM3302-1.4	2	3										2		
AM3302-1.5	2	3										2		

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Thinking on the Web – Berners Lee, Godel and Turing, Wiley inter science,2008.
2.	Social Networks and the Semantic Web,PeterMika,Springer,2007.

REFERENCE BOOKS:

1.	Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer, P. Warren, John Wiley & Sons.
2.	Semantic Web and Semantic Web Services-Liyang Lu Chapman and Hall/CRC

E Books / MOOCs/ NPTEL

1.	https://www.youtube.com/watch?v=RTmafl2rzEw
2.	http://www.cs.jyu.fi/ai/vagan/itks544.html
3.	https://www.classcentral.com/subject/semantic-web

OPERATION RESEARCH

Course Code:	**AM3303-1**	**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**

<u>Course Learning Objectives:</u>

This Course will enable students to:

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 1	
INTRODUCTION Introduction to OR, nature and meaning, applications, modeling in OR, phases of OR study **LINEARPROGRAMMING** 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)***	15
Unit II	
TRANSPORATION PROBLEMS Transportation problems, methods to find initial feasible solution and modification to obtain optimal solution (Degeneracy in transportation problems, unbalanced transportation problems **ASSIGNMENTPROBLEM** Mathematical formulation of an assignment problem, unbalanced assignment problem, Travelling Salesman Problem (TSP), Hungarian method. ***(Text Book-1: Chapter 15,16)***	15
Unit III	
CPM, PERT Representation of a project by a network, activities and events, starting times, finishing times, floats, slacks, CPM, Idea of crashing probabilistic times and PERT analysis	9

(Text Book-1: Chapter 31)

Course Outcomes:

At the end of the course the 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.

TEXTBOOK:

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 / Online Resources:

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

MOOCs:

1. Fundamentals of Operations Research IIT Madras Course, Prof. G. Srinivasan:https://swayam.gov.in/

Table-2: Mapping Levels of COs to POs / PSOs

COs	**Program Outcomes (POs)**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3												3		
CO2	2	3											3		
CO3	2	3											3	3	
CO4	2	3											3	3	
CO5	2	3											3	3	

Professional Elective Courses
Stream 2
Computer Networking Technologies and Cyber Security
(Group-1)

SOFTWARE DEFINED NETWORKS

Course Code:	**AM4211-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Recognize the fundamentals and characteristics of Software Defined Networks
2.	Understand the basics of Software Defined Networks Operations and Data flow
3.	Discriminate different Software Defined Network Operations and Data Flow
4.	Analyze alternative definitions of Software Defined Networks
5.	Apply different Software Defined Network Operations in real world problem

Prerequisite	**AM3001-1**

UNIT-I

Introduction to SDN

Understanding the SDN, Understanding the SDN technology, Control Plane, Data Plane, Moving information between planes, separation of the control and data planes, Distributed control planes, Load Balancing, Creating the MPLS Overlay, Centralized control planes.

14 Hours

UNIT-II

Working of SDN

13 Hours

Evaluation of Switches and Control planes, SDN Implications, Data center Needs, Forerunner of SDN, Software Defined Networks is Born, Sustain SDN interoperability, Open source contribution, Fundamental Characteristics of SDN, SDN Operations, SDN Devices, SDN Controllers, SDN Applications, Alternate SDN methods.
The Open Flow Specifications

Open Flow Overview, Open Flow Basics, Open Flow 1.0 additions, Open Flow 1.1 additions, Open Flow 1.2 additions, Open Flow 1.3 additions, Open Flow limitations.

UNIT-III

Data Center

13 Hours

Data centers definition, Data centers demand, tunneling technologies for Data centers Path technologies in data centers, Ethernet fabrics in Data centers, SDN use case in Data centers.

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

1.	Recognize the fundamentals and characteristics of Software Defined Networks
2.	Understand the basics of Software Defined Networks Operations and Data flow
3.	Discriminate different Software Defined Network Operations and Data Flow
4.	Analyze alternative definitions of Software Defined Networks
5.	Apply different Software Defined Network Operations in real world problem

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
AM4211-1.1	3	3	3						2	2	1	1		
AM4211-1.2	3	3	2	2					2	2	1	1		
AM4211-1.3	3	3	3	2	2		1	2	3	3	1	2		
AM4211-1.4	3	3	3	2	2	2	2		3	4	1	1		
AM4211-1.5	3	3	2	2							1	1		

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Software Defined Networking by Thomas D Nadeau and Ken Gray.
2.	Software Define Networks, A Comprehensive Approach, Paul Goransson, Chuck Black. MK Publications.
REFERENCE BOOKS:	
1.	Software Defined Networking for Dummies brought you by cisco, Brian Underdahl and Gary Kinghorn

WIRELESS SENSOR NETWORKS

Course Code:	**AM4212-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

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

Prerequisite AM3101-1

UNIT-I

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

15 Hours

UNIT-II

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.

15 Hours

UNIT-III

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.

10 Hours

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

1.	Comprehend the architecture and applications of Wireless Networks.
2.	Understand the basics of WSN and its applications.
3.	Analyze the MAC protocols and real time applications.
4.	Understand the Routing Protocols for Wireless Sensor Networks.
5.	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**
AM4212-1.1	2	1												
AM4212-1.2	3	3												2
AM4212-1.3	2	1												1
AM4212-1.4	2	2												
AM4212-1.5	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.
Courses/E-books/MOOC:	
1.	https://nptel.ac.in/courses/106105160
2.	https://www.udemy.com/course/wireless-sensor-networks-electronics-telecommunication-f/

CRYPTOGRAPHY AND CYBER SECURITY

Course Code:	**AM3311-1**	**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**

Credits – 3

Course Learning Objectives:

This Course will enable students to:

1. Analyze the principles and underlying mathematical theory of cryptography and classical encryption techniques.
2. Select appropriate data encryption techniques and apply them to solve a given problem.
3. Get the idea of various public key cryptosystems.
4. Analyze the fundamentals of cyber security and its essentials.
5. Describe various actions and motivations of attackers, involved in the cyber threat.

Unit I	**Contact 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. **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.	15
Unit II	

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. **Cyber Security Fundamentals:** Information Assurance Fundamentals: Authentication, Authorization, Nonrepudiation, Confidentiality, Integrity, Availability; Basic Cryptography; Symmetric Encryption: Example ofSimple Symmetric Encryption with Exclusive OR (XOR) and Improving upon Stream Ciphers withBlock Ciphers; Public Key Encryption; The Domain Name System (DNS) : Security and the DNS; Firewalls: History Lesson, What's in a Name? Packet-Filtering Firewalls, Stateful Firewalls,Application Gateway Firewalls	15
Unit III	
Attacker Techniques And Motivations: How Hackers Cover Their Tracks (Antiforensics): How and Why Attackers Use Proxies, Types of Proxies, Detecting the Use of Proxies, Tunneling Techniques - HTTP, DNS, ICMP, Intermediaries, Steganography, and Other Concepts, Detection and Prevention; Fraud Techniques : Phishing, Smishing, Vishing, and Mobile Malicious Code - Mobile Malicious Code, Phishing against Mobile Devices; Rogue Antivirus - Following the Money: Payments; Click Fraud - Pay-per-Click, Click Fraud Motivations, Click Fraud Tactics and Detection. Threat Infrastructure: Botnets, Fast-Flux, Advanced Fast-Flux.	10
Course Outcomes: Upon completion of this course, students will be able to: 1. Comprehend the cryptography techniques. 2. Apply the Knowledge of number theory in public key crypto systems. 3. Analyze and determine various public key cryptosystems. 4.Explain the requirements of the cyber security and various methods to provide the security to the computer networks. 5.Determine the various actions and motivations of attackers, involved in the cyber threat.	
Textbooks: 1.William Stallings: Cryptography and Network Security, Pearson 6th Edition, 2013. 2. Cyber security essentials --Edited by James Graham, Richard Howard, Ryan Olson, publication: CRC press, Taylor and Francis group, 2011.	
Reference Books: 1. V K Pachghare: Cryptography and Information Security, PHE, 2013. 2. Yuri Diogenes, Erdal Ozkaya, "Cybersecurity - Attack and Defense Strategies: Infrastructure security with Red Team and Blue Team tactics (Kindle Edition)". 3. Joseph carson, "Cybersecurity for Dummies", CISSP 4. Scott Augenbaum, "The Secret to Cybersecurity A Simple Plan to Protect Your Family and Business from Cybercrime". 5. Cyber Security –Nina godbole, Sunit Belapure, Publication: John Wiley, 2012.	

Table 1: Mapping Levels of COs to POs

COs	**Program Objectives (POs)**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	1	3	1								2	
CO2	3	3	2	3	1								2	
CO3	3	3	2	2	1								2	
CO4	3	2	1		1								2	
CO5	3	3	1		1								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,5.1.1,5.2.1,5.2.2,5.3.1	L2
CO2	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,5.1.1,5.2.1,5.2.2,5.3.1	L3
CO3	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,5.1.1,5.2.1,5.2.2,5.3.1	L2
CO4	1,2,3,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO5	1,2,3,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2

CYBER SECURITY AND CYBER LAWS

Course Code:	**AM3312-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Define the area of cybercrime and forensics.
2.	Explain the motive and causes for cybercrime, detection, and handling.
3.	Investigate Areas affected by cybercrime
4.	Illustrate tools used in cyber forensic.
5.	Infer legal Perspectives in cyber security

Prerequisite **NIL**

UNIT-I

Introduction to Cybercrime [1st textbook] **15 Hours**

Cybercrime- Definition and Origins of the Word

Cybercrime and Information Security, who are Cyber criminals? Classifications of Cybercrimes, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. (1.2-1.5,1.9,1.10) Cyber offenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing. (2.2-2.8) **Cybercrime:** Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops. (3.1-3.12)	
UNIT-II	
Tools and Methods Used In Cybercrime Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS At-tacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. (4.1-4.12) Phishing and Identity Theft: Introduction to Phishing, Identity Theft (ID Theft). (5.2,5.3) **Understanding Computer Forensics** Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics 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. (7.1,7.3-7.13)	**15 Hours**
UNIT-III	
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. (7.14-7.19) **Introduction to Security Policies and Cyber Laws [2nd Textbook]** Need for An Information Security Policy, Information Security Standards – ISO, Introducing Various Security Policies and Their Review Process, Introduction to Indian Cyber Law, Objective and Scope of the IT Act, 2000, Intellectual Property Issues, Overview of Intellectual Property Related Legislation in India, Patent, Copyright, Law Related to Semiconductor Layout and Design, Software License. (4.1-4.11)	**10 Hours**

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

1.	Outline the concept of cyber security to determine the threats
2.	Illustrate the current cybercrime attacks and preventive measures
3.	Apply tools and methods used in cyber crime
4.	Utilize the digital forensic techniques to mitigates the threats
5.	Summarize the Security Policies and Cyber Laws

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
AM3312-1.1	2	2								1		1		1
AM3312-1.2	2	2								1		1		1
AM3312-1.3	2	2	3							1		1	2	2
AM3312-1.4	2	3								1		1	2	2
AM3312-1.5	2	2								1		1		2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Sunit Belapure and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013.

2. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. “Introduction to information security and cyber laws”. Dreamtech Press. ISBN: 9789351194736, 2015.

REFERENCE BOOKS:

1. Thomas J. Mowbray, “Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions”, Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 978 -1-118 -84965 -1.

2. James Graham, Ryan Olson, Rick Howard, “Cyber Security Essentials”, CRC Press, 15-Dec 2010.

3. Anti- Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw-Hill.

E-BOOKS/MOOC:

1. https://onlinecourses.swayam2.ac.in/ugc19_hs25/preview

2. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview

Professional Elective Courses

Stream 3

Machine Learning and Data Science

(Group-1)

INTRODUCTION TO DATA SCIENCE

Course Code:	**AM1221-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

Course Objectives:

1.	Understand the types of data analysis and its process.
2.	Practice out quick data analysis, extracting data values from text.
3.	Demonstrate the export of data to excel, PivotTable etc.
4.	Describe R basics, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions, R packages and Develop Simple programs using R.
5.	Understand the R Data Visualization concept and apply R programming in plotting various Charts and Graphs.

Prerequisite	NIL

UNIT-I

Introduction to Data Analysis Using Excel	**15 Hours**

Introduction to Data Analysis using Excel, Types of Data Analysis, Data Mining, Business Intelligence, Statistical Analysis, Predictive Analytics, Text Analytics Data Analysis with Excel, Data Analysis with Excel and Advanced Data Analysis with Excel.

Data Analysis Process: Data Requirements Specification, Data Collection, Data Processing, Data Cleaning, Data Analysis, Communication. Data Cleaning – Text Functions, Dates and Times: With Text Functions, Containing Date Values, Containing Time Values. Conditional Formatting, Sorting and Filtering, Subtotals with Ranges.

UNIT-II

Data Quick Analysis	**15 Hours**

Data Quick Analysis: Understanding Lookup Functions, PivotTables, Data Visualization, Data Validation, Financial Analysis.

Data Consolidation, Cleaning Data with Text Functions, Extracting Data Values from Text, Extracting Data Values with Convert Text to Columns Wizard, What-If Analysis, Importing Data into Excel, Data Model, Exploring Data with PivotTable, Exploring Data with PowerPivot, Exploring Data with Power View, Aesthetic Power View Reports, Key Performance Indicators (KPIs)Preparing Data for Consolidation

UNIT-III

R Programming Basics	**10 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, R packages. **Data Visualization using R:** Reading and getting data into R (External Data): Using CSV files, XML files, Web Data, JSON files, Excel files. **Working with R Charts and Graphs:** Histograms, Boxplots, Bar Charts, Line Graphs, Scatterplots, Pie Charts.

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

1.	Understand the types of data analysis and carry out the data analysis process.
2.	Practice out quick data analysis, extracting data values from text.
3.	Demonstrate the export of data to excel, PivotTable etc.
4.	Describe R basics, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions, R packages and Develop Simple programs using R.
5.	Understand the R Data Visualization concept and apply R programming in plotting various Charts and Graphs.

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**
AM1221-1.1	2	3		2									2		
AM1221-1.2	3	3		3									3		
AM1221-1.3	3	3		2									3		
AM1221-1.4	3	3		2									3		
AM1221-1.5	3	3		2									3		

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Microsoft Excel 2019 Data Analysis and Business Modelling (Business Skills) 6th Edition 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.

REFERENCE BOOKS:

1.	Microsoft Excel 2019 Formulas and Functions (Business Skills) 1st Edition ISBN-13: 978-1509306190 ISBN-10: 1509306196 Paul McFedries
2.	Collect, Combine, and Transform Data Using Power Query in Excel and Power BI (Business Skills) 1st Edition ISBN-13: 978-1509307951 ISBN-10: 1509307958 Gil Raviv (Author)
3.	Microsoft Power BI Quick Start Guide: Bring your data to life through data modeling, visualization, digital storytelling, and more, 2nd Edition 2nd ed. Edition by Devin Knight (Author), Mitchell Pearson (Author), Bradley Schacht (Author), Erin Ostrowsky (Author) 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 https://www.coursera.org/specializations/excel-data-analytics-visualization
2	IBM Data Analytics with Excel and R Professional Certificate https://www.coursera.org/professional-certificates/ibm-data-analyst-r-excel
3	Introduction to Data Analysis Using Excel https://www.coursera.org/learn/excel-data-analysis

EMPOWERING WITH ARTIFICIAL INTELLIGENCE

Course Code:	**AM2221-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Acquire basic understanding of Artificial Intelligence
2.	Illustrate the application of computer vision and natural language processing
3.	Identify and experience the transition from traditional computer vision to artificial intelligence.
4.	Analyze the process of congestion control algorithms
5.	Illustrate IP Packets and fragmentation process.

Prerequisite	**AM1101-1**

UNIT-I

Basics of AI and Statistical Data

Basic understanding of Artificial Intelligence: What is AI? The 3 domains of AI: Statistical Data, Computer Vision, NLP, AI Applications, AI in industries, UN Sustainable Development Goals, AI Ethics issues- privacy, bias, access to AI.
Non-technical Introduction to AI: AI Project Cycle-Problem scoping, Data Acquisition, Data Visualization, Decision Trees, Introduction to Neural Networks.
Domain - Fundamentals Hands-on Sessions
Statistical Data: Data Import and Processing, Machine Learning Techniques, AI for Data Walkthrough

15 Hours

UNIT-II

Computer vision

15 Hours

Basic Techniques in Computer Vision: - How do computer see?, How image is represented with numbers (RGB), Tresholding, masking and region of interest, Geometric transformation, resizing and cropping
From Traditional Computer Vision to Artificial Intelligence: Feature extraction , selecting appropriate features, Pre processing images, Introduction to K-Nearest neighbour algorithm, Training a simple machine learning algorithm with a few samples, Support Vector Machines.
Types of Inference Models with OpenVINO and NCS2: Use Pre-trained model from OpenVINO, Run an inference model using the Neural Compute Stick 2, Image classification, Object detection.

UNIT-III

Natural Language Processing

10 Hours

Data Collection and Processing for NLP: Requesting website information with Python, Storing data, Curated data sources, NLP tools, Processing NLP data"
Classification for NLP: Converting data into a bag of words, Selecting important words from a list of words using tfidf method, Choose a machine learning model using the sklearn library, Data pipelining.
Creating a Chatbot: Introduction to chatbots, Finding your chatbot’s specialty, Teach your chatbot to match topics, Get your chatbot to say its first words, Teach and play with your chatbot

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

1.	Acquire basic understanding of Artificial Intelligence

2.	Illustrate the application of computer vision and natural language processing
3.	Identify and experience the transition from traditional computer vision to artificial intelligence.
4.	Understand the different models used in NLP
5.	Understand the Implemention of chatbots

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**
AM2221-1.1	2	1										2		
AM2221-1.2	2	2										2		
AM2221-1.3	2	2										2		
AM2221-1.4	2	2										2		
AM2221-1.5	2	3										2		

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig
2.	Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili
3.	Artificial Intelligence: Foundations of Computational Agents" by David Poole and Alan Mackworth

REFERENCE BOOKS:

1.	Prediction Machines: The Simple Economics of Artificial Intelligence" by Ajay Agrawal, Joshua Gans, and Avi Goldfarb
2.	The Hundred-Page Machine Learning Book" by Andriy Burkov

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/112103280
2.	https://onlinecourses.nptel.ac.in/noc22_cs56/preview
3.	https://www.coursera.org/learn/ai-for-everyone

DATA MINING

Course Code:	**AM3221-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Understand the functionalities, interesting patterns and kind of data for data mining & the need of pre-processing of data.
2.	Learn to identify frequent patterns and develop the association's rules.
3.	Classify the data using classification algorithms like Decision tree and Bayesian classification, partitional clustering and Hierarchical clustering methods.
4.	Experiment with rule-based classification method to classify the data.

Prerequisite	**CS2102-1**

UNIT-I

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.	**16 Hours**

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

Classification — **14 Hours**

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. — **10 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	3
AM3221-1.1	2	2								1		1			
AM3221-1.2	2	2		2						1		1		2	
AM3221-1.3	2	2		2						1		1		2	
AM3221-1.4	2	2		3						1		1		2	
AM3221-1.5	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. M. H. Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson Education. 2001.
2. D. Hand, H. Mannila and P. Smyth, “Principles of Data Mining”, Prentice-Hall. 2001.
3. I. H. Witten and E. Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Morgan Kaufmann. 2000.

E Books / MOOCs/ NPTEL

1. https://www.coursera.org/specializations/data-mining
2. https://www.udemy.com/topic/data-mining/
3. https://www.mygreatlearning.com/academy/learn-for-free/courses/data-mining1

HUMAN COMPUTER INTERACTION

Course Code:	**AM3222-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Understand basics of HCI and different HCI models.
2.	Understand the research methods.
3.	Examine the guidelines to be followed in designing HCI.
4.	Learn to design HCI systems.

Prerequisite	CS1001-1- Problem-Solving through Programming, CS2002-1-Object Oriented Programming

UNIT-I	
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.	**15 Hours**
UNIT-II	
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	**16 Hours**
UNIT-III	
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 Method on a Mobile Phone, Case Study2-GUIdesignforamobilephone based Matrimonial application. Case Study 3 - Employment Information System for unorganised construction workers on a Mobile Phone.	**09 Hours**

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.
4.	Learn the concepts of task modelling and analysis.
5.	Examine cognitive architecture and various applications in the real world scenario.

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**

AM3222-1.1	2		2	1										
AM3222-1.2	2		1	1										
AM3222-1.3	2		2	2										
AM3222-1.4	2		2	2										
AM3222-1.5	2		2	3										

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-ComputerInteraction,6th Edition, Pearson,2017

REFERENCE BOOKS:

1.	Alan Dix, Janet Finlay, Gregory D, Abowd, Russell Beale, Human-Computer Interaction,Third edition,Pearson publications,2004
2.	Rajendra Kumar ,Human Computer Interaction, Laxmi Publications, second edition (2016)

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/106103115
2.	https://nptel.ac.in/courses/106106177
3.	https://onlinecourses.nptel.ac.in/noc19_cs86/preview

OPTIMIZATION TECHNIQUES IN MACHINE LEARNING

Course Code:	**AM3223-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives: This course will enable students to:

1.

1. Learn about the basics of optimization techniques
2. Describe the concepts on meta heuristic evolutionary algorithms
3. Apply particle swarm optimization on real time problems
4. Describe genetic algorithms and its applications
5. Demonstrate optimization techniques for large scale machine learning

Prerequisite	AM2001-1-Advanced Machine Learning.

UNIT-I

Overview of Optimization: Optimization, Objective function, Decision Variables, Solutions for optimization problem, Decision space, Constraints or restrictions, State variables, Local and Global optima, Near Optimal solutions, Simulation **Introduction to Meta Heuristic and Evolutionary Algorithms:** Introduction to optimization and meta heuristic algorithms, Searching the decision space for Optimal solutions, Definition of Terms of meta heuristic and Evolutionary algorithms, Initial state, Iterations, Final state, Initial data, Decision variables, state variables, objective function, Constraints, Fitness function	**15 Hours**
UNIT-II	
Particle swarm optimization: Introduction, mapping particle swarm optimization to social behaviour of some animals, generating an initial population of particles, an individual and global best positions, Velocities of particles, Updating the position of particles, Termination criteria, User defined parameters of the PSO **Genetic algorithm:** Introduction, Mapping the genetic algorithm to natural evolution, Creating the initial population, Selection of parents to create new generation: Proportionate selection, Ranking selection, Tournament selection, Population diversity and selective pressure, Reproduction: Crossover, Mutation, Termination criteria	**15 Hours**
UNIT-III	
Optimization techniques large scale machine learning: Stochastic optimization methods for large datasets, Distributed optimization algorithms, Online learning and incremental optimization, Markov Decision Processes (MDPs) and reinforcement learning, Value iteration and policy iteration, Q-learning and SARSA algorithms, Function approximation in reinforcement learning	**10 Hours**

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

1.	Learn about the basics of optimization techniques
2.	Describe the concepts on meta heuristic evolutionary algorithms
3.	Apply particle swarm optimization on real time problems
4.	Describe genetic algorithms and its applications
5.	Demonstrate optimization techniques for large scale machine 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**
AM3223-1.1	3	2	2		2				2	2			2	
AM3223-1.2	3	2	2		2				2	2			2	
AM3223-1.3	3	2	2		2				2	2			2	
AM3223-1.4	3	2	2		2				2	2			2	
AM3223-1.5	3	2											2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. "Meta-Heuristic and Evolutionary Algorithms for Engineering Optimization" by Omid Bozorg-Haddad, Mohammad Solgi, Hugo A. Loáiciga, 2017

REFERENCE BOOKS:

1. Metaheuristics - From Design to Implementation: 74 (Wiley Series on Parallel and Distributed Computing) by EI-Ghazali Talbi 2009

2. Essentials of Metaheuristics by Sean Luke, Second Edition February, 2016

E Books / MOOCs/ NPTEL

1. https://www.coursera.org/learn/optimize-machine-learning-model-performance

2. https://nptel.ac.in/courses/106106245

PATTERN RECOGNITION

Course Code:	**AM3224-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Understand the basics of pattern recognition systems and Bayesian Decision Theory.
2.	Determine the maximum likelihood, Bayesian parameter estimation and nonparametric techniques.
3.	Learn density estimation, nearest neighbor estimation linear discriminant functions, minimizing the perception criterion function and minimum squared-error procedures
4.	Examine the various unsupervised learning and clustering methods.

Prerequisite

UNIT-I

Introduction — **15 Hours**

Introduction: Machine Perception, Pattern Recognition systems, Design cycle, learning and adaptation Bayesian Decision Theory: Introduction, Bayesian Decision theory – continuous features, classifiers, discriminant functions, and decision surfaces, normal density and discriminant functions, Bayes decision theory –discrete features. Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian Estimation, Bayesian parameter estimation, problem of dimensionality, sufficient and exponential family, complex analysis & discriminants.

UNIT-II

Nonparametric Techniques — **15 Hours**

Introduction, Density Estimation, Parzen Windows,kn-nearest neighbor estimation, nearest neighbor rule, Metrics and nearest-neighbour classification, fuzzy classification, reduced coulomb energy, approximations by series expansions.

Linear discriminant functions: Introduction, linear discriminant functions, generalized linear discriminant functions, minimizing the Perceptron criterion function, relaxation procedures, non-separable behaviours, minimum squared-error procedures, Ho-Kashyap procedures

UNIT-III

Unsupervised learning and clustering — **10 Hours**

Mixture densities and identifiability, maximum-likelihood estimates, application to normal mixtures, unsupervised Bayesian learning, data decryption and clustering, criterion functions and clustering, hierarchical clustering, on-line clustering. Component analysis, low-dimensional representations and multidimensional scaling.

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

1.	Recall the basics of pattern recognition systems and Bayesian Decision Theory.
2.	Determine the maximum likelihood and Bayesian parameter estimation.
3.	Express the nonparametric techniques such as density estimation and nearest neighbor estimation.
4.	Examine linear discriminant functions, minimizing the perception criterion function and minimum squared-error procedures
5.	Describe the various unsupervised learning and 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**
AM3224-1.1	3	1	1										1	
AM3224-1.2	3	3	3										2	

AM3224-1.3	2	1	2										3	
AM3224-1.4	3	3	2										3	
AM3224-1.5	3	1	1										2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Richard O. Duda, Peter E. Hart and David G Stork,” Pattern Classification”, John Wiley & Sons, Inc.2nd Ed.2001.
2.	Robert Schalkoff, “Pattern Recognition: Statistical, Structural and Neural Approaches”, John Wiley & Sons,Inc.1992.

REFERENCE BOOKS:

1.	Christopher M. Bishop, "Pattern recognition and machine learning (information science and statistics).", Springer –Verlag NewYorkInc, 2006.
2.	Anzai,Yuichiro,”Pattern recognition and machine learning”,Elsevier, 2012.

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/117105101
2.	https://nptel.ac.in/courses/106106046
3.	https://nptel.ac.in/courses/117108048

REINFORCEMENT LEARNING

Course Code:	**AM3225-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Understand basics of Reinforcement learning, policy improvement and policy iteration.
2.	Learn Temporal Difference Learning.
3.	Understand different reinforcement learning techniques.
4.	Identify different reinforcement learning related applications.

Prerequisite	AM2001-1-Advanced Machine Learning.

UNIT-I

Introduction: Machine Learning Overview, Reinforcement Learning, examples, elements of reinforcement learning, Limitations. Learning Definition, Markov Decision Process, Goals and Rewards, Returns and Episodes, Policies and Value Functions, Bellman Equation and Optimality.	**15 Hours**

UNIT-II

Dynamic Programming, Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Monte Carlo Methods, Monte Carlo Prediction. Temporal Difference Learning, TD Prediction, Optimality of TD Q-learning: Q-policy TD Control	**15 Hours**

UNIT-III

On-Policy prediction with Approximation: Value function approximation, The prediction objective, Stochastic gradient and Semi-gradient methods, Linear methods, Feature construction for Linear Methods: Polynomials, Fourier Basis, Coarse Coding, Tile Coding, Radial Basis Functions	**10 Hours**

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

1.	Understand basics of Reinforcement learning.
2.	Differentiate policy improvement and policy iteration

3.	Understand Temporal Difference Learning
4.	Understand different reinforcement learning techniques
5.	Identify different reinforcement learning related 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**
AM3225-1.1	3	2		2										
AM3225-1.2	1	1		1										
AM3225-1.3	3	1		2										
AM3225-1.4	3	3		2										
AM3225-1.5	1	1		1										

1: Low 2: Medium 3: High

TEXTBOOKS:

1. "Reinforcement learning-an introduction" by Richard Sutton and Andrew G Barto, second edition, MIT press, 2018
2. Reinforcement Learning: An Introduction, Sutton and Barto, 2nd Edition. 2018 (free pdf version available)

REFERENCE BOOKS:

1. Reinforcement Learning: State-of-the-Art, Marco Wiering and Martijn van Otterlo, Eds., 2012

E Books / MOOCs/ NPTEL

1. https://nptel.ac.in/courses/106106143
2. https://onlinecourses.nptel.ac.in/noc19_cs55/preview
3. https://www.coursera.org/learn/fundamentals-of-reinforcement-learning

SOFT COMPUTING

Course Code:	**AM3226-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Learn the constitutes and applications of Soft Computing
2.	Analyze the reproduce operations like mutations and crossover
3.	Demonstrate the concepts of neural networks.
4.	Explain the fuzzy member ship functions, models and decision-making expert systenms.

Prerequisite **AM2001-1**

UNIT-I

Introduction to Soft Computing: **16 Hours**

Evolution of Computing, Soft and Hard Computing, Soft Computing characteristics, Constituents and Applications, I Definitions and Intelligent systems architecture.

Genetic Algorithms:

Introduction to Genetic Algorithms (GA) – Conceptual GA algorithm, Reproduction operators Mutation and cross over, Applications of GA, Learning Definitions, strategies, Machine Learning Approach, applications and Architecture of learning agent

UNIT-II

Neural Networks : **15 Hours**

Introduction to Neural Networks, Applications, Structure and function of Biological Neuron, ANN introduction, Perceptron, Multi-layer feed forward Networks with Back propagation

Fuzzy Logic:

Fuzzy Sets,Operations on Fuzzy Sets,Membership Functions,Fuzzy Rules, Models,Fuzzy Reasoning and Fuzzy Inference Systems.

UNIT-III

Decision Making and Expert Systems: **09 Hours**

Single person, multi person, Multi criteria and Multi stage decision making, Expert system features, architecture and applications

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

1.	Explain the constitutes and applications Soft Computing
2.	Perform reproduce operations like mutations and crossover
3.	Demonstrate the concepts of neural networks.
4.	Explain the fuzzy member ship functions and models
5.	Apply decision making strategies to real world examples

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**
AM3226-1.1	1	1		1									1	
AM3226-1.2	1	1		1									1	
AM3226-1.3	2	1		2									2	
AM3226-1.4	1	2		1									1	
AM3226-1.5	2	2		3									2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Jyh-Shing Roger Jang,Chuen-Tsai Sun,Eiji Mizutani,"Neuro-Fuzzy and Soft Computing", Prentice-Hall of India,2003.
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications",Prentice Hall,1995.
3. James A. Freeman and David M.Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edition.,2003.
4. Simon Haylion "Neural Networks", Prentice-Hall of India,2003.

REFERENCE BOOKS:

1. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall,1998.
2. David E.Goldberg,"Genetic Algorithms in Search,Optimization and Machine Learning", Addison Wesley,1997.
3. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer,2007.
4. S. N. Sivanandam, S. N. Deepa,"Introduction to Genetic Algorithms", Springer,2007.
5. Jacek M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishers,1992.

E Books / MOOCs/ NPTEL

1. https://archive.nptel.ac.in/courses/106/105/106105173/
2. https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html

Professional Elective Courses

Stream 3

Machine Learning and Data Science

(Group-2)

R PROGRAMMING

Course Code	**AM1321-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**1:0:2:0**	**Credits**	**03**
Total Teaching Hours	**26**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

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.

Prerequisite	NIL

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.	Learn the Concepts of data science, data mining and warehousing.
2.	Describe R basics, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, functions.
3.	Analysis and visualization of the data using different R graphs and Charts.
4.	Understand descriptive statistics and its options.
5.	Understand linear regression and multiple regression.

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
AM1321-1.1	2		1	3									3		
AM1321-1.2	2		3	3									3		
AM1321-1.3	2		3	3									3		

AM1321-1.4	2		2	2											
AM1321-1.5	1		1	1									1		

1: Low 2: Medium 3: High

TEXTBOOKS:

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/

INTRODUCTION TO DRONES

Course Code:	**AM2321-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1. Explain the concepts of drones
2. Illustrate the use basic components used for drones
3. Describe the basic of sensors used in drone
4. Apply the basic knowledge of drone to gliding drones
5. Illustrate the application of drones in different fields

Prerequisite	AM3004-1- Neural Networks and Deep Learning

UNIT-I

Introduction to drones and their applications: Definition of drones, History of drones, India and drones, Tinkering and drones, Do's and Don'ts, Classification of drones based on structure, Fixed wing structure, Lighter than air systems, Rotary-wing aircraft, Application of drones. **Dynamics of an aerial system:** Forces of flight, Principal axes and rotation of aerial systems, .1 Longitudinal axis, Lateral(transverse) axis , Perpendicular axis , Stability and Control Equilibrium , Stability, Stable system, Unstable system , Neutrally stable system, Control , Roll , Pitch, Yaw , Throttle.	**15 Hours**

UNIT-II

Sensors in Drone: Sensors – Accelerometer, Barometer, Gyro Sensor, Magnetometer, Distance sensors, Time of Flight (ToF) Sensors, Thermal sensors, Chemical Sensors and Sensor Testing – Test Philosophies and methodologies Test equipment, Performance testing of sensors **Gliding Drones :** Glider, Lift, Drag, Airfoil and its type, Incident and decalage angle , Three axis motions (roll, pitch, and yaw) , Thrust, Aspect ratio and glide ratio ,Glide or dive and descent, gliding angle , Climb, Center of pressure, Pitching moment , Load factor, Angle of attack, Build our own glider drone.	**15 Hours**

UNIT-III

Drones for Mission Control Application: ESP8266, Downloading and installing APM Planner or Mission Planner, Configuring the quadcopter - Frame type selection, Compass calibration, Access calibration, Radio calibration, Flight mode calibration and Failsafe calibration, Surveying with a drone, tweaks with the Flight Plan screen. Future of Drone Systems	**10 Hours**

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

1.	Get the basic concepts of drones
2.	Study different parts of drones
3.	Describe the different sensors used in drones
4.	Analysis the working of drones and gliding drones
5.	Acquire the knowledge of drones used in different fieds.

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
AM2321-1.1	3	3	1										1	
AM2321-1.2	3	3	2										1	
AM2321-1.3	3	3	2		2								3	
AM2321-1.4	3	3	3		3				2				3	
AM2321-1.5	3	3											3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Syed Omar Faruk Towaha, "Building Smart Drones with ESP8266 and Arduino: Build exciting drones by leveraging the capabilities of Arduino and ESP8266" Packt Publishing, 2018
2.	Aaron Asadi, "Drones The Complete Manual. The essential handbook for drone enthusiasts", Imagine Publishing Limited, 2016
3.	Neeraj Kumar Singh, Porselvan Muthukrishnan, Satyanarayana Sanpini, "Industrial System Engineering for Drones: A Guide with Best Practices for Designing", Apress, 2019

REFERENCE BOOKS:	
1.	Felipe Gonzalez Toro, Antonios Tsourdos, “UAV or Drones for Remote Sensing Applications”2018.
2.	K R Krishna, “Agricultural Drones: A Peaceful Pursuit”, Apple Academic Press; CRC Press, 2018
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/101104073
2.	https://www.coursera.org/learn/robotics-flight

AUGMENTED AND VIRTUAL REALITY

Course Code:	**AM3321-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Outline the historical and modern overviews and perspectives on virtual reality.
2.	Understand geometric modelling and its types.
3.	Understand the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.
4.	Understand virtual reality applications
5.	Provide a foundation to the fast growing field of AR and make the students aware of the various AR devices.

Prerequisite	AM1101-1- Artificial Intelligence, AM2001-1-Advanced Machine Learning

UNIT-I

Introduction to Virtual Reality:	**15 Hours**

Introduction: What Is Virtual Reality?, Modern VR Experiences, History Repeats, Bird’s-Eye View, Hardware, Software, Human Physiology and Perception

The Geometry of Virtual Worlds & the Physiology of Human Vision

Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR.

UNIT-II

Virtual Environment	**15 Hours**

Visual Perception & Rendering

Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information

Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates.

Motion & Tracking

Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies

UNIT-III

Introduction to Augmented Reality	**10 Hours**

What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship between Augmented Reality and Other Technologies(Text book 2:Chapter 1)
AR Techniques- Marker based & Marker less tracking , Marker-based tracking: Marker detection, Marker pose, Multi-marker setups (marker fields) , Marker types and identification: Template markers, 2D barcode markers, imperceptible markers, Discussion on marker use.
Alternative visual tracking methods and hybrid tracking: Visual tracking in AR, Feature-based tracking, Hybrid tracking, Initialization and recovery
(Text book 3:Chapter 3, 4 and 5)

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

1.	Describe how VR systems work and list the applications of VR.
2.	Understand the design and implementation of the hardware that enables VR systems to be built.
3.	Understand the system of human vision and its implication on perception and rendering.
4.	Explain the concepts of motion and tracking in VR systems.
5.	Describe how AR systems work and list the applications of AR

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
AM3321-1.1	1	3	3	2									3	
AM3321-1.2	3	2	3	3									3	
AM3321-1.3	3	3	3	3									3	
AM3321-1.4	3	3	3	3									3	
AM3321-1.5	3	3	3	3									3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
2. Augmented Reality: Principles & Practice by Schmalstieg/Hollerer, Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494
3. SanniSiltanen- Theory and applications of marker-based augmented reality,Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0

REFERENCE BOOKS:

1. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)”. Morgan Kaufmann Publishers, San Francisco, CA, 2002
2. John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.
3. Adams, “Visualizations of Virtual Reality”, Tata McGraw Hill,2000.
4. Grigore C. Burdea, Philippe Coiffet, “Virtual Reality Technology”, Wiley Interscience, 2nd Edition,2006.

E Books / MOOCs/ NPTEL

1. https://nptel.ac.in/courses/106106138
2. https://elearn.nptel.ac.in/shop/iit-workshops/ongoing/foundation-course-on-virtual-reality-and-augmented-reality/
3. http://lavalle.pl/tutorials.html

BIG DATA ANALYTICS

Course Code	**AM3322-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Study and comprehend in depth the fundamental issues behind the Big Data problem.
2.	Understand various Big Data technologies and different NoSQL databases. Learn MongoDB NoSQL database.
3.	Understand various Big Data technologies and Hadoop Components such as HDFS, Map Reduce. Learn Map Reduce Programming
4.	Determine various techniques for analyzing the data such as Spark,Pig and Hive.

Prerequisite	**AM3221-1**

UNIT-I

Introduction to Big Data	**15 Hours**

Overview of Big Data: Big data, Defining big data, Growth of and digitization of Global Information Storage Capacity, Big data types, Analytics, Industry Examples of Big data, Big data technologies, The evolution of big data architecture, Selecting big data technology, The Benefits of big data(Text Book 1).

Basics of Hadoop: Big data and Hadoop, Architecture of Hadoop, Main components of Hadoop framework, Analysing big data with Hadoop, Distributed application concept: Comparison between Hadoop and RDBMS, Hadoop clustering, YARN, The Map Reducer’s Engine, Advantages of Hadoop, Hadoop security concerns, Hadoop Streaming: Basics. (Text Book 1).

Hadoop Distributed File System: HDFS**,** Architecture of Apache, Other file systems, HDFS File Blocks, HDFS File commands: cat, chgrp, chmod, chown, count, cp, ls, rm, mkdir (Text Book 1)

UNIT-II

Introduction to Hadoop	**15 Hours**

NO SQL Data management and MONGODB: NO SQL Data Management, Types of NO SQL databases, Benefits of No SQL(Text book 1)

MongoDB: What, Why- Replication, Sharding, Terms used in RDBMS and MongoDB, Data types in MongoDB (Text Book 2), Advantages of MongoDB over RDBMS (Text book 1)

HBASE and CASSANDRA: Introduction to HBase, Row-oriented vs column oriented data stores, HDFS vs HBase, HBase architecture, HBase Performance, Understanding HBase model (Text book 1)

Cassandra: Introduction, Features of Cassandra, Data replication in Cassandra, Components of Cassandra ,Cassandra Data model, Data models of Cassandra and RDBMS (Text book 1),

CQL Data types, CQLSH, Keyspaces (Text book 2)

MAP REDUCE: Introduction to Map Reduce-5 steps, How Map reduce works, What is map operations, What is reduce operations, Submitting a map reduce job.(Text book 1)

UNIT-III

Hadoop Ecosystem	**10 Hours**

Introduction to Hive-Define, features, architecture, Hive data models, Hive building blocks, Hive data file formats (Text Book 1).

Hive data types, Basics of HQL(Text Book 2)

PIG: The higher level programming environment: Introduction to pig, Components of Pig, Pig program execution modes, Data formats and models, Other capabilities, pig v/s map reduce, Difference between hive and pig(Text Book 1).

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

1.	Outline the theory of big data and explain applications of big data.
2.	Get the idea of NoSQL databases, different types of NoSQL data stores.
3.	Analyse the technological foundations for Big data with hadoop and design of hadoop distributed file system.
4.	Understand the concept of Map Reduce programmig and Spark workflow.
5.	Understand the need of Big Data Analytics and Analyze Hadoop Ecosystem

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**
AM3322-1.1	2		2	2									1	
AM3322-1.2	2		2	2									2	
AM3322-1.3	3		2	3									3	
AM3322-1.4	3		2	3									2	
AM3322-1.5	2		2	3									2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Seema Acharya, Subhashini Chellappan, “Big Data Analytics”, 1st Edition, Wiley, 2015.
2.	Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, Packet Publishing 2013.
3.	Tom White, Hadoop: The Definitive Guide, 4th Edition, O'Reilley, 2012.

REFERENCE BOOKS:

1.	V1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.
2.	Chris Eaton, Dirk derooset al. , “Understanding Big data ”, McGraw Hill, 2012.
3.	E. Capriolo, D. Wampler, and J. Rutherglen, Programming Hive, O'Reilley, 2012.
4.	Lars George, HBase: The Definitive Guide, O'Reilley, 2011.
5.	Alan Gates, Programming Pig, O'Reilley, 2011

E Books / MOOCs/ NPTEL

1.	https://www.upgrad.com/big-data-analytics-
2.	https://www.coursera.org/courses?query=big%20data%20analytics.
3.	https://www.edx.org/micromasters/big-data

SOCIAL AND WEB ANALYTICS

Course Code:	**AM3323-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3-0-0-0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

Course Objectives:
This course will enable students to:-

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.

Prerequisite AM3322-1-Big Data Analytics.

UNIT-I

Introduction to web and social analytics: **15 Hours**

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

Kpi/Metrics: **15 Hours**

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:

Analyzing 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

Data Mining in Social Media : **10 Hours**

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
AM3323-1.1	2	2											2	
AM3323-1.2	3	2	3											3
AM3323-1.3	2	3											1	
AM3323-1.4	1	2												2
AM3323-1.5	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.	http://dbmanagement.info/Books/MIX/Computer_Science_Mit_Press_Principles_Of_Data_Mining_Big_Data.pdf/http://nptel.ac.in/courses/106106146/21#watch/ https://www.coursera.org/learn/social-media-data-analytics

TEXT MINNING

Course Code:	**AM3324-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Learn text extraction and its techniques.
2.	Visualize clustering techniques for text.

3.	Understand different classification techniques for text
4.	Practice festure extraction and visualization methodologies using tools.

Prerequisite	NIL

UNIT-I

Text Extraction Text Extraction: Introduction, Rapid automatic keyword extraction: candidate keywords, keyword scores, adjoining keywords, extracted keywords, Benchmark evaluation: precision and recall, efficiency, stoplist generation, Evaluation on new articles.
Clustering Clustering: Multilingual document clustering: Multilingual LSA, Tucker1 method, PARAFAC2 method, LSA with term alignments, LMSA, LMSA with term alignments

15 Hours

UNIT-II

Classification: Content-based spam email classification using machine-learning algorithms, utilizing nonnegative matrix factorization for email classification problems, Constrained clustering with k-means type algorithms.
Anomaly and trend detection Anomaly and trend detection: Text Visualization techniques such as tag clouds, authorship and change tracking, Data Exploration and the search for noval patterns, sentiment tracking, visual analytics and FutureLens, scenario discovery, adaptive threshold settting for novelty mining.

16 Hours

UNIT-III

Text streams Text streams: Introduction, Text streams, Feature extraction and data reduction, Event detection, Trend detection, Event and trend descriptions, Embedding semantics in LDA topic models: Introduction, vector space modeling, latent semantic analysis, probabilistic latent semantic analysis, Latent Dirichlet allocation, embedding external semantics from Wikipedia, data-driven semantic embedding.

09 Hours

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

1.	Design text extraction techniques.
2.	Design clustering techniques for text.
3.	Design classification techniques for text
4.	Practice visualization methodologies using tools.
5.	Practice feature extraction using 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**
AM3324-1.1		3	2	2		3								
AM3324-1.2		3	2	2		3								
AM3324-1.3		3	2	2		3								
AM3324-1.4		2	3	3		1								
AM3324-1.5		2	3	3		1								

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Michael W. Berry & Jacob Kogan ,"Text Mining Applications and Theory", Wiley publications.
2.	Aggarwal, Charu C., and ChengXiangZhai, eds. Mining text data. Springer Science & Business Media, 2012.

REFERENCE BOOKS:

1.	Miner, Gary, et al. Practical text mining and statistical analysis for non-structured text data applications. Academic Press, 2012
2.	Srivastava, Ashok N., and Mehran Sahami. Text mining: Classification, clustering, and applications. Chapman and Hall/CRC, 2009.
3.	Buitelaar, Paul, Philipp Cimiano, and Bernardo Magnini, eds. Ontology learning from text: methods, evaluation and applications. Vol. 123. IOS press, 2005.

E Books / MOOCs/ NPTEL	
1.	https://onlinecourses.nptel.ac.in/noc19_mg47/preview
2.	https://www.coursera.org/courses?query=text%20mining
3.	https://www.coursera.org/learn/text-mining-analytics

WEB APPLICATIONS USING ML

Course Code:	**AM3325-1**	**Course Type:**	**PEC**
Teaching Hours/Week (L:T:P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Learn the basics of HTML5 and create interactive web applications.
2.	Apply validation checks using client-side programming languages like HTML, CSS, Java Script.
3.	Design interactive web pages using AngularJS programming language
4.	Generate responses dynamically using PHP for business data.
5.	Construct web application development frameworks for designing web applications.

Prerequisite	AM2001-1-Advanced Machine Learning.

UNIT-I	
HTML5: Overview of HTML5, New features in HTML5, Removed elements from HTML, HTML5 Semantic elements, HTML5 input types, HTML5 new form elements and attributes, HTML5 Video and Audio. CASCADING STYLE SHEETS (CSS): Introduction, Levels of style sheets, style specification formats, selector forms, Property Value forms, Font properties, List properties, Color, Alignment of Text, The Box model, Background images, The <span> and <div> tags, Conflict resolution. THE BASICS OF JAVASCRIPT: Overview, Object orientation and JavaScript, General syntactic characteristics, Primitives, Operations, and Expressions, Screen output and keyboard input, control statements, Object creation and modification, Arrays, Functions, Constructors, Patterns matching using Regular Expressions, Errors in Scripts. JAVASCRIPT The JavaScript Execution Environment, The Document object model, Element access in JavaScript, Events and Event handling, Handling events from Body elements, Handling events from Button elements, Handling events from Text Box and Password elements.	**15 Hours**
UNIT-II	
IoT Application Development:	**15 Hours**
Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.	
IoT Case Studies:	
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, and Productivity Applications.	
UNIT-III	
Managing Data in web apps, Data Integration, Extracting and organizing SQL databases, deployment, Visualization, Integrating,	**10 Hours**

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

1.	Gain technical competencies in web application development and maintenance.
2.	Implement interactive web pages and apply validation checks using client side programming languages like HTML, CSS, Java Script.
3.	Implement interactive web pages using AngularJS programming language
4.	Process the business data and generate responses dynamically using PHP.
5.	Use web application development frameworks for designing web 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**
AM3325-1.1	2			2		1	1						1	
AM3325-1.2	2			3		3	3						3	
AM3325-1.3	2			3		3	3						3	
AM3325-1.4	2			2		1	2						1	
AM3325-1.5	2			3		3	3						2	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. HTML5 Black Book: Covers CSS3, Javascript, XML, XHTML, Ajax, PHP and Jquery", Kogent Learning Solutions Inc. Dreamtech Press, First Edition, ISBN 9789350040959.
2. Html, XHTML, CSS & XML by Example", TeodoreGugoiu Publication –FIREWAL MEDIA

REFERENCE BOOKS:

1. "Beginning PHP5", Dave W. Mercer, Allan Kent, Steven D. Nowicki, David Mercer, Wrox Publication, First Edition, ISBN 978-0764557835
2. "Commence Web Development with PHP and MySQL", Sagar S. Sawant & Ashwini B. Patil, Aruta Publication, First Edition, ISBN-978-93-81476-13-0
3. "Real-World Solutions for Developing High-Quality PHP Frameworks and Applications", Sebastian Bergmann, Stefan Priebsch, Wrox, ISBN:978-1-4571-0652- 1

E Books / MOOCs/ NPTEL

1. https://www.analyticsvidhya.com/blog/2020/09/integrating-machine-learning-into-web-applications-with-flask/
2. https://www.udemy.com/course/building-machine-learning-web-apps-with-python/
3. https://www.quora.com/How-can-I-implement-machine-learning-algorithms-in-a-web-application

EMPOWERING WITH ARTIFICIAL INTELLIGENCE

Course Code:	**AM3326-1**	**Course Type:**	**PEC**
Teaching Hours/Week (L:T:P: S):	**2:0:2:0**	**Credits:**	**03**
Total Teaching Hours:	**26+0+26**	**CIE + SEE Marks:**	**50+50**
Credits – 3			

Course Objectives:
This Course will enable students to:

1. Acquire basic understanding of Artificial Intelligence
1. Illustrate the application of computer vision and natural language processing
2. Identify and experience the transition from traditional computer vision to artificial intelligence.
3. Analyze the process of congestion control algorithms
4. Illustrate IP Packets and fragmentation process.

Unit I	**Contact Hours**
Basics of AI and Statistical Data	
Basic understanding of Artificial Intelligence: What is AI? The 3 domains of AI: Statistical Data, Computer Vision, NLP, AI Applications, AI in industries, UN Sustainable Development Goals, AI Ethics issues- privacy, bias, access to AI. **Non-technical Introduction to AI**: AI Project Cycle-Problem scoping, Data Acquisition, Data Visualization, Decision Trees, Introduction to Neural Networks. **Domain - Fundamentals Hands-on Sessions** **Statistical Data**: Data Import and Processing, Machine Learning Techniques, AI for Data Walkthrough	9 (T) 8 (P)
Unit II	
Computer vision	
Basic Techniques in Computer Vision: - How do computer see?, How image is represented with numbers (RGB), Tresholding, masking and region of interest, Geometric transformation, resizing and cropping **From Traditional Computer Vision to Artificial Intelligence:** Feature extraction , selecting appropriate features, Pre processing images, Introduction to K-Nearest neighbour algorithm, Training a simple machine learning algorithm with a few samples, Support Vector Machines. **Types of Inference Models with OpenVINO and NCS2:** Use Pre-trained model from OpenVINO, Run an inference model using the Neural Compute Stick 2, Image classification, Object detection.	9 (T) 8 (P)
Unit III	
Natural Language Processing	
Data Collection and Processing for NLP: Requesting website information with Python, Storing data, Curated data sources, NLP tools, Processing NLP data" Classification for NLP: Converting data into a bag of words, Selecting important words from a list of words using tfidf method, Choose a machine learning model using the sklearn library, Data pipelining. **Creating a Chatbot:** Introduction to chatbots, Finding your chatbot's specialty, Teach your chatbot to match topics, Get your chatbot to say its first words, Teach and play with your chatbot **Exemplar AI use cases with AI project cycle** **Project Work-time and Presentation**	8 (T) 12 (P)

Course Outcomes:

This Course will enable students to:

1. Understand the concept of Artificial Intelligence and its applications
2. Describe the application of computer vision and its types
3. Describe the transition from traditional computer vision to artificial intelligence.
4. Analyse the data collection and processing for natural language processing
5. Outline the concept of chatbot creation

Textbooks:

1) Artificial Intelligence: A Modern Approach, by Peter Norvig and Stuart J. Russell, 3rd edition
2) Computer vision Algorithms and Applications, Richard Szeliski, SPRINGER publications
3) “Natural language understanding” by James Allen

Reference Books:

1. Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), Natural LanguageProcessing and Text Mining, Springer-Verlag London Limited 2007.

Mooc/NPTEL

1) https://www.coursera.org/learn/introduction-to-ai-Introduction - Introduction toAI
2) https://nptel.ac.in/courses/106105216 -computer vision

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2											2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom’s Taxonomy Level
CO1	PO1, PO2	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3	L2
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3

Professional Elective Courses
Stream 4
Applied Computational Electives
(Group-1)

FUNDAMENTALS OF IMAGE PROCESSING

Course Code:	**AM2231-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

Course Objectives:

1.	Outline the theory behind the basics of digital image processing, the relation between the components of image processing system. Make use of Electromagnetic Spectrum, find the equivalence between pixels.
2.	Make use of spatial and frequency domain, smoothing and sharpening filters.
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. Understand different compression model.
5.	Tell how Components of an Image Processing System works, their design, and get the feeling of Histogram Processing.

Prerequisite	CS1001-1-Problem-Solving through Programming

UNIT-I

Introduction	**15 Hours**

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. Digital Image Fundamentals - Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels.

Intensity Transformations and Spatial Filtering-Background, Some Basic Intensity Transformation Functions, Histogram Processing-Histogram Equalization, Histogram Matching. Local Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. [Textbookchapters1,2,3]

UNIT-II

Filtering in Frequency Domain	**15 Hours**

Background, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform (DFT)of Functions of one continuous variable, Image smoothing using Frequency-Domain Filters – Ideal Lowpass Filters, Butterworth Lowpass Filters,
Gaussian Lowpass Filters, Image Sharpening using Frequency Domain Filters -Ideal Highpass Filters, Butterworth Highpass Filters, Gaussian Highpass Filters, Homomorphic Filtering.
[Text book chapter 4.1,4.3,4.4,4.8,4.9]
Image Compression – Fundamentals- Coding Redundancy, Spatial and Temporal Redundancy, Image Compression Model. Some Basic Compression Model – Huffman Coding, Arithmetic Coding, LZW

coding, Bit-Plane Coding, Run -Length Coding.
[Textbook chapter 8.1,8.2]

Morphological Image Processing – Preliminaries, Dilation and Erosion, Opening and Closing, the Hit-or-Miss Transformation, Some Basic Morphological Algorithms -Boundary Extraction, Thinning, Thickening
[Textbook chapter 9.1,9.2,9.3,9.4,9.5]

UNIT-III

Image Segmentation	**10 Hours**

Point, Line and Edge Detection – Background, Detection of Isolated Points, Line Detection, Edge Model, Basic Edge Detection, Edge Linking and Boundary Detection, Thresholding- Foundation, Basic Global Thresholding, Region Based Segmentation Region growing, splitting and merging.
[Textbook chapter 10.1,10.2,10.3,10.4]

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

1.	Apply the concept of Digital Image Processing and Steps in Digital Image Processing, **Able** to apply the Knowledge of Image Sampling and Quantization and **Illustrate** Some Basic Relationships between Pixels using Knowledge of 4-8 and Madjacency.
2.	Design and **Formulate** Histogram processing. **Analyze** Smoothing Spatial Filters, Sharpening Spatial Filters by applying mathematical knowledge.
3.	Explain Frequency domain and illustrate Smoothing Frequency-Domain Filters. **Analyze** Sharpening Frequency-Domain Filters. **Apply** and **Design** Image Compression Standards and models.
4.	Analyze the concept to fMorphological Image Processing by applying mathematical knowledge.
5.	**Design** and **Formulate** Image segmentation techniques and prove the properties Region-Based Segmentation.

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**
AM2231-1.1	1	2	3										3	2
AM2231-1.2		3											3	
AM2231-1.3	2	3											3	
AM2231-1.4	2		3										3	2
AM2231-1.5		2	3										3	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson Education, Third Edition.

REFERENCE BOOKS:

1.	Digital Image Processing With Matlab &Lab view Vipula Singh Published by Reed Elsevier India Pvt. Ltd| Language –English |Binding-Paper Back.
2.	Anil K Jain, “Fundamentals of Digital Image Processing”,Prentice-Hall of India Pvt.Ltd.,1997.
3.	Milan Sonka, Vaclav Hlavac and Roger Boyle,“Image Processing, Analysis and Machine Vision”,Thomoson Learning, Brooks/Cole, Second Edition. 2001.
4.	B.Chanda,DDuttaMajumder,“DigitalImageProcessingandAnalysis”,Prentice-Hall,India,2002.
5.	Steven W.Smith,“The Scientist and Engineers Guide to Digital Signal Processing“,California Technical Publishing,SecondEdition,1999.

E Books / MOOCs/ NPTEL	
1.	iitlab.bit.edu.cn/HandbookofImageandVideoProcessing.pdf
2.	http://www.cs.ukzn.ac.za/~sviriri/Books/Image-Processing/book4.pdf
3.	https://nptel.ac.in/courses/117105079/
4.	https://swayam.gov.in/nd1_noc19_ee55/preview
5.	https://www.coursera.org/learn/image-processing
6.	https://www.coursera.org/learn/image-processing

BIO INFORMATICS

Course Code:	**AM3231-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Understand the basics of bioinformatics and identify different types of biological sequence.
2.	Evaluate HMM and its algorithms for applications in bio informatics.
3.	Analyze multiple sequences and find conserved regions.
4.	Explain RNA and Protein folding.

Prerequisite **AM3001-1**

UNIT-I	
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	**15 Hours**
UNIT-II	
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.	**15 Hours**
UNIT-III	
General introduction to Gene expression in prokaryotes and eukaryotes	**10 Hours**
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 HMM and its algorithms and its applications in bio informatics.
4.	Analyze multiple sequences and find conserved regions.
5.	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**
AM3231-1.1	2	1										2		
AM3231-1.2	2	1										2		
AM3231-1.3	3	3										2		
AM3231-1.4	2	3										2		
AM3231-1.5	2	3										2		

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

1.	https://nptel.ac.in/courses/102106065
2.	https://onlinecourses.nptel.ac.in/noc21_bt06/preview
3.	https://onlinecourses.swayam2.ac.in/cec21_bt04/preview

GAME THEORY AND APPLICATIONS

Course Code:	**AM3232-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Understand the basics and architecture of Games.
2.	Learn the achitecture of Game Playing.
3.	Analyze the use of Equilibrium in Games and concepts of Game Theory.
4.	Understand the dominance solvability in games

Prerequisite	AM2001-1-Advanced Machine Learning,

CS3004-1- Design and Analysis of Algorithms.

UNIT-I

Introduction; Strategic Games — 15 Hours

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 method; 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

Extensive Games — 16 Hours

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 &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

Applications Of Game Theory — 09 Hours

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, Pare to 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.
3. Apply the use of Equilibrium in Games.
4. Understand the dominance solvability in games
5. Apply the Concepts of Game Theory.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
AM3233-1.1	1	2		2									1	
AM3233-1.2	2	2		3									3	
AM3233-1.3	3	2		3									3	
AM3233-1.4	3	2		2									2	
AM3233-1.5	3	3		3									3	

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 Rough garden, 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	
1.	https://onlinecourses.nptel.ac.in/noc19_ge32/preview
2.	https://nptel.ac.in/courses/106101237
3.	https://www.coursera.org/learn/game-theory-1

MULTIMEDIA PROCESSING

Course Code:	**AM3233-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

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.

Prerequisite	DS

UNIT-I	
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	**15 Hours**
UNIT-II	
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.	**15 Hours**
UNIT-III	

Video compression standards: H.261, H.263, MPEG 1, MPEG 2, MPEG 4 (scene composition, coder, decoders), MPEG 7 , MPEG 21 multimedia framework.	**10 Hours**

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**
AM3234-1.1	1		2	2									2	
AM3234-1.2	1		2	2									2	
AM3234-1.3	2		3	3									2	
AM3234-1.4	3		3	3									3	
AM3234-1.5	3		3	3									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. Raifsteinmetz, KlaraNahrstedt, “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

2. Kharagpur :http://nptel.iitk.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Multimedia %20Processing/New_index1.html

NATURE INSPIRED COMPUTING

Course Code:	**AM3234-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	To establish basic knowledge in NP hard problems and understand the need for approximation algorithms.

2.	Design algorithms that include operators, representations, fitness functions and potential hybridizations for non-trivial problems.
3.	Design algorithms that utilize the collective intelligence of simple organisms to solve problems.
4.	Design and implement an artificial neural network that employs learning to solve non-trivial problems.

Prerequisite	**AM3226-1**

UNIT-I	
Introduction to Computational Problems Computational Problems, Decision Problem, Optimization Problem, Hardness in Optimization Problems, NP class, NP-Hard, examples for NP-Hard problems, tackling NP-Hard problems, Rationale for seeking inspiration from nature **Evolutionary Systems** Pillars of Evolutionary Theory, The Genotype, Artificial Evolution, Genetic representations, Initial Population, Fitness Functions, Selection and Reproduction, Genetic Operators, Evolutionary Measures, Types of Evolutionary Algorithms. **Behavioral systems** Behavior in Cognitive Science, Behavior in Artificial Intelligence , Behavior-Based Robotics , Biological Inspiration for Robots , Robots as Biological Models, Robot Learning , Evolution of Behavioral Systems Evolution and Learning in Behavioral Systems , Evolution and Neural Development in Behavioral Systems	**16 Hours**
UNIT-II	
Artificial Neural Networks History, Mathematical model of neuron, ANN architectures, learning rules Backpropagation network, Backpropagation learning and its applications, Variants of BPA. **Collective Systems** Particle Swarm Optimization Algorithm, Hybrid PSO algorithms, Ant Colony Optimization, Artificial Bee Colony, Firefly Algorithm **Immuno Computing** Introduction- Immune System, Physiology and main components, Immune Network Theory- Danger Theory, Evaluation Interaction- Immune Algorithms, Bone Marrow Models, Forest's Algorithm, Artificial Immune Networks.	**14 Hours**
UNIT-III	
DNA Computing DNA Computing: Motivation, DNA Molecule, Adleman's experiment, Test tube programming language, Universal DNA Computers, PAM Model, Splicing Systems, Lipton's Solution to SAT Problem, Scope of DNA Computing, From Classical to DNA Computing. **Recent Trends**	**10 Hours**

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

1.	Understand fundamental concepts of NP-hardness and computational complexity.
2.	Understand the strengths, weaknesses and appropriateness of nature-inspired algorithms.
3.	Apply nature-inspired algorithms to optimization, design and learning problems.
4.	Analyze the Behavior systems of nature inspired algorithm applied in real world problems.
5.	Understand the theory behind the design of immune networks and DNA computing and their potential applications.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	 2
AM3235-1.1		1	1			2	2							
AM3235-1.2		1	1			2	2							
AM3235-1.3		2	3			3	3							
AM3235-1.4		3	3			3	3							
AM3235-1.5		1	2			3	3							

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Xin-She Yang, “Nature-Inspired Computation and Swarm Intelligence Algorithms, Theory and Applications”, Elsevier, Academic Press, 2020.

REFERENCE BOOKS:

1. Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007.
2. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
3. Licheng Jiao, Ronghua Shang , Fang Liu , Weitong Zhang , Brain and Nature-Inspired Learning, Computation and Recognition, Elsevier, 2020.

E Books / MOOCs/ NPTEL

1. https://www.computersciencedegreehub.com/faq/what-is-nature-inspired-computing/
2. https://www.youtube.com/watch?v=3OkQ72y77LM
3. https://en.wikipedia.org/wiki/Natural_computing

SPEECH PROCESSING

Course Code:	**AM3235-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3-0-0-0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1. Understand the fundamentals of speech processing.
2. Study the models of speech processing.
3. Explain the linear predictive coding.
4. Illustrate the application of speech processing.

Prerequisite **AM3003-1**

UNIT-I

Introduction **15 Hours**

Introduction, Fundamentals of Digital Speech Processing, Digital models for the speech signals, Time domain models for speech processing, Digital representation of the speech waveform, short term Fourier analysis.

UNIT-II

Homomorphic Speech Processing **15 Hours**

Homomorphic speech processing, Linear predictive coding of speech: Introduction, Basic principles of LP analyse, Computation of gain for the model, solution of LPC equation, Comparison between the methods of solution of the LPC analysis equation, the prediction error signal.

UNIT-III

Linear Predictive Coding of Speech **10 Hours**

Linear predictive coding of speech: Frequency domain interpretation of LP analysis, Relation of LP analysis, Relations between various speech parameters, applications
Digital speech for man machine communication by voice.

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

1.	Explain the fundamentals of speech processing.
2.	Summarize the models of speech processing.
3.	Learn the concepts of homomorphic speech processing.
4.	Infer the linear predictive coding.
5.	Illustrate the application of speech 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**
AM3236-1.1	1	1												
AM3236-1.2	2	2												
AM3236-1.3	2	2												
AM3236-1.4	2	2												
AM3236-1.5	1	3												

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Digital Processing of Speech Signals, Lawrence R. Rabiner , Ronald W. Schafer, Pearson

REFERENCE BOOKS:

1. Speech and Audio Signal Processing, A.R. JAYAN, PHI
2. Speech and Audio Processing, Apte Shaila D, Wiley India Pvt. Ltd

E Books / MOOCs/ NPTEL

1. https://nptel.ac.in/courses/117105145
2. https://www.coursera.org/courses?query=signal%20processing

GENERATIVE ADVERSARIAL NETWORKS

Course Code:	**AM3236-1**	**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**

Credits – 3

Unit I	**Contact Hours**
Introduction: What are generative models, what are generative adversarial networks, why we need GAN, Up sampling in GANs, how to use Up sampling layer, Transpose Convolutional Layer, GAN Training algorithm, Understanding GAN loss function, Train GAN models in practice, Challenge for training GANs, Heuristics for training GANs, Deep convolutional GANs	15

Developing 1D GAN: Select one dimensional function, Discriminator model, Generator model, Training generator model, Evaluating performance of GAN,	
Unit II	
Develop a DCGAN: Define and Train the discriminator model, Use generator model for DCGAN, Evaluate GAN model performance **Diagnose GAN Failure Modes:** Train a stable GAN, identify mode of collapse, Identify convergence failure **GAN evaluation:** Problem with evaluating generator models, Manual GAN Generator evaluation, Qualitative GAN Generator evaluation, Quantitative GAN generator evaluation	15
Unit III	
GAN Loss: Challenge of GAN Loss, Standard GAN loss function, alternate GAN Loss functions **Advanced GANs:** Brittleness of GAN Training, Develop better GANs by scaling up, How to scale up GANs with BigGAN	09

Course Outcomes:

Upon completion of this course, students will be able to:

1. Describe basics of Generative Adversarial Networks
2. Implement 1D Gan generation
3. Illustrate the generation of DCGAN
4. Apply GAN evaluation techniques
5. Describe Advanced GAN and Loss functions

Textbooks:

1. **Generative Adversarial Networks with Python:** Deep Learning Generative Models for Image Synthesis and Image Translation by Jason Brownlee, machine learning mastery, 2019
2. **Generative Deep learning: Teaching machines to Paint, Write, Compose and Play** by David Foster, Oreilly Publications, 2019

Table 1: Mapping Levels of COs to POs

Program Objectives (POs)												**PSOs**	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
3	2	2		2				2	2			2	
3	2	2		2				2	2			2	
3	2	2		2				2	2			2	
3	2	2		2				2	2			2	
3	2											2	

Table 2: Mapping of Cos to PIs, Pos and BTL

Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 3.2.1,5.1.1, 9.1.1, 10.1.1	L2, L3
CO2	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 3.2.1,5.1.1, 9.1.1, 10.1.1	L2, L3
CO3	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3,5.1.1, 9.1.1, 10.1.1	L2, L3
CO4	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 5.1.2, 9.1.1, 10.1.1	L2, L3
CO5	1, 2	1.3.1,1.4.1, 2.1.3	L2

Professional Elective Courses
Stream 4
Applied Computational Electives
(Group-2)

AUTONOMOUS SYSTEMS

Course Code:	**AM3331-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	This course helps the students with a complete understanding of autonomous systems.
2.	They will be able to create a model of basic autonomous vehicle.
3.	The students will also be able to design and implement an autonomous robot.

Prerequisite	NIL

UNIT-I

Introduction What are autonomous systems?, Examples of autonomous systems, Sensors and fusion, Autonomous system software architecture, Software foundation for safe systems, AI in autonomous systems, Autonomous systems vs robots. **Introduction to robots** Introduction, Definition, Types of robots, Automation and robotics, Advantages and disadvantages, The grand challenges in robotics, Overview of robots, The characteristics and application of the present robots (industrial), Advanced technological features of the modern robots, Needs for robots, The characteristics and applications of future Industrial robot.	**16 Hours**

UNIT-II

Structure of robotic system Anatomy of a robot, classification of robots, robot configurations-Advantages, robotic system, joints in robots, robot specifications, robot drive system (actuators) in brief. **Sensors in robots** Terminology, Sensors that measure the robot's joint configuration, What is Robot Sensor: Working & Its Applications. **Operation, programming and path planning of robots** Types of industrial robot and their methods of operation- Pick and place manipulators, Point to point robots, Continuous path robots, Path planning in robots: Algorithms used in robotics and industrial automation, Path planning, Overview of path planning algorithms used by robots, Programming languages for Robots.	**14 Hours**

UNIT-III

Introduction to Drones Unmanned Aerial Vehicles, Classification of UAVs, Physical structure of a drone, Advantages and disadvantages, Applications of drones. **Flight Mechanics** Forces acting on a drone, Flight mechanism, Degrees of a freedom of a quadcopter **Drone Electronics** Frame, Motor, Propeller, Electronic speed controller, Flight controller, GPS module, Battery, Radio transmitter, Radio receiver, Communication protocols-PWM,PPM	**10 Hours**

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

1.	Complete understanding of autonomous systems.
2.	Create a model of basic autonomous vehicle.

3.	Understand, design and implement an autonomous robot.
4.	Understand the different models used in the autonomous systems.
5.	Understand, design and implement an autonomous drone.

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**
AM3331-1.1	3	1	2											
AM3331-1.2	2	2	2											
AM3331-1.3	3	3	3											
AM3331-1.4	2	3	3											
AM3331-1.5	3	3	3											

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Intelligent Autonomous Systems Foundations and Applications by Pratihar, Dilip Kumar, Springer, 2010

REFERENCE BOOKS:

1. The Autonomous System: A Foundational Synthesis of the Sciences of the Mind Szabolcs Michael de Gyurky, Mark A. Tarbell, Wiley, 2013
2. Creating Autonomous Vehicle Systems by Shaoshan Liu, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc Gaudiot, Morgan & Claypool Publishers , 2018

E Books / MOOCs/ NPTEL

1. https://www.cloudflare.com/learning/network-layer/what-is-an-autonomous-system/
2. https://www.udacity.com/school-of-autonomous-systems
3. https://www.microsoft.com/en-us/ai/autonomous-systems

BUSINESS INTELLIGENCE AND ITS APPLICATIONS

Course Code:	**AM3332-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

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

Prerequisite **AM1101-1**

UNIT-I

Business View of Information Technology Applications **15 Hours**

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	
Getting Started with Business Intelligence	**15 Hours**
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	
Measures, Metrics, KPIs, and Performance Management	**10 Hours**
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**	**3**
AM3332-1.1		2							1	1		1		1	
AM3332-1.2	2	2			2				1	1		1		3	
AM3332-1.3	2	2				2			1	1		1		3	
AM3332-1.4	2	2				2			1	1		1		3	
AM3332-1.5	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.

USER INTERFACE DESIGN

Course Code:	**AM3333-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

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.

Prerequisite	**AM1601-1**

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

System menus | **12 Hours**

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

The psychology of everyday actions | **13 Hours**

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.

Knowing what to do: constraints, discoverability, and feedback: 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	3
AM3333-1.1	3	3							1	1		1	1		
AM3333-1.2	2	3							1	1		1	1		
AM3333-1.3	1	3	2						1	1		1	3	2	
AM3333-1.4	1	3	2						1	1		1	3	2	
AM3333-1.5		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)

BLOCKCHAIN TECHNOLOGY

Course Code:	**AM4331-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

Course Objectives:

1.	Understand basic of Blockchain Technology
2.	Explain cryptographic primitives used in Blockchain
3.	Get the idea of Ethereum Blockchain and Smart Contract
4.	Explore Solidity Programming language and Remix IDE to develop smart contract.
5.	Understand Hyperledger fabric and its framework

Prerequisite	AM3101-1

UNIT-I

15 Hours

Introduction: Blockchain , Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized Organizations.
Cryptographic primitives: Symmetric cryptography, Stream ciphers, Block ciphers, Block encryption mode, Keystream generation modes, Message authentication modes, Electronic code book, Cipher block chaining, Counter mode, Data Encryption Standard (DES) Advanced Encryption Standard (AES),Asymmetric cryptography; Public and private keys, Encryption and decryption using RSA,Cryptographic Hash Function, Properties of a hash function, Digital signatures :Sign then encrypt, Encrypt then sign, Merkle tree.

UNIT-II

15 Hours

Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian Contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.
Introducing solidity: Types, Value types :Boolean, Integers, Address, Array value types (fixed size and dynamically sized byte arrays), Literals, Integer literals, String literals, Hexadecimal literals, Enums, Function types, Internal functions, External functions, Reference types, Arrays, Structs, Data location, Mappings, Global variables, Control structures, Events, Inheritance, Libraries, Functions, Layout of a solidity source code file.
Truffle Basics and Unit Testing, Debugging Contracts Remix IDE: Programs execution.

UNIT-III

10 Hours

Exploring Hyperledger Fabric: Building on the foundations of open computing, Fundamentals of the Hyperledger project, The Linux Foundation, Hyperledger, Open source and open standards, Hyperledger frameworks, tools, and building blocks, Hyperledger Fabric component design, Principles of Hyperledger design, Hyperledger Fabric reference architecture, Hyperledger Fabric runtime architecture, Strengths and advantages of componentized design

Course Outcomes:

Upon completion of this course, students will be able to:

1. Explain the fundamental building blocks of Blockchain technology.
2. Understand the significance of Consensus and working of cryptocurrency.
3. Explain basics of Ethereum blockchain and smart contract
4. Develop block chain-based solutions and write smart contract using Solidity, Remix IDE and Ethereum frameworks.
5. Describe Hyperledger fabric and its framework, design principles and architecture

Textbooks:

1. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing.
2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O’Dowd, Venkatraman Ramakrishna, “Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer”, Import, 2018.

Reference Books:

1. Melanic Swan, “Block Chain: Blueprint for a New Economy”, O’Reilly, 2015.
2. Josh Thompsons, “Block Chain: The Block Chain for Beginners-Guide to Block chain Technology and Leveraging Block Chain Programming”.
3. Daniel Drescher, “Block Chain Basics”, Apress; 1st edition, 2017.
4. Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi.
5. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Block Chain”, Packt Publishing.

E Books / MOOCs/ NPTEL

R1: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=5&lesson=9

R2: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=5&lesson=10

R3: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=5&lesson=11

R4: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=5&lesson=13

R5: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=6&lesson=14

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
AM4331-1.1	3	3								1		1		1
AM4331-1.2	2	3	3							1		1		2
AM4331-1.3	2	3	3							1		1		2
AM4331-1.4	2	2	3							1		1		2
AM4331-1.5	2	2	3							1		1		2

1: Low 2: Medium 3: High

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

MULTICORE ARCHITECTURE AND PROGRAMMING

Course Code:	**AM4332-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3-0-0-0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

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. Analyze the process of code optimization
5. Recognize the need and usage of multi-threading tools

Prerequisite **AM2101-1**

UNIT-I

Introduction to Multi-Core Architecture — 15 Hours

Introduction, Moore’s law, Amdahl’s law, Gustafson’s law, Motivation for Multi-core processors, Types and levels of parallelism, Flynn’s classification of multi-processors, Introduction to parallelization and vectorization: Data dependencies, SIMD technology, Hardware Multithreading vs. Software multi-threading, Hyper threading, SMT, Case Study of multi-core processors: Intel, AMD, IBM/Sony.

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

UNIT-II

Parallel Programming with Distributed Memory Parallel Computers — 15 Hours

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.

UNIT-III

Compiler Optimizations and Parallel Algorithms — 10 Hours

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.

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	3
AM4332-1.1	2	3							1	1		1	3		
AM4332-1.2			3						1	1		1		3	
AM4332-1.3			3						1	1		1		3	
AM4332-1.4				3					1	1		1	3		
AM4332-1.5				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, AartJ.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 /http://nptel.ac.in/courses/106104025/2
2.	http://www.cs.cmu.edu/afs/cs/user/fp/www/courses/15213-s07/lectures/27-multicore.pdf / https://www.mooc-list.com/tags/parallel-programming
3.	www.openmp.org for OpenMP

<table>
<tr><th colspan="5">PROMPT ENGINEERING</th></tr>
<tr><td>Course Code:</td><td>AM4333-1</td><td>Course Type</td><td colspan="2">PEC</td></tr>
<tr><td>Teaching Hours/Week (L: T: P: S)</td><td>3-0-0-0</td><td>Credits</td><td colspan="2">03</td></tr>
<tr><td>Total Teaching Hours</td><td>40</td><td>CIE + SEE Marks</td><td colspan="2">50+50</td></tr>
<tr><td colspan="5">Credits – 3</td></tr>
<tr><td colspan="4">Unit I</td><td>Contact Hours</td></tr>
<tr><td colspan="4">Introduction to Transformers: Motivation behind transformers, Self-attention mechanism, Transformer architecture and components
Pretrained language models (PLMs): Introduction to PLMs, Transformer based models: BERT, Fine tuning, and transfer learning with PLMs
Introduction to Large language models: What are large language models, Popular modern LLMs, Domain specific LLMs, Applications of LLMs</td><td>15</td></tr>
<tr><td colspan="4">Unit II</td><td></td></tr>
<tr><td colspan="4">Prompt Engineering with GPT3: Introduction, Prompt engineering, working with prompts across models, Building Q/A bot with GPT
Optimizing LLMs with Customized Fine Tuning: Introduction, Transfer learning and fine tuning, OpenAI Fine tuning API, Amazon Review category classification
Advanced Prompt Engineering: Introduction, Prompt engineering, Introduction, Prompt injection attacks, Input/Output Validation, Batch Prompting, Prompt Chaining, chain of thought prompting, Testing and Iterative prompt development.</td><td>15</td></tr>
<tr><td colspan="4">Unit III</td><td></td></tr>
<tr><td colspan="4">Hugging Face: Introduction, Features of hugging face platform, Components of hugging face, Pipelines
Tasks using hugging face library: Introduction to Gradio, Creating a space on hugging face, Hugging face tasks</td><td>09</td></tr>
<tr><td colspan="4">Course Outcomes:</td><td></td></tr>
</table>

Upon completion of this course, students will be able to:

6. Learn details on transformers and BERT models
7. Illustrate how pretrained models work
8. Apply prompt engineering with GPT3 and optimizing LLMs
9. Describe advanced prompt engineering
10. Learn about hugging face and hugging face library

Textbooks:

3. **"Quick Start Guide to Large Language Models: Strategies and Best Practices for using ChatGPT and Other LLMs"** by Sinan Ozdemir, O'reilly publications, October 2023
4. **"Introduction to Transformers for NLP: With the Hugging Face Library and Models to Solve Problems"** by Shashak mohan Jain, O'reilly publications, October 2022

Table 1: Mapping Levels of COs to POs

COs	**Program Objectives (POs)**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2		2				2	2			2	
CO2	3	2	2		2				2	2			2	
CO3	3	2	2		2				2	2			2	
CO4	3	2	2		2				2	2			2	
CO5	3	2											2	

Table 2: Mapping of Cos to PIs, Pos and BTL

Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 3.2.1,5.1.1, 9.1.1, 10.1.1	L2, L3
CO2	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 3.2.1,5.1.1, 9.1.1, 10.1.1	L2, L3
CO3	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3,5.1.1, 9.1.1, 10.1.1	L2, L3
CO4	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 5.1.2, 9.1.1, 10.1.1	L2, L3
CO5	1, 2	1.3.1,1.4.1, 2.1.3	L2

Ability Enhancement Courses

INNOVATION & DESIGN THINKING

Course Code	**ME1013-1**	**Course Type**	**AEC**
Teaching Hours/Week (L:T:P: S)	**1:0:2:0**	**Credits**	**02**
Total Teaching Hours	**13+0+26**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	To explain the concept of design thinking for product and service development
2.	To explain the fundamental concept of innovation and design thinking
3.	To discuss the methods of implementing design thinking in the real world.

Note: Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain concepts
3. Encourage collaborative (Group Learning) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

SYLLABUS

Unit 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 captures 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– **03 hours**
Unit 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 **– 05 hours**
Unit 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– **07 hours**

Course Outcomes: Upon the successful completion of the course, students will be able to:

1.	Explain various design process procedure
2.	Generate and develop design ideas through different techniques
3.	Explain 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
ME1013-1.1	2		2										1	1	1
ME1013-1.2							2	2					1	1	1
ME1013-1.3										3	3		1	1	1

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. HassoPlattner, 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, Second
Edition, 2011.

6. Book - Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business
School Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author),
Kevin Bennett (Author).

E Resources

1. www.tutor2u.net/business/presentations/. /productlifecycle/default.html

2. https://docs.oracle.com/cd/E11108_02/otn/pdf/. /E11087_01.pdf

3. www.bizfilings.com › Home › Marketing › Product Developmen

4. https://www.mindtools.com/brainstm.html

5. https://www.quicksprout.com/. /how-to-reverse-engineer-your-competit

6. www.vertabelo.com/blog/documentation/reverse-engineering
https://support.microsoft.com/en-us/kb/273814

7. https://support.google.com/docs/answer/179740?hl=en

8. https://www.youtube.com/watch?v=2mjSDIBaUlM
thevirtualinstructor.com/foreshortening.html
https://dschool.stanford.edu/.../designresources/.../ModeGuideBOOTCAMP2010L.pdf
https://dschool.stanford.edu/use-our-methods/ 6. https://www.interactiondesign.
org/literature/article/5-stages-in-the-design-thinking-process 7.
http://www.creativityatwork.com/design-thinking-strategy-for-innovation/ 49 8.
https://www.nngroup.com/articles/design-thinking/ 9.

	https://designthinkingforeducators.com/design-thinking/ 10. www.designthinkingformobility.org/wp-content/.../10/NapkinPitch_Worksheet.pdf
9.	Activity Based Learning (Suggested Activities in Class)/ Practical Based learning http://dschool.stanford.edu/dgift/

RESEARCH METHODOLOGY

Course Code	**ME1014-1**	**Course Type**	**AEC**
Teaching Hours/Week (L:T:P: S)	**1:2:0:0**	**Credits**	**02**
Total Teaching Hours	**15**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	Explain the importance of research methodology, Explain the steps in defining the research problem.
2.	Explain methods of reviewing the literature and research design.
3.	Discuss the methods of designing sampling survey. Discuss methods of scaling and measuring of the data.
4.	Perform Hypothesis testing using the concept of mean and variance.
5.	Discuss interpretation and report writing techniques.

Unit-1

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Research Process

Defining the Research Problem: Research Problem, Selecting the Problem

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to research problem

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design **- 5 hours**

Unit-2

Design of Sample Surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors,

Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary, Data, Selection of Appropriate Method for Data Collection, Case Study Method.

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, **- 5 hours**

Unit-3

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. **– 5 hours**

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

1.	Explain the importance of research methodology, Explain the steps in defining the research problem.
2.	Explain methods of reviewing the literature and research design.
3.	Discuss the methods of designing sampling survey.
4.	Perform Hypothesis testing using the concept of mean and variance

5.	Discuss interpretation and report writing techniques.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
ME1014-1.1	3	2								3					1
ME1014-1.2	3	2								3					1
ME1014-1.3	3	2								3					1
ME1014-1.4	3	2								3					1
ME1015-1.5	3	2								3					1

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International 4th Edition, 2018
2.	Research Methodology a step-by step guide for beginners. (For the topic Reviewing the literature under Unit 2),Ranjit Kumar, SAGE Publications Ltd . 3rd Edition, 2011
3.	Research Methods: the concise knowledge base Trochim Atomic Dog Publishing 2005
4.	Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications, 2009

E Resources

1.	NPTEL course material related to operations management, operations research and entrepreneurship

PROGRAMMING WITH C++ WITH EXAMPLES

Course Code	**AM1651-1**	**Course Type**	**AEC**
Teaching Hours/Week (L:T:P: S)	**1:0:2:0**	**Credits**	**02**
Total Teaching Hours	**13+0+26**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Get the idea of declaring variables , operators in C++
2.	Illustrate the use of function and Class
3.	Describe the basic concepts of constructors and destructor
4.	Apply the concepts of inheritance to use the code
5.	Explain the concepts of files in C++.

Prerequisite	

List of Experiments

1. Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.

2. Write a C++ program to declare Struct. Initialize and display contents of member variables.

3. Write a C++ program to declare a class. Declare pointer to class. Initialize and display the contents of the class member.

4. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.

5. Write a C++ program to read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).

6. Write a C++ to illustrate the concepts of console I/O operations.

7. Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels.

8. Write a C++ program to allocate memory using new operator.

9. Write a C++ program to create multilevel inheritance

10. Write a C++ program to create an array of pointers. Invoke functions using array objects.

11. Write a C++ program to use pointer for both base and derived classes and call the member function. Use Virtual keyword

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

1. Explain the basics of Object Oriented Programming concepts.

2. Show the use of function and class in C++

3. Apply the object initialization and destroy concepts using constructors and destructors.

4. Use the concept of inheritance to reduce the length of code and Apply the concept of polymorphism to implement compile time polymorphism in programs.

5. Apply the concept of files in C++

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**
AM1651-1.1	2		2			2						1		
AM1651-1.2	2		2			3						3		
AM1651-1.3	3		3			3						3		
AM1651-1.4	3		3			3						3		
AM1651-1.5	3		3			3						3		

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1. Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013.

2. Sourav Sahay, Object Oriented Programming with C++ , 2nd Ed, Oxford University Press,2006.

3. Object Oriented Programming using C++, Robert Lafore, Galgotia publication 2010.

4. Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003.

5. Stanley B.Lippman, JoseeLajore, C++ Primer, 4th Edition, Pearson Education, 2005

E Resources

1. https://onlinecourses.nptel.ac.in/noc21_cs02/preview

2. https://www.tutorialspoint.com/cplusplus/cpp_useful_resources.htm

3. https://www.oreilly.com/library/view/practical-c-programming/0596004192/ape.html

UNIX SHELL AND SYSTEM PROGRAMMING

Course Code	**AM1653-1**	**Course Type**	**AEC**
Teaching Hours/Week (L:T:P: S)	**1:0:2:0**	**Credits**	**02**
Total Teaching Hours	**13+0+26**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

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.

Prerequisite	

List of Experiments

1.	**Week 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.	**Week 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.	**Week 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.	**Week 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.	**Week 5** String handling operations/Command Substitution
	1. For the given path names (ex 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.	**Week 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 doesnt exist using shell script. 2. Execution of exercise Shell scripts
7.	**Week 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.	**Week 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 have permission to send the signal or not.
9.	**Week 9** Signals
	1. Write a C Program to register signal handler for SIGSTOP.
10.	**Week 10** AWK scripts
	1. Simple program to catch SIGUSR1 and SIGUSR2
11.	**Week 11** AWK scripts
	1. Write a C Program to handle user defined signals.
12.	**Week 12** AWK scripts
	1. Write a C Program to create a Daemon process.
13.	**Week 13** 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
AM1653-1.1	**3**											**1**		
AM1653-1.2	**2**	**1**	**2**	**2**								**2**		
AM1653-1.3	**2**	**1**	**2**	**2**								**2**		
AM1653-1.4	**2**	**1**	**2**	**2**								**2**		
AM1653-1.5	**2**	**1**	**2**	**2**								**2**		

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1. **"UNIX-Concepts and Applications"**, Sumitaba Das, 4th Edition, Tata McGraw Hill, 2006.(Chapters 1.1,1.2,2,3,4,5,6,7,8,9,11,12,13,14,19,21).
2. **"Advanced Programming in the UNIX Environment"** - W.Richard Stevens, Stephen A. Rago, 3nd Edition, Pearson Education / PHI, 2005.
3. **"Unix and Shell Programming",** M.G. Venkateshmurthy, Pearson Education, 2005.
4. **"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 & Signalsgeekstuff.com

INTRODUCTION AND PRACTICES OF DRONES

Course Code	**AM4651-1**	**Course Type**	**AEC**
Teaching Hours/Week (L:T:P: S)	**1:0:2:0**	**Credits**	**02**
Total Teaching Hours	**13+0+26**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

Course Objectives:

1. Understand basic drone concepts and terminology
2. Describe the different steps for drone design
3. Understand the technical characteristics
4. Describe the process and algorithms used for drone fabrication

Prerequisite Deep Learning

List of Experiments

PART-A

1. Develop a drone for colour detection
2. Develop a drone to count the object
3. Develop a drone to identify the animals
4. Develop a drone to note down the room temperature
5. Develop a drone to control the room lights
6. Develop a drone to identify the crops

PART-B

1. Develop the Drone Pi using a MultiWii board based on Arduino.
2. Develop the drone for Collision Avoidance System
3. Develop the drone to detect the object
4. Develop the drone for weather reporting
5. Launch Pad Count Down Sequence Display for drone
6. Build a DIY thurst station

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
AM1653-1.1	2	3												1
AM1653-1.2	3	3												2

AM1653-1.3	3	3												2
AM1653-1.4	3	3												2
AM1653-1.5	3	3												2

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	https://www.intechopen.com/chapters/61037
2.	https://www.techtarget.com/iotagenda/definition/drone
3.	https://nptel.ac.in/courses/101104073

E Resources

1.	https://www.techtarget.com/iotagenda/definition/drone

PROGRAMMING IN JAVA

Course Code	**AM1652-1**	**Course Type**	**AEC**
Teaching Hours/Week (L:T:P: S)	**1:0:2:0**	**Credits**	**02**
Total Teaching Hours	**13+0+26**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Learn fundamental features of object-oriented language and JAVA
2.	Set up Java JDK environment to create, debug and run simple Java programs.
3.	Learn object-oriented concepts using programming examples.
4.	Study the concepts of importing of packages and exception handling mechanism.
5.	Discuss the String Handling examples with Object Oriented concepts.

Prerequisite	CPP

List of Experiments

Students have to write, execute, and test programs covering the syllabus of JAVA

Typical problems that may be tried are

1. Data types in Java language
2. Function overloading
3. Visibility of the variables
4. Classes and Objects
5. Constructors in Java
6. Inheritance
7. Exception handling mechanisms
8. Method overriding
9. Packages and Interfaces
10. Applets and Swings
11. Java and Database Programming

PART-A

1.	Write a Java program that prints all real solutions to the quadratic equation
2.	ax2+bx+c = 0. Read in a, b, c and use the quadratic formula. If the discriminate
3.	b2 -4ac is negative, display a message stating that there are no real solutions
4.	The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 1, 1. Every subsequent value is the sum of the 2 values preceding it. Write a Java program that uses both recursive and nonrecursive functions to print the nth value of the Fibonacci sequence?
5.	Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer
6.	Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer
7.	Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome
8.	Write a Java program for sorting a given list of names in ascending order
9.	Write a Java program to multiply two given matrices
10.	Write a Java program that reads a line of integers and then displays each integer and the sum of all integers. (use StringTokenizer class)
PART-B	

1.	Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes?
2.	Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.
3.	Develop an Applet that receives an integer in one text field & compute its factorial value & returns it in another text filed when the button “Compute” is clicked
4.	Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a NumberFormatException. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box
5.	Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
6.	Write a java program that connects to a database using JDBC and does Department of add, deletes, modify and retrieve operations
7.	Write a java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “stop” or “ready” or “go” should appear above the buttons in a selected color. Initially there is no message shown.
8.	Write a java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contain only the method printArea( ) that prints the area of the given shape.
9.	Suppose that a table named Table.txt is stored in a text file. The first line in the file header and the remaining lines correspond to row in the table. The elements are separated by commas. Write a Java program to display the table using labels in grid layout
10.	Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).

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

1.	Understand fundamental features of object-oriented language and JAVA
2.	Set up Java JDK environment to create, debug and run simple Java programs.
3.	Learn object-oriented concepts using programming examples.
4.	Implement the concepts of importing of packages and exception handling mechanism.
5.	Design the String Handling examples with Object Oriented concepts.

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**
AM1652-1.1	3	2	2									3	2	
AM1652-1.2	3	2	1									1	1	
AM1652-1.3	3	2	1									3	2	
AM1652-1.4	3	3	3									3	3	
AM1652-1.5	3	3	3									3	3	

1: Low 2: Medium 3: High

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

1.	Understand fundamental features of object-oriented language and JAVA
2.	Set up Java JDK environment to create, debug and run simple Java programs.
3.	Learn object-oriented concepts using programming examples.
4.	Implement the concepts of importing of packages and exception handling mechanism.
5.	Design the String Handling examples with Object Oriented concepts.

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**
AM1652-1.1	3	2	2									3	2	
AM1652-1.2	3	2	1									1	1	
AM1652-1.3	3	2	1									3	2	
AM1652-1.4	3	3	3									3	3	
AM1652-1.5	3	3	3									3	3	

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	https://www.javatpoint.com/java-tutorial
2.	https://www.w3schools.com/java/
3.	https://www.programiz.com/java-programming
4.	https://www.geeksforgeeks.org/java/

E Resources

1.	https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2.	https://www.freecodecamp.org/news/learn-java-free-java-courses-for-beginners/

REFERENCE MATERIALS:

1.	https://www.javatpoint.com/java-tutorial
2.	https://www.w3schools.com/java/
3.	https://www.programiz.com/java-programming
4.	https://www.geeksforgeeks.org/java/

E Resources

1.	https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2.	https://www.freecodecamp.org/news/learn-java-free-java-courses-for-beginners/

Humanities & Management Courses

ENHANCING SELF-COMPETENCE

Course Code	**HU2001-1**	**Course Type**	**HU**
Teaching Hours/Week (L:T:P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**26+0+0**	**CIE + SEE Marks**	**50+50**
Pre-requisite	**HU1001-1 (Technical English)**		

Teaching Department: Humanities

Course Objectives:

1.	Introspect and learn about oneself.
2.	Develop professional writing skills.
3.	Acquaint with the various social behaviour and etiquette.
4.	Apply the techniques of fundamental communication skills.
5.	Develop necessary techniques for formal presentations.

Unit - I

Personality Traits Types & Kinds of personality, Ways to Identify Self (SWOT Analysis, Johari Window), Concepts of Self-Management and Self-Motivation	**9 Hours**
Effective Communication Skills One-way and Two-way Communication, Interpersonal & Social Skills	

Unit - II

Social Behaviour and Cultural Etiquette Time Management, Personal Grooming, Making Small Talk, Customs & Manners	**9 Hours**
Professional Presentation Techniques Formal Presentation, Sensitivity towards multi-cultural workspaces.	

Unit - III

Job-Related Communication Resume & Cover Letter, Formal E-mails, Framing Requests, Greetings, Salutations, Close	**8 Hours**

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
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 MATERIALS:

1.	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,

	New Delhi, 2010.

REFERENCE MATERIALS:

1.	Adler, Ronald B & Jeanne Marquardt Elmhorst. Communicating at Work – Principles and Practices for Business and the Professions. 6th Ed. McGraw Hill College.
2.	Covey, Stephen R. The 7 Habits of Highly Effective People. Great Britain: Simon &Schuster, 1994.
3.	Gulati, Sarvesh Corporate grooming and Etiquette. New Delhi: Rupa Publications India Pvt. Ltd., 2010.
4.	Luthans, Fred. Organizational Behaviour. McGraw Hill International.
5.	Rath, Tom Strengths Finder 2.0. New York: Gallup Press, 2007.
6.	Rizvi, M Ashraf. Effective Technical Communication. New Delhi: Tata McGraw- Hill, 2005.
7.	Robbins, Stephen P. Organizational Behaviour. New Delhi: Prentice Hall.
8.	Dale Carnegie, How to Win Friends and Influence People, Latest Edition,2016. Gallery Books, New York.

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**
Prerequisite			

Teaching Department: Humanities

Course Objectives:

1.	Enable students appreciate values, skills and behaviour with an appropriate understanding of ‘Self’ to attain sustained happiness and prosperity with right aspirations of life.
2.	Develop a holistic perspective among the students towards physical needs and prosperity of life.
3.	Develop a holistic approach and understand the importance of co-existence and living in harmony ensuring mutually fulfilling interaction with the society and nature.
4.	Strengthening of self-reflection.
5.	Development of commitment and courage to act.

UNIT-I

Need, Basic Guidelines, Content and Process for Value Education	**06 Hours**

Self-Exploration; ‘Natural Acceptance’ and Experiential Validation; Continuous Happiness and Prosperity; Right understanding, Relationship and Physical Facility; Understanding Happiness and Prosperity - living in harmony at various levels.

UNIT-II

Understanding Harmony in the Human Being, Family and Society	**06 Hours**

Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body; the needs of Self (‘I’) and ‘Body’; the Body as an instrument; Holistic perspective of Physical needs and Prosperity; Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

UNIT-III

Whole existence as Coexistence: Implications of the above Holistic Understanding	**03 Hours**

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

MANAGEMENT AND ENTREPRENEURSHIP

Course Code:	**MG1003-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Explain fundamentals management functions of a manager. Also explain planning and decision making processes.
2.	Explain the organizational structure, staffing and leadership process.
3.	Explain understanding of Entrepreneurships and Entrepreneurship development process.
4.	Illustrate Small Scale Industries, various types of supporting agencies and financing available for an entrepreneur.
5.	Summarize the preparation of project report, need significance of report. Also to explain about industrial ownership

UNIT-I

Management: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as art or science, art or profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches - Modem management approaches.
Planning: Nature, importance and purpose of planning process objectives - Types of plans (meaning only) - Decision making, Importance of planning - steps in planning & planning premises - Hierarchy of plans.
Organizing and staffing: Nature and purpose of organization, Principles of organization – Types of organization-Departmentation Committees-Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning only) Nature and importance of staffing-- :Process of Selection & Recruitment (in brief).
Directing: Meaning and nature of directing Leadership styles, Motivation, Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of coordination.
Controlling: Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief).

15 Hours

UNIT-II

15 Hours

Entrepreneur Entrepreneur: Meaning of Entrepreneur; Evolution of .the Concept; Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging. Class. Concept of Entrepreneurship - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship - its Barriers.

Small scale industries: Definition; Characteristics; Need and rationale; Objectives; Scope; roleof SSI in Economic Development. Advantages of SSI, Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition Only).

Institutional support: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.

UNIT-III

10 Hours

Preparation of project: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of. Business Opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

Industrial ownership: Definition and meaning of Partnership, Characteristics of Partnership, Kinds of Partners, Partnership Agreement or Partnership Deed, Registration of Partnership Firm, Rights, Duties and Liabilities of Partners, Advantages and Disadvantages of Partnership, Sole proprietorship, Features, Scope Advantages and Disadvantages of Sole Proprietorship

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

1. Explain management functions of a manager. Also explain planning and decision making processes.
2. Explain the organizational structure, staffing and leadership processes.
3. Understanding of Entrepreneurships and Entrepreneurship development process.
4. Illustrate Small Scale Industries, various types of supporting agencies and financing available for an entrepreneur.
5. Summarize the preparation of project report, need significance of report. Also to explain about industrial ownership.

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
CS2015-1.1	1	1					2	2						
CS2015-1.2						2	2	2	2	2				1
CS2015-1.3	1	2	3			2			2			2		1
CS2015-1.4	1	2								2	2			
CS2015-1.5	1	2				2	2	2			2	2		

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Principles of Management – P. C. Tripathi, P.N. Reddy – Tata McGraw Hill.
2. Dynamics of Entrepreneurial Development & Management-Vasant Desai,Himalaya Publishing House.
3. Entrepreneurship Development – Poornima. M. Charantimath, Small Business Enterprises – Pearson Education - 2006 (2 & 4).

REFERENCE BOOKS:

1.	Management Fundamentals - Concepts, Application, Skill Development – RobersLusier, Thomson.
2.	Entrepreneurship Development - S. S. Khanka, S. Chand & Co. New Delhi. 3. Management - Stephen Robbins, Pearson Education/PHI - 17thEdition, 2003.

E Books / MOOCs/ NPTEL

1.	https://archive.nptel.ac.in/courses/110/105/110105067/
2.	https://onlinecourses.swayam2.ac.in/cec20_mg19/preview
3.	https://www.coursera.org/browse/business/entrepreneurship

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	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

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 — **16 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 Breakeven Analysis — **09 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: Artificial Intelligence and Machine Learning

Course Objectives:

1. To explain the students the necessity of clearing the aptitude tests irrespective of the written test is for jobs or higher education.

2. To assess the readiness of the students to appear for the aptitude test and assisting them to better it if already ready, else train them.

3. To evaluate the understanding of the students in answering quantitative multiple-choice questions and guide them to improve it.

4. To evaluate the preparedness of the students to answer the analytical and logical questions.

5. To evaluate the quality of the students with regard to their professional language grammar, vocabulary and communication skills.

UNIT-I

Quantitative **06 Hours**

Numbers (Odd, even, H.C.F & L.C.M, Square roots & cube roots, Average, Percentage), Ratios & Proportions, Partnership, Time & work, Pipes & Cistern, Speed, Problems on trains, Problems on boats & streams, Allegation & Mixtures.

UNIT-II

Analytical/ Logical — **06 Hours**

Numerical logic (next number in series, odd man out), Coded language, Syllogism, Direction (N-E-W-S), Seating arrangement, Blood relations, Statement & Conclusion

UNIT-III

Verbal — **03 Hours**

Vocabulary (root words, prefix, suffix, synonyms, antonyms), One word substitution, Idiom/phrases, Sentence completion, Active & Passive voice, Direct and indirect speech.

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

1.	Answer the quantitative multiple-choice questions.
2.	Analyse the analytical and logical questions.
3.	Improve the professional language grammar, vocabulary and communication skills.
4.	Clear the aptitude tests of any employer or higher educational institution.
5.	Advance in the chosen field of interest by appending aptitude skills with the technical skills

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
UM1003-1.1	3	3							2	2	1			
UM1003-1.2	3	3							2	2	1			
UM1003-1.3	3	3	2						2	2	1			
UM1003-1.4	3	3	2						2	2	1			
UM1003-1.5	3	3	2						2	2	1			

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Aggarwal R.S, “Quantitative Aptitude for Competitive Examinations”, S Chand Publishing.
2.	Aggarwal R.S, “A modern approach to verbal and non-verbal reasoning”, S Chand Publishing.

REFERENCE BOOKS:

1.	Bharath Patodi and Aditya Choudhary, “Verbal Ability & Comprehension”, Disha Publication, Second edition, 2015.
2.	Shakuntala Devi, “Joy of numbers”, Orient Black Swan.
3.	Shakuntala Devi, “More puzzles to puzzle you”, Orient Black Swan.

E Books / MOOCs/ NPTEL

1.	https://www.indiabix.com
2.	https://www.faceprep.in

EMPLOYABILITY SKILL DEVELOPMENT - II

Course Code:	**UM1004-1**	**Course Type**	**MNC**
Teaching Hours/Week (L: T: P: S)	**1:0:0:0**	**Credits**	**0**
Total Teaching Hours	**15+0+0+0**	**CIE + SEE Marks**	**50+00**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	To explain the students the necessity of clearing the aptitude tests irrespective of the written test is for jobs or higher education.
2.	To assess the readiness of the students to appear for the aptitude test and assisting them to better it if already ready, else train them.
3.	To evaluate the understanding of the students in answering quantitative multiple-choice questions and guide them to improve it.
4.	To evaluate the preparedness of the students to answer the analytical and logical questions.
5.	To evaluate the quality of the students with regard to their professional language grammar, vocabulary and communication skills.

UNIT-I

Quantitative **06 Hours**

Permutations & Combinations, Area, volume & surface areas, Profit & loss, Simple and compound interest, Logarithms, Stocks & Shares, Discounts (True discounts, bankers' discount), Clocks & Calendars

UNIT-II

Analytical/ Logical **04 Hours**

Cause & Effect statements, Scenario based questions, Figure series & mathematical puzzles, Statement & assumption, Reasoning analogies, Tables, bar charts, Line graphs & Pie charts, Data sufficiency.

UNIT-III

Verbal **05 Hours**

Sentence corrections (Pronoun errors & misplaced modifiers, Parallel construction & Parallel Comparison, Tense usage, Subject-verb agreement), Verbal analogies, Reading comprehension (simple passage, difficult passage), Inferences from passages.

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

1.	Answer the quantitative multiple-choice questions.
2.	Analyse the analytical and logical questions.
3.	Improve the professional language grammar, vocabulary and communication skills.
4.	Clear the aptitude tests of any employer or higher educational institution.
5.	Advance in the chosen field of interest by appending aptitude skills with the technical skills

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
UM1004-1.1	3	3							2	2	1			
UM1004-1.2	3	3							2	2	1			
UM1004-1.3	3	3	2						2	2	1			
UM1004-1.4	3	3	2						2	2	1			
UM1004-1.5	3	3	2						2	2	1			

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Aggarwal R.S, "Quantitative Aptitude for Competitive Examinations", S Chand Publishing.
2.	Aggarwal R.S, "A modern approach to verbal and non-verbal reasoning", S Chand Publishing.

REFERENCE BOOKS:	
1.	Bharath Patodi and Aditya Choudhary, “Verbal Ability & Comprehension”, Disha Publication, Second edition, 2015.
2.	Shakuntala Devi, “Joy of numbers”, Orient Black Swan.
3.	Shakuntala Devi, “More puzzles to puzzle you”, Orient Black Swan.
E Books / MOOCs/ NPTEL	
1.	https://www.indiabix.com
2.	https://www.faceprep.in

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	**13+0+0**	**CIE + SEE Marks**	**50+0**

Teaching Department: Any Department

Course Objectives:

1.	ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡದ ಜೊತೆಗೆ ಕ್ರಿಯಾತ್ಮಕ ಕನ್ನಡವನ್ನು, ಕನ್ನಡ ಸಾಹಿತ್ಯ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಡು ನುಡಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2.	ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು ಮತ್ತು ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
3.	ಕನ್ನಡ ಭಾಷಾ ಬರೆಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗು ಅವುಗಳನಿವಾರಣೆ.
4.	ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆಸರ್ಕಾರಿ ಪತ್ರ ವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಡಿಸುವುದು.
5.	ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡ ದಪದಗಳ ಪರಿಚಯ ಮಾಡಿ ಕೊಡುವುಧು.

Unit – I

ಲೇಖನಗಳು:

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ: ಹಂಪನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ: ಒಂದು ಅಪೂರ್ವಚರಿತ್ರೆ–ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ
3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ – ವಿತಾವಿಯ ಆಡಳಿತ ಕನ್ನಡ ಪುಸ್ತಕದಿಂದ ಆಯ್ದ ಲೇಖನ

ಕಾವ್ಯಭಾಗ (ಆಧುನಿಕಪೂರ್ವ)

1. ವಚನಗಳು: ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿಲಕ್ಕಮ್ಮ
2. ಕೀರ್ತನೆಗಳು: ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ–ಪುರಂದರದಾಸ
3. ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳುಮನವೆ–ಕನಕದಾಸ
4. ತತ್ವಪದಗಳು: ಸಾವಿರ ಕೊಡಗಳಸುಟ್ಟು–ಶಿಶುನಾಳಪಂಥಷರೀಫ
5. ಶಿವಯೋಗಿ: ಬಾಲಲೀಲಾ ಮಹಾಂತ ಶಿವಯೋಗಿ
6. ಜನಪದಗೀತೆ: ಬೀಸುವಪದ, ಬಡವರಿಗೆ ಸಾವ ಕೊಡಬೇಡ

6 Hours

Unit – II

ಕಾವ್ಯಭಾಗ (ಆಧುನಿಕ)

1. ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ: ಡಿ.ವಿ.ಜಿ.
2. ಕುರುಡು ಕಾಂಚಾಣ: ದ.ರಾ.ಬೇಂದ್ರೆ
3. ಹೊಸಬಾಳಿನ ಗೀತೆ: ಕುವೆಂಪು
4. ಹೆಂಡತಿಯ ಕಾಗದ: ಕೆ .ಎಸ್. ನರಸಿಂಹಸ್ವಾಮಿ
5. ಮಬ್ಬಿನಿಂದ ಮಬ್ಬಿಗೆ: ಜಿ. ಎಸ್. ಶಿವರುದ್ರಪ್ಪ

5 Hours

6. ಆಮರ ಈ ಮರ: ಚಂದ್ರಶೇಖರ ಕಂಬಾರ
7. ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು: ಸಿದ್ಧಲಿಂಗಯ್ಯ

ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಪರಿಚಯ, ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ

1. ಡಾ. ಸ ರ್ಎಂ ವಿಶ್ವೇಶ್ವರಯ್ಯ – ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ: ಎ ಎನ್ಮೂರ್ತಿ ರಾವ್
2. ಯುಗಾದಿ: ವಸುಧೇಂದ್ರ
3. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ. ಚಿ. ಬೋರಲಿಂಗಯ್ಯ

Unit – III

ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ:

1. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ: ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ
2. ‘ಕ’ ಮತ್ತು ‘ಬ’ ಬರಹ ತಂತ್ರಾಂಶಗಳು ಮತ್ತು ಕನ್ನಡ ಟೈಪಿಂಗ್
3. ಕನ್ನಡ: ಕಂಪ್ಯೂಟರ್ಶಬ್ದಕೋಶ
4. ತಾಂತ್ರಿಕ ಪದಕೋಶ: ತಾಂತ್ರಿಕ ಹಾಗೂ ಪಾರಿಭಾಷಿಕ ಕನ್ನಡ ಪದಗಳು

2 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 ಕಂಡು ಬರುವ ದೋಷಗಳು ಹಾಗು ಅವುಗಳನಿವಾರಣೆ.
4.	ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರ ವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಡಿಸುವುದು.
5.	ಕನ್ನಡಭಾಷಾಭ್ಯಾಸ, 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
HU1003-1.1								3			1	1		
HU1003-1.2								2			1	1		
HU1003-1.3			2				1	2			1	1		
HU1003-1.4								1						
HU1003-1.5			1					3			1	1		

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	ಸಂಕ್ಷಿಪ್ತ ಕನ್ನಡನಿಗಂಟು (ಪರಿಷ್ಕೃತ), ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು.
2.	ಆಡಳಿತ ಪದಕೋಶ, ಕನ್ನಡ ಅಭಿವೃದ್ಧಿಪ್ರಾಧಿಕಾರ, ಬೆಂಗಳೂರು.
3.	ಕಾನೂನು ಪದಕೋಶ (ಪರಿಷ್ಕೃತ) ಕನ್ನಡ- ಇಂಗ್ಲಿಷ್, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂಗಳೂರು.
4.	ಡಿ.ಎನ್. ಶಂಕರ್ಭಟ್, ಕನ್ನಡವಾಕ್ಯಗಳ ಒಳರಚನೆ, ೨೦೦೬, ಭಾಷಾಪ್ರಕಾಶನ, ಮೈಸೂರು.
5.	ಕನ್ನಡ ಭಾಷಿಕ (ಅವಿಸ್ತರ)- ಪ್ರಬಂಧ ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ, ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮುಕ್ತ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಮೈಸೂರು.
6.	ಆಡಳಿತ ಕನ್ನಡ, ಎಚ್ಚೆಸ್ಕೆ, ಚೇತನ ಬುಕ್ಹೌಸ್, ಮೈಸೂರು.

BALAKE KANNADA (COMMUNICATION IN KANNADA)

Course Code	**HU1003-1**	**Course Type**	**MNC**
Teaching Hours/Week (L: T: P: S)	**1:0:0:0**	**Credits**	**0**
Total Teaching Hours	**15+0+0+0**	**CIE + SEE Marks**	**50+0**

Teaching Department: Any Department

Course Objectives:

1.	The course will enable the students to cognize Kannada and communicate in basic Kannada language.

UNIT – I

Basic Kannada Grammar Personal Pronouns, Possessive Forms, Interrogative words Possessive forms of nouns, Dubitive question and Relative nouns Qualitative Quantitative and Colour Adjectives, Numerals Predictive Forms, Locative Case Dative Cases, and Numerals Ordinal numerals and Plural markers Defective / Negative Verbs and Colour Adjectives Permission, Commands, encouraging and Urging words (Imperative words and sentences) Accusative Cases and Potential Forms used in General Communication Helping Verbs “iru and iralla”, Corresponding Future and Negation Verbs Comparative, Relationship, Identification and Negation Words Different types of forms of Tense, Time and Verbs Formation of Past, Future and Present Tense Sentences with Verb Forms Karnataka State and General Information about the State Kannada Language and Literature Do's and Don'ts in Learning a Language	**06 Hours**

UNIT – II

Kannada Language Script Part – 1	**06 Hours**

UNIT – III

Kannada Vocabulary List & Kannada Words in Conversation	**03 Hours**

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

1.	Understand the parts of speech of Kannada
2.	Know the script in Kannada
3.	Able to Converse daily usages in Kannada
4.	Enrich Basic Kannada Vocabulary
5.	Have knowledge about Karnataka and its culture

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	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.	English –Kannada Rapidex Dictionary of Spoken Words, S N Raju, Bengaluru
2.	English Kannada Standard Dictionary, D K Bharadwaj, Sankeshwar Printers Pvt Ltd, Bengaluru
3.	ಮಾತಾಡುವ ಕನ್ನಡ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು (೨೦೧೮).

4.	ಸಂಕ್ಷಿಪ್ತ ಕನ್ನಡನಿಗಂಟು (ಪರಿಷ್ಕೃತ), ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು.
5.	ಆಡಳಿತ ಪದಕೋಶ, ಕನ್ನಡ ಅಭಿವೃದ್ಧಿಪ್ರಾಧಿಕಾರ, ಬೆಂಗಳೂರು.
6.	ಕನ್ನಡ ಭಾಷಾಕೈಪಿಡಿ, ಸಂಗಮೇಶ್ವವ ದತ್ತಿಮಠ, ರೂಪರಶ್ಮಿ ಪ್ರಕಾಶನ, ಗುಲ್ಬರ್ಗ, ೧೯೯೫.
7.	ಡಿ.ಎನ್. ಶಂಕರ್ಭಟ್, ಕನ್ನಡ ವಾಕ್ಯಗಳ ಒಳ ರಚನೆ, ೨೦೦೮, ಭಾಷಾ ಪ್ರಕಾಶನ, ಮೈಸೂರು.
8.	ಕಾನೂನು ಪದಕೋಶ (ಪರಿಷ್ಕೃತ) ಕನ್ನಡ- ಇಂಗ್ಲಿಷ್, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂಗಳೂರು.

Vocational Education Course (VEC)

PYTHON PROGRAMMING WITH DATA SCIENCE

Course Code:	**AM1551-1**	**Course Type:**	**PCC Lab**
Teaching Hours/Week (L: T: P):	**0:0:2**	**Credits:**	**01**
Total Teaching Hours:	**0+0+26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**NIL**		

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	Execute the basic operations of python programming.
2.	Explain the elementary programming constructs and file operations and use it in Python programming.
3.	Describe the concepts like strings, conversion of strings to numbers, lists, tuples, and dictionaries and apply these in python programming.
4.	Illustrate the functions, recursive functions and object-oriented programming concepts in Python.
5.	Write data handling program in python.

List of Experiments

•	The concept of data types; immutable variables; Conditions, Boolean logic, logical operators; ranges;
•	control statements: if-else, loops (for, while); text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv ortab-separated).
•	String operations, slicing a string; strings and number system: converting strings to numbers and vice versa.
•	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.
•	Python Functions: Arguments and return values; formal vs actual arguments**.** Named arguments.
•	Object Oriented Concepts: Classes, objects, attributes and methods, inheritance, types of inheritance.
•	Introduction to NumPy - The Basics of NumPy Arrays, Computation on NumPy Arrays: Universal Functions,
•	Aggregations: Min, Max, Computation on Arrays: Broadcasting, Boolean Logic, Fancy Indexing, Sorting Arrays, Structured Data: NumPy’s Structured Arrays
•	Data Manipulation with Pandas- Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing,
•	Combining Datasets: Concat and Append, Combining Datasets: Merge and Join, Data Manipulation with Pandas- Aggregation and Grouping, Pivot Tables, Vectorized String Operations.
•	Visualization with Matplotlib - General Matplotlib Tips, Simple Line Plots, Simple Scatter Plots, Pie chart, Bar chart.

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

1.	**Execute** basic python functionalities. **Demonstrate** the file handling and change of the

	permission according to the user's requirement.
2.	**Execute and comprehend** the data handling operations.
3.	Apply the knowledge of basic program constructs and file operations of python to **develop** the solutions for engineering problems. **Implement** programs using a suitable modern tool.
4.	Illustrate the usage of strings, conversion of strings to numbers, lists, tuples and dictionaries to **develop** data handling programs in Python.
5.	**Apply** the knowledge of functions and data handling libraries of Python to **analyze**the problem and **develop** solutions.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
AM1551-1.1	2	3							1	1		1		3	
AM1551-1.2	2	3							1	1		1		3	
AM1551-1.3	1	2	3		1				1	1		1		3	
AM1551-1.4	1	2	3		1				1	1		1		3	
AM1551-1.5	1	2	3		1				1	1		1		3	

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Sumitaba Das," UNIX-Concepts and Applications", Fourth Edition, Tata McGraw Hill, 2006. (Chapters 1.1,1.2,2,3,4,5,6,7,8,9,11,12,13,14,19,21).
2. Kenneth A. Lambert, "The Fundamentals of Python: First Programs", Cengage Learning, 2011.
3. Magnus Lie Hetland, "Beginning Python from Novice to Professional", Second Edition, Apress, 2009.
4. Mark Summerfield, "Programming in Python 3 - A Complete Introduction to the Python Language", Second Edition, Addison-Wesley, 2009.
5. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, ISBN: 978-0-13-274718-9, 2013.

REFERENCE BOOKS:

1. Chun, J Wesley, "Core Python Programming", 2nd Edition, Pearson, 2007 Reprint 2010.
2. David Beazley and Brian K. Jones, Shroff ,"Python Cookbook", Third Edition, Publishers & Distributors Pvt. Ltd., ISBN : 978-93-5110-140-6, 2013.
3. Mark Lutz ,"Learning Python" Fifth Edition,2013
4. Mark Lutz ,"Programming Python (English)", Fourth Edition,2011.
5. David Sale,"Testing Python", Wiley India (P) Ltd., ISBN : 978-81-265-5277-1,2014
6. Behrouz A. Forouzan and Richard F. Gilberg ,"UNIX and Shell Programming", Thomson 2005. (Chapters Appendix H,9).

E Resources

1. http://www.davekuhlman.org/python_book_01.pdf
2. http://slav0nic.org.ua/static/books/python/OReilly%20%20Core%20Python%20Programming.pdf
3. http://www.freebookcentre.net/UnixCategory/Free-Unix-Books-Download.html
4. http://nptel.ac.in/courses/106105166/26
5. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/lecture-slides-code/

DATA AND VISUAL ANALYTICS IN AI

Course Code:	**AM1552-1**	**Course Type:**	**VEC**
Teaching Hours/Week (L:T:P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**0+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Artificial Intelligence and Machine Learning

Course Objectives:

1.	1. The student will be able to understand techniques of visualization 2. Understand the algorithms for creating effective visualizations 3. Understand basic principles of graphic design. 4. They will also be introduced to several industry-standard software tools to 5. Create a compelling and interactive visualization of various types of data..

Prerequisite	AM2001-1-Advanced Machine Learning

UNIT-I

Introduction What Is Visualization? Relationship between Visualization and Other Fields, the Visualization Process, the Role of Cognition, pseudocode Conventions, the Scatterplot, The Role of the User **Data Foundations** Types of Data, Structure within and between Records, Data Preprocessing **Visualization Foundations** The Visualization Process in Detail, Semiology of Graphical Symbols, the Eight Visual Variables **Visualization Techniques for Spatial Data** One-Dimensional Data, Two-Dimensional Data, Three-Dimensional Data, Dynamic Data, **Visualization Techniques for Geospatial Data** Visualizing Spatial Data, Visualization of Point Data, Visualization of Line Data, Visualization of Area Data **Visualization Techniques for Time-Oriented Data** Introduction, Definitions: Characterizing Time-Oriented Data, Visualizing Time-Oriented Data **Visualization Techniques for Multivariate Data** Point-Based Techniques, Line-Based Techniques, Region-Based Techniques, Combinations of Techniques	**10Hours**

UNIT-II

Visualization Techniques for Trees, Graphs, and Networks Displaying Hierarchical Structures, Displaying Arbitrary Graphs/Networks, Other Issues **Text and Document Visualization** Introduction, Levels of Text Representations, The Vector Space Model, Single Document Visualizations, Document Collection Visualizations, Extended Text Visualizations **Data Manipulation with Pandas** Installing and Using Pandas, Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Datasets: Concat and Append, Combining Datasets: Merge and Join, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series, High-Performance Pandas: eval() and query() **Visualization with Matplotlib** General Matplotlib Tips, Two Interfaces for the Price of One, Simple Line Plots, Simple Scatter Plots, Visualizing Errors, Density and Contour Plots, Histograms, Binnings, and Density, Customizing Plot Legends, Customizing Colorbars, Multiple Subplots, Text and Annotation, Customizing Ticks, Customizing Matplotlib: Configurations and Stylesheets, Three-Dimensional Plotting in Matplotlib, Geographic Data with Basemap, Visualization with Seaborn	**10 Hours**

UNIT-III

Introduction to Tableau: Building Your First Visualization, Creating Calculations to Enhance Your Data, Using Maps to Improve Insight, Developing an Ad Hoc Analysis Environment.	**6 Hours**

Suggested List of Experiments

1.	Exploring Data Visualization tools like Power BI and tableau
2.	Drawing Charts
3.	Drawing Graphs
4.	Creating Scatter Plot maps
5.	Visualize Network Data
6.	Tableau Charts
7.	Tableau Advanced Reports
8.	Tableau Calculations & Filters
9.	Sales Performance Dashboard example
10.	Financial Performance Dashboard example
11.	Social Media Marketing Dashboard example
12.	Customer Service Dashboard example

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

1.	Understand the key techniques and theory used in visualization.
2.	Apply knowledge to a number of common data domains and corresponding analysis tasks, including multivariate data, time-series data, and spatial data.
3.	Apply the knowledge of visualization to networks, text and documents.
4.	Demonstrate skills on creating visual representation of Data.
5.	Perform basic and complex visual analytics using tableau.

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**
AM1552-1.1	2		1				2							
AM1552-1.2	3		3				1							
AM1552-1.3	1		1				3							
AM1552-1.4	2		1				1							
AM1552-1.5	2		1				2							

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Matthew Ward, Georges Grinstein, Daniel Keim “Interactive Data Visualization Foundations, Techniques, and Applications”, Second Edition, CRC Press, Chapter 1, 2, 4, 5, 6, 7, 8, 9, 10
2.	Jake VanderPlas, “python data science handbook: essential tools for working with data”, O’Reilly, First edition Chapter 3,4
3.	Daniel G. Murray with the Inter Works BI Team “Tableau Your Data! Fast and Easy Visual Analysis with Tableau Software” Chapter 3, 4, 5, 6

REFERENCE BOOKS:

1.	Interactive Data Visualization for the Web by S. Murray O'Reilly Press, 2nd Edition, 2017
2.	Kieran Healy, Data Visualization: A Practical Introduction, 1st Edition, 2018
3.	Beginner’s Guide for Data Analysis using R Programming, Jeeva Jose, Khanna Publishing 2019

UNIX SHELL PROGRAMMING

Course Code	**AM1553-1**	**Course Type**	**VEC**
Teaching Hours/Week (L:T:P: S)	**0:0:2:0**	**Credits**	**01**
Total Teaching Hours	**0+0+26**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence & Machine Learning

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.

Prerequisite	

List of Experiments

1.	**Week 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.	**Week 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.	**Week 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.	**Week 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.	**Week 5** String handling operations/Command Substitution
	1. For the given path names (ex 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.	**Week 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 doesnt exist using shell script. 2. Execution of exercise Shell scripts
7.	**Week 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.	**Week 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 have permission to send the signal or not.
9.	**Week 9** Signals
	1. Write a C Program to register signal handler for SIGSTOP.
10.	**Week 10** AWK scripts
	1. Simple program to catch SIGUSR1 and SIGUSR2
11.	**Week 11** AWK scripts
	1. Write a C Program to handle user defined signals.
12.	**Week 12** AWK scripts
	1. Write a C Program to create a Daemon process.
13.	**Week 13** 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
AM1553-1.1	**3**											**1**		
AM1553-1.2	**2**	**1**	**2**	**2**								**2**		
AM1553-1.3	**2**	**1**	**2**	**2**								**2**		
AM1553-1.4	**2**	**1**	**2**	**2**								**2**		
AM1553-1.5	**2**	**1**	**2**	**2**								**2**		

1: Low 2: Medium 3: High

REFERENCE MATERIALS:	
1.	“**UNIX-Concepts and Applications**”, Sumitaba Das, 4th Edition, Tata McGraw Hill, 2006.(Chapters 1.1,1.2,2,3,4,5,6,7,8,9,11,12,13,14,19,21).
2.	**"Advanced Programming in the UNIX Environment"** - W.Richard Stevens, Stephen A. Rago, 3nd Edition, Pearson Education / PHI, 2005.
3.	**“Unix and Shell Programming”,** M.G. Venkateshmurthy, Pearson Education, 2005.
4.	**“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 & Signalsgeekstuff.com

University Core Courses

INTERNSHIP-I

Course Code	**UC1001-1**	**CIE Marks**	**100**
Teaching Hours/Week (L: T: P: S)	**-**	**SEE Marks**	**-**
Total Hours of Pedagogy	80-90 Hours (During I/II semesters)	**Total Marks**	**100** (Evaluation in I/II/III Semester and grades earned shall be included in IV Semester grade card)
Credits	**2**	**Exam Hours**	**--**

Course objective

1. This course is meant to provide students an opportunity to be involved in Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the institution; contribution at incubation/ innovation /entrepreneurship cell of the institution; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working for consultancy/ research projects within the institution and Participation in all the activities of Institute’s Innovation Council.

Activities: Refer Appendix B - 3.4 for details

Course outcomes

1. Experience the working in Inter / Institutional activities

2. Work in teams and communicate efficiently both written and oral.

3. Develop the ability to do work in different activities, which will provide the necessary understanding and contribute to the same and provide a foundation to undergo higher level training in subsequent internships.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
UC2001-1.1	**3**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**1**	**-**	**-**	**-**
UC2001-1.2	**3**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**1**	**-**	**-**	**-**
UC2001-1.3	**3**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**1**	**-**	**-**	**-**
1: Low 2: Medium 3: High														

INTERNSHIP-II

Course Code:	**UC2001-1**	**Course Type**	**UCC**
Teaching Hours/Week (L: T: P: S)	**-**	**Credits**	**08**

Total Teaching Hours	**-**	**CIE + SEE Marks**	**50+50**
Prerequisite			

Course Objectives:

1. This course is meant to provide students an avenue to understand the work environment, ethics and practices in an industry/organization and take up assignments/jobs in the future.

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

1. Analyse and Develop technical solutions for a specific problem that is assigned to them.
2. Communicate ideas that are developed through brainstorming, presentation and prepare a report.
3. Understand and inculcate industry practices in their professional career.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		**PSO↓**
↓ Course Outcomes													**1**	**2**
UC2001-1.1	3	2	-	-	1	1	-	-	2	3	1	-	1	1
UC2001-1.2	3	2	-	-	1	1	-	-	2	3	1	-	1	1
UC2001-1.3	3	2	-	-	1	1	-	-	2	3	1	-	1	1

1: Low 2: Medium 3: High

MAJOR PROJECT I and II

Course Code:	**UC3001-1/UC3002-1**	**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 Electrical and Electronics Engineering

Students will carry out a detailed project in Electronics 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 electrical and 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/UC3002-1.1	3	2	2	3	3	2	2	2	3	1	3	3	3	3	3
UC3001-1/UC3002-1.2	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 ELECTIVE COURSES

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)
59	AM	AM1501-1	Empowering Artificial Intelligence and Machine Learning

*** 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 Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CS2502-1.1	-	-	-	-	-	-	-	-	-	-	-	-
CS2502-1.2	3	1	2	-	-	-	-	1	-	-	-	1
CS2502-1.3	3	2	2	-	-	-	-	1	-	-	-	1
CS2502-1.4	3	2	-	-	-	-	-	1	-	-	-	1
CS2502-1.5	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Aaron M. Tenenbaum, Yedidyah Langsam& Moshe J. Augenstein, “Data Structures using C”, Pearson Education/PHI, 2009.
2.	Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures in C”, 2nd edition, Universities Press, 2014.

REFERENCE BOOKS:

1.	Seymour Lipschutz, “Data Structures, Schaum’s Outlines”, Revised 1st edition, McGraw Hill, 2014.

E Books / MOOCs/ NPTEL

1.	Data Structures Using C, ISRD Group, Tata McGraw Hill, 2006.
2.	Data Structures Using C, Reema Thareja, 2nd edition, Oxford University Press, 2014
3.	Introduction to Data Structures by edx , URL: https://www.edx.org/course/
4.	Data structures by Berkley, URL: https://people.eecs.berkeley
5.	Advance Data Structures by MIT OCW , URL: https://www.mooclab.club/
6.	Data Structure by Harvard Extension School, URL: http://www.extension.harvard.

DISASTER MANAGEMENT

Course Code:	**CV2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P:S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV1002-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand difference between Disaster, Hazard, Vulnerability, and Risk.
2.	Know the Types, Trends, Causes, Consequences and Control of Disasters
3.	Apprehend Disaster Management Cycle and Framework.
4.	Know the Disaster Management in India
5.	Appreciate Applications of Science and Technology for Disaster Management.

UNIT-I	
Understanding Disasters	**04 Hours**
Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management.	
Types, Trends, Causes, Consequences and Control of Disasters	**10 Hours**
Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters	
UNIT-II	
Disaster Management Cycle and Framework	**10 Hours**
Disaster Management Cycle and Framework: Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action.	
Disaster Management in India	**06 Hours**
Disaster Management in India: Disaster Profile of India – Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter-Governmental Agencies.	
UNIT-III	
Applications of Science and Technology for Disaster Management	**06 Hours**
Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non Structural Mitigation of Disasters S&T Institutions for Disaster Management in India	
Case Studies	**04 Hours**
Study of Recent Disasters (at local, state and national level), Preparation of Disaster Risk Management Plan of an Area or Sector, Role of Engineers in Disaster Management	

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

1.	Explain Concepts, Types, Trends, Causes of Disasters
2.	Describe Consequences and Control of Disasters
3.	Explain Disaster Management Cycle and Framework
4.	Explain the lesson learnt from the disasters in India and discuss the financial mechanism, roles and responsibilities of Non-Government and Inter-Governmental Agencies for Disaster management
5.	Describe the Applications of Science and Technology recent disasters, role of engineers for Disaster Management and prepare a report of Disaster Risk Management Plan.

Course Outcomes Mapping with Program Outcomes

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→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
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.	1. Agarwal, "Organic Chemistry of Natural Products", Vol.-I & Vol.-II, O.P. Goel Publishing House, 2014.

REFERENCE BOOKS:

1.	K. Nakanishi, T. Goso, S. Ito, S. Natori and S. Nozoe, "Natural Products Chemistry", Vol. I & II, Academic Press, Ny, 1974.
2.	Gurudeep R. Chatwal, "Organic Chemistry of Natural Products", Vol. I & II, Himalaya Publishing House, 2013.
3.	G.A. Swal, "An Introduction to Alkaloids", Backwell Scientific Publications, 1967.
4.	Hand book of naturally occurring Compounds, Vol. II, terpenes, T.K. Davon, A.I. Scott, Academic Press, Ny, 1974.

ARTIFICIAL NEURAL NETWORK SYSTEMS

Course Code:	**EC1501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	To learn basic building blocks of ANNs and its terminology
2.	To understand the working of McCulloch-Pitts Neuron and different types of learning rules
3.	To understand decision regions, discriminant functions and training concept
4.	To understand the working of perceptron as classifier
5.	To understand the mathematics behind different types of single layer feedback networks

UNIT-I

Introduction to Artificial Neural networks	**16 Hours**

Introduction, Basic building blocks: network architecture, setting the weights, activation functions, ANN terminologies: weights, activation functions, bias, threshold, McCulloch-Pitts Neuron Model, Learning Rules

UNIT-II

Single Layer Perceptron Classifiers	**15 Hours**

Classification Model, Features, and Decision Regions, Discriminant Functions, Linear Machine and Minimum Distance Classification, Nonparametric Training Concept, Training and Classification Using the Discrete Perceptron: Algorithm and Example, Single-Layer Continuous Perceptron Networks for Linearly Separable Classifications, Multicategory Single-Layer Perceptron Networks

UNIT-III

Single-Layer Feedback Networks	**09 Hours**

Basic Concepts of Dynamical Systems, Mathematical Foundations of Discrete-Time Hopfield Networks, Mathematical Foundations of Gradient-Type Hopfield Networks. Transient Response of Continuous-Time Networks, Relaxation Modeling in Single-Layer Feedback Networks

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

1.	Describe the building blocks of artificial neural and terminologies
2.	Describe the working of neural network and learning rules
3.	Describe training of Single layer perceptron and classification using it.
4.	Explain use of Single layer perceptron for linearly separable and multicategory problems
5.	Explain the mathematics behind different single-layer feedback networks

Course Outcomes Mapping with Program Outcomes

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
EC1501-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EC1501-1.2	3	-	-	-	-	-	-	-	-	-	-	-
EC1501-1.3	3	-	-	-	-	-	-	-	-	-	-	-
EC1501-1.4	3	-	-	-	-	-	-	-	-	-	-	-
EC1501-1.5	3	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	S. N. Sivanandam, S. Sumathi, S. N. Deepa, "Introduction to Neural Networks Using MATLAB 6.0", Tata McGraw-Hill Education, 2006
2.	Jacek M. Zurada "Introduction to Artificial Neural Systems", 1st Edition, St. Paul West Publishers-USA, 1992.
3.	Michael A Neilsen, "Neural Networks and Deep Learning", Determination Press, 2015

INTRODUCTION TO MATLAB PROGRAMMING: A HANDS-ON APPROACH

Course Code:	**EC1502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**2:0:2:0**	**Credits**	**03**
Total Teaching Hours	**27+0+26+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Electronics & Communication Engineering Offered to Civil & BT

Course Objectives:

1.	To demonstrate basic understanding of MATLAB programming
2.	To use and write functions
3.	To use MATLAB programming for image processing

Unit-I	**27 Hours**

Introduction to MATLAB: Starting MATLAB and familiarization with its user interface, syntax and semantics, ways in which MATLAB provides help, create plots in MATLAB.

Matrices and Operators: defining matrices, manipulation of matrices, extract parts of them and combine them to form new matrices, use of operators to add, subtract, multiply, and divide matrices, and we will learn that there are several different types of multiplication and division.

Functions: creating reusable functions, how the environment inside a function is separated from the outside via a well-defined interface through which it communicates with that outside world, define a function to allow input to it when it initiates its execution.

Programmer’s Toolbox: polymorphism and how MATLAB exploits it to change a function's behavior on the basis of the number and type of its inputs, random number generator, how to get input from the keyboard, how to print to the Command Window, and how to plot graphs in a Figure window, how to find programming errors with the help of the debugger, how to print to the Command Window, and how to plot graphs in a Figure window, how to find programming errors with the help of the debugger.

Selection Statement and Loops: how to use the if-statement, how to use relational operators and logical operators, how to write polymorphic functions and how to make functions resistant to error, the for-loop and the while-loop, how the break-statement works, nested loops, logical indexing and implicit loops.

Data Types: character arrays and how the characters in them are encoded as numbers, string and datetime datatype, how to produce heterogeneous collections of data via structs and cells.

File Input/Output: reading and writing files, how to create, read from, and write into MAT-files, Excel files, text files, and binary files, how to navigate among folders with MATLAB commands.

Image Processing using MATLAB: pre-processing – conversion of color image to gray scale image, decomposition of color images to single color component image, histogram of image, thresholding

List of Experiments

1	Starting MATLAB and familiarization with its user interface, syntax and semantics, ways in which MATLAB provides help, create plots in MATLAB.
2	Defining matrices, manipulation of matrices, extract parts of them and combine them to form new matrices, use of operators to add, subtract, multiply, and divide matrices, and we will learn that there are several different types of multiplication and division.
3	creating reusable functions, how the environment inside a function is separated from the outside via a well-defined interface through which it communicates with that outside world, define a function to allow input to it when it initiates its execution.
4	Polymorphism and how MATLAB exploits it to change a function's behavior on the basis of the number and type of its inputs, random number generator, how to get input from the keyboard, how to print to the Command Window

5	How to plot graphs in a Figure window, how to find programming errors with the help of the debugger, how to print to the Command Window, and how to plot graphs in a Figure window, how to find programming errors with the help of the debugger.
6	How to use the if-statement, how to use relational operators and logical operators, how to write polymorphic functions and how to make functions resistant to error.
7	The for-loop and the while-loop, how the break-statement works, nested loops, logical indexing and implicit loops.
8	Character arrays and how the characters in them are encoded as numbers, string and datetime datatype, how to produce heterogeneous collections of data via structs and cells.
9	Reading and writing files, how to create, read from, and write into MAT-files, Excel files, text files, and binary files, how to navigate among folders with MATLAB commands.
10	Reading an image, saving, basic manipulation of images, arithmetic operations
11	Pre-processing – conversion of color image to gray scale image, decomposition of color images to single color component image.
12	Histogram processing.
13	Thresholding operation.

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

1.	Use matrices and operators in MATLAB programming
2.	Use and write functions; use MATLAB toolbox
3.	Use toolbox and selection statement in MATLAB programming
4.	Write MATLAB programs using loops and summarize data types
5.	Summarize file input/output methods using MATLAB commands and apply pre-processing and thresholding operations on images

Course Outcomes Mapping with Program Outcomes

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
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→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
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→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EC2501-1.1	1	-	-	-	-	1	-	-	-	-	2	2
EC2501-1.2	1	-	-	-	-	1	-	-	-	-	2	2
EC2501-1.3	1	-	-	-	-	1	-	-	-	-	2	2
EC2501-1.4	1	-	-	-	-	1	-	-	-	-	2	2
EC2501-1.5	1	-	-	-	-	1	-	-	-	-	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Anand, "Consumer Electronics", Khanna publications, 2011.
2.	Bali S. P., "Consumer Electronics", Pearson Education, 2005.

REFERENCE BOOK:

1.	Gulati R. R. "Modern Television Engineering", Wiley Eastern.

PCB DESIGN AND FABRICATION

Course Code	**EC2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**1:0:4:0**	**Credits**	**03**
Total Teaching Hours	**15+0+52+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC1001-1**		

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	To enable students to gain knowledge of Schematic Design techniques & PCB design techniques
2.	To expose students to complete PCB Design & manufacturing process

Unit-I

Circuit Schematic	**05 Hours**

Introduction to Kicad schematic design tool, features, node connections, labeling, creating new component.

Unit-II

PCB Layout:	**05 Hours**

Introduction to Kicad layout editor, features, layer selections, manual and auto routing in Kicad, verification of footprint, creating footprint for a given component.

Unit-III

PCB Fabrication	**05 Hours**

Generating and verifying the PCB Gerber file, preparing artwork for a single side PCB fabrication, preparing PCB artwork for double side PCB, Etching process, tin plating, legend printing, green masking and through hole plating

List of Experiments

1	Exploring the Kicad Schematic and layout tool
2	Developing a schematic circuit for microphone preamplifier
3	Designing a single side PCB layout for microphone preamplifier
4	Developing a schematic circuit for a microcontroller development board
5	Designing a double side PCB layout for a microcontroller development board
6	Choosing a new sensor/display module and building a schematic circuit for the user level application
7	Building a layout using single or double side PCB for the sensor/display module
8	Preparing the film for the bottom copper, solder mask and top silk (legend) to fabricate a single side PCB using chemical process
9	Preparing the film for the top copper, bottom copper, top solder mask, bottom solder mask and legend to fabricate double side PCB using chemical process
10	PCB routing, etching, cutting and drilling using CNC machine

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

1.	Draw schematic circuit and create PCB layout for single or multilayer PCB
2.	Fabricate single and double-layer PCB

Course Outcomes Mapping with Program Outcomes

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

1.	Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, "Bio-Medical Instrumentation and Measurements", II edition, Pearson Education, 2002.
2.	R. S. Khandpur, "Handbook of Bio-Medical instrumentation", Tata McGraw Hill Publishing CoLtd., 2003.
3.	J. Webster, "Medical Instrumentation", John Wiley & Sons, 1995.
4.	L. A. Geddes and L. E. Baker, "Principles of Applied Bio-Medical Instrumentation", John Wiley & Sons, 1975.
5.	David. Cooney and Michel Deckker, "Bio- Medical Engineering Principles", INC.

REFERENCE BOOKS:

1	David Cooney, "Bio-Medical Engineering Principles", 2015, 1st Edition, Marcel Deckker Pub Co., New York.

ELECTRIC VEHICLE TECHNOLOGY

Course Code:	**EE2503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EE1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1	To Understand the fundamental laws and vehicle mechanics.
2	To Understand working of Electric Vehicles and recent trends.
3	Ability to analyze different power converter topology used for electric vehicle application
4	Ability to develop the electric propulsion unit and its control for application of electric vehicles

UNIT-I

Vehicle Mechanics	**07 Hours**

Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Nonconstant FTR, General Acceleration, Propulsion System Design..

Electric and Hybrid Electric Vehicles	**07 Hours**

Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive train).

UNIT-II

Energy storage for EV and HEV	**08 Hours**

Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Supercapacitors.

Electric Propulsion	**08 Hours**

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives.

UNIT-III

Design of Electric and Hybrid Electric Vehicles	**10 Hours**

Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design.

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

1	Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design
2	Explain the working of electric vehicles and hybrid electric vehicles in recent trends.
3	Model batteries, Fuel cells, PEMFC and super capacitors.
4	Analyze DC and AC drive topologies used for electric vehicle application.
5	Develop the electric propulsion unit and its control for application of electric vehicles.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EE2503-1.1	2	3	-	-	-	-	-	-	-	-	-	-
EE2503-1.2	1	2	3	-	-	-	-	-	-	-	-	-
EE2503-1.3	1	2	3	-	-	-	-	-	-	-	-	-
EE2503-1.4	1	2	3	-	-	-	-	-	-	-	-	-
EE2503-1.5	1	2	2	-	-	-	-	-	-	-	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1	Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.

2	M. Ehsani, Y. Gao, S.Gay and Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2005.
REFERENCE BOOKS:	
1	Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles", Springer, 2013.
2	C.C. Chan and K.T. Chau, "Electric Vehicle Technology", OXFORD University, 2001
3	Chris Mi, M. Abul Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles Principles And Applications with Practical Perspectives", Wiley Publication, 2001
E Books / MOOCs/ NPTEL	
1.	Introduction to Mechanics | Coursera
2.	Electric Vehicles - Part 1 - Course (nptel.ac.in)
3.	NPTEL: Electrical Engineering - Introduction to Hybrid and Electric Vehicles
4.	Hybrid Vehicles (edX) | MOOC List (mooc-list.com)
5.	Electric Cars: Technology | My MOOC (my-mooc.com)

FUNDAMENTALS OF PLC AND ITS APPLICATIONS

Course Code:	**EE2504-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1.	To understand main parts and their functions, basic sequence of operation of PLC.
2.	To study the different programming languages and fundamental wiring diagrams.
3.	To explain the functions of PLC counter instructions, applying combinations of counters and timers to control systems.
4.	To explain the basic operation of PLC closed-loop control system, various forms of mechanical sequencers and their operations
5.	To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes

UNIT-I

Programmable Logic Controllers	**02 Hours**
Introduction, Parts of a PLC, Principles of Operation, PLC Size and Application.	
PLC Hardware Components	**05Hours**
The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Human Machine Interface (HMIs).	
Basic Programming Language	**05Hours**
Ladder diagrams, Ladder conventions, Logic functions with timing diagram, latching, multiple outputs, entering programs, Functional blocks, Program examples, instruction list, branch codes, programming examples, Sequential functions charts, branching and convergence, actions, Structured Text, conditional and iteration statements	
Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs	**03Hours**
Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches,	

Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.

UNIT-II

Programming Timers	**02 Hours**
Introduction, Necessity of Energy Storage and Methods of Energy Storage (Classification and brief description using block diagram representation)	
Programming Counters	**04 Hours**
Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.	
Program Control Instructions	**05 Hours**
Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction.	
Data Manipulation Instructions	**02 Hours**
Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control.	
Math Instructions	**02 Hours**
Math Instructions, Addition Instruction, Subtraction Instruction, Multiplication Instruction, Division Instruction, Other Word-Level Math Instructions, File Arithmetic Operations	

UNIT-III

Sequencer and Shift Register Instructions	**05 Hours**
Mechanical Sequencers, Sequencer Instructions, Sequencer Programs, Bit Shift Registers, Word Shift Operations.	
Process Control, Network Systems, and SCADA	**05 Hours**
Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA).	

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

1.	Identify main parts, functions of PLC and describe basic circuitry for I/O modules to select PLC for desired application
2.	Apply suitable logic using various programming languages to achieve specific control mechanism for a given application
3.	Identify timer/counter resources of a PLC to design control logic for interfaced device.
4.	Interpret data manipulation and math instructions as they apply to a PLC program
5.	Develop programs that use shift registers and explain functions of control elements of a closed loop control system

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EE2504-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EE2504-1.2	1	3	-	-	-	-	-	-	-	-	-	-
EE2504-1.3	1	2	3	-	-	-	-	-	-	-	-	-
EE2504-1.4	1	2	3	-	-	-	-	-	-	-	-	-
EE2504-1.5	1	2	3	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Frank Petruzella, "Programming Logic Controllers", Fifth Edition.
2.	W Bolton, "Programmable Logic controllers", 6th edition, Elsevier- newness, 2015.
REFERENCE BOOKS:	
1.	John W Webb, Ronald A Reis, "Programmable logic controllers - principles and applications", 5th edition, 2nd impression, Pearson education, 2009
2.	L. A Bryan, E. A Bryan, "Programmable Controller Theory and Implementations", 2nd edition, 2003
3.	S. P. Sukhumi, J. K. Nayak, “Solar Energy: Principles Collection and Storage”, 3rd edition, McGraw-Hill Education (India) , 2009.
E Books / MOOCs/ NPTEL	
1.	https://library.automationdirect.com/category/product/programmable-control/
2.	https://www.coursera.org/lecture/intelligent-machining/programmable-logic-controllers-plc-fGz3r
3.	https://www.udemy.com/course/plc-programming-from-scratch/

MOTORS AND MOTOR CONTROL CIRCUITS

Course Code:	**EE2505-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EE1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1.	Study architecture of induction motor and synchronous motor
2.	Understanding control of AC motor
3.	Study principle of operation of different dc motors
4.	Understand the different types of control techniques
5.	Study different sensors and their role in control of a motor

UNIT-I

AC Motor Designs	**08 Hours**

Introduction, Three phase AC motor architecture, Torque speed curve, wound rotor, Synchronous motors
Single phase AC motors, split phase motor, capacitor start and shaded pole motors, Universal and gear motors, AC Motor Specifications, Specifying an AC motor for an application.

AC Motor Control:	**07 Hours**

AC motor Enclosures, AC motor control components, Manual motor starting systems, Direct On Line Starter, semi-automatic star delta starter, fully automatic star delta starter, control circuit for sequence operation of two motors

UNIT-II

DC Motors	**07 Hours**
DC motor principle of operation, Brushed DC motors, shunt, series and compound wound motors, Brushless DC motors, driving a brushless DC motor, Commutation, Specifying a DC motor	
DC Motor Control and Stepper Motors	**08 Hours**
Stepper motor principles of operation, Illustrative example of a stepper motor drive, stepper motor specification and operation, commercial stepper motor drive chips and packages, Direction Controller- H Bridge, Speed Controller: Pulse Width Modulation (PWM), Armature Controller: Variable resistance, DC vs.AC motors	

UNIT-III

Sensors	**10 Hours**
Unipolar Hall Effect Switches, Omnipolar Hall Effect Switches, Latched Hall Effect Switches, Current Sensors: Shunt resistor, Current-sensing transformer, Hall effect current sensor, Speed/position sensors: Quadrature encoder, Hall effect tachometer, Back EMF/Sensorless control method, BLDC motor control with Hall sensor, Block diagram approach of BLDC Fan and Motor Control	

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

1.	Demonstrate an understanding of the general principles of AC Motor.
2.	Understand the basic principles of AC motor controls which includes starters, contactors, and control relays
3.	Demonstrate an understanding of the general principles of DC Motor.
4.	Understand the basic principles of DC motor controls which includes starters, contactors, and control relays
5.	Set up sensors in order to give feedback to a control circuit

Course Outcomes Mapping with Program Outcomes

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
EE2505-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EE2505-1.2	2	3	3	-	-	2	-	-	-	-	-	-
EE2505-1.3	3	-	-	-	-	-	-	-	-	-	-	-
EE2505-1.4	2	3	3	-	-	2	-	-	-	-	-	-
EE2505-1.5	2	3	3	-	-	2	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. S. K. Bhattacharya Birjindersingh, "Control of electrical machines", New Age International.
2. Gary J. Rockis & Glen A. Mazura, "Electrical Motor Controls", 5th Edition, ISBN number is 9780826912268

REFERENCE BOOKS:

1. Stephen L. Herman, "Industrial Motor Control", Delmar Publishers, Inc., latest Edition.

E Books / MOOCs/ NPTEL

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→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1505-1.1	-	-	-	-	-	3	3	1	-	-	-	-	-	-
HU1505-1.2	-	-	-	-	-	3	3	-	-	-	-	-	-	-
HU1505-1.3	-	-	-	-	-	-	-	-	1	-	-	-	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. R.K. Guptha, "Cadets Handbook", Ramesh Publishing House, New Delhi.

OVERVIEW OF INDIAN CULTURE

Course Code	**HU1506-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Humanities

Course Objectives:

1. To understand the relevance of Culture in Human Life, dynamism of Indian Culture and Arts through ages.
2. To understand the local culture and its vibrancies.
3. To develop awareness about Indian Society, Culture and Arts under Western rule.
4. To comprehend different dimension and aspects of the Indian culture and arts.
5. To appreciate cultural performances in India.

UNIT - I

Knowing Culture **08 Hours**

What is Culture, Different aspects of Culture, Cultural expression, Importance of Culture

Influence of Culture **07 Hours**

Relationship of Culture with: Language, Religion and History, Gender

UNIT - II

Media and Culture	**07 Hours**
Role of News Papers, Indian Cinema, Music, Advertisements	
Languages, Literature and Culture	**07 Hours**
Role of Sanskrit, Vedas, Upanishads, Ramayana and Mahabharata, Puranas, other Sanskrit Literature, Buddhist and Jain Literature, Dravidian Languages and Literature, North Indian Languages and Literature, Subaltern Literature	
UNIT - III	
Arts and Culture	**07 Hours**
Indian Theatre and Performing Arts, Ritual performances, and Tuluva cultural and ritual performances.	
(Self-study Component) **Contribution of Indian History to Culture**	**04 Hours**
Ancient India – Persian and Macedonian invasions and its impact on Indian Culture, Development of Culture and Arts during the Mauryan Empire (Ashoka), the Guptas, the South Indian Dynasties – the Cholas, Nalanda as a Centre of Learning. Medieval India – Life of People under Delhi Sultanate, Rise of Islam and Sufism, Political Scene of India, Bhakti Movement, Folk Arts, Rise of Modern Indian Languages. Modern India – British Ruling and its impact on Indian Culture, Social and Religious Reforms, Indian National Movement and Achievement of Independence.	

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

1.	Examine how the culture has a very important role in human life and growth of human civilization and have a general awareness on historical perspective of growth of Indian Culture and Arts.
2.	Appreciate their own local culture from an academic perspective.
3.	Know about the impact of Western Rule in India and Indian Struggle for Freedom and also its impact on Indian Culture and Arts and able to appreciate and the role of language in connecting people, growth of culture and arts beyond the barriers of religion and ages.
4.	Take interest in learning these forms of arts, and also appreciate and preserve them for the future generations feeling proud of Indian Culture, Arts and Architecture.
5.	Appreciate art performances in India which will enable them to get exposed to an artistic sphere, which eventually help them to be creative and imaginative.

Course Outcomes Mapping with Program Outcomes

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 universe	
NasidiyaSukta: “Who really knows?” Brhadaranyaka Upanishad; Chandogya Upanishad: Non-Self, real and unreal Taithriya Upanishad: SikshaValli Plato’s Symposium: Lack as the source if desire and knowledge. Socratic method of knowledge as discovery Language: word as root of knowledge (Bhartrahari’s Vakyapadiyam) Fourteen Knowledge basis as a source of Vidya: Four Vedas, six auxiliary sciences (vedangas); Purana, Nyaya, Mimamsa and Dharma Sastras.	

UNIT - II

Knowledge as Power	**16 Hours**
Francis Bacon. Knowledge as both power and self- realization in Bhagavad Gita.	
Knowledge as Oppression	
M. Foucault. Discrimination between Ram and Satyam in Indian Philosophy.	
Knowledge as Invention	
Modern definition of creativity; scientific activity in the claim that science invents new things at least through technology.	

UNIT - III

	10 Hours
Knowledge about the self, transcendental self; knowledge about society, polity and nature Knowledge about moral an ethics codes.	

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

1. To provide a new understanding based on which one can move to overcome the current problems, both at the individual level as well as at the societal level.
2. To introduce an orientation course for humanities courses in general and for philosophy courses in particular.
3. To relate philosophy to literature, culture, society and lived experience.
4. To train students in already available philosophical systems.
5. To bridge the gap between theory and practice.

Course Outcomes Mapping with Program Outcomes

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→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
HU1508-1.1	-	-	-	-	-	3	-	-	2	1	-	1
HU1508-1.2	-	-	-	-	-	3	-	-	2	1	-	1
HU1508-1.3	-	-	-	-	-	3	-	-	2	1	-	1
HU1508-1.4	-	-	-	-	-	3	-	-	2	1	-	1
HU1508-1.5	-	-	-	-	-	3	-	-	2	1	-	1

1: Low 2: Medium 3: High

COMMON SENSE AND CRITICAL THINKING

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.	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
HU2501-1.1	-	3	-	-	-	-	-	-	3	3	-	3
HU2501-1.2	-	2	-	-	-	-	-	3	2	3	-	2

HU2501-1.3	-	3	-	-	-	-	-	-	2	2	-	3
HU2501-1.4	-	3	-	-	-	-	-	-	2	2	-	3
HU2501-1.5	-	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/>.

LINGUISTICS & LANGUAGE TECHNOLOGY

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.	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→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
HU2502-1.1	-	1	-	-	1	1	-	-	1	-	-	2
HU2502-1.2	-	-	2	-	-	-	-	-	2	2	-	-
HU2502-1.3	2	3	-	3	-	-	-	-	3	2	-	-
HU2502-1.4	-	-	-	-	2	-	-	-	1	2	-	-
HU2502-1.5	-	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.

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. 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→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
IS2504-1.1	1	2	-	2	-	-	-	-	-	-	-	1
IS2504-1.2	1	-	-	2	-	-	-	-	-	-	-	1
IS2504-1.3	1	2	-	2	3	-	-	-	-	-	-	1
IS2504-1.4	1	2	-	2	3	-	-	-	-	-	-	1
IS2504-1.5	1	-	-	2	3	-	-	-	-	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development”, 1st Edition, Pearson Education India. (ISBN:978-9332575271).

E Books / MOOCs/ NPTEL

1.	nptel.ac.in/courses/106105084/11

GRAPH THEORY

Course Code:	**MA1501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mathematics

Course Objectives:

1.	Explain subgraphs, bipartite graphs, isomorphic graphs etc. Apply the concept of trees and its properties
2.	Distinguish between Hamilton and Eulerian graph. Distinguish between planar and nonplanar graphs and apply their properties to solve problems.
3.	Represent a graph in terms of adjacency matrix, incidence matrix etc. and vice-versa.

4.	Find the shortest path between two vertices in a graph. Find minimal spanning tree.

UNIT-I

Introduction to graphs	**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→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
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 components, 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, simple 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 mesh 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→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
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→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
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→	1	2	3	4	5	6	7	8	9	10	11	12

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

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.

2.

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.

3.

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:

Sekhar Satya G.V., "Working Capital Management", 1/e; New Delhi: Wiley, 2014.

Bhalla V. K., "Working Capital Management", 1/e; New Delhi: S. Chand Publishing, 2014.

Sagner James S., "Working Capital Management, Applications and Cases", 1/e, New Delhi: Wiley, 2015.

NANOTECHNOLOGY

Course Code:	**PH2501 -1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**PH1001 -1**		

Teaching Department: PHYSICS

Course Objectives:

1.	To understand the basic scientific concepts of nanoscience, properties of nano materials, synthesis and fabrication of nano materials.
2.	To understand the various characterization techniques of nano materials.
3.	Study of carbon nano technology and its characterizations.
4.	To understand the applications of nano technology in various science, engineering and technology fields.

UNIT-I

Properties of Materials	**07 Hours**
Introduction: History of nano science, definition of nano meter, nanomaterials, nano technology. Classification of nano materials. Crystal symmetries, crystal directions, crystal planes, Band structure. Properties Of Materials: Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.	
Synthesis and Fabrication	**08 Hours**
Synthesis of bulk polycrystalline samples, growth of single crystals, Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography, Requirements for realizing semiconductor nano structure, growth techniques for nano structures.	

UNIT-II

Characterization Techniques	**15 Hours**
X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy (TEM), scanning probe microscopy (SEM), atomic force microscopy (AFM), piezoresponse microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, UV-VIS-IR Spectrophotometers, Magnetic and electrical measurements and Infrared/ Raman, EPR and NMR	

UNIT-III

Carbon Nano Technology	**05 Hours**
Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalling diamond films, grapheme, and applications of carbon nano tubes.	
Applications of Nano Technology	**05 Hours**
Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin films, applications of quantum dots.	

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

1.	Ability to choose the appropriate nano material to meet the requirerment of a particular application.
2.	Identify the essential concepts used in nanotechnology.
3.	Identify the materials, properties, synthesis and fabrication of nanomaterials.
4.	Understand the various characterization techniques of nano materials.
5.	Applications of nanomaterials in various fields

Course Outcomes Mapping with Program Outcomes

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

EMPOWERING WITH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Code:	**AM1501-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Artificial Intelligence Machine Learning

Course Objectives:

1.	Acquire basic understanding of Artificial Intelligence
2.	Illustrate the application of computer vision and natural language processing
3.	Identify and experience the transition from traditional computer vision to artificial intelligence.
4.	Analyze the process of congestion control algorithms
5.	Illustrate IP Packets and fragmentation process.

Prerequisite	**AM1101-1**

UNIT-I

Basics of AI and Statistical Data	**15 Hours**

Basic understanding of Artificial Intelligence: What is AI? The 3 domains of AI: Statistical Data, Computer Vision, NLP, AI Applications, AI in industries, UN Sustainable Development Goals, AI Ethics issues- privacy, bias, access to AI.
Non-technical Introduction to AI: AI Project Cycle-Problem scoping, Data Acquisition, Data Visualization, Decision Trees, Introduction to Neural Networks.
Domain - Fundamentals Hands-on Sessions
Statistical Data: Data Import and Processing, Machine Learning Techniques, AI for Data Walkthrough

UNIT-II

Computer vision **15 Hours**

Basic Techniques in Computer Vision: - How do computer see?, How image is represented with numbers (RGB), Tresholding, masking and region of interest, Geometric transformation, resizing and cropping
From Traditional Computer Vision to Artificial Intelligence: Feature extraction , selecting appropriate features, Pre processing images, Introduction to K-Nearest neighbour algorithm, Training a simple machine learning algorithm with a few samples, Support Vector Machines.
Types of Inference Models with OpenVINO and NCS2: Use Pre-trained model from OpenVINO, Run an inference model using the Neural Compute Stick 2, Image classification, Object detection.

UNIT-III

Natural Language Processing **10 Hours**

Data Collection and Processing for NLP: Requesting website information with Python, Storing data, Curated data sources, NLP tools, Processing NLP data"
Classification for NLP: Converting data into a bag of words, Selecting important words from a list of words using tfidf method, Choose a machine learning model using the sklearn library, Data pipelining.
Creating a Chatbot: Introduction to chatbots, Finding your chatbot’s specialty, Teach your chatbot to match topics, Get your chatbot to say its first words, Teach and play with your chatbot

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

1.	Acquire basic understanding of Artificial Intelligence
2.	Illustrate the application of computer vision and natural language processing
3.	Identify and experience the transition from traditional computer vision to artificial intelligence.
4.	Understand the different models used in NLP
5.	Understand the Implemention of chatbots

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**
AM2221-1.1	2	1										2		
AM2221-1.2	2	2										2		
AM2221-1.3	2	2										2		
AM2221-1.4	2	2										2		
AM2221-1.5	2	3										2		

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig
2.	Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili
3.	Artificial Intelligence: Foundations of Computational Agents" by David Poole and Alan Mackworth
REFERENCE BOOKS:	
1.	Prediction Machines: The Simple Economics of Artificial Intelligence" by Ajay Agrawal, Joshua Gans, and Avi Goldfarb
2.	The Hundred-Page Machine Learning Book" by Andriy Burkov
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/112103280
2.	https://onlinecourses.nptel.ac.in/noc22_cs56/preview
3.	https://www.coursera.org/learn/ai-for-everyone