



DADI INSTITUTE OF ENGINEERING & TECHNOLOGY
AN AUTONOMOUS INSTITUTE

DEPARTMENT OF

CSE- ARTIFICIAL INTELLEGENCE & MACHINE LEARNING
AND
CSE- DATA SCIENCE

B.Tech (Regular-Fulltime)-DR23

(Effective for the students admitted into I year from the
Academic Year **2023-24** onwards)



DADI INSTITUTE OF ENGINEERING & TECHNOLOGY- AUTONOMOUS

Anakapalle - Andhra Pradesh, India



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Academic Regulations (DR23) for
B. Tech (Regular-Fulltime)

(Effective for the students admitted into I year from the Academic Year 2023-24 onwards)

&

Academic Regulations (DR23) for B.Tech.(Lateral Entry Scheme)

(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year 2024 - 25 onwards)



Academic Regulations (DR23) for B. Tech (Regular-Full time)
(Effective for the students admitted into I year from the Academic Year **2023-24** onwards)

1. Award of the Degree

(a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:

(i) Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).

(ii) Registers for 160 credits and secures all 160 credits.

(b) Award of B.Tech. degree with Honors if he/she fulfils the following:

(i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 160 credits.

(ii) Registering for Honors is optional.

(iii) Honors is to be completed simultaneously with B.Tech. programme.

2. Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. This clause shall be read along with clause 1 a) i).

3. Admissions

Admission to the B. Tech Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either based on the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

4. Program related terms



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Credit: A unit by which the course work is measured. It determines the number of hours of instruction required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

1Hr.Lecture(L) per week	1credit
1Hr.Tutorial(T)per week	1credit
1Hr.Practical(P) per week	0.5credit
2Hrs.Practical(Lab) per week	1credit

a) Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.

b) Choice Based Credit System (CBCS): The CBCS provides a choice for students to select from the prescribed courses.

5. Semester/Credits:

i) A semester comprises 90 working days and an academic year is divided into two semesters.

ii) The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.

iii) Regular courses may also be completed well in advance through MOOCs satisfying prerequisites.

6. Structure of the Undergraduate Programme

All courses offered for the undergraduate program (B. Tech.) are broadly classified as follows:

S.No.	Category	Breakup of Credits (Total160)	Percentage of total credits	AICTE Recommendation (%)
1.	Humanities and Social Science including Management (HM)	13	8%	8–9%
2.	Basic Sciences(BS)	20	13%	12-16%
3.	Engineering Sciences(ES)	23.5	14%	10 –18%
4.	Professional Core(PC)	54.5	34%	30 –36%
5.	Electives –Professional (PE)& Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21%	19-23%



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6.	Internships & Project work(PR)	16	10%	8–11%
7.	Mandatory Courses(MC)	Non-credit	Non-credit	-

7. Course Classification:

All subjects/courses offered for the under graduate programme in Engineering & Technology (B.Tech. degree programmes) are broadly classified as follows:

S.No	Broad Course Classification	Course Category	Description
1.	Foundation Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses
2.	Core Courses	Professional Core Courses(PC)	Includes subjects related to the parent discipline/department/branch of Engineering
3.	Elective Courses	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/department/ branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering
		Domain specific skill enhancement courses (SEC)	interdisciplinary/job-oriented/domain courses which are relevant to the industry
4.	Project & Internships	Project	B.Tech. Projector Major Project
		Internships	Summer Internships–Community based and Industry Internships; Industry oriented Full Semester Internship
5.	Audit Courses	Mandatory non-credit courses	Covering subjects of developing desired attitude among the learners

8. Programme Pattern

- i. Total duration of the of B. Tech (Regular) Programme is four academic years.
- ii. Each academic year of study is divided into two semesters.
- iii. Minimum number of instruction days in each semester is 90 days.



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- iv. There shall be mandatory student induction program for freshers, with a three- week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.
- v. Health/wellness/yoga/sports and NSS /NSS /Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduate students.
- vi. Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.
- vii. Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.
- viii. Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.
- ix. Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.
- x. A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for B.Tech. Degree with a Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.
- xi. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.
- xii. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.
- xiii. Students shall undergo mandatory summer internships, for a minimum of eight weeks duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year.
- xiv. There shall also be mandatory full internship in the final semester of the programme along with the project work.
- xv. Undergraduate degree with Honors is introduced by the University for the students having good academic record.



xvi. Each college shall take measures to implement Virtual Labs (<https://www.vlab.co.in>) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.

xvii. Each college shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.

xviii. Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

9. Evaluation Process

The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. Summer Internships shall be evaluated for 50 marks, Full Internship & Project work in final semester shall be evaluated for 200 marks, mandatory courses with no credits shall be evaluated for 30 mid semester marks.

A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. In case of a mandatory course, he/she should secure 40% of the total marks.

Theory Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

i) For theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.

ii) For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.

iii) If any course contains two different branch subjects, the syllabus shall be written in two parts with 3 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.

iv) If any subject is having both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given same subject code with an extension of „T“ for theory subject and „P“ for practical subject.


a) Continuous Internal Evaluation

i) For theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.

ii) Objective paper shall contain for 05 short answer questions with 2 marks each or maximum of 20 bits for 10 marks. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type of questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

Note:

- The objective paper shall be prepared in line with the quality of competitive examinations questions.
- The subjective paper shall contain 3 either or type questions of equal weightage of 10 marks. Any fraction shall be rounded off to the next higher mark.
- The objective paper shall be conducted by the respective institution on the day of subjective paper test.
- Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester and the average marks shall be considered

iii) If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.

iv) First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.

v) Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

For Example:

Marks obtained in first mid: 25 Marks obtained in second mid: 20

Final mid semester Marks: $(25 \times 0.8) + (20 \times 0.2) = 24$

If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other. For Example:

Marks obtained in first mid: Absent Marks obtained in second mid: 25

Final mid semester Marks: $(25 \times 0.8) + (0 \times 0.2) = 20$



b) End Examination Evaluation:

End examination of theory subjects shall have the following pattern:

- i) There shall be 6 questions and all questions are compulsory.
- ii) Question I shall contain 10 compulsory short answer questions for a total of 20marks such that each question carries 2 marks.
- iii) There shall be 2 short answer questions from each unit.
 - a) In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
- iv) The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

End examination of theory subjects consisting of two parts of different subjects, for Example: Basic Electrical & Electronics Engineering shall have the following pattern:

- i) Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.
- ii) In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1mark.
- iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
- iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

Practical Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

b) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.

c) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the record/viva and 15 marks for the internal test.

d) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.

- Procedure: 20 marks
- Experimental work & Results: 30 marks



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- Viva voce: 20 marks.

In a practical subject consisting of two parts (Eg: Basic Electrical & Electronics Engineering Lab), the end examination shall be conducted for 70 marks as a single laboratory in 3 hours. Mid semester examination shall be evaluated as above for 30 marks in each part and final mid semester marks shall be arrived by considering the average of marks obtained in two parts.

e) For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination.

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and 20% for the other. The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid semester examination. The sum of day-to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

The end examination pattern for Engineering Graphics, shall consists of 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the end examination. However, the end examination pattern for other subjects related to design/drawing , multiple branches, etc is mentioned along with the syllabus.

f) There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

g) The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

10. Skill oriented Courses

- i) There shall be five skill-oriented courses offered during III to VII semesters.



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- ii) Out of the five skill courses two shall be skill-oriented courses from the same domain. Of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.
- iii) The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.
- iv) The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The marks/grades shall be assigned to the students by the above committee based on their performance.
- v) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.
- vi) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the University at the beginning of the semester. The principal of the respective college shall forward such proposals to the University for approval.
- vii) If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the University.

11. Massive Open Online Courses (MOOCs):

A Student has to pursue and complete one course compulsorily through MOOCs approved by the University. A student can pursue courses other than core through MOOCs and it is mandatory to complete one course successfully through MOOCs for awarding the degree. A student is not permitted to register and pursue core courses through MOOCs.

A student shall register for the course (Minimum of either 8 weeks or 12 weeks) offered through MOOCs with the approval of Head of the Department. The Head of the Department shall appoint one mentor to monitor the student's progression. The student needs to earn a certificate by passing the exam. The student shall be awarded the credits assigned in the curriculum only by submission of the certificate. Examination fee, if any, will be borne by the student.



Students who have qualified in the proctored examinations conducted through MOOCs platform can apply for credit transfer as specified and are exempted from appearing internal as well as external examination (for the specified equivalent credit course only) conducted by the university.

Necessary amendments in rules and regulations regarding adoption of MOOC courses would be proposed from time to time.

12. Credit Transfer Policy

Adoption of MOOCs is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the University shall allow up to a maximum of 20% of the total courses being offered in a particular programme i.e., maximum of 32 credits through MOOCs platform.

- i) The University shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses.
- ii) Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.
- iii) Credit transfer policy will be applicable to the Professional & Open Elective courses only.
- iv) The concerned department shall identify the courses permitted for credit transfer.
- v) The University/institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.
- vi) The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.
- vii) The university shall ensure no overlap of MOOC exams with that of the university examination schedule. In case of delay in results, the university will re-issue the marks sheet for such students.
- viii) Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.
- ix) The institution shall submit the following to the examination section of the university:
 - a) List of students who have passed MOOC courses in the current semester along with the certificate of completion.
 - b) Undertaking form filled by the students for credit transfer.
- x) The universities shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.



Note: Students shall be permitted to register for MOOCs offered through online platforms approved by the University from time to time.

13. Academic Bank of Credits (ABC)

The University has implemented Academic Bank of Credits (ABC) to promote flexibility in curriculum as per NEP 2020 to

- i. provide option of mobility for learners across the universities of their choice
- ii. provide option to gain the credits through MOOCs from approved digital platforms.
- iii. facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC
- iv. execute Multiple Entry and Exit system with credit count, credit transfer and credit acceptance from students' account.

14. Mandatory Internships

Summer Internships : Two summer internships either onsite or virtual each with a minimum of 08 weeks duration, done at the end of second and third years, respectively are mandatory. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the Undergraduate program. One of the two summer internships at the end of second year (Community Service Project) shall be society oriented and shall be completed in collaboration with government organizations/NGOs & others. The other internship at the end of third year is Industry Internship and shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The guidelines issued by the APSCHE / University shall be followed for carrying out and evaluation of Community Service Project and Industry Internship.

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate of successful completion from industry shall be included in the report. The report and the oral presentation shall carry 50% weightage each. It shall be evaluated for 50 external marks. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University.

Full Semester Internship and Project work: In the final semester, the student should mandatorily register and undergo internship (onsite/virtual) and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship.



The project report shall be evaluated with an external examiner. The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the University and is evaluated for 140 marks.

The college shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

15. Guidelines for offering a Minor

To promote interdisciplinary knowledge among the students, the students admitted into B.Tech. in a major stream/branch are eligible to obtain degree in Minor in another stream.

- i) The Minor program requires the completion of 12 credits in Minor stream chosen.
- ii) Two courses for 06 credits related to a Minor are to be pursued compulsorily for the minor degree, but maybe waived for students who have done similar/equivalent courses. If waived for a student, then the student must take an extra elective course in its place. It is recommended that students should complete the compulsory courses (or equivalents) before registering for the electives.
- iii) Electives (minimum of 2 courses) to complete a total of 12 credits.

Note: A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for Minor by opting for the courses offered through various verticals/tracks under Open Electives.

16. Guidelines for offering Honors

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

- i) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
- ii) A student shall earn additional 15 credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).



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- iii) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.
- iv) The concerned Principal of the college shall arrange separate class work and timetable of the courses offered under Honors program.
- v) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.
- vi) Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.
- vii) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.
- viii) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.
- ix) A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree programme.
- x) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- xi) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

Enrolment into Honors:

- i) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline
- ii) The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for Honors.
- iii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.



- iv) Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.
- v) Honors is to be completed simultaneously with a Major degree program.

Registration for Honors:

- i) The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.
- ii) The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.
- iii) The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.
- iv) There is no fee for registration of subjects for Honors program offered in offline at the respective institutions.

17. Attendance Requirements:

- i) A student shall be eligible to appear for the University external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects.
- b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.
- ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.
- iii) A stipulated fee shall be payable towards condonation of shortage of attendance to the University.
- iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
- v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.
- vi) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
- vii) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

18. For induction programme attendance shall be maintained as per AICTE norms. Promotion Rules:

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in section 16.



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- i) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per university norms.
- ii) A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any *decimal* fraction should be *rounded off to lower* digit) up to in the subjects that have been studied up to III semester.
- iii) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any *decimal* fraction should be *rounded off to lower* digit) in the subjects that have been studied up to V semester.

And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

- iv) When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfillment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

19. Grading:

As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed:

After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	Grade	Grade points
		Assigned
90&above	Superior	10
80- 89	A(Excellent)	9
70- 79	B(Very Good)	8
60- 69	C(Good)	7
50-59	D(Average)	6
40-49	E(Pass)	5
<40	F (Fail)	0
Absent	Ab(Absent)	0



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- i) A student obtaining Grade „F“ or Grade „Ab“ in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.
- ii) For non-credit audit courses, “Satisfactory” or “Unsatisfactory” shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$SGPA = \frac{\sum (C_i \times G_i)}{\sum C_i}$$

where, C_i is the number of credits of the i th subject and G_i is the grade point scored by the student in the i th course.

The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses undergone by a student over all the semesters of a program, i.e.,

$$CGPA = \frac{\sum (C_i \times S_i)}{\sum C_i}$$

where “ S_i ” is the SGPA of the i th semester and C_i is the total number of credits up to that semester. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts. While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	$\geq 6.5 < 7.5$
Second Class	$\geq 5.5 < 6.5$
Pass Class	$\geq 5.0 < 5.5$

CGPA to Percentage conversion Formula $-(CGPA - 0.5) \times 10$

20. With-holding of Results



If the candidate has any dues not paid to the university or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld in such cases.

21. Multiple Entry / Exit Option

(a) Exit Policy:

The students can choose to exit the four-year programme at the end of first/second/third year.

i) **UG Certificate in (Field of study/discipline)** - Programme duration: First year (first two semesters) of the undergraduate programme, 40 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6- credit job-specific internship/apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

ii) **UG Diploma (in Field of study/discipline)** - Programme duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6- credit job-specific internship/apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

iii) **Bachelor of Science (in Field of study/discipline) i.e., B.Sc. Engineering in (Field of study/discipline)**- Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits.

(b) Entry Policy:

Modalities on multiple entry by the student into the B.Tech. programme will be provided in due course of time.

Note: The Universities shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE and State government.

22. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/to establish startups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The principal of the respective college shall forward such proposals submitted by the students to the University. An evaluation committee constituted by the University shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not

23. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations



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or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

24. Minimum Instruction Days for a Semester:

The minimum instruction days including exams for each semester shall be 90 days.

25. Medium of Instruction:

The medium of instruction of the entire B. Tech undergraduate programme in Engineering & Technology (including examinations and project reports) will be in English only.

26. Student Transfers:

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the Universities from time to time.

27. General Instructions:

- i. The academic regulations should be read as a whole for purpose of any interpretation.
- ii. Malpractices rules-nature and punishments are appended.
- iii. Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.
- iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- v. The Universities may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Universities.
- vi. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Vice-Chancellor / Head of the institution is final.

ACADEMIC REGULATIONS (DR23) FOR B. TECH. (LATERAL ENTRY SCHEME)

(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year 2024-25 onwards)

1. Award of the Degree

(a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:



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(i) Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).

(ii) Registers for 120 credits and secures all 120 credits.

(b) **Award of B.Tech. degree with Honors** if he/she fulfils the following:

(i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 120 credits.

(ii) Registering for Honors is optional.

(iii) Honors is to be completed simultaneously with B.Tech. programme.

2. Students, who fail to fulfill the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.

3. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.2

i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.

ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester.

And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. Course Pattern

i) The entire course of study is three academic years on semester pattern.

ii) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.

iii) When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

5. All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme)



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B.TECH. - COURSE STRUCTURE – DR23 (Applicable from the academic year 2023-24 onwards)

INDUCTION PROGRAMME

S.No.	Course Name	Category	L-T-P-C
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	MC	2-0-2-0
3	Orientation to all branches -- career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0



B. Tech (Regular-Full time)

B.TECH-CSE,IT,CSE(DS),CSE(AI),CSE(CS),CSE(AI&ML),AI&DS,AI&ML

(Effective for the students admitted into I year from the Academic Year **2023-24** onwards)

I Year I Semester						
S.No	Course Code	Course Name	L	T	P	Credits
1.	DR23BST01	Linear Algebra & Calculus	3	0	0	3
2.	DR23BST03	Engineering Physics	3	0	0	3
3.	DR23HST01	Communicative English	3	0	0	3
4.	DR23EST01	Basic Civil & Mechanical Engineering	3	0	0	3
5.	DR23EST07	Introduction to Programming	1	0	4	3
6.	DR23HST01	Communicative English Lab	3	0	0	3
7.	DR23BSL03	Engineering Physics Lab	0	0	2	1
8.	DR23ESL02	Engineering Workshop	0	0	2	1
9.	DR23ESL06	IT Workshop	0	0	3	1.5
10.	DR23ESL07	Computer Programming Lab	0	0	3	1.5
11.	DR23MCL02	Health and Wellness, Yoga and Sports	0	0	1	0.5
		Total				20.5



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I Year II Semester						
S.No	Course Code	Course Name	L	T	P	Credits
1	DR23BST02	Differential Equations and Vector Calculus	3	0	0	3
2	DR23BST04	Chemistry	3	0	0	3
3	DR23EST03	Engineering Graphics	2	0	0	2
4	DR23EST04	Basic Electrical & Electronics Engineering	3	0	0	3
5		Data Structures	3	0	0	3
6	DR23BSL04	Chemistry Lab	0	0	2	1
7	DR23ESL05	Electrical & Electronics Engineering workshop	0	0	3	1.5
8		Data Structures Lab	0	0	3	1.5
9	DR23MCL02	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5
		Total				19.5



I Year I Semester	LINEAR ALGEBRA & CALCULUS	L	T	P	C
		3	0	0	3

(Common to All Branches of Engineering)

Course Objectives: To equip the students with standard concepts and tools of mathematics to handle various real-world problems and their applications.

Course Outcomes:

At the end of the course, the student will be able to:

- Develop matrix algebra techniques that is needed by engineers for practical applications.
- To find the given values and given vectors and solve the problems by using linear transformation
- Learn important tools of calculus in higher dimensions.
- Familiarize with functions of several variables which is useful in optimization.
- Familiarize with double and triple integrals of functions of several variables in two and three dimensions.

UNIT - I: Matrices

Rank of a matrix by echelon form, normal form. Cauchy –Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method

System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

UNIT- II: Linear Transformation and Orthogonal Transformation

Eigen values, Eigen vectors and their properties (without Proof), Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation

UNIT- III : Calculus

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

UNIT- IV : Partial differentiation and Applications (Multi variable calculus)

Partial derivatives, total derivatives, chain rule, change of variables, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT – V : Multiple Integrals (Multi variable Calculus)

Duble integrals - change of variables (Cartesian and Polar coordinates), Change of order of integration,

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cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Text books:

1. B.S.Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018

Reference Books:

1. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
3. Glyn James, Advanced Modern Engineering Mathematics, 5/e, Pearson publishers, 2018.
4. Michael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
5. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand, 2021



I Year I Semester	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

(Common for all branches of Engineering)

Course Objectives:

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

Course Outcomes:

- Analyze the intensity variation of light due to polarization, interference and diffraction.
- Familiarize with the basics of crystals and their structures.
- Explain fundamentals of quantum mechanics and apply it to one dimensional motion of particles.
- Summarize various types of polarization of dielectrics and classify the magnetic materials.
- Explain the basic concepts of Quantum Mechanics and the band theory of solids.
- Identify the type of semiconductor using Hall effect.

UNIT I Wave Optics

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative). Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT II Crystallography and X-ray diffraction

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffract meter – crystal structure determination by Laue's and powder methods

XI-



UNIT III Dielectric and Magnetic Materials

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT IV Quantum Mechanics and Free electron Theory

Quantum Mechanics: Dual nature of matter – Heisenberg’s Uncertainty Principle – Significance and properties of wave function – Schrodinger’s time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

UNIT V Semiconductors

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein’s equation – Hall effect and its applications.

Textbooks:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

Reference Books:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press. 2010
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

Web Resources: <https://www.loc.gov/rr/scitech/selected-internet/physics.html>



I Year I Semester	COMMUNICATIVE ENGLISH	L	T	P	C
		2	0	0	2

(Common to All Branches of Engineering)

Course Objectives:

The main objective of introducing this course, *Communicative English*, is to facilitate using Listening, Reading, Speaking and Writing skills effectively by the students. It should result in their better comprehending abilities, oral presentations, reporting useful information and with enhanced knowledge of grammatical structures and vocabulary. This course helps the students in using speaking and writing (productive) skills more efficiently and to make them industry-ready

Course Outcomes

- **By the end of the course the students will have** Learned how to understand the context, topic, and specific information from social or transactional dialogues.
- Remedially learn applying grammatical structures to formulate sentence and use appropriate words and correct word forms.
- Using discourse markers to speak clearly on a specific topic in formal as well as informal discussions. (not required)
- Improved communicative competence in formal and informal contexts and for social and academic purposes.
- Critically comprehending and appreciating reading /listening texts and to write summaries based on global comprehension of these texts.
- Writing coherent paragraphs essays, letters/e-mails and resume.

Instructions:

1. The reading texts can be given as podcasts to the students so that their listening skills can be enhanced
2. While listening and reading to the text can be given as homework, the class work for the students can be to discuss and critically evaluate the texts based on the context, purpose or writing the text and understanding it from the author's as well as reader's point of view.
3. Reading as habit for both academic and non-academic (pleasure) purposes has to be inculcated in the students. So training has to be given in intensive and extensive reading strategies.
4. Writing for both academic (assignments, examinations, reports, e-mails/letters etc)
5. The writing tasks given in the class are to be self and peer evaluated by the students before they are finally graded by the faculty.

Note: Please note that the texts given here are just contexts for teaching various language skills and sub skills. The students' ability to use language cannot be confined to comprehending or using the language related to the given texts (textbooks). The given texts can be used only for practice.

6. All the activities to develop language skills have to be integrated and interconnected, within each unit and across the units.



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7. Use as many supplementary materials as possible in various modes (Audio, visual and printed versions) in the classroom so that the students get multimode input and will how to use language skills in the absence of the teacher.

UNIT- I

Lesson: HUMAN VALUES: A Power of a Plate of Rice by Ifeoma Okoye (Short story)

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences. (That has to be part of the bridge course- 2 weeks before the actual academic programme starts)

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT-II

Lesson: NATURE: Night of the Scorpion by Nissim Ezekiel (Indian and contemporary)

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics)

Grammar: Cohesive devices -linkers, use of articles and zero article prepositions.

Vocabulary: Homonyms, Homophones, Homographs.

UNIT-III

Lesson: BIOGRAPHY: Steve Jobs

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed

Reading: Reading a text in detail by making basic inferences-recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, paraphrasing

Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations

Vocabulary: Compound words, Collocations



UNIT- IV

Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphicalements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters, Resumes

Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons

UNIT- V

Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic contexts

Reading: Reading comprehension.

Writing: Writings structured essays on specific topics.

Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject-verb agreement)

Vocabulary: Technical Jargons

Textbooks:

1. Pathfinder: Communicative English for Undergraduate Students, 1stEdition, OrientBlackSwan, 2023 (Units 1,2 & 3)
2. Empowering English by Cengage Publications, 2023 (Units 4 & 5)

Suggestion: Instead of giving the syllabus in the form of textbooks it would be better to procure the soft copies of individual texts (stories or poems or biographies and non-fiction texts)by the university and make them available on the university website for registered students to access and download

Reference Books:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge,



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- 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University
4. Press, 2019.
5. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Web Resources:

GRAMMAR:

www.bbc.co.uk/learningenglish

<https://dictionary.cambridge.org/grammar/british-grammar/>



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I Year I Semester	BASIC CIVIL & MECHANICAL ENGINEERING	L	T	P	C
		2	0	0	2

(Common to All branches of Engineering)

Part-A:

Course Objectives:

- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

Course Outcomes:

On completion of the course, the student should be able to:

- Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.
- Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.
- Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.
- Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.
- Understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.

UNIT I

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

UNIT II

Surveying: Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.



UNIT III

Transportation Engineering Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Textbooks:

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

PART B: BASIC MECHANICAL ENGINEERING

Course Objectives: The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

Course Outcomes:

- On completion of the course, the student should be able to Understand the different manufacturing processes.
- Explain the basics of thermal engineering and its applications.
- Describe the working of different mechanical power transmission systems and power



- Describe the basics of robotics and its applications.

UNIT I

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT II

Manufacturing Processes: Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III

Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants. **Mechanical Power Transmission** - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

Textbooks:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

Reference Books:

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak MPandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.



DADI INSTITUTE OF ENGINEERING & TECHNOLOGY
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I Year I Semester	INTRODUCTION TO PROGRAMMING	L	T	P	C
		3	0	0	3

(Common to All branches of Engineering)

Course Objectives:

The objectives of this course is to acquire knowledge on the

- To impart adequate knowledge on the need of programming languages and problem-solving techniques and develop programming skills.
- To enable effective usage of Control Structures and Implement different operations on arrays.
- To demonstrate the use of Strings and Functions.
- To impart the knowledge of pointers and understand the principles of dynamic memory allocation.
- To understand structures and unions and illustrate the file concepts and its operations.
- To impart the Knowledge Searching and Sorting Techniques

Course Outcomes:

At the end of the Course, Student should be able to:

- Illustrate the Fundamental concepts of Computers and basics of computer programming and problem-solving approach
- Understand the Control Structures, branching and looping statements
- Use of Arrays and Pointers in solving complex problems.
- Develop Modular program aspects and Strings fundamentals.
- Demonstrate the ideas of User Defined Data types, files. Solve real world problems using the concept of Structures, Unions and File operations.

UNIT-I Introduction to Computer Problem Solving:

Programs and Algorithms, Computer Problem Solving Requirements, Phases of Problem Solving, Problem. Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

UNIT-II Introduction to C Programming:

Introduction, Structure of a C Program. Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements. Operators, Type Conversion. Control Flow, Relational Expressions: Conditional Branching Statements: if, if-else, if-else—if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, goto statement.

**UNIT-III Arrays:**

Introduction, Operations on Arrays, Arrays as Function Arguments, Two Dimensional Arrays, Multidimensional Arrays. Pointers: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers as Function Arguments, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer, Command Line Arguments.

UNIT-IV Functions:

Introduction Function : Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Variable Storage Classes. Recursion. Strings: String Fundamentals, String Processing with and without Library Functions, Pointers and Strings.

UNIT-V

Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type —Enum variables, Using Typedef keyword, Bit Fields. Data Files: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

Note: The syllabus is designed with C Language as the fundamental language of implementation.

Text Books:

1. A Structured Programming Approach Using C, Forouzan, Gilberg, Cengage.
2. How to solve it by Computer, R. G. Dromey, and Pearson Education.
3. Programming In C A-Practical Approach. Ajay Mittal, Pearson

References:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. Computer Programming. Reema Thareja, Oxford University Press
3. The C Programming Language, Dennis Richie And Brian Kernighan, Pearson Education.

Web References:

1. <http://www.c4learn.com/>
2. <http://www.geeksforgeeks.org/c/>
3. <http://nptel.ac.in/courses/122104019/>
4. <http://www.learn-c.org/>
5. <https://www.tutorialspoint.com/cprogramming/>



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I Year I Semester	COMMUNICATIVE ENGLISH LAB	L	T	P	C
		0	0	2	1

(Common to All Branches of Engineering)

The main objective of introducing this course, *Communicative English Laboratory*, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. (That can be for theory paper) is to train the students in oral communication skills in real situations. Students will get trained in the basic communication skills and also make them ready to face job interviews. They will be helped to overcome the mother tongue/local language influence and neutralize their accent which makes their speech more intelligible to all listeners.

Course Outcomes:

By the end of the course, the students will be have

- Understand the different aspects of the English language oral communication with emphasis on Listening and Speaking S skills.
- Apply communication skills through various language learning activities.
- Analyze the English speech sounds, stress, rhythm and intonation for better listening and speaking comprehension.
- Evaluate and exhibit professionalism in participating in debates and group discussions with polite turn taking strategies and sound more professional while communicating with others
- Create effective resonate and prepare them to face interviews communicate appropriately in corporate settings.

List of Topics:

1. Vowels & Consonants(Not rules but use of them in various syllable structures)
2. Neutralization/Accent Rules(No rules again, required more practice)
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. (This can be part of theory course)Resume Writing, Cover letter, SOP
6. Group Discussions-methods & practice
7. Debates- Methods & Practice
8. PPT Presentations/ Poster Presentation
9. Interviews Skills

Suggested Software:

- Walden InfoTech
- Young India Films

Reference Books:

1. Meenakshi Raman, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.(This can be for theory and not for lab)
2. Samson T : Innovate with English, Foundations
3. Grant Taylor: English Conversation Practice, Tata McGraw-Hill EducationIndia,2016

**DADI INSTITUTE OF ENGINEERING & TECHNOLOGY****AN AUTONOMOUS INSTITUTE****Web Resources:****Spoken English:**

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. <https://www.britishcouncil.in/english/online>
5. <http://www.letstalkpodcast.com/>
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. <https://www.youtube.com/c/ArnelsEverydayEnglish/featured>
8. <https://www.youtube.com/c/engvidAdam/featured>
9. <https://www.youtube.com/c/EnglishClass101/featured>
10. <https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists>
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw
12. <https://www.linguahouse.com/en-GB>
13. <https://www.ted.com/watch/ted-ed>

Voice & Accent:

1. <https://www.youtube.com/user/letstalkaccent/videos>
2. <https://www.youtube.com/c/EngLanguageClub/featured>
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA



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I Year I Semester	ENGINEERING PHYSICS LAB	L	T	P	C
		0	0	2	1

(Common to All Branches of Engineering)

Course Objectives:

To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

Course Outcomes:

The students will be able to

- Operate optical instruments like travelling microscope and spectrometer.
- Estimate the wavelengths of different colours using diffraction grating.
- Plot the intensity of the magnetic field of circular coil carrying current with distance.
- Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively.
- Calculate the band gap of a given semiconductor.
- Identify the type of semiconductor using Hall effect.

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.



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17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.

18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

References:

- A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. ChandPublishers, 2017.

Web Resources

- www.vlab.co.in
- <https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html.prototype>



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I Year I Semester	ENGINEERING WORKSHOP	L	T	P	C
		0	0	2	1

(Common to All branches of Engineering)

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

Course Outcomes:

- Identify workshop tools and their operational capabilities.
- Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.
- Apply fitting operations in various applications.
- Apply basic electrical engineering knowledge for House Wiring Practice

SYLLABUS

1. **Demonstration:** Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
 - a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridlejoint
3. **Sheet Metal Working:** Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
 - a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
 - a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring:** Familiarity with different types of basic electrical circuits and make the following connections.
 - a) Parallel and series b) Two-way switch c) Godown lighting
 - d) Tube light e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop:** Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.



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Textbooks:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, MediaPromoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; AtulPrakashan, 2021-22.



I Year I Semester	IT WORKSHOP	L	T	P	C
		0	0	2	1

(Common to all branches of Engineering)

Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

Course Outcomes:

- Perform Hardware troubleshooting.
- Understand Hardware components and inter dependencies.
- Safeguard computer systems from viruses/worms.
- Document/ Presentation preparation.
- Perform calculations using spreadsheets.

PC Hardware & Software Installation

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva



Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is

no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

Task 3: Creating project abstract Features to be covered:- Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text



Task 2: Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI TOOLS – Chat GPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition



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I Year I Semester	COMPUTER PROGRAMMING LAB	L	T	P	C
		0	0	3	1.5

(Common to All branches of Engineering)

Course Objectives:

The course aims to give students hands – on experience and train them on the concepts of the C- programming language.

Course Outcomes:

- Read, understand, and trace the execution of programs written in C language.
- Select the right control structure for solving the problem.
- Develop C programs which utilize memory efficiently using programming constructs like pointers.
- Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

UNIT I

WEEK -1

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

- i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
- ii) Exposure to Turbo C, gcc
- iii) Writing simple programs using printf(), scanf()

WEEK 2

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab 1: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

- i) Sum and average of 3 numbers
- ii) Conversion of Fahrenheit to Celsius and vice versa
- iii) Simple interest calculation

WEEK 3

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.



Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

- i) Finding the square root of a given number
- ii) Finding compound interest
- iii) Area of a triangle using heron's formulae
- iv) Distance travelled by an object

UNIT II

WEEK 4

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:

Lab4: Simple computational problems using the operator' precedence and associativity

- i) Evaluate the following expressions.
 - a. $A+B*C+(D*E) + F*G$
 - b. $A/B*C-B+A*D/3$
 - c. $A+++B---A$
 - d. $J= (i++) + (++i)$
- ii) Find the maximum of three numbers using conditional operator
- iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5

Objective: Explore the full scope of different variants of -if construct namely if-else, null-else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for -if construct.

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

Lab 5: Problems involving if-then-else structures.

- i) Write a C program to find the max and min of four numbers using if-else.
- ii) Write a C program to generate electricity bill.
- iii) Find the roots of the quadratic equation.
- iv) Write a C program to simulate a calculator using switch case.
- v) Write a C program to find the given year is a leap year or not.

WEEK 6

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each



of these statements is more appropriate to use.

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

Lab 6: Iterative problems e.g., the sum of series

- i) Find the factorial of given number using any loop.
- ii) Find the given number is a prime or not.
- iii) Compute sine and cos series
- iv) Checking a number palindrome
- v) Construct a pyramid of numbers.

UNIT III
WEEK 7:

Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7: 1D Array manipulation, linear search

- i) Find the min and max of a 1-D integer array.
- ii) Perform linear search on 1D array.
- iii) The reverse of a 1D integer array
- iv) Find 2's complement of the given binary number.
- v) Eliminate duplicate elements in an array.

WEEK 8:

Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort

- i) Addition of two matrices
- ii) Multiplication two matrices
- iii) Sort array elements using bubble sort
- iv) Concatenate two strings without built-in functions
- v) Reverse a string using built-in and without built-in string functions

UNIT IV

WEEK 9: Objective: Explore pointers to manage a dynamic array of integers, including memory allocation value initialization, resizing changing and reordering the contents of an array and memory de-allocation



using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

- i) Write a C program to find the sum of a 1D array using malloc()
- ii) Write a C program to find the total, average of n students using structures
- iii) Enter n students data using calloc() and display failed students list
- iv) Read student name and marks from the command line and display the student details along with the total.
- v) Write a C program to implement realloc()

WEEK 10:

Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

Suggested Experiments/Activities:

Tutorial 10: Bitfields, Self-Referential Structures, Linked lists

Lab10 : Bitfields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

- i) Create and display a singly linked list using self-referential structure.
- ii) Demonstrate the differences between structures and unions using a C program.
- iii) Write a C program to shift/rotate using bitfields.
- iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT V

WEEK 11:

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:

Tutorial 11: Functions, call by value, scope and extent,

Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

- i) Write a C function to calculate NCR value.
- ii) Write a C function to find the length of a string.
- iii) Write a C function to transpose of a matrix.
- iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12:

Objective: Explore how recursive solutions can be programmed by writing recursive functions



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that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

- i) Write a recursive function to generate Fibonacci series.
- ii) Write a recursive function to find the lcm of two numbers.
- iii) Write a recursive function to find the factorial of a number.
- iv) Write a C Program to implement Ackermann function using recursion.
- v) Write a recursive function to find the sum of series.

WEEK 13:

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers.

- i) Write a C program to swap two numbers using call by reference.
- ii) Demonstrate Dangling pointer problem using a C program.
- iii) Write a C program to copy one string into another using pointer.
- iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK14:

Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

- i) Write a C program to write and read text into a file.
- ii) Write a C program to write and read text into a binary file using fread() and fwrite()
- iii) Copy the contents of one file to another file.
- iv) Write a C program to merge two files into the third file using command-line arguments.
- v) Find no. of lines, words and characters in a file
- vi) Write a C program to print last n characters of a given file.

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw Hill



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Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE



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I Year I Semester	HEALTH AND WELLNESS, YOGA AND SPORTS	L	T	P	C
		0	0	1	1.5

(Common to All branches of Engineering)

Course Objectives:

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

Course Outcomes: After completion of the course the student will be able to

- Understand the importance of yoga and sports for Physical fitness and sound health.
- Demonstrate an understanding of health-related fitness components.
- Compare and contrast various activities that help enhance their health.
- Assess current personal fitness levels.
- Develop Positive Personality

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

- i) Organizing health awareness programmes in community
- ii) Preparation of health profile
- iii) Preparation of chart for balance diet for all age groups

UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar



UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

- i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
Practicing general and specific warm up, aerobics
- ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.



I Year II Semester	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS	L	T	P	C
		0	0	1	1.5

(Common to All Branches of Engineering)

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them in to advanced level by handling various real-world applications.

Course Outcomes:

At the end of the course, the student will be able to:

- solve the differential equations related to various engineering fields.
- model engineering problems as higher order differential equations and solve analytically.
- identify solution methods for partial differential equations that model physical processes.
- interpret the physical meaning of different operators such as gradient, curl and divergence.
- estimate the work done against a field, circulation and flux using vector calculus.

UNIT- I : Differential equations of first order and first degree

Linear differential equations – Bernoulli’s equations- Exact equations and equations reducible to exact form. Applications: Newton’s Law of cooling – Law of natural growth and decay- Electrical circuits

UNIT – II : Linear differential equations of higher order (Constant Coefficients)

Definitions, homogenous and non-homogenous, complimentary function, general particular integral, Wronskian, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT – III : Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange’s method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT - IV : Vector differentiation

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions - Divergence and Curl, vector identities

UNIT –V : Vector integration

Line integral- circulation- work done, surface integral-flux, Green’s theorem in the plane (without proof), Stoke’s theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.



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Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B.S.Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Books:

1. Dennis G.Zill and Warren S.Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn



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I Year II Semester	CHEMISTRY	L	T	P	C
		3	0	0	3

(Common to EEE, ECE, CSE, IT & allied branches)

Course Objectives:

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches.

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

- Compare the materials of construction for battery and electrochemical sensors.
- Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.
- Explain the principles of spectrometry, slc in separation of solid and liquid mixtures.
- Apply the principle of Band diagrams in the application of conductors and semiconductors.
- Summarize the concepts of Instrumental methods.

UNIT I Structure and Bonding Models:

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2 , particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O₂ and CO, etc. π -molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II Modern Engineering materials

Semiconductors – Introduction, basic concept, application Super conductors-Introduction basic concept, applications. Super capacitors: Introduction, Basic Concept-Classification – Applications. Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphines nano particles.

UNIT III Electrochemistry and Applications

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conduct metric titrations (acid-base titrations).



Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples. Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries Including cell reactions; Fuel cells, hydrogen-oxygenfuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT IV Polymer Chemistry

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA).

UNIT V Instrumental Methods and Applications

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

Textbooks:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
2. J.D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley Publications, Feb.2008
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition



I Year II Semester	ENGINEERING GRAPHICS	L	T	P	C
		1	0	4	3

(Common to All branches of Engineering)

Course Objectives:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

Course Outcomes:

- Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.
- Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
- Understand and draw projection of solids in various positions in first quadrant.
- Explain principles behind development of surfaces.
- Prepare isometric and perspective sections of simple solids.

UNIT I

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involute, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

UNIT II

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes,



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perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT III

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

UNIT IV

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT V

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end examination*).

Textbook:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.



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I Year II Semester	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

(Common to All branches of Engineering)

Course Objectives

To expose to the field of electrical & electronics engineering, laws and principles of electrical/electronic engineering and to acquire fundamental knowledge in the relevant field.

Course Outcomes: After the completion of the course students will be able to

Course Outcomes:

CO1: Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.

CO2: Understand the problem solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.

CO3: Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.

CO4: Analyze different electrical circuits, performance of machines and measuring instruments.

CO5: Evaluate different circuit configurations, Machine performance and Power systems operation.

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I DC & AC Circuits

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).


UNIT II Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

UNIT III Energy Resources, Electricity Bill & Safety Measures

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of –unit used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Textbooks:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhattacharya, Person Publications, 2018, Second Edition.

Web Resources:

1. <https://nptel.ac.in/courses/108105053>
2. <https://nptel.ac.in/courses/108108076>



PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

- To teach the fundamentals of semiconductor devices and its applications, principles of digital electronics.

UNIT I SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT III DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

Textbooks:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.



I Year II Semester	DATA STRUCTURES	L	T	P	C
		3	0	0	3

(Common to CSE, IT & allied branches)

Course Objectives:

- Understand the significance of linear data structures in problem-solving and basic time/space complexity analysis.
- Create and manage linked lists to efficiently organize and manipulate data, emphasizing memory efficiency.
- Implement and apply stacks to manage program flow and solve problems involving expression evaluation and backtracking.
- Utilize queues to model real-world scenarios, such as process scheduling and breadth-first search algorithms and understand the versatility of deques and prioritize data management using priority queues.
- Impart basic understanding of non-linear data structures such as trees.
- Explore basic concepts of hashing and apply it to solve problems requiring fast data retrieval and management.

Course Outcomes:

At the end of the course, Student will be able to

- Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
- Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
- Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
- Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.
- Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees
- Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

UNIT I

Introduction to Linear Data Structures: Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures. **Searching Techniques:** Linear & Binary Search, **Sorting Techniques:** Bubble sort, Selection sort, Insertion Sort



UNIT II

Linked Lists: Singly linked lists, representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

UNIT III

Stacks: Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.

UNIT IV

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc.

Deque: Introduction to deque (double-ended queues), Operations on deque and their applications.

UNIT V

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversals

Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum



I Year II Semester	CHEMISTRY LAB	L	T	P	C
		0	0	2	1

(Common to EEE, ECE, CSE, IT & allied branches)

Course Objectives:

- Verify the fundamental concepts with experiments.

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

CO1: Determine the cell constant and conductance of solutions.

CO2: Prepare advanced polymer Bakelite materials.

CO3: Measure the strength of an acid present in secondary batteries.

CO4: Analyse the IR spectra of some organic compounds.

CO5: Calculate strength of acid in Pb-Acid battery.

List of Experiments:

1. Measurement of $10Dq$ by spectrophotometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

Reference:

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications



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by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar

I Year II Semester	ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP	L	T	P	C
		0	0	3	1.5

(Common to All branches of Engineering)

Course Objectives:

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

Course Outcomes:

CO1: Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.

CO2: Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.

CO3: Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.

CO4: Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.

CO5: Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
 - Provide some exercises so that hardware tools and instruments are learned to be used by the students.

2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
 - Provide some exercises so that measuring instruments are learned to be used by the students.



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3. Components:

- Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
- Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

Reference Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Note: Minimum Six Experiments to be performed

PART B: ELECTRONICS ENGINEERING LAB

Course Objectives:

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

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

CO1: Identify & testing of various electronic components.

CO2: Understand the usage of electronic measuring instruments.

CO3: Plot and discuss the characteristics of various electron devices.



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CO4: Explain the operation of a digital circuit.

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

References:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.



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I Year II Semester	DATA STRUCTURES LAB	L	T	P	C
		0	0	3	1.5

(Common to CSE, IT & allied branches of Engineering)

Course Objectives:

- Understand the significance of linear data structures in problem-solving and basic time/space complexity analysis.
- Create and manage linked lists to efficiently organize and manipulate data, emphasizing memory efficiency.
- Implement and apply stacks to manage program flow and solve problems involving expression evaluation and backtracking.
- Utilize queues to model real-world scenarios, such as process scheduling and breadth-first search algorithms and understand the versatility of deques and prioritize data management using priority queues.
- Impart basic understanding of non-linear data structures such as trees.
- Explore basic concepts of hashing and apply it to solve problems requiring fast data retrieval and management.

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

- Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
- Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
- Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
- Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.
- Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees
- Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

List of Experiments:

Exercise 1: Array Manipulation



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- i) Write a program to reverse an array.
- ii) C Programs to implement the Searching Techniques – Linear & Binary Search
- iii) C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

Exercise 2: Linked List Implementation

- i) Implement a singly linked list and perform insertion and deletion operations.
- ii) Develop a program to reverse a linked list iteratively and recursively.
- iii) Solve problems involving linked list traversal and manipulation.

Exercise 3: Linked List Applications

- i) Create a program to detect and remove duplicates from a linked list.
- ii) Implement a linked list to represent polynomials and perform addition.
- iii) Implement a double-ended queue (deque) with essential operations.

Exercise 4: Double Linked List Implementation

- i) Implement a doubly linked list and perform various operations to understand its properties and applications.
- ii) Implement a circular linked list and perform insertion, deletion, and traversal.

Exercise 5: Stack Operations

- i) Implement a stack using arrays and linked lists.
- ii) Write a program to evaluate a postfix expression using a stack.
- iii) Implement a program to check for balanced parentheses using a stack.

Exercise 6: Queue Operations

- i) Implement a queue using arrays and linked lists.
- ii) Develop a program to simulate a simple printer queue system.
- iii) Solve problems involving circular queues.

Exercise 7: Stack and Queue Applications

- i) Use a stack to evaluate an infix expression and convert it to postfix.
- ii) Create a program to determine whether a given string is a palindrome or not.
- iii) Implement a stack or queue to perform comparison and check for symmetry

Exercise 8: Binary Search Tree

- i) Implementing a BST using Linked List.
- ii) Traversing of BST.

Exercise 9: Hashing

- i) Implement a hash table with collision resolution techniques.
- ii) Write a program to implement a simple cache using hashing.

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft



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3. Algorithms by Robert Sedgewick.

I Year II Semester	NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE	L	T	P	C
		0	0	3	1.5

(Common to All branches of Engineering)

Course Objectives:

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

Course Outcomes: After completion of the course the students will be able to

- CO1:** Understand the importance of discipline, character and service motto.
- CO2:** Solve some societal issues by applying acquired knowledge, facts, and techniques.
- CO3:** Explore human relationships by analyzing social problems.
- CO4:** Determine to extend their help for the fellow beings and downtrodden people.
- CO5:** Develop leadership skills and civic responsibilities.

UNIT I Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, careerguidance.

Activities:

- i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
- ii) Conducting orientations programs for the students –future plans-activities-releasingroad map etc.
- iii) Displaying success stories-motivational biopics- award winning movies on societalissues etc.
- iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II Nature & CareActivities:

- i) Best out of waste competition.
- ii) Poster and signs making competition to spread environmental awareness.
- iii) Recycling and environmental pollution article writing competition.
- iv) Organising Zero-waste day.
- v) Digital Environmental awareness activity via various social media platforms.
- vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
- vii) Write a summary on any book related to environmental issues.

UNIT III Community ServiceActivities:

- i) Conducting One Day Special Camp in a village contacting village-area leaders-Surveyin the village, identification of problems- helping them to solve via media-authorities- experts-etc.
- ii) Conducting awareness programs on Health-related issues such as General Health,Mental health, Spiritual Health, HIV/AIDS,
- iii) Conducting consumer Awareness. Explaining various legal provisions etc.
- iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and

Population Education.

- v) Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., –Introduction to Environmental Engineeringl, McGraw Hill, New York 4/e 2008

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

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DADI INSTITUTE OF ENGINEERING & TECHNOLOGY
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Department of CSE (AI & ML) COURSE STRUCTURE

B.Tech– II Year- I Semester						
S.No.	Category	Title	L	T	P	Credits
1	DR2321T421	Discrete Mathematics & Graph Theory	2	1	0	3
2	DR2321THS1	Universal Human Values – Understanding Harmony & Ethical Human Conduct	2	1	0	3
3	DR2321T422	Principles of Artificial Intelligence	3	0	0	3
4	DR2321T423	Advanced Data Structures & Algorithms Analysis	3	0	0	3
5	DR2321T054	Object-Oriented Programming Through JAVA	3	0	0	3
6	DR2321L425	Advanced Data Structures and Algorithms Lab	0	0	3	1.5
7	DR2321L056	Object-Oriented Programming Through JAVA Lab	0	0	3	1.5
8	DR2321LC42	Python programming	0	1	2	1.5
9	DR2321M1AC	Environmental Science	2	0	0	-
Total			16	3	8	19.5

B. Tech– II Year II Semester						
S.No.	Category	Title	L	T	P	Credits
1	DR2322TMB1	Managerial Economics & Financial Analysis	3	0	0	3
2	DR2322TES2	Probability & Statistics	2	0	0	3
3	DR2322T421	Machine Learning	3	0	0	3
4	DR2322TC51	Database Management Systems	3	0	0	3
5	DR2322TC01	Digital Logic and Computer Organization	2	0	0	2
7	DR2322T422	Machine Learning Lab	0	0	3	1.5
8	DR2322LC51	Database Management Systems Lab	0	0	3	1.5
9	DR2322LCS2	Full Stack development -1	0	1	2	1.5
10	DR2322LC01	Design Thinking & Innovation	1	0	2	2
Total			14	1	10	20.5
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation						

II Year I Semester	DISCRETE MATHEMATICS & GRAPH	L	T	P	C
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	THEORY	3	0	0	3
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Course Objectives:

- To understand mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional, predicate logic, and truth tables.
- To understand about elementary of combinatorics, , the principle of inclusion and exclusion and the pigeonhole principle.
- To expose the students to Binary relations, posets, Hasse diagram, lattice, and discuss various properties of relations.
- To understand Algebraic structures like groups, semi groups , monoids.
- To introduce generating functions and recurrence relations.

Course Outcomes:

Re call the concepts of Mathematical logic and statement & predicate calculus

- Re call the concepts of combinatorics, set theory, posets and lattices
- Re call the concepts of algebraic structures, recurrence relations and generating functions
- Use and interpret the concepts of Mathematical logic and statement & predicate calculus
- Use and interpret the concepts of combinatory, set theory, pose sand lattices
- Use and interpret the concepts of algebraic structures, recurrence relations and generating functions
- Apply the concepts of discreet mathematical structures to computer science and engineering

Unit-I : Mathematical Logic & Statement Calculus **Statements and Connectives:** statements, connectives, compound statements (Formulas), well-formed formulas, truth tables, tautologies, equivalence of formulas, converse, contra positives & inverse of an implication, duality law, tautological implications, Normal forms: Principal disjunctive and conjunctive normal forms; Statement calculus: Validity of an argument using truth tables and rules of inference, consistency of premises, indirect method of proof.

Unit-II : Predicates & Predicate Calculus **Predicate calculus:** Predicates, statement of functions, variables and quantifiers, predicate formulas, free and bound variables, universe of discourse, valid formulas and equivalences involving quantifiers, rules of inference, theory of inference for predicate calculus

Unit-III : Combinatorics, Set Theory, Posets and Lattices

Combinatorics: Principles of counting (product and sum rules), Pigeonhole principle and its applications, Principle of Inclusion-Exclusion and its applications.

Relations: Binary relation, properties, equivalence relation, partition of a set, equivalence classes Partial ordering: Partial order relation, partially ordered set (poset), Chanhassen diagrams, Lattices.

Unit-IV : Algebraic Structures

Algebraic Systems (Structures): Binary operation, algebraic structures such as Semi group, Monoid, Group, commutative group with suitable examples, properties satisfied by the algebraic structures and the elements; Special group structures: Sub group and its criteria, order of an element, Cosets ,index of subgroup ,properties of cosets, order of a group, Lagrange’s theorem

Unit-V : Recurrence Relations & Generating Functions

Recurrence Relations: Formation, iterative method of solving recurrence relations, solving homogeneous and non-homogeneous recurrence relations by characteristic roots method; Generating Functions: Generating functions of sequences, calculation of coefficients of expansions, solving recurrence relations by generating functions

Textbooks:

1. J.P.Tremblay and R.Manohar,DiscreteMathematical Structures with Applications to CSc, TataMcGrawHill,1997
2. S.Santha and EV Prasad,Mathematical FoundationsforComputerScience, CENG AGE Publishers

Reference Books:

1. Kenneth.H.Rosen, Discrete Mathematics and its Applications,6/e,TataMcGraw-Hill,2009.
2. Dr.D S Chandrasekharaiah, Mathematical Foundations of Computer Science ,Prism Book Pvt Ltd.
3. Swapan Kumar Sarkar, Mathematical FoundationofComputerScience,9th Edition,S Chand Publishers.

II Year I Semester	Universal Human Values - Understanding Harmony & Ethical Human Conduct	L	T	P	C
		2	1	0	3

Course Objectives:

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Outcomes:

- By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1- hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher’s Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I: Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself

Lecture 3: self-exploration as the Process for Value Education

Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 Exploring Human Consciousness

Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations

Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II: Harmony in the Human Being (6 lectures and 3 tutorials for practice session)

Lecture 7: Understanding Human being as the Co-existence of the self and the body.

Lecture 8: Distinguishing between the Needs of the self and the body

Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.

Lecture 9: The body as an Instrument of the self

Lecture 10: Understanding Harmony in the self

Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self

Lecture 11: Harmony of the self with the body

Lecture 12: Programme to ensure self-regulation and Health

Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III: Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction

Lecture 14: 'Trust' – the Foundational Value in Relationship

Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust

Lecture 15: 'Respect' – as the Right Evaluation

Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect

Lecture 16: Other Feelings, Justice in Human-to-Human Relationship

Lecture 17: Understanding Harmony in the Society

Lecture 18: Vision for the Universal Human Order

Tutorial 9: Practice Session PS9 Exploring Systems to fulfill Human Goal

UNIT IV :Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)

Lecture 19: Understanding Harmony in the Nature

Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature

Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature

Lecture 21: Realizing Existence as Co-existence at All Levels

Lecture 22: The Holistic Perception of Harmony in Existence

Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)

Lecture 23: Natural Acceptance of Human Values

Lecture 24: Definitiveness of (Ethical) Human Conduct

Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order

Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education

Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession

Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness

PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)

PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

Readings:

Textbook and Teachers Manual

a. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Mode of Conduct:

- Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.
- Tutorial hours are to be used for practice sessions.
- While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
- In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.
- Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf>
2. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf>

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3. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf>
4. <https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%202023.pdf>
5. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf>
6. <https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf>
7. <https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf>
8. <https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385>
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

II Year I Semester	Principles of Artificial Intelligence	L	T	P	C
		3	0	0	3

Pre-requisites:

1. Knowledge in Computer Programming.
2. A course on “Mathematical Foundations of Computer Science”.
3. Background in linear algebra, data structures and algorithms, and probability.

Course Objectives:

1. The student should be made to study the concepts of Artificial Intelligence.
2. The student should be made to learn the methods of solving problems using Artificial Intelligence.
3. The student should be made to introduce the concepts of Expert Systems.
4. To understand the applications of AI, namely game playing, theorem proving, and machine learning.
5. To learn different knowledge representation techniques

UNIT – I : Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT – II: Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT – III: Representation of Knowledge & Reasoning : Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Bayes’ probabilistic interferences and dempstershafer theory. reasoning with defaults, reasoning about knowledge, sample applications.

UNIT – IV: Logic concepts: First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

UNIT – V: Expert Systems & Decision Making: Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells. **Decision-Making:** basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications.

Textbooks:

1. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, Second Edition, Pearson Education.
2. Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill

Reference Books:

1. David Poole, Alan Mackworth, Randy Goebel, “Computational Intelligence: a logical approach”, Oxford University Press.
2. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem solving”, Fourth Edition, Pearson Education.
3. J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers.
4. Artificial Intelligence, Saroj Kaushik, CENGAGE Learning.

Online Learning Resources:

1. <https://ai.google/>
2. https://swayam.gov.in/nd1_noc19_me71/preview

II Year I Semester	Advanced Data Structures & Algorithm Analysis	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to

- provide knowledge on advance data structures frequently used in Computer Science domain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various data structures in the algorithm design

UNIT – I: Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations. AVL Trees – Creation, Insertion, Deletion operations and Applications
B-Trees – Creation, Insertion, Deletion operations and Applications

UNIT – II: Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications
Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications
Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen’s matrix multiplication, Convex Hull

UNIT – III: Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths
Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths – General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem

UNIT – IV: Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem
Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

UNIT – V: NP Hard and NP Complete Problems: Basic Concepts, Cook’s theorem
NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP)
NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

Textbooks:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh 2nd Edition Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran2nd Edition University Press



Reference Books:

1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein&Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures & Programs:, N.Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz Sahni& Mehta, Galgottia Pub.
7. Data structures in Java:, Thomas Standish, Pearson Education Asia

Online Learning Resources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. <http://peterindia.net/Algorithms.html>
3. Abdul Bari,1. [Introduction to Algorithms \(youtube.com\)](#)

II Year I Semester	Object-Oriented Programming through JAVA	L	T	P	C
		3	0	0	3

Course Objectives:

The learning objectives of this course are to:

- Identify Java language components and how they work together in applications
- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java APIs for program development

UNIT I : Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators : Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final,

Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II: Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III : Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV: Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

UNIT V : String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Text Books:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.



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References Books:

1. The complete Reference Java, 11th edition, Herbert Schildt, TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_share_d/overview

II Year I Semester	Advanced Data Structures & Algorithm Analysis Lab	L	T	P	C
		0	0	3	1.5

Course Objectives:

The objectives of the course is to

- Acquire practical skills in constructing and managing Data structures
- Apply the popular algorithm design methods in problem-solving scenarios

Experiments covering the Topics:

- Operations on AVL trees, B-Trees, Heap Trees
- Graph Traversals
- Sorting techniques
- Minimum cost spanning trees
- Shortest path algorithms
- 0/1 Knapsack Problem
- Travelling Salesperson problem
- Optimal Binary Search Trees
- N-Queens Problem
- Job Sequencing

Sample Programs:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations.
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
4. Implement BFT and DFT for given graph, when graph is represented by
 - a) Adjacency Matrix
 - b) Adjacency Lists
5. Write a program for finding the bi-connected components in a given graph.
6. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
7. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
8. Implement Job sequencing with deadlines using Greedy strategy.
9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
10. Implement N-Queens Problem Using Backtracking.
11. Use Backtracking strategy to solve 0/1 Knapsack problem.
12. Implement Travelling Sales Person problem using Branch and Bound approach.

Reference Books:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2nd Edition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2nd Edition, University Press



DADI INSTITUTE OF ENGINEERING & TECHNOLOGY
AN AUTONOMOUS INSTITUTE

3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
4. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill

Online Learning Resources:

1. <http://cse01-iiith.vlabs.ac.in/>
2. <http://peterindia.net/Algorithms.html>

II Year I Semester	Object-Oriented Programming through JAVA Lab	L	T	P	C
		0	0	3	1.5

Course Objectives:

The aim of this course is to

- Practice object oriented programming in the Java programming language
- implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- Illustrate inheritance, Exception handling mechanism, JDBC connectivity
- Construct Threads, Event Handling, implement packages, Java FX GUI

Experiments covering the Topics:

- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

Sample Experiments:

Exercise – 1:

1. Write a JAVA program to display default value of all primitive data type of JAVA
2. Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise - 2

1. Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
2. Write a JAVA program to sort for an element in a given list of elements using bubble sort
3. Write a JAVA program using String Buffer to delete, remove character.

Exercise - 3

1. Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
2. Write a JAVA program implement method overloading.
3. Write a JAVA program to implement constructor.
4. Write a JAVA program to implement constructor overloading.

Exercise – 4

1. Write a JAVA program to implement Single Inheritance
2. Write a JAVA program to implement multi level Inheritance
3. Write a JAVA program for abstract class to find areas of different shapes

Exercise – 5

1. Write a JAVA program give example for “super” keyword.
2. Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
3. Write a JAVA program that implements Runtime polymorphism

Exercise - 6

1. Write a JAVA program that describes exception handling mechanism
2. Write a JAVA program Illustrating Multiple catch clauses
3. Write a JAVA program for creation of Java Built-in Exceptions
4. Write a JAVA program for creation of User Defined Exception

Exercise - 7

1. Write a JAVA program that creates threads by extending Thread class. First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds, (Repeat the same by implementing Runnable)
2. Write a program illustrating **is Alive** and **join ()**
3. Write a Program illustrating Daemon Threads.
4. Write a JAVA program Producer Consumer Problem

Exercise – 8

1. Write a JAVA program that import and use the user defined packages
2. Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX)
3. Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

Exercise – 9

1. Write a java program that connects to a database using JDBC
2. Write a java program to connect to a database using JDBC and insert values into it.
3. Write a java program to connect to a database using JDBC and delete values from it

II Year I Semester	Python Programming (Skill Enhancement Course)	L	T	P	C
		0	1	2	2

Course Objectives:

The main objectives of the course are to

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

UNIT-I: History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif...else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
 - i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT-II: Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.

- i. Addition ii. Insertion iii. slicing

12. Write a program to perform any 5 built-in functions by taking any list.

UNIT-III: Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
14. Write a program to count the number of vowels in a string (No control flow allowed).
15. Write a program to check if a given key exists in a dictionary or not.
16. Write a program to add a new key-value pair to an existing dictionary.
17. Write a program to sum all the items in a given dictionary.

UNIT-IV:Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V: Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas. Matplotlib for Python plotting, Seaborn for Statical plots, interactive Dynamic visualizations, SciKit for Machine learning.

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
 - a) Apply head () function to the pandas data frame
 - b) Perform various data selection operations on Data Frame
30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Reference Books:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1. <https://www.coursera.org/learn/python-for-applied-data-science-ai>
2. <https://www.coursera.org/learn/python?specialization=python#syllabus>

II Year I Semester	ENVIRONMENTAL SCIENCE	L	T	P	C
		2	0	0	-

Course Objectives:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

UNIT I: Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT II: Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem.
- b. Grassland ecosystem
- c. Desert ecosystem.
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III: Environmental Pollution: Definition, Cause, effects and control measures of :

- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT IV: Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies: Wasteland reclamation

Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V : Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Textbooks:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

References:

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

II Year II Semester	Managerial Economics & Financial Analysis	L	T	P	C
		2	0	0	2

Course Objectives:

- To inculcate the basic knowledge of microeconomics and financial accounting
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

Course Outcomes:

- Define the concepts related to Managerial Economics, financial accounting and management(L2)
- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2)
- Apply the Concept of Production cost and revenues for effective Business decision (L3)
- Analyze how to invest their capital and maximize returns (L4)
- Evaluate the capital budgeting techniques. (L5)
- Develop the accounting statements and evaluate the financial performance of business entity (L5)

UNIT – I: Managerial Economics

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

UNIT – II: Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination– Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

UNIT – III: Business Organizations and Markets

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition– Oligopoly-Price-Output Determination - Pricing Methods and Strategies

UNIT – IV: Capital Budgeting

Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

UNIT – V: Financial Accounting and Analysis

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

Reference Books:

1. Ahuja HI Managerial economics Schand.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

Online Learning Resources:

<https://www.slideshare.net/123ps/managerial-economics-ppt>
<https://www.slideshare.net/rossanz/production-and-cost-45827016>
<https://www.slideshare.net/darkyla/business-organizations-19917607>
<https://www.slideshare.net/balarajbl/market-and-classification-of-market>
<https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396>
<https://www.slideshare.net/ashu1983/financial-accounting>

II Year II Semester	PROBABILITY & STATISTICS	L	T	P	C
		3	0	0	3

(Common to CSE, CSE (AI &ML), CSE(IoT), CSE(AI), AI &ML, CS, IT)

Course Outcomes:

After successful completion of this course, the students should be able to:

- Acquire knowledge in finding the analysis of the data quantitatively or categorically and various statistical elementary tools
- Develop skills in designing mathematical models involving probability, random variables and the critical thinking in the theory of probability and its applications in real life problems.
- Apply the theoretical probability distributions like binomial, Poisson, and Normal in the relevant application areas.
- Analyze to test various hypotheses included in theory and types of errors for large samples.
- Apply the different testing tools like t-test, F-test, chi-square test to analyze the relevant real-life problems

UNIT I: Descriptive statistics

Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Measures of Central tendency, Measures of Variability (spread or variance) Skewness, Kurtosis, correlation, correlation coefficient, rank correlation, regression coefficients, method of least squares, regression lines.

UNIT II: Probability

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye’s theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

UNIT III : Probability distributions

Probability distributions: Binomial, Poisson and Normal-their properties (Chebyshevs inequality). Approximation of the binomial distribution to normal distribution.

UNIT IV: Estimation and Testing of hypothesis, large sample tests

Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems of fit.

UNIT V: Small sample tests Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), χ^2 - test for goodness of fit, χ^2 - test for independence of attributes.

Textbooks:

1. Miller and Friends, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

Reference Books:

1. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education. Scientists, 8th Edition, Pearson 2007.
2. S. Ross, a First Course in Probability, Pearson Education India, 2002.
3. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968

Online Learning Resources:

https://onlinecourses.nptel.ac.in/noc21_ma74/preview

https://onlinecourses.nptel.ac.in/noc22_mg31/preview

II Year II Semester	Machine Learning	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of the course is to

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

UNIT-I: Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT-II: Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures, K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT-III: Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.

The Bayes Classifier: Introduction to the Bayes Classifier, Bayes’ Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)

UNIT-IV: Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Backpropagation for Training an MLP.

UNIT-V: Clustering : Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering

Text Books:

1. “Machine Learning Theory and Practice”, M N Murthy, V S Ananthanarayana, Universities Press (India), 2024

Reference Books:

1. “Machine Learning”, Tom M. Mitchell, McGraw-Hill Publication, 2017
2. “Machine Learning in Action”, Peter Harrington, DreamTech
3. “Introduction to Data Mining”, Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th

II Year II Semester	Database Management Systems	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

UNIT I:Introduction:Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

Unit II: Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL:Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT III: SQL:Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

UNIT IV: Schema Refinement (Normalization):Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependencyLossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V:Transaction Concept:Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Text Books:

- 1) Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
- 2) Database System Concepts, 5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

Reference Books:

1. Introduction to Database Systems, 8th edition, C J Date, Pearson.
2. Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:

1. <https://nptel.ac.in/courses/106/105/106105175/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview

II Year II Semester	Digital Logic & Computer Organization	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to

- provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals
- Describe memory hierarchy concepts
- Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices

UNIT – I:

Data Representation: Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, components, Signed binary numbers, Binary codes

Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers

UNIT – II:

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von- Neumann Architecture

UNIT – III:

Computer Arithmetic : Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multi programmed Control

UNIT – IV:

The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage

UNIT – V:

Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces

Textbooks:

1. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 6th edition, McGraw Hill, 2023.
2. Digital Design, 6th Edition, M. Morris Mano, Pearson Education, 2018.
3. Computer Organization and Architecture, William Stallings, 11th Edition, Pearson, 2022.

Reference Books:

1. Computer Systems Architecture, M.Moris Mano, 3rd Edition, Pearson, 2017.
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier, 2004.
3. Fundamentals of Logic Design, Roth, 5th Edition, Thomson, 2003.

Online Learning Resources:

<https://nptel.ac.in/courses/106/103/106103068/>

II Year II Semester	Machine Learning Lab	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To learn about computing central tendency measures and Data preprocessing techniques
- To learn about classification and regression algorithms
- To apply different clustering algorithms for a problem.

Software Required: Python/R/Weka

Lab should cover the concepts studied in the course work, sample list of Experiments:

1. Compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation.
2. Apply the following Pre-processing techniques for a given dataset.
 - a. Attribute selection
 - b. Handling Missing Values
 - c. Discretization
 - d. Elimination of Outliers
3. Apply KNN algorithm for classification and regression
4. Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results
5. Demonstrate decision tree algorithm for a regression problem
6. Apply Random Forest algorithm for classification and regression
7. Demonstrate Naïve Bayes Classification algorithm.
8. Apply Support Vector algorithm for classification
9. Demonstrate simple linear regression algorithm for a regression problem
10. Apply Logistic regression algorithm for a classification problem
11. Demonstrate Multi-layer Perceptron algorithm for a classification problem
12. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.
13. Demonstrate the use of Fuzzy C-Means Clustering
14. Demonstrate the use of Expectation Maximization based clustering algorithm

II Year II Semester	Database Management Systems Lab	L	T	P	C
		0	0	3	1.5

Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers,

Experiments covering the topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers,
- Database connectivity- ODBC/JDBC

Sample Experiments:

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5.
 - i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
 - ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.
8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.

10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12. Create a table and perform the search operation on table using indexing and non-indexing techniques.
13. Write a Java program that connects to a database using JDBC
14. Write a Java program to connect to a database using JDBC and insert values into it
15. Write a Java program to connect to a database using JDBC and delete values from it

Text Books/Suggested Reading:

1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

II Year II Semester	Full Stack Development – 1 (Skill Enhancement Course)	L	T	P	C
		0	1	2	2

Course Objectives:

The main objectives of the course are to

4. Make use of HTML elements and their attributes for designing static web pages
5. Build a web page by applying appropriate CSS styles to HTML elements
6. Experiment with JavaScript to develop dynamic web pages and validate forms

Experiments covering the Topics:

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events
- Node.js

Sample Experiments:

1. Lists, Links and Images

- a. Write a HTML program, to explain the working of lists.
Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.
- b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.
- c. Create a HTML document that has your image and your friend’s image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.
- d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

2. HTML Tables, Forms and Frames

- Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)
- Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
- Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).
- Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame image, second frame □ paragraph, third frame □ hyperlink. And also make sure of using “no frame” attribute such that frames to be fixed)

3. HTML 5 and Cascading Style Sheets, Types of CSS

- Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, <div>, tags.
- Write a HTML program, to embed audio and video into HTML web page.
- Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms

- Write a program to apply different types of selector forms
 - Simple selector (element, id, class, group, universal)
 - Combinator selector (descendant, child, adjacent sibling, general sibling)
 - Pseudo-class selector
 - Pseudo-element selector
 - Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model

- Write a program to demonstrate the various ways you can reference a color in CSS.
- Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
- Write a program using the following terms related to CSS font and text:
 - font-size
 - font-weight
 - font-style
 - text-decoration
 - text-transformation
 - text-alignment
- Write a program, to explain the importance of CSS Box model using
 - Content
 - Border
 - Margin
 - padding

6. Applying JavaScript - internal and external, I/O, Type Conversion

- Write a program to embed internal and external JavaScript in a web page.
- Write a program to explain the different ways for displaying output.
- Write a program to explain the different ways for taking input.
- Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

7. JavaScript Pre-defined and User-defined Objects

- Write a program using document object properties and methods.
- Write a program using window object properties and methods.
- Write a program using array object properties and methods.
- Write a program using math object properties and methods.
- Write a program using string object properties and methods.
- Write a program using regex object properties and methods.
- Write a program using date object properties and methods.
- Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. JavaScript Conditional Statements and Loops

- Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".
- Write a program to display week days using switch case.
- Write a program to print 1 to 10 numbers using for, while and do while loops.

- e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e., $1^3 + 5^3 + 3^3 = 153$]
- f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's)

9. Javascript Functions and Events

- a. Design a appropriate function should be called to display
 - Factorial of that number
 - Fibonacci series up to that number
 - Prime numbers up to that number
 - Is it palindrome or not
- b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
 8. Factorial of that number
 9. Fibonacci series up to that number
 10. Prime numbers up to that number
 11. Is it palindrome or not
- c. Write a program to validate the following fields in a registration page
 - i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
 - ii. Mobile (only numbers and length 10 digits)
 - iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

Text Books:

1. Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson, 2013.
2. Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.

Web Links:

1. <https://www.w3schools.com/html>
2. <https://www.w3schools.com/css>
3. <https://www.w3schools.com/js/>
4. <https://www.w3schools.com/nodejs>
5. <https://www.w3schools.com/typescript>

II Year II Semester	DESIGN THINKING & INNOVATION	L	T	P	C
		1	0	2	2

Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes:

- Define the concepts related to design thinking. (L1, L2)
- Explain the fundamentals of Design Thinking and innovation (L1, L2)
- Apply the design thinking techniques for solving problems in various sectors. (L3)
- Analyse to work in a multidisciplinary environment (L4)
- Evaluate the value of creativity (L5)
- Formulate specific problem statements of real time issues (L3, L6)

UNIT I: Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT II: Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT III: Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT IV: Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT V: Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes.

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown, Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell, Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough.H, The Era of Open Innovation – 2013

Online Learning Resources:

<https://nptel.ac.in/courses/110/106/110106124/>

<https://nptel.ac.in/courses/109/104/109104109/>

https://swayam.gov.in/ndl_noc19_mg60/preview

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Department of CSE (AI & ML) COURSE STRUCTURE

B.Tech–III Year- I Semester

S.No	Category	Subject Code	Title	L	T	P	Credits
1	PC	DR231CM5T01	Information Retrieval Systems	3	0	0	3
2	PC	DR231CM5T02	Computer Networks	3	0	0	3
3	PC	DR231CM5T03	Deep Learning with Applications	3	0	0	3
4	PE-I	DR231CM5E11	1. Software Engineering	3	0	0	3
		DR231CM5E12	2. Digital Twin				
		DR231CM5E13	3. Mobile Edge Computing				
		DR231CM5E14	4. Optimization Techniques				
		DR231CM5E15	5. Any of 12 Week Course Swayam /NPTEL Course suggested by BOS				
5	OE-I		Open elective offered by other department	3	0	0	3
6	PC	DR231CM5L01	Information Retrieval & Deep Learning Lab	0	0	3	1.5
7	PC	DR231CM5L02	Computer Networks Lab	0	0	3	1.5
8	SEC	DR231CM5S01	Nodes JS	0	1	2	2
9	ES	DR231ES5L01	Tinkering Lab	0	0	2	1
10	Evaluation of Community Service Internship			-	-	-	2
Total				15	1	10	23

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B.Tech–III Year II Semester

S.No	Category	Subject Code	Title	L	T	P	Credits
1	PC	DR231CM6T01	Operating System	3	0	0	3
2	PC	DR231CM6T02	Automata Theory & Compiler Design	3	0	0	3
3	PC	DR231CM6T03	Computer Vision	3	0	0	3
4	PE-II	DR231CM6E21	1. Software Testing Methodology	3	0	0	3
		DR231CM6E22	2. Cryptography & Network Security				
		DR231CM6E23	3. Internet of Things				
		DR231CM6E24	4. Recommender Systems				
		DR231CM6E16	5. 12-Week SWAYAM /NPTEL Course suggested by the BoS				
5	PE-III	DR231CM6E31	1. Software Project Management	3	0	0	3
		DR231CM6E32	2. Ethical AI				
		DR231CM6E33	3. Data Visualization				
		DR231CM6E34	4. Soft computing				
		DR231CM6E17	5. 12-Week SWAYAM /NPTEL Course suggested by the BoS				
6	OE-II		Open elective offered by other department	3	0	0	3
7	PC	DR231CM6L01	Computer Vision Lab	0	0	3	1.5
8	PC	DR231CM6L02	Operating System lab	0	0	3	1.5
9	SEC	DR231CM6S01	Soft Skills	0	1	2	2
10	AC	DR231CM6A01	Technical Paper Writing & IPR	2	0	0	-
Total				20	1	06	23
Mandatory Industry Internship of 08 weeks duration during summer vacation							

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B.Tech–IV Year I Semester

S.No	Category	Subject Code	Title	L	T	P	Credits
1	PC	DR231CM7TO1	Natural Language Programming	3	0	0	3
2	MC-II		1.Management Science 2.Human resource Management 3.Entrepreneurship &Incubation	2	0	0	2
3	PE-IV	DR231CM7E41	1. Federated Learning	3	0	0	3
		DR231CM7E42	2. NoSQL databases				
		DR231CM7E43	3. Quantum Computing				
		DR231CM7E44	4. Computational Neuroscience				
		DR231CM7E18	5. 12-Week SWAYAM /NPTEL Course suggested by the BoS				
4	PE-V	DR231CM7E51	1. Model Evaluation & Selection	3	0	0	3
		DR231CM7E52	2. Big Data Analytics				
		DR231CM7E53	3. Reinforcement Learning				
		DR231CM7E54	4. High-Performance Computing				
		DR231CM7E19	5. 12-Week SWAYAM /NPTEL Course suggested by the BoS				
5	OE-III		Open elective offered by other department	3	0	0	3
6	OE-IV		Open elective offered by other department	3	0	0	3
7	SEC	DR231CM7S01	Prompt Engineering	0	1	2	2
8	AC	DR231CM7A01	Gender Sensitization	2	0	0	-
9	Internship	DR231CM7P01	Evaluation of Industry Internship	-	-	-	2
Total				19	1	02	21

B.Tech–IV Year II Semester

S.No	Category	Subject Code	Title	L	T	P	Credits
1	Internship & Project Work	DR231CM8P01	Full semester Internship & Project Work	0	0	24	12

OPEN ELECTIVES OFFERED BY CSE (AI & ML) TO OTHER BRANCHES

OPEN ELECTIVE -I	OPEN ELECTIVE -II
<ul style="list-style-type: none">1. Fundamentals of Data Science (DR 231CD5001)2. Exploratory Data Analysis with Python (DR 231CD5002)3. Internet of Things (DR 231CD5003)	<ul style="list-style-type: none">1. Fundamentals of Data Base Management System (DR 231CD6001)2. Data Wrangling and Pre-processing (DR 231CD6002)3. Social Media Analytics (DR 231CD6003)
OPEN ELECTIVE -III	OPEN ELECTIVE -IV
<ul style="list-style-type: none">1. Introduction to Artificial Intelligence (DR 231CD7001)2. Data science applications (DR 231CD7002)3. Java Programming (DR 231CD7003)	<ul style="list-style-type: none">1. Introduction to Machine Learning (DR 231CD7004)2. Block Chain Technologies (DR 231CD7005)3. AI Chabot (DR 231CD7006)

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III Year I Semester	INFORMATION RETRIEVAL SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

1. Implement text indexing and retrieval systems for efficient information access.
2. Evaluate the performance of information retrieval systems using key metrics.
3. Analyse and preprocess textual and semi-structured datasets for meaningful insights.
4. Apply text similarity measures for effective comparison and clustering of documents.
5. Understand the principles of search engines and implement text classification models.

Course Outcomes:

1. Understand the fundamentals of text retrieval systems, including Boolean retrieval and index construction.
2. Gain knowledge of retrieval models like Vector Space Model, TF-IDF, and the evaluation metrics in information retrieval.
3. Learn techniques for query expansion, feedback, and reformulation in information retrieval systems.
4. Understand probabilistic models, including statistical language models and Okapi/BM25, for efficient text retrieval.
5. Apply text classification and clustering algorithms, such as Naive Bayes, K-means, and DBSCAN, for text analysis tasks.

Unit- I: Overview of text retrieval systems, Boolean retrieval, the term vocabulary and postings list, Dictionaries and tolerant retrieval, Index construction and compression

Unit-II: Retrieval models and implementation: Vector Space Models, Vector Space Model, TF-IDF Weight, Evaluation in information retrieval

Unit-III: Query expansion and feedback, Relevance feedback, pseudo relevance feedback, Query Reformulation

Unit-IV: Probabilistic models; statistical language models, Okapi/BM25; Language models, KL-divergence, Smoothing.

Unit-5: Text classification & Text clustering, The text classification problem, Naive Bayes text classification, k- nearest neighbors, Support vector Machine, Feature Selection, Vector-space clustering; K-means algorithm, Hierarchical clustering, DBSCAN algorithm, PAM and PAMK EM algorithm Development, Application Structure, Application Process management.

Text Books:

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, Introduction to Information Retrieval, Cambridge University Press. 2008. <http://nlp.stanford.edu/IR-book/informationretrieval-book.html>
2. ChengXiang Zhai, Statistical Language Models for Information Retrieval (Synthesis Lectures Series on Human Language Technologies), Morgan & Claypool Publishers, 2008.



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IT R20 Course Structure & Syllabus

E-Link:

1. <http://www.morganclaypool.com/doi/abs/10.2200/S00158ED1V01Y200811HLT001>

Reference Books:

1. Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theory and Implementation, Springer, 2004.
2. Soumen Chakrabarti, Mining the Web : Discovering Knowledge from Hypertext Data, Morgan – Kaufmann Publishers, 2002.
3. Christopher D Manning, Prabhakar Raghavan, Hinrich Schutze, An Introduction to Information Retrieval By Cambridge University Press, England, 2009

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III Year I Semester	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To educate basic knowledge of networking technologies and network management concepts
2. To interpret the layering concepts in computer networks.
3. To analyze the functions of each layer and gain knowledge in different applications that use computer networks.
4. To emphasize the hand-on experience of network topology in a laboratory environment
5. To be familiar with contemporary issues in networking technologies

COURSE OUTCOMES:

1. Understand various network topologies and compare OSI and TCP/IP reference models.
2. Learn about physical layer transmission media, multiplexing techniques, and switching methods.
3. Master data link layer protocols, including error control, flow control, and HDLC.
4. Understand random and controlled access techniques, including CSMA, FDMA, TDMA, and CDMA.
5. Explore transport and application layer protocols such as TCP/UDP, congestion control, and HTTP.

UNIT – I: Introduction:

Network Topologies WAN, LAN, MAN. Reference models-The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models Examples of Networks: Novell Networks, Arpanet, Internet.

UNIT – II: Physical Layer and overview of Physical Layer Switching:

Transmission Modes-Transmission media (Guided and Unguided Media). Multiplexing: frequency division multiplexing, wave length division multiplexing, synchronous time division multiplexing, statistical time division multiplexing, introduction to switching: Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks

UNIT-III: Data link layer: Design issues: Framing, Flow control, Error control, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, Elementary Data Link Layer protocols: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel. Sliding window protocol: One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC: configuration and transfer modes, frames, control field.

UNIT-IV: Random Access: ALOHA, MAC addresses, Carrier sense multiple access (CSMA), CSMA /CD, CSMA/CA, Controlled Access: Reservation, Polling, Token Passing, Channelization: frequency division multiple access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA).

Network Layer: IP Addresses – Ipv4&IPv6 – Internetworking, Routing algorithm shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing. IEEE Standards: – Standard Ethernet: MAC sub layer, physical layer, Fast Ethernet: MAC sub layer, physical layer, IEEE-802.11: Architecture, MAC sub layer, addressing mechanism, frame structure.

UNIT-V: Transport Layer & Application Layer: Process to Process Delivery -User Datagram - Protocol (UDP) - Transmission Control Protocol (TCP) - Congestion Control- Quality of services (QOS) - Integrated Services - Domain Name Space (DNS) - FTP – HTTP- WWW & HTTP.



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TEXT BOOKS:

1. Tanenbaum and David J Wetherall, Computer Networks, 5th Edition, Pearson Edu, 2010
2. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw Hill Education

REFERENCE BOOKS:

1. Larry L. Peterson and Bruce S. Davie, "Computer Networks - A Systems Approach" (5th edition)
2. Computer Networks, Mayank Dave, CENGAGE Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

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III Year I Semester	Deep Learning with Applications	L	T	P	C
		3	0	0	3

Course Objectives:

1. To acquire knowledge on the basics of neural networks.
2. To implement neural networks using computational tools for variety of problems.
3. To explore various deep learning algorithms.

Course Outcomes:

Students will be able to:

1. Develop algorithms simulating human brain.
2. Implement Neural Networks in Tensor Flow for solving problems.
3. Explore the essentials of Deep Learning and Deep Network architectures.
4. Define, train and use a Deep Neural Network for solving real world problems that require artificial Intelligence based solutions.

Unit1: Introduction to Deep Learning, Bayesian Learning, Decision Surfaces
 Linear Classifiers, Linear Machines with Hinge Loss, Optimization Techniques, Gradient Descent, Batch Optimization

Unit2: Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning

Unit 3: Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization

Unit 4: Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN etc. Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection etc.

Unit 5: LSTM Networks, Generative Modelling with DL, Variational Autoencoder, Generative Adversarial Network Revisiting Gradient Descent

Text Books:

- 1) " Deep Learning (Adaptive Computation and Machine Learning series", Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2017.
- 2) Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.
- 3) "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", Nikhil Buduma, Nicholas Locascio, O'Reilly Media, 2017.

Reference Books:

- 1) Deep learning from first principle, 2nd edition, tinniam v Ganesh, 2018
- 2) Introduction to Deep Learning , 1st edition, by Eugene charniak, The MIT Press, 2019

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III Year I Semester	Professional Elective-I 1. Software Engineering	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on the

1. To understand the software life cycle models.
2. To understand the software requirements and SRS document.
3. To understand the importance of modeling and modelling languages.
4. To design and develop correct and robust software products.

Course Outcomes:

1. 2. Define and develop a software project from requirement gathering to implementation.
2. Obtain knowledge about principles and practices of software engineering.
3. Focus on the fundamentals of modeling a software project.
4. . Obtain basic knowledge of coding
5. . Obtain knowledge about estimation maintenance and reuse of software systems.

UNIT – I:

Software and Software Engineering: The Nature of Software, The Unique Nature of Web Apps, Software Engineering, Software Process, Software Engineering Practice, Software Myths.

Process Models: A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Terminology, Product and Process.

UNIT - II:

Requirements Analysis And Specification: Requirements Gathering and Analysis, Software Requirement Specification (SRS), Formal System Specification.

Software Design: Overview of the Design Process, How to Characterize of a Design, Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design

UNIT – III:

Function-Oriented Software Design: Overview of SA/SD Methodology, Structured Analysis, Developing the DFD Model of a System, Structured Design, Detailed Design, Design Review, over view of Object Oriented design.

User Interface Design: Characteristics of Good User Interface, Basic Concepts, Types of User Interfaces, Fundamentals of Component-based GUI Development, A User Interface Design Methodology.

UNIT - IV:

Coding And Testing: Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tool, Integration Testing, Testing Object-Oriented Programs, System Testing, Some General Issues Associated with Testing

UNIT - V:

Software Reliability And Quality Management: Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model.

Software Maintenance: Software maintenance, Maintenance Process Models, Maintenance Cost, Software Configuration Management.



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Software Reuse: what can be reused? Why almost No Reuse So Far? Basic Issues in Reuse Approach, Reuse at Organization Level

Text Books:

1. Software engineering A practitioner's Approach, Roger S. Pressman, Seventh Edition McGrawHillInternationalEdition.
2. Fundamentals of Software Engineering, Rajib Mall, Third Edition,PHI.
3. Software Engineering, Ian Sommerville, Ninth edition, Pearsoneducation

References:

1. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill,2008
2. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
3. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
4. Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition,2006.

Web References:

<https://nptel.ac.in/courses/106/105/106105182/>

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III Year I Semester	Professional Elective-I 2. Digital Twin	L	T	P	C
		3	0	0	3

Course Objectives:

1. To introduce the concept of Digital Twin and its significance in modern engineering and technology.
2. To understand the architecture and components of Digital Twin systems.
3. To explore the role of sensors, IoT, AI, and data analytics in enabling Digital Twins.
4. To examine real-world applications of Digital Twins across industries such as manufacturing, healthcare, and smart cities.
5. To develop skills in designing and implementing basic Digital Twin models using simulation tools and platforms.

Course Outcomes:

1. Understand the fundamental principles and architecture of Digital Twin systems.
2. Apply enabling technologies like IoT, AI, and cloud computing in developing Digital Twin models.
3. Design and simulate real-world systems using Digital Twin modeling techniques.
4. Analyze and visualize real-time data for decision-making using machine learning and visualization tools.
5. Evaluate and apply Digital Twin technologies across various industrial domains through case studies.

UNIT I: Introduction to Digital Twin: Introduction to the concept of Digital Twin – Evolution, definitions, and relevance in the context of Industry 4.0. Types of Digital Twins – Product Twin, Process Twin, and System Twin. Overview of components: physical entity, digital representation, and data connection. Role of sensors, data acquisition, and IoT in enabling Digital Twins. Benefits and challenges in Digital Twin implementation.

UNIT II: Digital Twin Architecture and Technologies: Core architecture of Digital Twin systems. Enabling technologies – Internet of Things (IoT), Cloud Computing, Edge Computing, Artificial Intelligence (AI), and Machine Learning (ML). Communication protocols and middleware platforms. Data integration from heterogeneous sources. Synchronization between physical and virtual entities.

UNIT III: Modeling and Simulation in Digital Twin: System modeling techniques – CAD models, physics-based models, and data-driven models. Simulation frameworks and tools. Real-time monitoring and predictive analytics. Feedback loops and control systems. Integration with simulation software (ANSYS, MATLAB/Simulink, etc.). Model calibration and validation.

UNIT IV: Data Analytics and Visualization: Role of Big Data and real-time data analytics in Digital Twins. Data storage, preprocessing, and analysis techniques. Application of machine learning algorithms for fault prediction, anomaly detection, and optimization. Visualization tools and dashboards. Augmented Reality (AR) and Virtual Reality (VR) integration.

UNIT V: Applications and Case Studies: Application of Digital Twin in manufacturing, predictive maintenance, healthcare systems, energy sector, automotive, aerospace, and smart cities. Case studies on Siemens, GE Digital, and Microsoft Azure Digital Twins. Emerging trends, standards, and future directions. Ethical considerations and cybersecurity in Digital Twin environments.

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TEXT BOOKS:

1. Grieves, M., & Vickers, J. (2017). Digital Twin: Mitigating Unpredictable, Undesirable Emergent Behavior in Complex Systems. Springer.
2. Rajiv Pandey, et al. (2021). Digital Twin Technology: Concepts and Applications. CRC Press.
3. Manoj Kumar Tiwari & Nilesh N. (2020). Digital Twin Development and Deployment on the Cloud: Developing Cloud-Friendly Dynamic Models using Simulink/Simscape. Academic Press.

REFERENCE BOOKS:

1. Parlikad, A.K., et al. (2022). Digital Twins for Smart Cities. Institution of Engineering and Technology.
2. Peters, S. (2021). The Digital Twin: Bringing Industry 4.0 to Life. McGraw Hill.
3. Boschert, S., & Rosen, R. (2021). Digital Twin – Fundamental Concepts to Applications. Springer.

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III Year I Semester	Professional Elective-I 3. Mobile Edge Computing	L	T	P	C
		3	0	0	3

Course Objectives

1. Understand the evolution and fundamentals of Mobile Edge Computing (MEC).
2. Explore the architecture, components, and deployment models of MEC systems.
3. Analyze the integration of AI/ML techniques within edge environments.
4. Examine real-world applications of MEC across various domains like IoT, AR/VR, and smart cities.
5. Identify security, privacy, and performance challenges in MEC systems and explore emerging trends.

COURSE OUTCOMES:

After completing this course, students will be able to:

1. Explain the key concepts and architecture of Mobile Edge Computing.
2. Design and evaluate MEC systems and their integration with AI/ML technologies.
3. Implement edge-based AI models for real-time data processing.
4. Analyze and propose MEC solutions for domain-specific problems (e.g., healthcare, autonomous systems).
5. Assess security, scalability, and future directions of MEC in AI-driven ecosystems.

UNIT I – Introduction to Mobile Edge Computing

Evolution from Cloud Computing to Edge Computing, Definition and Architecture of MEC, Characteristics and Benefits of MEC, MEC vs Mobile Cloud Computing, Role of 5G in MEC, MEC Use Cases Overview, Edge Nodes, Edge Data Centers, and Deployment Models

UNIT II – MEC Architecture and Components

MEC Reference Architecture (ETSI), Components: Edge Server, Orchestrator, User Equipment, Communication Protocols (REST, MQTT, CoAP), Integration with IoT, Cloud, and 5G, Virtualization and Containerization at the Edge (Docker, Kubernetes)

UNIT III – AI/ML in Mobile Edge Computing

Role of AI/ML at the Edge, Inference vs Training in Edge Environments, Use of TinyML, ONNX, TensorFlow Lite, Edge TPU

Case Studies: Real-time object detection at the edge, Predictive maintenance in smart factories, Personalized content delivery using edge AI

UNIT IV – Applications and Use Cases

Smart Cities and Edge Analytics, Augmented/Virtual Reality (AR/VR) over MEC, Edge-based Autonomous Vehicles, Industrial IoT (IIoT) with MEC, Healthcare and Remote Patient Monitoring, MEC for Video Analytics and Surveillance

UNIT V – Security, Challenges, and Future Trends

Security & Privacy Challenges in MEC, Trust Models and Data Protection at the Edge, Network Slicing & QoS in 5G Edge Networks, Standardization (ETSI, 3GPP), Emerging Trends: Edge Federations, Serverless Edge, AI Ops at Edge, Research Directions & Career Opportunities



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TEXTBOOKS BOOKS:

1. **"Mobile Edge Computing: Principles and Applications"** Yan Zhang, Mehdi Bennis, Mário Costa Springer.
2. **"Edge Computing: A Primer"**, Jie Cao, Quan Zhang, Weisong Shi, Springer Briefs in Computer Science
3. **"Multi-Access Edge Computing in Action"**, ETSI (European Telecommunications Standards Institute)

REFERENCE BOOKS:

1. **"Edge AI: Convergence of Edge Computing and Artificial Intelligence"**, Xiaofei Wang, Yi Pan, Springer
Focuses on deploying AI models at the edge—ideal for AI & ML integration in MEC.
2. **"Architecting the Internet of Things"**, Dieter Uckelmann, Mark Harrison, Florian Michahelles, Springer

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III Year I Semester	Professional Elective-I 4. Optimization Techniques	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
- To state single variable and multi variable optimization problems, without and with constraints.
- To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
- To state transportation and assignment problem as a linear programming problem to determine Simplex method.
- To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.

COURSE OUTCOMES:

At the end of the course, student will be able to

1. State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.
2. Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.
3. Apply and Solve transportation and assignment problem by using Linear programming Simplex method.
4. Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions
5. Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.

UNIT I:

Introduction and Classical Optimization Techniques: Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems.

Classical Optimization Techniques: Single variable Optimization, multi variable Optimization without constraints, necessary and sufficient conditions for minimum/maximum, multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers, multivariable Optimization with inequality constraints, Kuhn – Tucker conditions

UNIT II: Linear Programming: Standard form of a linear programming problem, geometry of linear programming problems, definitions and theorems, solution of a system of linear simultaneous equations, pivotal reduction of a general system of equations, motivation to the simplex method, simplex algorithm, Duality in Linear Programming, Dual Simplex method.

UNIT III: Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel’s approximation method, testing for optimality of balanced transportation problems, Special cases in transportation problem.

UNIT IV: Nonlinear Programming: Unconstrained cases, One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method, Univariate method, Powell’s method and steepest descent method.



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Constrained cases– Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods, Introduction to convex Programming Problem.

UNIT V: Dynamic Programming: Dynamic programming multistage decision processes, types, concept of sub optimization and the principle of optimality, computational procedure in dynamic programming, examples illustrating the calculus method of solution, examples illustrating the tabular method of solution.

TEXT BOOKS:

1. “Engineering optimization: Theory and practice”, S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. “Introductory Operations Research”, H.S. Kasene & K.D. Kumar, Springer (India), Pvt. LTd.

REFERENCE BOOKS:

1. “Optimization Methods in Operations Research and systems Analysis”, by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Operations Research, Dr. S.D.Sharma, Kedarnath, Ramnath & Co

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III Year I Semester	Information Retrieval & Deep Learning Lab	L	T	P	C
		0	0	3	1.5

Software Required :

Python 3.7+, Jupyter Notebook, TensorFlow, Keras, PyTorch, Scikit-learn, NLTK, NumPy, Pandas, Matplotlib, Seaborn, Google Colab (optional), Anaconda (optional).

LIST OF EXPERIMENTS

1. Implement a simple document retrieval system using Boolean retrieval. Pre-process documents to create a term vocabulary and postings list.
2. Implement an inverted index with basic compression techniques (e.g., delta encoding, variable byte encoding).
3. Apply smoothing techniques like Laplace or Jelinek-Mercer smoothing to improve the performance of language models.
4. Implement a Naive Bayes classifier to classify documents into predefined categories.
5. Implement K-Nearest Neighbors (KNN) for document classification based on feature vectors.
6. Implement K-Means clustering to group similar documents into clusters based on their feature vectors.
7. Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.
8. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset
9. Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset.
10. Design a neural network for predicting house prices using Boston Housing Price dataset.
11. Build a Convolution Neural Network for MNIST Hand written Digit Classification.
12. Build a Convolution Neural Network for simple image (dogs and Cats) Classification
13. Implement a Recurrent Neural Network for IMDB movie review classification problem.

TEXT BOOKS:

1. "Introduction to Information Retrieval" by Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, Cambridge University Press, 2008.
2. "Statistical Language Models for Information Retrieval" by ChengXiang Zhai, Morgan & Claypool Publishers, 2008.
3. Reza Zadeh and Bharath Ramsundar, "Tensorflow for Deep Learning", O'Reilly publishers, 2018

REFERENCE BOOKS:

1. "Information Storage and Retrieval Systems: Theory and Implementation" by Gerald J. Kowalski, Mark T. Maybury, Springer, 2004.
2. "Mining the Web: Discovering Knowledge from Hypertext Data" by Soumen Chakrabarti, Morgan Kaufmann Publishers, 2002.
3. "An Introduction to Information Retrieval" by Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, Cambridge University Press, 2009.

LINK:

<https://github.com/fchollet/deep-learning-with-python-notebooks>

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III Year I Semester	Computer Networks Lab	L	T	P	C
		0	0	3	1.5

Course Objectives:

1. Understand and implement data link layer framing techniques, including character and bit stuffing.
2. Develop client-server applications and protocols using C programming for network communication.
3. Explore error-detection methods by implementing CRC (Cyclic Redundancy Check) polynomials.
4. Apply and implement graph algorithms such as Dijkstra's algorithm for routing and pathfinding.
5. Simulate and understand routing protocols such as Distance Vector Routing and OSPF in network systems.

Course Outcomes:

1. Apply data link layer framing methods like character and bit stuffing to handle data transmission efficiently.
2. Develop and test a DNS client-server application to resolve domain names using C programming.
3. Implement and evaluate CRC-12, CRC-16, and CRC-CCIP for error detection on datasets of characters.
4. Implement Dijkstra's algorithm to compute the shortest path in a graph and understand routing protocols.
5. Simulate and calculate routing tables using distance vector routing and broadcast tree creation for network subnets.

LIST OF EXPERIMENTS

- 1) Implement the data link layer framing methods such as character stuffing and bit stuffing.
- 2) Write a program to develop a DNS client server to resolve the given hostname.
- 3) Implement on a data set of characters the three CRC polynomials – CRC-12, CRC-16 and CRC-CCIP.
- 4) Implement Dijkstra's algorithm to compute the Shortest path in a graph.
- 5) Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm
- 6) Take an example subnet of hosts. Obtain broadcast tree for it.
- 7) Write a client-server application for chat using UDP
- 8) Implement programs using raw sockets (like packet capturing and filtering)
- 9) Write a program to perform sliding window protocol.
- 10) Get the MAC or Physical address of the system using Address Resolution Protocol.
- 11) Simulate the Implementing Routing Protocols using border gateway protocol(BGP)
- 12) Simulate the OPEN SHORTEST PATH FIRST routing protocol based on the cost assigned to the path.

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III Year I Semester	Nodes JS (Skill Enhancement Course)	L	T	P	C
		0	1	2	2

Course Objectives:

- To understand the Node's Web Server Development.
- To understand npm and NodeJS Modules.
- To create NodeJS applications using Express.JS.
- To deploy NodeJS applications.

Course Outcomes:

- Understand the Node's unique approach to asynchronous development.
- Understand the Node Package Manager (npm) and Modules.
- Implement NodeJS applications with the Express frame work and Connect Middleware.
- Learning-depth practices for debugging and testing NodeJS applications.

Deploy NodeJS applications in the cloud or on your own system

Unit I : Node JS – Introduction, What is Node JS? Advantages of Node JS, Traditional Web Server Model, Node. Js Process Model. **Setup Dev Environment:** Install Node.json Windows/Linux, Working in REPL, Node JS Console.

Unit II : Node JS Modules: Functions, Buffer, Module, Module Types, Core Modules, Local Modules, Module. Exports, Node Package Manager: What is NPM? Installing Packages Locally. Adding the dependency in package.json, installing packages globally, Updating packages. Web server: Creating web server, Handling HTTP requests, Sending requests

Unit III : File System: Synchronous vs Asynchronous, Open a File, Get File Information, Writing a File, Reading a File, Closing a File, Delete a File, Other IO Operations. **Callbacks:** What is Callback? Blocking Code Example, Non-Blocking Code. **Events:** Event Emitter Class, Methods, Events, Returning event emitter, Inhering events.

Unit IV : Express.JS: Configuring routes, Working with express, **Serving Static Resources:** Serving static files, Working with middleware. **Debugging Node JS Application:** Core Node JS debugger. Debugging with Visual Studio.

Unit V : Database Connectivity: Introduction to MongoDB, Connecting Node.Js to Database, Connection string, Configuring, working with the select command, updating records, deleting records, Creating Rest APIs..



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TEXT BOOKS:

1. NodeJS Book: Learning Node by Shelley Powers, O'Reilly, second edition, May 2016.
2. Learning Node.js Development: Learn the fundamentals of Node.js, and deploy and test Node.js applications on the web By Andrew Mead, Packet, first edition, January 2018.

REFERENCE BOOKS:

1. Mastering Node.js: Build robust and callable real-time server-side web applications efficiently, Second Edition, Packet

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III Year I Semester	Tinkering Lab	L	T	P	C
		0	0	2	1

Course Objective

1. A small unique idea can be become big changer when it gets the suitable platform and transformed into a product or re-define existing products with better enhancement.
2. This lab provides a platform to seed, fertilize and encourage the spirit of curiosity and innovation among young minds. It is a work place where students can give shape to their ideas.

Course Outcome:

In the tinkering lab, students able to

- Apply prior knowledge to develop and conceptualize scientific methods and engineering techniques.
- Analyze real-world problems through self-directed exploration and iterative experimentation.
- Design and develop technical experiments or prototypes with available financial and mentoring support.
- *Evaluate and refine self-initiated projects by learning from failures, feedback, and performance metrics.*
- Create innovative, application-oriented solutions by integrating technical skills, creativity, and exploratory learning.

List of Sample Projects:

- Face Recognition Door lock System
- Hand gesture recognition
- Text to speech
- Smart City
- Private chat room
- Android app controlled robot icarm
- Smart Traffic System
- Vehicle Accident Alarm System
- Smart dustbin
- Surveillance BOT
- Automatic Water Gardening System
- e-Mirror
- Smart Parking System
- Service Bot
- Drone Surveillance
- Wall painting robot
- Home automation
- Automated wheelchair
- Any Innovative Idea–Real Time application



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Expectations from the Lab:

- Workshop on empathy, ideation, and identifying real-world problems.
- Understanding the basic logics with interaction as teams.
- Working Hand-on using present tools available
- Students form teams, plan their mini project and starts working with the help of the mentor
- Students do Hands-on building, troubleshooting, testing
- Finalize, document, and prepare for demonstration

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III Year II Semester	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

1. Understand the fundamental principles of the operating system, its services and functionalities.
2. Illustrate the concepts of processes, inter-process communication, synchronization and scheduling.
3. Understand different types of memory management viz. virtual memory, paging and segmentation.
4. Identify the reasons for deadlock and understand the techniques for deadlock detection, prevention and recovery.
5. Understand the need of protection and security mechanisms in computer systems.

Course Outcomes

1. Describe the structure of operating system and basic architectural components involved in operating system design.
2. Understand the objectives and functions of modern operating systems.
3. Analyze and design the applications to run in parallel either using process or thread models of different operating system.
4. Understand and analyze implementation of virtual memory.
5. Describe the mutual exclusion, deadlock detection in operating system.

UNIT I: OPERATING SYSTEMS OBJECTIVES AND FUNCTIONS:

Computer system architecture, operating systems structure, operating systems operations; Evolution of operating systems: Simple batch, multi programmed, time shared, personal computer, parallel distributed systems, real time systems, special purpose systems, operating system services, user operating systems interface; Systems calls: Types of systems calls, system programs, protection and security, operating system design and implementation.

UNIT II: PROCESS CONCEPTS:

The process, process state, process control block, threads; Process scheduling: Scheduling queues, schedulers, context switch, pre-emptive scheduling, dispatcher, scheduling criteria, scheduling algorithms, multiple processor scheduling; Real time scheduling; Thread scheduling; Case studies Linux windows; Process synchronization, the critical section problem; Peterson's solution, synchronization hardware, semaphores and classic problems of synchronization, monitors.

UNIT III: SYSTEM MODEL:

Deadlock characterization, methods of handling deadlocks, deadlock prevention, dead lock avoidance, dead lock detection and recovery form deadlock system protection, goals of protection.

UNIT IV: LOGICAL AND PHYSICAL ADDRESS SPACE:

Swapping, contiguous memory allocation, paging, structure of page table. Segmentation: Segmentation with paging, virtual memory, demand paging; Performance of demand paging: Page replacement, page replacement algorithms, allocation of frames, thrashing.

UNIT V: FILE SYSTEM IMPLEMENTATION AND DISK SCHEDULING:

The concept of a file, access methods, directory structure, file system mounting, file sharing, protection, file system structure, file system implementation, allocation methods, free space management, directory implementation, efficiency and performance; Overview of mass storage structure: Disk structure, disk attachment, disk scheduling, disk management, swap space management; Dynamic memory allocation: Basic concepts.



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TEXT BOOK:

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 9th Edition, John Wiley and Sons Inc., 2012.
2. William Stallings, Operating Systems: Internals and Design Principles, 8th edition Pearson Education Limited, 2014 ISBN: 1292061944, 9781292061948
3. Operating Systems-S Halder, Alex A Aravind Pearson Education Second Edition 2016 .

REFERENCE BOOKS:

1. D.M Dhamdhare: Operating systems –A concept-based Approach, 3rd Edition, Tata McGrawHill,2012.
2. P.C.P. Bhatt: Introduction to Operating Systems Concepts and Practice, 3rd Edition, PHI, 2010.
3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 2011.

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III Year II Semester	Automata Theory & Compiler Design	L	T	P	C
		3	0	0	3

Course Objectives:

- Automata and compiler Design mainly deal with the languages which are formal and regular and also deals with grammar present in the machine.
- A compiler is a program that accepts a program in source language and converts into a machine understandable format.
- The push down automata is the major one it's a five-tuple set containing states, alphabets, transition function and accept states.

Course Outcomes:

1. Graduate should be able to understand the concept of abstract machines and their power to recognize the languages.
2. Attains the knowledge of language classes & grammars relationship among them with the help of chomsky hierarchy.
3. Ability to understand the design of a compiler given features of the languages.

UNIT - I:

Formal Language and Regular Expressions: Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, Lex tools.

Context Free grammars and parsing: Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL (1) parsing

UNIT - II:

Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification. **Semantics:** Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements.

UNIT - III:

Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.

UNIT - IV:

Run time storage: Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation.

Code optimization: Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.

UNIT - V:

Code generation: Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.



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TEXT BOOKS:

1. Introduction to Theory of computation. Sipser, 2nd Edition, Thomson.
2. Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.

REFERENCES:

1. Modern Compiler Construction in C, Andrew W. Appel Cambridge University Press.
2. Compiler Construction, LOUDEN, Thomson.
3. Elements of Compiler Design, A. Meduna, Auerbach Publications, Taylor and Francis Group.
4. Principles of Compiler Design, V. Raghavan, TMH.
5. Engineering a Compiler, K. D. Cooper, L. Torczon, ELSEVIER.

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III Year II Semester	COMPUTER VISION	L	T	P	C
		3	0	0	3

Course Objective:

To Recognize and describe both the theoretical and practical aspects of computing with images and to Connect issues from Computer Vision to Human Vision

Course Outcomes:

1. Provide an introduction to computer vision including fundamentals of image formation
2. Enumerate the concepts of Feature detection and Matching
3. Discuss about Image Segmentation Techniques
4. Discuss applications of Feature based alignment like pose estimation
5. Discuss different recognition techniques.

UNIT-I

Introduction: What is computer vision, A brief history, Image Formation, Geometric primitives and transformations, Photometric image formation, The digital camera.

UNIT-II

Feature detection and matching: Points and patches, Feature detectors, Feature descriptors, Feature matching, Feature tracking, Application: Performance-driven animation, Edges, Application: Edge editing and enhancement, Lines, Application: Rectangle detection.

UNIT-III

Segmentation: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods, Application: Medical image segmentation.

UNIT-IV

Feature-based alignment: 2D and 3D feature-based alignment, Pose estimation, Geometric intrinsic calibration, Calibration patterns, Vanishing points, Application: Single view metrology, Rotational motion, Radial distortion.

UNIT-V

Recognition: Object detection, Face detection, Pedestrian detection, Face recognition, Eigenfaces, Active appearance and 3D shape models, Application: Personal photo collections, Instance recognition, Category recognition, Context and scene understanding.

Text Books:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010.
2. Rafael C. Gonzalez "Digital Image Processing", Pearson Education; Fourth edition (2018)

Reference Books:

1. Forsyth /Ponce, "Computer Vision: A Modern Approach", Pearson Education India; 2nd edition (2015)
2. S.Nagabhushana, "Computer Vision and Image Processing", New Age International Pvt Ltd; First edition (2005)

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III Year II Semester	Professional Elective-II 1. Software Testing Methodology	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on the

1. Describe the principles and procedures for designing testcases.
2. Provide supports to debugging methods.
3. Acts as the reference for software testing techniques and strategies.

Course Outcomes:

The students should be able to:

1. Define Software testing terminology and methodology
2. Discuss and classify various testing techniques for conducting different types of software testing
3. Apply different software testing techniques.
4. Construct test cases by understanding test suite management and software quality management.
5. Demonstrate modern software testing tools and testing of Object-Oriented Software and Webbased software

UNIT-I:

Introduction: Purpose of Testing, Dichotomies, Model for Testing, Consequences of Bugs, Taxonomy of Bugs. FLOW GRAPHS AND PATH TESTING: Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing.

UNIT-II:

Transaction Flows Testing: Transaction Flows, Transaction Flow Testing Techniques. Dataflow Testing: Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing. Domain Testing: Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interfaces Testing, Domain and Interface Testing, Domains and Testability.

UNIT-III:

Paths, Path Products and Regular Expressions:

Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection.

Syntax Testing: Why, What and How, A Grammar for formats, Test Case Generation, Implementation and Application and Testability Tips.

Based Testing: Overview, Decision Tables, Path Expressions, KV Charts, and Specifications.

UNIT-IV:

State, State Graphs And Transition Testing: State Graphs, Good & Bad State Graphs, State Testing, and Testability Tips.

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm.

UNIT-V:

Software Testing Tools: Introduction to Testing, Automated Testing, Concepts of Test Automation, Introduction to list of tools like Win Runner, Load Runner, Jmeter, Selenium. About Win Runner, Using Win runner, Mapping the GUI, Recording Test, Working with Test, Enhancing Test, Checkpoints, Test Script Language, putting it all together, Running and Debugging Tests, Analyzing Results, Batch Tests, Rapid Test Script Wizard.

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TEXT BOOKS:

1. Software testing techniques – Boris Beizer, Dreamtech, second edition.
2. Software Testing- Yogesh Singh, Cambridge

REFERENCES:

1. The Craft of software testing - Brian Marick, Pearson Education.
2. Software Testing, 3rd edition, P.C. Jorgensen, Aurbach Publications (Dist.by SPD).
3. Software Testing, N.Chauhan, Oxford University Press.
4. Introduction to Software Testing, P.Ammann & J. Offutt, Cambridge Univ. Press.
5. Effective methods of Software Testing, Perry, John Wiley, 2nd Edition, 1999.
6. Software Testing Concepts and Tools, P.Nageswara Rao, dreamtech Press
7. Win Runner in simple steps by Hakeem Shittu, Genixpress, 2007.
8. Foundations of Software Testing, D.Graham & Others, Cengage Learning.

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III Year II Semester	Professional Elective-II 2. Cryptography & Network Security	L	T	P	C
		3	0	0	3

Course Objectives:

In this course, the following principles and practice of cryptography and network security are covered:

1. Classical systems, symmetric block ciphers (DES, AES, other contemporary symmetric ciphers)
2. Public-key cryptosystems (RSA, El Gamal, and ECC),
3. Algorithms for factoring and discrete logarithms, cryptographic protocols, hash functions, authentication, keymanagement, key exchange, signature schemes.
4. The fundamental aspects of Email and web security, viruses, firewalls, cyberlaws, and other topics are discussed

Course Outcomes (COs):

1. To be familiar with information security awareness and a clear understanding of its importance.
2. To master fundamentals of secret-key and public-key cryptographic systems.
3. To master protocols that provide security and authentication services.
4. To be familiar with network security threats and countermeasures.
5. To be familiar with different types of cyber-crimes and cyberlaws.

UNIT-I: Introduction and Mathematical Background

Security Goals, Attacks, Services and Mechanisms, Model for Network Security, Cryptography and Cryptanalysis, Symmetric vs. Asymmetric Ciphers, Substitution vs. Transposition Ciphers, Stream vs. Block ciphers. Number Theory: Primes, Coprimes, Primality Test, GCD (Euclid's algorithm), Groups and Fields, Discrete Logarithmic Problem. Modular Arithmetic: Basics, Congruence, Fermat's little theorem, Euler's theorem, Computing Inverse, Chinese Remainder Theorem

UNIT-II: Symmetric Ciphers

Classic Ciphers, Confusion, and Diffusion, Feistel Structure, DES, Modes of operation, Triple DES, IDEA, Blowfish, AES

UNIT-III: Public Key Cryptography

RSA(algorithm, performance, and attacks), Diffie Hellman Key Exchange, El Gamal (encryption and signatures), Elliptic Curve Cryptography (Elliptic Curves, encryption, key exchange, and signatures)

UNIT-IV: Key Management and Authentication

Cryptographic Hash, Message Authentication Codes, Digital Signatures, X.509 certificates, PKI, One Way Authentication, Mutual Authentication, Centralised Authentication, Kerberos

UNIT-V: Network Security and Malware

IPsec (Transport vs. Tunnel, AH, ESP, Security Associations, IKE), SSL, Firewalls and Intrusion Detection Systems, DoS and DDoS, Buffer Overflow, Format Sting Vulnerabilities, The IT Act 2000: Aim and Objectives, Scope, Offences and Punishments



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TEXTBOOKS:

1. Cryptography and Network Security: Principles and Practice, Sixth Edition, William Stallings, Pearson, 7th edition.
2. Cryptography and Network Security, Third Edition, Behrouz A Forouzan, Debdeep Mukhopadhyay, Mc Graw Hill.
3. Cryptography, Network Security and Cyber Laws, Bernard L. Menezes, Ravinder Kumar, Cengage.

REFERENCES BOOKS:

1. Introduction to Computer Networks & Cyber Security, Chwan Hwa Wu, J. David Irwin, CRCpress.
2. Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, Wiley Dreamtech.
3. Everyday Cryptography, Fundamental Principles & Applications, Keith Martin, Oxford.

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III Year II Semester	Professional Elective-II 3. Internet of Things	L	T	P	C
		3	0	0	3

Course Objectives:

- Learns about various types of sensors, actuators and different network protocols.
- Construction of wireless sensor networks and communication using different connectivity technologies
- To Know about how m2M communication performs and communication between user and the device
- Learns about how data is handled generated by IOT application how IoT is used for industrial purpose , able to builds viors IoT applications

Course Outcomes (COs):

After completion of course, students would be able to:

1. Design recommendation system for a particular application domain.
2. Evaluate recommender systems on the basis of metrics such as accuracy, rank accuracy, diversity, product coverage, and serendipity

UNIT- I: Introduction to IOT:Sensing: Sensors, Transducers, Sensor Classes and sensor types. Actuation: Actuator, Actuator Types: Hydraulic Actuators, Pneumatic Actuators, Electric Actuators, Thermal or Magnetic Actuators, Mechanical Actuators, Soft Actuators.

Basic of Networking: IoT Components, IoT Categories, N/w Protocols: MQTT(Message Queue Telemetry Transport), CoAP(Constrained Application Protocol), XMPP(Extensible Messaging and Presence Protocol), AMQP(Advanced Message Queuing Protocol).

UNIT- II: Communication protocols: Zigbee, 6LoWPAN, Z-Wave, NFC,RFID, IEEE 802.15.4.

Sensor Networks: Wireless Sensor Networks (WSNs), Sensor Nodes, Basic Components Sensor Node, Challenges, Node Behavior in WSNs, Applications of WSNs, Types of sensor networks: Static WSN's and Dynmaic WSN's.

UNIT- III: Machine to Machine communication: Introduction, M2M Overview, M2M Applications, M2M Features, M2M Node Types

Interoperability in IOT: Definition, Types of Interoperability: UserInteroperability, Device Interoperability

IoT Platforms: Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

UNIT- IV:

Introduction to Python programming, Introduction to Raspberry Pi:

Specifications, Basic Architecture, Raspberry Pi OS Setup,

Implementation of IoT with Raspberry Pi.

Software-Defined Networking: Overview of Current Network, Current Network to SDN, SD Architecture, Basic Concepts of SDN, Components/Attributes of SDN, Challenges

Platforms for data collection and storage:

Cloud Computing:Characteristics, Components of Cloud Computing, Service Models, Deployment Models and sensor clouds: Introduction, Actors in Sensor-cloud, Architecture, and Work Flow of Sensor-Cloud. Introduction to fog computing.



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UNIT- V:

Introduction to IOE: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II, Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories Group recommender systems.

TEXT BOOKS:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
3. Internet of Things, A. Bahgya and V. Madisetti, Univesity Press, 2015

REFERENCE BOOKS:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
2. Getting Started with the Internet of Things CunoPfister , Oreilly
3. Industry 4.0: The Industrial Internet of Things”, by Alasdair Gilchrist (Apress)
4. “Industrial Internet of Things: Cybermanufacturing Systems “by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer)

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III Year II Semester	Professional Elective-II 4. Recommender Systems	L	T	P	C
		3	0	0	3

Course Objectives:

1. To learn techniques for making recommendations, including non-personalized, content-based, and collaborative filtering
2. To automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations

Course Outcomes:

After completion of course, students would be able to:

1. Design recommendation system for a particular application domain.
2. Evaluate recommender systems on the basis of metrics such as accuracy, rank accuracy, diversity, product coverage, and serendipity

Unit 1:

Introduction: Overview of Information Retrieval, Retrieval Models, Search and Filtering Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

Unit 2:

Content-based Filtering: High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, pre-processing and feature extraction, Obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Unit 3:

Collaborative Filtering: User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems.

Unit 4:

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies

Unit 5:

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations. Types of Recommender Systems: Recommender systems in personalized web search, knowledge-based recommender system, Social tagging recommender systems, Trust-centric recommendations, Group recommender systems.



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TEXT BOOKS:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: AnIntroduction, Cambridge University Press (2011), 1sted.
2. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer (2016), 1sted.

REFERENCES:

1. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender SystemsHandbook, Springer(2011), 1sted.
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer

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III Year II Semester	Professional Elective-III 1. Software Project Management	L	T	P	C
		3	0	0	3

Course Objective:

The objectives of this course is to acquire knowledge on the

1. To study how to plan and manage projects at each stage of the software development life cycle(SDLC)
2. To train software project managers and other individuals involved in software project planning and tracking and oversight in the implementation of the software project management process.
3. To understand successful software projects that support organization's strategic goals.

Course Outcomes:

At the end of this course, the student will be able to

1. Estimate overall cost of a software project.
2. Explain software development process.
3. Distinguish workflows of process.
4. Design project organization structure & analyze quality.
5. Estimate effort and schedule needed for project.

UNIT-I:

Conventional Software Management: The Waterfall Model, Conventional Software Management Performance.

Evolution Of Software Economics: Software Economics, Pragmatic Software Cost Estimation.

Improving Software Economics: Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation through Software Economics.

UNIT-II:

The Old Way and the New: The Principles of Conventional Software Engineering, The Principles of Modern Software Management, Transitioning to an Iterative Process.

Life Cycle Phases: Engineering and Production Stages, Inception Phase, Elaboration Phase, Construction Phase, Transition Phase.

UNIT-III:

Model Based Software Architectures: A Management Perspective, A Technical Perspective.

Workflows of the Process: Software Process Workflows, Iteration Workflows.

Iterative Process Planning: Work Breakdown Structures, Planning Guidelines, The Cost and Schedule Estimating Process, The Iteration Planning Process.

UNIT-IV:

Project Organization and Responsibilities: Line-Of-Business Organizations, Project Organizations, Evolution of Organizations. **Project Control and Process Instrumentation:** The Seven Core Metrics, Management Indicators, Quality Indicators Modern Project Profiles. The COCOMO Cost Estimation Model:

UNIT-V:

Effort Estimation and Scheduling: Effort Estimation, Scheduling.

Quality Planning: Quality Concepts, Quantitative Quality Management Planning. **RISK MANAGEMENT:** Risk Assessment, Risk Control.



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Text Books:

1. Walker Royce, "Software Project Management – A Unified Framework", 1st Edition, Pearson Education, 2002.
2. Pankaj Jalote, "Software Project Management in Practice", 1st Edition, Pearson Education, 2005.
3. Software Project Management, Bob Hughes & Mike Cotterell, TATA McGraw-Hill.

References:

1. Bob Hughes, "Mike Cotterell, Rajib Mall, Software Project Management", 5th Edition, McGraw-Hill Higher Education, 2011.
2. Joel Henry, "Software Project Management", 1st Edition, Pearson Education, 2006.
3. Norman E. Fenton, Shari Lawrence Pfleeger, "Software Metrics: A Rigorous and Practical Approach", 1st Edition, PWS Publishing Company, 1997

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III Year II Semester	Professional Elective-III 2. Ethical AI	L	T	P	C
		3	0	0	3

Course Objectives:

1. To introduce the core concepts of ethics and moral reasoning relevant to Artificial Intelligence.
2. To explore the ethical challenges in the design, development, and deployment of AI systems.
3. To familiarize students with fairness, accountability, transparency, and privacy issues in AI.
4. To study legal, societal, and philosophical implications of AI across different domains.
5. To enable students to critically assess AI systems using ethical frameworks and case studies.

Course Outcomes:

After successful completion of the course, the student will be able to:

1. Understand key ethical theories and their application to artificial intelligence systems.
2. Identify and address bias, fairness, and discrimination in AI algorithms and datasets.
3. Analyze AI systems for transparency, explainability, and accountability.
4. Evaluate privacy concerns and regulatory frameworks relevant to AI deployment.
5. Critically assess the societal implications of AI and develop ethically responsible AI solutions.

UNIT I: Introduction to Ethics and AI:

Overview of ethics – types of ethics: descriptive, normative, applied. Relevance of ethics in AI systems. Understanding moral agency in artificial systems. Foundations of machine ethics. Importance of responsible AI. Introduction to professional codes of conduct and IEEE/EU ethical AI guidelines.

UNIT II: Fairness, Bias, and Discrimination:

Understanding algorithmic bias and its societal impact. Sources of bias – data, model, and usage. Fairness metrics and approaches. Case studies on biased AI systems (e.g., facial recognition, credit scoring). Strategies to mitigate discrimination in AI applications. Inclusive and equitable AI design.

UNIT III: Transparency, Explainability, and Accountability:

Black-box nature of AI models. Importance of explainability in AI decisions. Techniques for interpretability (e.g., LIME, SHAP). Concepts of accountability and responsibility in AI errors. AI auditing frameworks. Legal accountability and liability of AI-driven decisions.

UNIT IV: Privacy, Surveillance, and Consent:

Data privacy principles and AI implications. Informed consent in AI applications. Ethical concerns in surveillance systems, facial recognition, and biometric data use. Privacy-preserving AI – federated learning, differential privacy. General Data Protection Regulation (GDPR) and other global standards.

UNIT V: Societal Impacts and Future of Ethical AI:

Autonomous systems – ethical issues in self-driving cars, military drones, and robotics. Employment and economic disruption due to AI. Misinformation and deepfakes. AI and human rights. Global perspectives on AI ethics. Future challenges – general AI and superintelligence. Designing for trust in AI systems.



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TEXT BOOKS:

1. Markus D. Dubber, Frank Pasquale, Sunit Das (2020). *The Oxford Handbook of Ethics of AI*. Oxford University Press.
2. Virginia Dignum (2019). *Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way*. Springer.
3. Wendell Wallach and Colin Allen (2008). *Moral Machines: Teaching Robots Right from Wrong*. Oxford University Press.

REFERENCE BOOKS:

1. Cathy O'Neil (2016). *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy*. Crown Publishing.
2. Nick Bostrom and Eliezer Yudkowsky (2014). *The Ethics of Artificial Intelligence*. Cambridge Handbook of Artificial Intelligence.
3. Luciano Floridi (2013). *The Ethics of Information*. Oxford University Press.

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III Year II Semester	Professional Elective-III 3. Data Visualization	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. This course is all about data visualization, the art and science of turning data into readable graphics. Will explore how to design and create data visualizations based on data available and tasks to be achieved.
2. This process includes data modeling, data processing (such as aggregation and filtering), mapping data attributes to graphical attributes, and strategic visual encoding based on known properties of visual perception as well as the task(s) at hand.
3. Students will also learn to evaluate the effectiveness of visualization designs, and think critically about each design decision, such as choice of color and choice of visual encoding.
4. Students will create their own data visualizations, and learn to use Open Source data visualization tools, especially D3.js.
5. Students will also read papers from the current and past visualization literature and create video presentations of their findings.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

1. Understand basics of Data Visualization
2. Implement visualization of distributions
3. Write programs on visualization of time series, proportions & associations
4. Apply visualization on Trends and uncertainty
5. Explain principles of proportions

Unit 1: INTRODUCTION TO VISUALIZATION

Visualizing Data-Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes- Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Color Scales-Color as a Tool to Distinguish, Color to Represent Data Values, Color as a Tool to Highlight, Directory of Visualizations- Amounts, Distributions, Proportions, x–y relationships, Geospatial Data

UNIT 2: VISUALIZING DISTRIBUTIONS

Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heatmaps, Visualizing Distributions: Histograms and Density Plots- Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots-Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile Quantile Plots, Visualizing Many Distributions at Once-Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis

UNIT 3: VISUALIZING ASSOCIATIONS & TIME SERIES

Visualizing Proportions-A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total, Visualizing Nested Proportions- Nested Proportions Gone Wrong, Mosaic Plots and Treemaps, Nested Pies, Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatterplots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an Independent Variable-Individual Time Series, Multiple Time Series and Dose-Response Curves, Time Series of Two or More Response Variable

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UNIT 4: VISUALIZING UNCERTAINTY

Visualizing Trends-Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series Decomposition, Visualizing Geospatial Data-Projections, Layers, Choropleth Mapping, Cartograms, Visualizing Uncertainty-Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Visualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plots

UNIT 5: PRINCIPLE OF PROPORTIONAL INK

The Principle of Proportional Ink-Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations, Handling Overlapping Points-Partial Transparency and Jittering, 2D Histograms, Contour Lines, Common Pitfalls of Color Use- Encoding Too Much or Irrelevant Information, Using Nonmonotonic Color Scales to Encode Data Values, Not Designing for Color-Vision Deficiency

TEXTBOOKS

1. Claus Wilke, "Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures," 1st edition, O'Reilly Media Inc, 2019.

REFERENCE BOOKS

1. Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization, O'Reilly, 2016
2. Ossama Embarak, Data Analysis, and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems, Apress, 2018

EBOOKS

1. <https://www.netquest.com/hubfs/docs/ebook-data-visualization-EN.pdf>

MOOC

2. <https://www.coursera.org/learn/data-visualization>
3. <https://www.coursera.org/learn/python-for-data-visualization#syllabus>

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III Year II Semester	Professional Elective-III 4. Soft Computing	L	T	P	C
		3	0	0	3

Course Objectives:

This course will cover fundamental concepts used in Soft computing:

- The concepts of Fuzzy logic (FL) will be covered first, followed by Artificial Neural Networks (ANNs) and optimization techniques using Genetic Algorithm (GA).
- Applications of Soft Computing techniques to solve a number of real life problems will be covered to have hands on practices.
- The course will provide exposure to theory as well as practical systems and software used in soft computing.

Course Outcomes:

After completing this course, you will be able to learn:

- Fuzzy logic and its applications.
- Artificial neural networks and its applications.
- Solving single-objective optimization problems using GAs.
- Solving multi-objective optimization problems using Evolutionary algorithms(MOEAs).
- Applications of Soft computing to solve problems in varieties of application domains.

UNIT-I

Introduction to Soft Computing : Concept of computing systems."Soft" computing versus "Hard" computing
 Characteristics of Soft computing Some applications of Soft computing techniques

UNIT-II

Fuzzy logic : Introduction to Fuzzy logic.Fuzzy sets and membership functions.Operations on Fuzzy sets.Fuzzy relations, rules, propositions, implications and inferences.Defuzzification techniques.Fuzzy logic controller design.Some applications of Fuzzy logic.

UNIT-III

Genetic Algorithms: Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques ,Basic GA framework and different GA architectures.GA operators: Encoding, Crossover, Selection, Mutation, etc. Solving single-objective optimization problems using GAs.

UNIT-IV

Multi-objective Optimization Problem Solving :Concept of multi-objective optimization problems (MOOPs) and issues of solving them.Multi-Objective Evolutionary Algorithm (MOEA).Non Pareto approaches to solve MOOPs,Pareto-based approaches to solve MOOPs,Some applications with MOEAs.

UNIT-V

Artificial Neural Networks : Biological neurons and its working.Simulation of biological neurons to problem solving.Different ANNs architectures.Training techniques for ANNs.Applications of ANNs to solve some real life problems

Text Books:

1. Fuzzy Logic: A Practical approach, F. Martin, Mc neill, and Ellen Thro, AP Professional, 2000.
2. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.

Reference Books:

1. Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, Nikola K. Kasabov, MIT Press, 1998.

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III Year II Semester	COMPUTER VISION LAB	L	T	P	C
		0	0	3	1.5

Course Objective:

1. To introduce students to the foundational concepts and applications of computer vision.
2. To enable understanding of image formation, feature extraction, and transformation techniques.
3. To provide knowledge on segmentation, object recognition, and visual analysis methods.
4. To develop the ability to implement and evaluate computer vision algorithms for real-world tasks.
5. To expose students to cutting-edge research and industry applications in computer vision.

Course Outcomes:

1. Students will understand the theoretical foundation and workflow of computer vision systems.
2. Students will be able to implement and evaluate feature extraction and matching algorithms.
3. Students will apply image segmentation techniques for practical use cases.
4. Students will develop the ability to perform calibration and feature-based alignment.
5. Students will build systems capable of detecting and recognizing objects and people in images and video.

List of Experiments

1. Implement image acquisition and display using OpenCV.
2. Detect and extract keypoints using Harris and SIFT.
3. Perform feature matching between two images using FLANN.
4. Apply Canny edge detection and visualize results.
5. Implement line detection using Hough Transform.
6. Segment an image using mean shift clustering.
7. Perform image segmentation using graph cuts.
8. Estimate homography and align images (image stitching).
9. Calibrate a camera using a chessboard pattern and OpenCV.
10. Implement face recognition using Eigenfaces.
11. Detect pedestrians in video using HOG + SVM.
12. Build a simple scene recognition model using a pre-trained CNN

Textbooks

1. Richard Szeliski, *Computer Vision: Algorithms and Applications*, Springer.
2. E. R. Davies, *Computer Vision: Principles, Algorithms, Applications, Learning*, Academic Press.
3. Simon J. D. Prince, *Computer Vision: Models, Learning, and Inference*, Cambridge University Press.

Reference Books

1. Gary Bradski and Adrian Kaehler, *Learning OpenCV: Computer Vision with the OpenCV Library*, O'Reilly.
2. David A. Forsyth and Jean Ponce, *Computer Vision: A Modern Approach*, Pearson.

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III Year II Semester	Operating System Lab	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To implement process scheduling algorithms to understand CPU management and process execution efficiency.
- To apply memory management techniques by simulating various allocation and deal location algorithms.
- To identify and implement solutions for critical section problems and virtual memory management using appropriate algorithms.
- To develop file allocation strategies by implementing common file organization algorithms.
- To understand and write shell scripts for automating basic tasks in a Unix/Linux environment..

Course Outcomes

Upon successful completion of the course, students will be able to:

- Simulate various CPU process scheduling algorithms to analyze system performance.
- Implement system calls for process creation, management, and inter-process communication.
- Apply different memory management techniques including paging, segmentation, and allocation methods.
- Simulate page replacement, banker’s algorithm, and file allocation strategies to evaluate their efficiency.
- Implement synchronization mechanisms in concurrent programming and demonstrate multithreading concepts for safe process execution

List of tasks

1. Simulate the following CPU scheduling algorithms
 a) Round Robin b) SJF c) FCFS d) Priority
2. Multiprogramming-Memory management-
 Implementation of fork (), wait (), exec() and exit (), System calls
3. Simulate the following
 a) Multiprogramming with a fixed number of tasks (MFT)
 b) Multiprogramming with a variable number of tasks (MVT)
4. Simulate Bankers Algorithm for Dead Lock Avoidance
5. Simulate Bankers Algorithm for Dead Lock Detection.
6. Simulate the following page replacement algorithms.
 a) FIFO b) LRU c) LFU
7. Simulate the following File allocation strategies
 a) Sequenced b) Indexed c) Linked
8. Write a program to simulate producer and consumer problem using semaphores
9. Write program to create a thread using pthreads library and let it run its function.
10. Write a program to illustrate concurrent execution of threads using pthreads library.

Text Books:

1. Operating System -Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley
2. The ultimate guide Unix, Sumiton das, McGraw-Hill Higher Education, 3rd Edition, January 21, 2012

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III Year II Semester	Soft skills OR IELTS (Skill Development Course)	L	T	P	C
		0	1	2	2

Course Objectives:

- Encourage use of a wide range of grammatical structures and vocabulary in speech and writing
- Demonstrate good writing skills for effective paraphrasing, argumentative essays, and formal correspondence
- Provide training and opportunities to develop fluency in English through participation informal group discussions and presentations using audio-visual aids
- Knowing the best practices at the workplace to perform well in the interview.
- Encouraging smart self-learning, communication skills that focus on employability.

Course Outcomes:

- Understand the grammatical forms of English and the use of these forms in specific communicative and career context
- Use a wide range of reading comprehension strategies appropriate to texts, to retrieve information
- Strengthen their ability to write paragraphs, essays, emails and summaries ➤ improve their speaking ability in English both in terms of fluency and comprehensibility by participating in Group discussion and oral assignments
- Prepare their own resume and answer interview related questions unhesitatingly with acceptable soft skills

Unit-I : Preparing for Written Assessment [6 Hours]

Grammar Articles: Know how to use different types of Articles, use articles appropriately in context Identify errors in the use of articles.

Prepositions: Learn to use prepositions in context, Identifying errors in the use of prepositions, Look at the different functions of Prepositions.

Tenses: understand the different form of tense used in sentences, know the various purposes of using different Tense forms, Use appropriate tense forms of verbs in context, Identify the errors in the use of tense forms.

Concord: Know how to identify Subject-Verb-Agreement in sentences, Use SVA appropriately in Context, identify the errors in the use of SVA

Voices: Know when to use Active or Passive Voice, Convert Active sentences to Passive ones, Relative Clause: Know what relative pronouns are, know when to use relative clauses, know the functions of Relative Clauses.

Soft Skills: Leadership: Introduction to Leadership, Leadership Power, Leadership Styles, Leadership in Administration.

Interpersonal Relations: Introduction to Interpersonal Relations, Analysis of different ego states, Analysis of Transactions, Analysis of Strokes, Analysis of Life position

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Learning Outcomes

At the end of the module, the learners will be able to

- Comprehend the factors that influence use of grammar and vocabulary in speech and writing(L3)
- Produce a range of valid grammatical sentences in the real-world situations and professional environment. (L3)
- develop employability skills through Leadership skills and interpersonal skills (L3)

Unit -II : Reading Comprehension [6 Hours]

Purposes & Strategies of Reading: know the general purpose of Reading, assess your skills of reading ,develop reading Strategies

Skimming for details: Skim through a variety of passages, understand how skimming will orient you to the text,
identifying main Ideas: Identify the main ideas in the give text, Look for supporting statements in a passage, understand how the writer supports main ideas with details

Scanning for information: Scan passages for factual information, understand how scanning can help find certain answers quickly, know how to look for factual answers.

Drawing inferences: Understand how to draw inferences, infer meanings while reading passages,

Vocabulary: Learn strategies to understand difficult words used in the passage, Apply strategies of reading to understand a variety of passages.**practise tests**

Soft Skills: Communication: Introduction to Communication, Flow of Communication, Listening, Barriers of Communication, How to overcome barriers of communication.

Stress Management: Introduction to Stress, Causes of Stress, Impact Stress, Managing Stress

Learning Outcomes

At the end of the module, the learners will be able to

- assess the reading skill by developing reading strategies (L3)
- Understand the skimming & scanning techniques orients to identify the theme, purpose and statements.(L2)
- develop employability skills through communication skills and stress management (L3)

Unit-III : Writing paragraphs & Essays [6 Hours]

Features of Good Writing: understand what makes a piece of writing good, analyse & discuss some samples of good & bad writing,

Gathering Ideas: Discuss various techniques for gathering ideas before you start writing, practice some of the techniques that can be used in the Prewriting stage ,

Purposes of Writing: understand the importance of purpose of writing, explore various purpose of writing, choose content & language based on the purpose

Writing for Specific audience: Study ways of tailoring content to suit a target audience, analyse text to deduce the target audience, discuss how language is used to suit the target audience

Organizing ideas: understand the importance of organizing ideas in a text, Learn the different ways of organizing ideas, practice organizing ideas while writing

Writing an introduction: Know the importance of a good introduction, understand the different ways in which writers catch the attention of readers,

Developing supporting ideas: Learn how to develop your ideas in a paragraph, discuss a variety of supporting ideas

,Writing a conclusion: Learn the different parts of a conclusion, Practice writing an effective conclusion

Using linkers: Learn the different types of Linkers or cohesive devices, Discuss why it is important to use connectors in writing,

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Choosing the right words: Discuss why writers make a careful choice of language, Learn how to select language to make the intended impact,

Writing film & book reviews: Learn the different categories of books & films, Know the elements which go into analyzing books & films, Write your own film & book reviews

Common errors in writing, editing & proofreading. Practice correcting errors in basic sentence structure, Learn to proof-read & edit your draft before writing the final version

Soft Skills: Group Dynamics and Team Building: Importance of groups in organization, Interactions in group, Group Decision Taking, Team Building, Interaction with the Team, How to build a good team?

Learning Outcomes

At the end of the module, the learners will be able to

- produce logically coherent argumentative essays (L3)
- understand the use of passive voice in academic writing (L2)
- use appropriate vocabulary to express ideas and opinions (L2)
- develop employability skills through group dynamics and team building (L3)

Unit –IV: Preparing for oral Assignment [6 Hours]

Group Discussion: Group Discussions as a tool for selection, skills for GD, Leadership & Problem-Solving Skills, Types of GD, Group Dynamics, Roles & Functions: Beginning, Presenting, Elaborating, Roles & Functions: Clarifying, Synthesizing & Challenging, Roles & Functions: Agreeing, Disagreeing & Summarizing., Etiquette: Body Language & Time Management, GD Activities

Soft Skills: Conflict Management: Introduction to Conflict, Causes of Conflict, Managing Conflict

Time Management: Time as a Resource, Identify Important Time Wasters, Individual Time Management Styles, Techniques for better Time Management.

Learning Outcomes

At the end of the module, the learners will be able to

- participate in group discussions using appropriate conventions and language strategies and develop advanced listening skills for in-depth understanding of academic text(L3)
- collaborate with a partner to make discussions (L2)
- develop employability skills through conflict management and time management (L3)

Unit-V: Interview Skills [6 Hours]

Purpose of interviews: Know what recruiters looking for during Interviews, Become familiar with the process of career search, understand your skills, interests, achievements and attitude better

Preparing a Resume: Understand what a job application is, know the details to be included in a CV, Know how to lay out details of a CV & prepare CV on your own

Writing a Cover Letter: Study the information which is included in a cover letter. Learn how to organise information in a cover letter ,

Before and at the interview: Learn how to prepare for an interview, learn how to behave during the interview, discuss what the interviewer might assess you on

Answering FAQs about yourself & your families: Learn how to answer questions about yourself & family, Learn how to identify & talk about your strengths and Weaknesses

Answering FAQs about Likes & Dislikes: Learn to choose interests which will be relevant to your Interview. learn to speak about your likes & Dislikes

Answering FAQs about Justifying your candidature: Know what you need to say to answer a question about yourself, Be able to answer questions about your suitability for a job

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Answering FAQs about Priorities, Attitudes & Biases: Understand what your priorities will be in a job & learn to talk about them, learn to correct understanding of your attitude, biases & prejudice, if any, towards others, know positive qualities that are valued at work

Answering FAQs about Professional goals: Become aware of the things you need to keep in mind while choosing a job, Set goals for your professional growth & plan how to achieve them

Public Speaking: Planning, Practice & Delivery: Plan one minute speeches on simple topics, understand how to capture the audience's attention, be able to create strong closing statements.

Soft Skills: Motivation: Introduction to Motivation, Relevance and types of Motivation, Motivating subordinates, Analysis of Motivation

Learning Outcomes

At the end of the module, the learners will be able to

- prepare a CV with a cover letter to seek internship/ job (L2)
- understand the structure of Interviews and familiar with frequently asked questions while interview and how to respond to it (L3)
- develop employability skills through motivation and analysis of motivation (L3)

The learners will demonstrate their knowledge and abilities through completion of the following required assessments while or at the end of this course. —1 Quiz, 1 GD, 2 Activities on Interview Readiness and Softskills, 1 Personal Interview

Quiz: (10M)

Quiz is conducted on Grammar, Vocabulary and Reading Comprehension. The Quiz consists of 50 questions and will be scaled down to 10 Marks. Duration of the quiz is 1hr 30 Min only and it is Computer Based Test (CBT)

Resume:(10 M)

Each student is required to submit 3 independently written Resumes during the course. Specific requirements for each one are accessed on the following Link:

https://docs.google.com/document/d/1W15961dOEnIxlnMm9BKyo8L9Wia7nPbEfgR-9DT_mRg/edit?usp=sharing

GD:(10 M)

1. Each student has to perform 5 Group Discussions during the course on a peer evaluation basis which fetches those 5Marks.
2. The Final Assessment through one formal GD by the Internal Examiner is for 5 marks.

The GD will be assessed on the following criteria :

- Content (3M)
- Body Language(2M)
- Group dynamics & Leadership Skills (3M)
- Communication Skills (2M)

Soft Skills:(10M)

Student will be assessed on

- Presentation of his/her Readiness of Interview (Grooming) with Prepared Resume (5M)
- Aptitude based question/Case study/Behavior based Question (5M)

Activities on Interview Readiness :(10M)

The external Examiner assesses on Interview readiness

1. **Tell something about Yourself (5M)**

Assessment Parameters:

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- a) Initiation
- b) Confidence level
- c) Body Language
- d) Attention Grabbing

2. JAM/Face to Face Interview (5M):

Student will be given a topic on-Spot for JAM and will be assessed by the External examiner on the candidate's

- Flow of Speech (2M)
- Accuracy and Language (2M)
- Confidence (1M)

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III Year II semester	Technical Paper Writing & IPR	L	T	P	C
		2	0	0	-

COURSE OBJECTIVES:

- To enable students to understand the process of writing quality technical papers and research articles.
- To familiarize students with effective strategies for literature survey, organization, and scientific writing.
- To introduce the basics of Intellectual Property Rights (IPR), including patents, copyrights, and trademarks.
- To provide insights into patent filing procedures, laws, and the role of IPR in academia and industry.
- To encourage ethical writing practices and awareness of plagiarism, authorship, and publication ethics.

COURSE OUTCOMES:

- Understand the components and structure of technical research papers.
- Develop skills in literature review, referencing, and use of writing tools.
- Apply ethical principles in academic writing and avoid plagiarism.
- Gain knowledge of various types of intellectual property and related legal aspects.
- Understand patent filing procedures and their importance in innovation and entrepreneurship.

Unit-I: Introduction to Technical Writing: Characteristics of technical writing – clarity, precision, formality, and structure. Types of technical documents – journal papers, conference papers, technical reports, theses. Components of a research paper – title, abstract, keywords, introduction, literature review, methodology, results, discussion, conclusion, and references. Importance of audience and purpose. Common errors in writing.

Unit-II: Research Process and Writing Tools: Understanding the research process – problem formulation, hypothesis, research design, and data interpretation. Conducting effective literature review using databases (IEEE Xplore, Scopus, Google Scholar). Citation and referencing styles – IEEE, APA, MLA. Use of tools such as LaTeX, Grammarly, Mendeley, and Zotero. Best practices in editing and proofreading.

Unit- III: Publication Ethics and Plagiarism: Ethics in research and authorship. Understanding plagiarism and how to avoid it. Tools for plagiarism detection. Roles of authors, co-authors, reviewers, and editors. Ethics in peer review. Predatory journals and conferences. Guidelines from COPE (Committee on Publication Ethics).

Unit- IV: Introduction to Intellectual Property Rights (IPR): Overview of IPR – need, scope, and types: patents, copyrights, trademarks, and trade secrets. Concept of novelty, utility, and non-obviousness in patents. Indian and international IPR frameworks (WIPO, TRIPS). Role of IPR in academia, startups, and innovation ecosystems.

Unit- V: Patent Filing and Case Studies: Patent search and patentability criteria. Process of patent application – drafting, filing, prosecution, and grant. Role of patent attorneys and patent offices. Infringement and litigation. Case studies of IPR in technology and research. Role of IP in commercialization and technology transfer.

TEXT BOOKS:

1. Ritu Arora (2020). Technical Writing and Professional Communication. McGraw-Hill Education.
2. Neeraj Pandey & Khushdeep Dharni (2014). Intellectual Property Rights. PHI Learning.
3. Gopalkrishnan, N. S. & Agitha, T. G. (2009). Principles of Intellectual Property. Eastern Book Company.

REFERENCE BOOKS:

1. WIPO (2016). Understanding Intellectual Property: A Guide for Beginners. World Intellectual Property Organization.
2. Day, R. A., & Gastel, B. (2012). How to Write and Publish a Scientific Paper. Cambridge University Press.
3. Deborah Bouchoux (2012). Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets. Cengage Learning

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IV Year I Semester	Natural Language Programming	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- Teach students the leading trends and systems in natural language processing.
- Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate the above-mentioned concepts.
- Teach them to recognize the significance of pragmatics for natural language understanding.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing

COURSE OUTCOMES:

- Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
- Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
- Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
- Able to design, implement, and analyze NLP algorithms 5. Able to design different language modeling Techniques.

UNIT-I

Finding the Structure of Words: **Words and Their Components, Issues and Challenges, Morphological Models**

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

Unit-II

Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues

Unit-III

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

Unit-IV

Predicate-Argument Structure
 Predicate-Argument Structure, Meaning Representation Systems, Software.

Unit-V

Discourse Processing: Cohension, Reference Resolution, Discourse Cohension and Structure
Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language Specific Modeling Problems, Multilingual and Crosslingual Language Modeling .



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TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

REFERENCE BOOKS:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications

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IV Year I Semester	Management Course- II	L	T	P	C
	Management Science Human resource Management Entrepreneurship & Incubation	2	0	0	2

Course Objectives:

- Outline an environment to inculcate entrepreneurial skills.(L2)
- Develop innovative products, services, processes and techniques.(L3)
- Plan to prepare financial proposals and start-ups.(L3)
- Analyse the ideas to collaborate entrepreneur skills in establishment of start-ups.(L3)
- Explain the financial resource existing in government and private sectors.(L2)

Course outcomes:

- Explain the knowledge of Entrepreneurial behavior and skill development.(L2)
- Choose business ideas that have value in the end-market.(L2)
- Identify the validity of idea and its unique selling proposition.(L3)
- Comprehend opportunity and challenges of-startup(L2)
- Analyze various Government and non-Government financial resource.(L3)

Unit-I: Fundamentals of Entrepreneurship : Entrepreneurship- Concept, Importance, Characteristics –Myths of Entrepreneurship -Role of Entrepreneurs in Indian economy–Distinguish between professional entrepreneurs Vs Family entrepreneurs - Social and Ethical Perspectives of Entrepreneurship.

Application: Case lets: Business cases of young entrepreneurs.

Unit-II: Ideation and Evaluation of Business Ideas : Opportunity identification–Ideations process- Sources of business ideas –Role of creativity– Sources of Innovation –Technological Innovation and Entrepreneurship - Product/ Service design – Design Thinking.

Case lets : Business cases of OYO.

Activity: Collection of novel business ideas.

Unit-III: Feasibility Analysis and Business Plan : Thrust areas of entrepreneurship- Techno-economic feasibility assessment- Financial feasibility – Market feasibility – Preparation of Business plan – Business canvas & Lean canvas.

Activity:

- Preparation of business plan(draft)
- Analysis on TED program Talks

Unit-IV: Business Incubation and startups : Fundamentals of business incubation-Services of incubators -Start-ups-meaning, significance - start up strategy-Present scenario of startups.

Activity:

- Evaluating new start-ups in India
- Analysis on Shark Tank India program

Unit-V: Financial resources : Sources of finance–Bootstrapping–Government Support–MSMEs–Crowd Funding– Venture Capitalists & Angel Investors - Schemes for women entrepreneurs



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Activity: Business plan final version

Contemporary Topics:

1. Green Business
2. Niche Markets
3. New perspectives in rural enterprises

Text Books:

1. T.V Rao, Donald F.Kuratko, Entrepreneurship, A South-Asian Perspective, Cengage Learning, 1st edition, 2012.
2. Datsy Davies, Indian Startups, Amazon Asia- Pacific Holdings Private Limited, 1st Edition, 2016

Reference Books:

1. P.N.Rath, Sarjue Pandita, Entrepreneurship :Startup India & Standup India, Lexicon Publishing House, 2018
2. MadhurimaLall, ShikhaSahai, Entrepreneurship, Excel Books(P)Ltd.2008

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IV Year I Semester	Professional Elective - IV 1.Federated Learning	L	T	P	C
		3	0	0	3

Course Objectives:

1. To introduce the fundamentals of Federated Learning and its need in privacy-preserving machine learning.
2. To understand the architectures, protocols, and algorithms used in Federated Learning systems.
3. To study optimization and communication challenges associated with distributed learning.
4. To explore privacy, security, and trust mechanisms in Federated Learning environments.
5. To apply Federated Learning techniques in real-world applications such as mobile devices, healthcare, and finance

Course Outcomes:

1. Understand the key principles, motivations, and applications of Federated Learning.
2. Apply suitable FL algorithms for different learning scenarios with privacy constraints.
3. Analyze and optimize Federated Learning systems under communication and data constraints.
4. Evaluate security and privacy-preserving techniques used in distributed ML.
5. Design Federated Learning models for real-world applications using appropriate tools and frameworks.

UNIT I: Introduction to Federated Learning: Fundamentals of distributed and decentralized learning. Evolution and definition of Federated Learning (FL). Motivation for FL – data privacy, regulatory constraints, and edge computing. Federated vs centralized learning. Components of FL – clients, server, and communication rounds. Real-world scenarios and case studies in Google Gboard and healthcare.

UNIT II: Federated Learning Algorithms and Architectures: Basic algorithms – Federated Averaging (FedAvg), FedProx, and SCAFFOLD. Model update and aggregation mechanisms. System architecture – client-server model, cross-device and cross-silo FL. Client selection strategies. Asynchronous and synchronous learning in FL environments.

UNIT III: Optimization and Communication Efficiency: Challenges in training models across heterogeneous clients. Techniques for reducing communication cost – model compression, quantization, sparsification. Handling non-IID (independent and identically distributed) data. Personalization strategies. Impact of client availability and system heterogeneity.

UNIT IV: Privacy, Security, and Trust in FL: Threats in Federated Learning – inference attacks, data poisoning, and model poisoning. Secure aggregation and encryption techniques – homomorphic encryption, differential privacy, secure multiparty computation. Trust frameworks and incentive mechanisms. Blockchain-enabled Federated Learning.

UNIT V: Applications and Future Directions: Applications in mobile computing, healthcare, banking, autonomous vehicles, and IoT. Case studies on real-world Federated Learning deployments. Frameworks and tools – TensorFlow Federated, PySyft, Flower. Current research trends and open challenges. Ethical considerations and regulatory compliance (GDPR, HIPAA).

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TEXT BOOKS:

1. Qiang Yang, Yang Liu, Tianjian Chen, Yongxin Tong (2019). Federated Machine Learning: Concept and Applications. Springer.
2. Jakub Konečný, Brendan McMahan et al. (2021). Advances and Open Problems in Federated Learning. NOW Publishers.
3. Rieke, Nicola, et al. (2020). The Future of Digital Health with Federated Learning. Springer.

REFERENCE BOOKS:

1. Peter Kairouz et al. (2021). Federated Learning: Strategies for Improving Communication Efficiency. arXiv preprint.
2. Mehdi Mohri, Gary Sivek, Ananda Theertha Suresh (2019). Agnostic Federated Learning. Proceedings of ICML.
3. Brendan McMahan et al. (2020). TensorFlow Federated: Machine Learning on Decentralized Data. Google AI Blog & Documentation.

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IV Year I Semester	Professional Elective - IV 2.NOSQL DATABES	L	T	P	C
		3	0	0	3

Course Objectives:

From the course the student will

1. To understand the basic concepts and the applications of database systems. To master the basics of SQL and construct queries using SQL.
2. To understand the relational database design principles.
3. To become familiar with the basic issues of transaction processing and concurrency control.
4. To become familiar with database storage structures and access techniques.

Course Outcomes:

After the completion of the course, student will be able to do the following.

1. Define, compare and use the four types of NoSQL Databases (Document-oriented, Key Value Pairs, Column oriented and Graph).
2. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
3. Explain the detailed architecture, define objects, load data, query data and performance tune.Document oriented NoSQL databases.
4. Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data

UNIT I

Introduction to NoSQL: Definition And Introduction, Sorted Ordered Column-Oriented Stores, Key/Value Stores, Document Databases, Graph Databases, Examining Two Simple Examples, Location Preferences Store,Car Make And Model Database, Working With Language Bindings.

UNIT II

Interacting with NoSQL: If NoSql Then What, Language Bindings ForNoSQL Data Stores, Performing Crud Operations, Creating Records,Accessing Data, Updating And Deleting Data

UNIT III

NoSQL Storage Architecture: Working With Column-Oriented Databases, Hbase Distributed Storage Architecture, Document Store Internals, Understanding Key/Value Stores In Memcached And Redis, Eventually Consistent Non-Relational Databases.

UNIT IV

NoSQL Stores: Similarities Between Sql And Mongoddb Query Features, Accessing Data From Column-Oriented Databases Like Hbase, QueryingRedis Data Stores, Changing Document Databases, Schema Evolution In Column-Oriented Databases, Hbase Data Import And Export, Data Evolution In Key/Value Stores.

UNIT V

Indexing and Ordering Data Sets: Essential Concepts Behind A Database Index, Indexing And Ordering In Mongoddb, Creating and UsingIndexes In Mongoddb, Indexing And Ordering In Couchdb, Indexing In Apache Cassandra.



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TEXT BOOKS:

- 1) Pramod Sadalage and Martin Fowler, NoSQL Distilled, Addison-Wesley Professional, 2012.
- 2) Dan McCreary and Ann Kelly, Making Sense of NoSQL, Manning Publications, 2013.

REFERENCE BOOKS:

- 1) Shashank Tiwari, Professional NoSQL, Wrox Press, Wiley, 2011, ISBN: 978-0-470-94224-6 Gaurav Vaish, Getting Started with NoSQL, Packt Publishing, 2013.

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IV Year I Semester	Professional Elective - IV 3.Quantum Computing	L	T	P	C
		3	0	0	3

Course Objectives:

Introduce the working of a Quantum Computing program, its architecture and program model

- Teach universal gates circuits on available simulators
- Illustrate the advantage of super position and entanglement
- Create an understanding of quantum algorithms to solve real world quantum problems
- Demonstrate the applications of quantum computing

Course Outcomes:

1. Understand underlying principles of Quantum Computing (L2)
2. Analyse the matrix operators for universal quantum gate (L4)
3. Demonstrate quantum fourier transformation(L1)
4. Analyse quantum algorithms for searching(L4)
5. Develop a quantum computing application for machine learning/Key distribution(L6)

Unit-I: INTRODUCTION TO QUANTUM COMPUTING

Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.), Origin of Quantum Computing, Overview of major concepts in Quantum Computing: Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation (1.1., 1.2., 1.3.,)

Math Foundation for Quantum Computing (Matrix Algebra): basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors (2.1)

UNIT-II: QUANTUM CIRCUITS BUILDING BLOCKS FOR QUANTUM PROGRAM

Quantum Algorithms, Single Qubit operations, Controlled operations, Measurement, Universal quantum gates, Simulation of quantum systems (4.1 to 4.5, 4.7)

UNIT-III: TENSOR PRODUCTS, TELEPORTATION AND SUPERDENSE CODING

Tensor Products, Multi Q-Bit system, Super Position, Entanglement, Decoherence, quantum teleportation, no-cloning theorem super dense coding (10th chapter of Book 2), Quantum Fourier transformations and its applications (5.1., 5.2., 5.3.)

UNIT-IV: QUANTUM ALGORITHMS

Hadamard Gates, phase gate, Quantum interference, Quantum parallelism a function evaluation, Deutsch-Jozsa Algorithm, Phase Estimation, Shor's algorithm, Quantum Searching and Grover's Algorithm (9th chapter of Book 2)

UNIT-V: QUANTUM ERRORS & QUANTUM COMPUTING APPLICATIONS

Single- Qubit error, Quantum Operations and Krauss Operations. Quantum Machine Learning (SVM), Quantum Cryptography (QKD, Post-Quantum Cryptography (Chapter 8, 10, 12)



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Textbook(s):

1. Michael A. Nielsen, Quantum Computation and Quantum Information, Cambridge University Press, 2013, ISBN:978-1107619197, 10th edition.
2. David McMahon, Quantum Computing Explained, Wiley Publisher, 2008, ISBN:978-0470096994, 1st edition.

Reference(s):

1. Introduction to Quantum Computing: Quantum Algorithms and Qiskit,
2. <https://nptel.ac.in/courses/106106232>
3. IBM Experience, <https://www.coursera.org/programs/gitam-open-learning-7qv77/learn/introduction-to-quantum-information?authProvider=gitam&source=ibm>
4. Microsoft Quantum Development Kit, <https://www.microsoft.com/en-us/quantum/development-kit>
5. Forest SDK PyQuil, <https://pyquil.readthedocs.io/en/stable/>

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IV Year I Semester	4.Computational Neuroscience Professional Elective-IV	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

From the course the student will

1. To introduce the interdisciplinary foundations of computational neuroscience combining biology, computer science, and mathematics.
2. To understand the structure and function of the brain from a computational modeling perspective.
3. To explore neural coding, neural networks, and mathematical modeling of brain activity.
4. To study various brain models from single neurons to large-scale neural circuits.
5. To apply computational methods to simulate and analyze neuronal dynamics and behavior.

COURSE OUTCOMES:

After the completion of the course, student will be able to do the following.

1. Understand the biological basis of neural systems and how they are modeled computationally.
2. Simulate and analyze the behavior of single neurons using mathematical models.
3. Interpret neural codes and apply information theory to brain signal processing.
4. Construct and analyze simple neural networks based on biological principles.
5. Apply computational techniques to study cognition, perception, and motor functions in the brain.

UNIT-I: Introduction to Neuroscience and Neural Systems: Overview of neuroscience – neurons, synapses, and brain architecture. Neuron anatomy and electrophysiology. Communication between neurons – action potentials, ion channels, and neurotransmitters. Organization of the central and peripheral nervous systems. Introduction to brain regions and cognitive functions. Motivation for computational modeling of neural systems.

UNIT-II: Modeling Single Neurons: Mathematical models of neuron dynamics – Hodgkin-Huxley model, integrate-and-fire model. Ion channel dynamics and membrane potentials. Numerical simulation of neuron models. Comparison of biologically realistic vs. simplified neuron models. Synaptic integration and postsynaptic potentials.

UNIT-III: Neural Coding and Information Processing: Concepts of neural coding – rate coding, temporal coding, population coding. Encoding and decoding information in the brain. Signal representation in the nervous system. Information theory in neuroscience – entropy, mutual information, and efficient coding hypothesis. Role of noise and variability in neural responses.

UNIT-IV: Artificial and Biological Neural Networks: Network models of interconnected neurons. Recurrent neural networks, Hopfield networks, and attractor dynamics. Learning rules – Hebbian learning, STDP (Spike-Timing Dependent Plasticity). Computational modeling of memory, learning, and decision-making. Comparison with artificial neural networks and deep learning models.

UNIT-V: Cognitive and Behavioral Modeling: Computational approaches to perception, motor control, and attention. Large-scale brain modeling and simulation platforms (e.g., NEURON, NEST, Brian2). Brain-computer interfaces. Case studies of computational models in visual processing, auditory systems, and sensory-motor integration. Future directions in computational neuroscience and brain-inspired computing.



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TEXT BOOKS:

1. Peter Dayan & L.F. Abbott (2001). *Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems*. MIT Press.
2. Thomas Trappenberg (2010). *Fundamentals of Computational Neuroscience*. Oxford University Press.
3. Eugene M. Izhikevich (2007). *Dynamical Systems in Neuroscience: The Geometry of Excitability and Bursting*. MIT Press.

REFERENCE BOOKS:

1. Wulfram Gerstner & Werner M. Kistler (2002). *Spiking Neuron Models: Single Neurons, Populations, Plasticity*. Cambridge University Press.
2. Bard Ermentrout & David Terman (2010). *Mathematical Foundations of Neuroscience*. Springer.
3. Christof Koch (1999). *Biophysics of Computation: Information Processing in Single Neurons*. Oxford University Press.

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IV Year I Semester	1. Agile methodologies Professional Elective-V	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce students to various software development methodologies,
- To familiarize students with popular Agile frameworks
- To enable students to apply Agile planning and estimation techniques.
- To train students in modern Agile development practices
- To develop students' ability to analyze Agile project performance using metrics

COURSE OUTCOMES:

Understand various software development methodologies

- Explain and compare different Agile frameworks like Scrum, XP, and Kanban, and identify appropriate practices for different software project scenarios.
- Apply Agile planning techniques such as release planning, iteration planning, and user story mapping,
- Demonstrate Agile development practices including TDD, BDD, CI/CD, refactoring, and pair programming,
- Analyze Agile project management metrics, team dynamics

UNIT I

Introduction to Agile Development- Overview of Software Development Methodologies, Traditional vs Agile: Waterfall vs Iterative vs Agile, Agile Manifesto and Principles, Benefits and Challenges of Agile, Agile vs Lean vs DevOps

UNIT II

Agile Frameworks and Practices- Scrum: Roles as Scrum Master, Product Owner, Dev Team , Artifacts, Ceremonies, Extreme Programming (XP): Practices and Values, Kanban: Workflow Visualization and WIP Limits, Agile Modelling and Crystal Methods, Choosing the Right Framework

UNIT III

Agile Project Planning and Estimation- Release Planning, Iteration Planning, User Stories and Story Mapping, Product Backlog and Sprint Backlog, Estimation Techniques: Planning Poker, T-Shirt Sizing, Velocity, Burn-down and Burn-up Charts

UNIT IV

Agile Design, Development and Testing- Test-Driven Development (TDD), Behaviour Driven Development (BDD), Continuous Integration and Delivery (CI/CD), Refactoring and Pair Programming, Acceptance Testing and Agile Test Automatio

UNIT V: Agile Project Management and Scaling-Agile Metrics and KPIs, Agile Team Dynamics and Roles, Scaling Agile: Safe, Less, Spotify Model, Agile in Distributed Teams, Agile Tools: JIRA, Trello, Azure DevOps.



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TEXT BOOKS :

1. Robert C. Martin and Micah Martin, "Agile Software Development: Principles, Patterns, and Practices", Pearson Education, 1st edition, 2002.
2. Andrew Stellman, Jill Alison Hart, Learning Agile, O'Reilly, 1st edition, 2015.

REFERENCE BOOKS:

3. "Essential Scrum: A Practical Guide to the Most Popular Agile Process" Kenneth S. Rubin
 4. "User Stories Applied: For Agile Software Development" Mike Cohn
 5. "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation" Jez Humble & David Farley
 6. "Large-Scale Scrum: More with Less" – Bas Vodde & Craig Larman
- .

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IV Year I Semester	2.Big Data Analytics Professional Elective-V	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objectives of this course is to acquire knowledge on the

- i. Necessity of Big data analysis and challenges in Big data analysis
- ii. Descriptive, Predictive, Real-time analysts is of big data
- iii. Programming tools PIG & HIVE in Hadoop echo system

COURSE OUTCOMES:

The students should be able to:

- i. Understand and Illustrate characteristics of big data and big data challenges in different domains including social media, transportation, finance and medicine
- ii. Demonstrate stream processing on real time applications
- iii. Do Big data processing using Map reduce on Hadoop
- iv. Do Big data processing using PIG scripts and Hive QLqueries
- v. Understand Predictive analysis of big data.

UNITI: Introduction:

Introduction to big data: Introduction to Big Data platform, Challenges of conventional systems, intelligent data analysis, Nature of data, Analytic processes and tools, Analysis vs. Reporting.Role of Big Data in AI/ML & IoT and Introduction to Data Lakes vs Data Warehouses

UNITII: Stream Processing:

Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies - Real Time Sentiment Analysis - Stock Market Predictions- Real-time Fraud Detection.

UNIT III: Introduction to Hadoop:

Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analyzing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment.Introduction to YARN (Yet Another Resource Negotiator), Limitations of Hadoop vs Modern Frameworks like Spark

UNITIV: Frameworks and Applications:

Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and Zoo Keeper.

UNIT V: Predictive Analytics and Visualizations:

Predictive Analytics, Simple linear regression, Multiple linear Regressions, Interpretation of regression coefficients, Visualizations, Visual data analysis techniques, interaction techniques, Systems and application

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Text Books

1. Tom White, “Hadoop: The Definitive Guide”, Third Edition, O’reilly Media, Fourth Edition, 2015.
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw-Hill Publishing, first edition, 2011.
3. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, CUP, first edition, 2011.

Reference Books

1. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & Sons, 2012.
2. Paul Zikopoulos, Dirk de Roos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, “Harness the Power of Big Data: The IBM Big Data Platform”, Tata McGraw Hill Publications, 2012.
3. Arshdeep Bahga and Vijay Madisetti, “Big Data Science & Analytics: A Hands On Approach”, VPT, 2016.
4. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)”, John Wiley & Sons, 2014.

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IV Year I Semester	Reinforcement Learning Professional Elective-V	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the fundamentals of Reinforcement Learning (RL) and its relevance in artificial intelligence.
2. To enable students to understand the mathematical foundations of Markov Decision Processes (MDPs) and Bellman Equations.
3. To explore key learning methods such as Q-learning, policy gradients, and actor-critic models.
4. To study model-based reinforcement learning and deep RL techniques.
5. To provide insight into real-world applications, ethics, and advanced topics like meta-learning and multi-agent environments.

Course Outcomes:

At the end of this course, the student will be able to

1. Understand the Basic concepts of Reinforcement learning.
2. Implement tabular methods to solve classical control problems.
3. Understand the policy gradient methods from vanillato more complex cases.
4. Apply various model based RL approaches to solve real world applications.
5. Recognize current advanced techniques and applications in RL

UNIT-I: Introduction and Basics of RL: Defining RL Framework and Markov Decision Process, Polices, Value Functions and Bellman Equations, Explorationvs.Exploitation, CodeStandards and Libraries used in RL (Python/Keras/Tensor flow)

UNIT-II: Tabular methods and Q-networks, Planning through the use of Dynamic Programming and Monte Carlo, Temporal-Difference learning methods (TD(0), SARSA, Q-Learning) ,Deep Q- networks (DQN, DDQN, Dueling DQN, Prioritised Experience Replay)

UNIT-III: Introduction to policy- based methods: Vanilla Policy Gradient, REINFORCE algorithm and stochastic policy search, Actor-critic methods (A2C,A3C) ,Advanced policy gradient (PPO, TRPO, DDPG)

UNIT-IV: Model-based RL approach: Analytic gradient computation, Sampling-based planning, Model-based data generation, Value-equivalence prediction, Model-based policy optimization. Model-based RL approach Recent Advances and Applications .

UNIT-V : Meta-learning: Multi-AgentReinforcementLearning.PartiallyObservableMarkovDecision Process. Ethics in RL . Applying RL for real-world problem

Text Books:

1. RichardS.SuttonandAndrewG.Barto,"Reinforcementlearning:Anintroduction", Second Edition, MIT Press, 2nd edition, 2018
2. Li,Yuxi."Deep rein for cement learning. "arXiv preprintarXiv:1810.06339 (2018).
3. Wiering, Marco, and MartijnVanOtterlo."Reinforcement learning."Adaptation, learning, and optimization 12 (2012):

Reference Books:

1. Russell, StuartJ., and Peter Norvig. "Artificial intelligence: a modern approach ." Pearson Education Limited, 2016.
2. Good fellow, Ian,Yoshua Bengio, and Aaron Courville."Deep learning." MITpress, 2016.David Silver' s course on Reinforcement Learning.

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IV Year I Semester	High-Performance Computing Professional Elective-V	L	T	P	C
		3	0	0	3

Course Objectives

- This course covers the design of advanced modern computing systems.
- In particular, the design of modern microprocessors, characteristics of the memory hierarchy, and issues involved in multi-threading and multi-processing are discussed.
- The main objective of this course is to provide students with an understanding and appreciation of the fundamental issues and trade offs involved in the design and evaluation of modern computers

Course Outcomes

1. Understand the concepts and terminology of high performance computing
2. Can write and analyze the behavior of high performance parallel programs for distributed memory architectures (using MPI).
3. Can write and analyze the behavior of high performance parallel programs for shared memory architectures (using Pthreads and OpenMP).
4. Can write simple programs for the GPU.
5. Can independently study, learn about, and present some aspect of high performance computing.

UNIT I: Introduction to Parallel hardware and software, need for high performance systems and Parallel Programming, SISD, SIMD, MISD, MIMD models, Performance issues.

UNIT II: Processors, PThreads, Thread Creation, Passing arguments to Thread function, Simple matrix multiplication using Pthreads, critical sections, mutexes, semaphores, barriers and conditional variables, locks, thread safety, simple programming assignments.

UNIT III: Open MP Programming: introduction, reduction clause, parallel for-loop scheduling, atomic directive, critical sections and locks ,private directive, Programming assignments, n body solvers using openMP.

UNIT IV: Introduction to MPI programming: MPI primitives such as MPI_Send, MPI_Recv, MPI_Init, MPI_Finalize, etc., Application of MPI to Trapezoidal rule, Collective Communication primitives in MPI, MPI derived data types, Performance evaluation of MPI programs, Parallel sorting algorithms, Tree search solved using MPI, Programming Assignments.

UNIT V: Introduction to GPU computing, Graphics pipelines, GPGPU, Data Parallelism and CUDA C Programming, CUDA Threads Organization, Simple Matrix multiplication using CUDA, CUDA memories. Bench Marking and Tools for High Performance Computing Environments, Numerical Linear Algebra Routines BLAS for Parallel Systems evaluation.

Text Books

1. Michael J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill Education, 1st edition, 2003
2. Ananth Grama, An Introduction to Parallel Programming, 2nd Edition, Pearson Education, 2nd edition, 2003
3. David R. Butenhof, “Programming with POSIX Threads”, Addison-Wesley, 1st edition, 1997.

Reference Books

1. Programming Massively Parallel Processors, Kirk &Hwu,Elsevier,4th Edition, 2022.
2. Barbara Chapman “Using OpenMP: Portable Shared Memory Parallel Programming”, MIT Press, ,21st edition ,2007

IV Year I Semester	Prompt Engineering (Skill oriented Course)	L	T	P	C
		0	1	2	2

Course Objectives:

Equip learners with the skills to design, optimize, and evaluate prompts for diverse tasks using LLMs in real-world applications.

Course Outcomes:

- Understand the Node’s unique approach to asynchronous development.
- Understand the Node Package Manager (npm) and Modules.
- Implement NodeJS applications with the Express frame work and Connect Middleware.
- Learning-depth practices for debugging and testing NodeJS applications.
- Deploy NodeJS applications in the cloud or on your own system.

Week-1

Introduction to Prompt Engineering :What is a prompt?, Types of language models (ChatGPT, Claude, Gemini, etc.), Prompting paradigms: zero-shot, few-shot, chain-of-thought

Activity:

- Exploring ChatGPT or OpenAI Playground
- Basic prompt crafting and analysis

Week-2

Foundations of Prompt Crafting :Role of clarity, context, and constraints, Prompt templates and best practices, Role-playing and persona-based prompting

Activity:

- Rewrite/improve prompts for clarity and output quality
- Use templates for different tasks (e.g., summarize, explain, translate)

Week-3

Task-Specific Prompting

Categories-Text generation (creative writing, marketing), Classification and extraction (e.g., sentiment analysis, data extraction), Question answering and summarization

Activity:

- Design prompts for each category
- Evaluate and iterate based on outputs

Week-4 and 5

Advanced Prompting Techniques

Chain-of-thought reasoning, Step-by-step breakdowns, Self-consistency and verification, System prompts and role instructions

Activity:

- Use multi-step prompts for logical reasoning or math
- Build a guided assistant with structured response flows

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Week-6 and 7

Prompt Evaluation & Iteration

Evaluation metrics (fluency, relevance, coherence), A/B testing and prompt tuning, Limitations of LLMs and prompt robustness

Activity:

- Compare prompt variants
- Analyze hallucinations and mitigate errors

Week-8 and 9

APIs and Automation

Using the OpenAI API (or other LLM APIs), Prompt injection defense basics, Automating tasks with prompts (scripts, tools)

Activity:

- Build a simple prompt-based app (e.g., email assistant or quiz generator)
- Use prompt chaining via API

Week-10

Capstone Project

Design a prompt-based solution for a real-world problem:

- Examples: résumé optimizer, content generator, legal contract explainer

TEXT BOOKS:

1. You Look Like a Thing and I Love You by Janelle Shane – fun intro to how AI interprets prompts, Online Guide, 2019
2. How to Talk to ChatGPT: The Art of Prompting by OpenAI , Online Guide, 2023
3. The Art of Prompt Engineering with ChatGPT by Nathan Hunter, Online Guide, 2023
4. **OpenAI Cookbook** – Prompt evaluation with GPT-4, Online, 2024

REFERENCEBOOKS:

1. *Designing Bots: Creating Conversational Experiences* by Amir Shevat
2. *Building Intelligent Systems: A Guide to Machine Learning Engineering* by Geoff Hulten

WEB REFERENCES

- Prompt Engineering Guide – <https://www.promptingguide.ai/>
- OpenAI Cookbook (Introduction to prompting) – <https://github.com/openai/openai-cookbook>
- Article: Anthropic’s Claude Prompting Guide – <https://docs.anthropic.com/claude/docs/prompting-best-practices>
- Notion Prompt Library – <https://www.notion.so/promptlibrary>
- **AI Text Generation Handbook (online)** – <https://textgeneration.com/>
- **OpenAI Cookbook** (Prompt examples: summarization, extraction, classification)
- **Deep Learning Prompt Engineering Course** by Andrew Ng & OpenAI - <https://learn.deeplearning.ai/chatgpt-prompt-eng/>
- **OpenAI API Docs** – <https://platform.openai.com/docs>
- **LangChain Documentation** – <https://docs.langchain.com>
- **Prompt Injection Guide** – <https://promptingguide.ai/risk/prompt-injection>

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IV Year I Semester	Gender Sensitization Audit course	L	T	P	C
		2	0	0	-

Course: Objectives

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To introduce students to information about some key biological aspects of genders.
4. To expose the students to debates on the politics and economics of work.
5. To help students reflect critically on gender violence.
6. To expose students to more egalitarian interactions between men and women.

COURSE OUTCOMES:

1. Students will have developed a better understanding of important issues related to gender in contemporary India.
2. Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
3. Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
4. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
5. Students will develop a sense of appreciation of women in all walks of life.

UNIT – I

UNDERSTANDING GENDER Introduction: Definition of Gender-Basic Gender Concepts and Terminology- Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

UNIT – II

GENDER ROLES AND RELATIONS: Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences- Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary

UNIT – III

GENDER AND LABOUR: Division and Valuation of Labour-Housework: The Invisible Labor- “My Mother doesn't Work.” “Share the Load.”-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. - Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

UNIT – IV

GENDER - BASED VIOLENCE :The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing-Coping with Everyday Harassment- Further Reading: “*Chupulu*”. Domestic Violence: Speaking Out/Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-“I Fought for my Life....”

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UNIT – V

GENDER AND CULTURE :Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals .Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks- The Brave Heart.

Text Book/ESSENTIAL READING:

The Textbook, “*Towards a World of Equals: A Bilingual Textbook on Gender*” written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu **published by Telugu Akademi, Telangana Government in 2015.**

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OPEN ELECTIVES OFFERED BY CSE(DS) TO OTHER BRANCHES

OPEN ELECTIVE -I	OPEN ELECTIVE -II
1. Fundamentals of Data Science (DR 231CD5O01) 2. Exploratory Data Analysis with Python (DR 231CD5O02) 3. Internet of Things (DR 231CD5O03)	1. Fundamentals of Data Base Management System (DR 231CD6O01) 2. Data Wrangling and Pre-processing (DR 231CD6O02) 3. Social Media Analytics (DR 231CD6O03)
OPEN ELECTIVE -III	OPEN ELECTIVE -IV
1. Introduction to Artificial Intelligence (DR 231CD7O01) 2. Data science applications (DR 231CD7O02) 3. Java Programming (DR 231CD7O03)	1. Introduction to Machine Learning (DR 231CD7O04) 2. Block Chain Technologies (DR 231CD7O05) 3. AI Chabot (DR 231CD7O06)

OPEN ELECTIVES OFFERED BY CSE (DS), (AI & ML) TO OTHER BRANCHES

OPEN ELECTIVE -I
1. Fundamentals of Data Science 2. Exploratory Data Analysis with Python 3. Internet of Things

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OPEN ELECTIVE -I	1. Fundamentals of Data Science	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES: From the course the student will learn

1. Knowledge and expertise to become a data scientist.
2. Essential concepts of statistics and machine learning that are vital for data science;
3. Significance of exploratory data analysis (EDA) in data science.
4. Critically evaluate data visualizations presented on the dashboards
5. Suitability and limitations of tools and techniques related to data science process

UNIT I: Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science

Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

UNIT II: Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modeling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning

Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

UNIT III: No SQL movement for handling Big data: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling

UNIT IV: Tools and Applications of Data Science: Introducing Neo4j for dealing with graph databases, graph query language Cypher, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts

UNIT V: Data Visualization and Prototype Application Development: Data Visualization options, Crossfilter, the JavaScript MapReduce library, Creating an interactive dashboard with dc.js, Dashboard development tools.

Applying the Data Science process for real world problem solving scenarios as a detailed case study.

Textbook:

- 1) Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, “Introducing to Data Science using Python tools”, Manning Publications Co, Dreamtech press, 2016
- 2) Prateek Gupta, “Data Science with Jupyter” BPB publishers, 2019 for basics

Reference Books:

- 1) Joel Grus, “Data Science From Scratch”, OReilly, 2019
- 2) Doing Data Science: Straight Talk From The Frontline, 1 st Edition, Cathy O’Neil and Rachel

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Schutt, O'Reilly, 2013 .

OPEN ELECTIVE -I	2. Exploratory Data Analysis with Python	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the fundamental operations of Numpy.
- To enable students to apply advanced Numpy functionalities.
- To equip learners with skills in data analysis using Pandas.
- To develop proficiency in data pre-processing and extraction techniques.
- To build competence in data visualization using Matplotlib, and to introduce natural language processing basics with libraries like NLTK

Course Outcomes:

1. Understand and apply Numpy operations for array creation, reshaping, slicing, and transformation to manipulate large datasets efficiently.
2. Apply advanced indexing, slicing, stacking, and broadcasting techniques
3. Utilize Pandas for data analysis tasks such as creating and modifying Data Frames, handling missing data, and reading various data file formats
4. Perform data pre-processing, database import, and web scraping using Python
5. Create insightful data visualizations using Matplotlib and evaluate basic Natural Language Processing tasks using NLTK and related Python libraries.

UNIT-I: Numpy Arrays - Creating a Numpy Array- Basic ndarray- Array of zeros- Array of one's- Random numbers in ndarray- An array of your choice- Imatrix in Numpy- Evenly spaced ndarray.

The Shape and Reshaping of Numpy Array- Dimensions of Numpy array- Shape of Numpy array- Size of Numpy array- Reshaping a Numpy array-Flattening a Numpy array- Transpose of a Numpy array.

Expanding and Squeezing a Numpy Array- Expanding a Numpy array- Squeezing a Numpy array- Sorting in Numpy Arrays

UNIT-II: Indexing and Slicing of NumPy Array: Slicing1-DNum Pyarrays-Slicing2-DNumPyarrays-Slicing 3-DNumPyarrays-NegativeslicingofNumPyarrays.

Stacking and Concatenating Numpy Arrays- Stackingndarrays-Concatenatingndarrays-Broadcasting in NumpyArrays.

UNIT-III: Operations using Pandas-Creating data frame-concat (-)-Setting conditions- Adding a new column. **Perform following operations using pandas**-Filling Nan with string-Sorting based on column values- group by().

Read the following file formats using pandas-Text files -CSVfiles-Excellfiles-JSONfiles

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UNIT-IV: Read the following file for mats- Picklefiles-ImagefilesusingPILc.MultiplefilesusingGlob-Importingdata from database. Demonstrate web scraping using python.

Case Study: Perform following preprocessing techniques on loan prediction dataset: Feature Scaling-Feature Standardization- Label Encoding- One Hot Encoding

UNIT-V: Visualizations using matplotlib- Bar Graph- Pie Chart- Box Plot- Histogram-Line Chart and Sub plots-Scatter Plot. Getting started with NLTK, NLTK using PIP, SciKit-Learn&NLTK, Python NLTK/ Spicy/Py NLPI

Text Books:

1. Python for Data Analysis, Oreilly, Wes McKinney, BIM Publishers, first edition, 2012.

Reference Books:

1. "Hands-On Exploratory Data Analysis with Python: Performed A techniques to understand, summarize, and investigate your data" by Suresh Kumar Machida and Us man Ahmed.

Links

1. <https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-datascience-beginners/>
2. <https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutesguide-to-key-concepts/>
3. <https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formatspython/>
4. <https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessingpython-scikit-learn/>
5. <https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-datavisualization-exploration-python/6>.

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OPEN ELECTIVE -I	1. Internet of Things	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of this course are

- Vision and Introduction to Internet of Things (IoT).
- Understand IoT Market perspective.
- Data and Knowledge Management and use of Devices in IoT Technology.
- Understand State of the Art – IoT Architecture.
- Understand Real World IoT Design Constraints, Industrial Automation and Commercial.

Course Outcomes (COs):

At the end of the course, student will be able to

- Explain in a concise manner how the general Internet as well as Internet of Things work.
- Understand constraints and opportunities of wireless and mobile networks for Internet of Things.
- Use basic sensing and measurement and tools to determine the real-time performance of network of devices.
- Develop prototype models for various applications using IoT technology.

UNIT I: The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles For Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

UNIT II: Business Models for Business Processes in the Internet of Things ,IoT/M2M systems LAYERS AND designs standardizations ,Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High- level capabilities ,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability

UNIT III: Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

UNIT IV: Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet Of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

UNIT V: Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.

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Text Books:

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press,2015

Reference Books:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
2. Getting Started with the Internet of Things, CunoPfister , Oreilly

OPEN ELECTIVE -II
<ol style="list-style-type: none">1. Fundamentals of Data Base Management System2. Data Wrangling and Pre-processing3. Social Media Analytics

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OPEN ELECTIVE -II	1. Fundamentals of Data Base Management System	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce about database management systems
- To give a good formal foundation on the relational model of data and usage of Relational Algebra
- To introduce the concepts of basic SQL as a universal Database language
- To demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- To provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

Course Outcomes:

By the end of the course, the student will be able to

- Describe a relational database and object-oriented database
- Create, maintain and manipulate a relational database using SQL
- Describe ER model and normalization for database design
- Examine issues in data storage and query processing and can formulate appropriate solutions
- Outline the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage

UNIT I: Introduction: Database system, Characteristics (Database Vs File System), Database Users(Actors on Scene, Workers behind the scene), Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

UNIT II: Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance
 BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion).

UNIT III: Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams. SQL: Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

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UNIT IV: Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V: Transaction Concept: Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.
Indexing Techniques: B+ Trees: Search, Insert, Delete algorithms, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes , Index data Structures, Hash Based Indexing: Tree base Indexing ,Comparison of File Organizations, Indexes and Performance Tuning

Text Books:

- 1) Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, TMH
- 2) Database System Concepts,5/e, Silberschatz, Korth, TMH

Reference Books:

- 1) Introduction to Database Systems, 8/e C J Date, PEA.
- 2) Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA
- 3) Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

e- Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105175/>
- 2) <https://www.geeksforgeeks.org/introduction-to-nosql/>

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OPEN ELECTIVE -II	2. Data Wrangling and Pre-processing	L	T	P	C
		3	0	0	3

Course Objectives

1. To understand the importance and foundational concepts of data wrangling and pre-processing.
2. To learn practical methods for cleaning and correcting raw datasets.
3. To transform and encode data effectively for machine learning applications.
4. To integrate and reduce data while preserving key information.
5. To prepare clean and structured data suitable for use in various machine learning models.

Course Outcomes

1. Students will gain proficiency in identifying, collecting, and organizing raw datasets from diverse sources.
2. Students will clean and pre-process data by handling missing values, outliers, and inconsistencies.
3. Students will apply transformation techniques such as encoding, scaling, and feature engineering.
4. Students will integrate, reduce, and aggregate datasets for performance and efficiency.
5. Students will prepare high-quality input datasets ready for training machine learning models.

Unit 1: Introduction to Data Wrangling

This unit introduces the concepts of data wrangling and pre-processing, highlighting their significance in analytics and machine learning. It covers the different types of data — structured, unstructured, and semi-structured — and their respective implications on data processing workflows. Students explore various data collection methods and formats, including CSV, JSON, XML, and data retrieved through APIs. Additionally, the unit presents a brief overview of essential tools such as Python, Pandas, and NumPy, which are widely used in data wrangling tasks. The goal is to build foundational knowledge and awareness of the data pre-processing ecosystem.

Unit 2: Data Cleaning

In this unit, students learn to address common issues found in raw datasets. Techniques for identifying and handling missing data are covered, as well as strategies to eliminate duplicates and inconsistencies. Data type conversions and formatting are discussed to ensure consistency and compatibility across tools. Students will also learn to detect and treat outliers, an essential step in preserving model accuracy. The unit includes practical exercises in parsing data, manipulating strings, and applying regular expressions to clean and organize unstructured or messy data effectively.

Unit 3: Data Transformation

This unit focuses on the transformation of data to make it more useful and compatible with machine learning models. Students explore methods such as normalization and standardization to scale numerical features. Feature extraction and engineering are introduced to enhance model input quality, and techniques like binning and discretization help simplify continuous variables. The unit also covers encoding categorical variables using label encoding and one-hot encoding. Special attention is given to processing temporal data, equipping students with the ability to handle dates and time-series information effectively.

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Unit 4: Data Integration and Reduction

Here, students explore how to combine and streamline multiple datasets. Techniques such as merging, joining, and concatenation are introduced for integrating data from different sources. The unit discusses methods for resolving conflicts and removing redundancies that can occur during integration. Students are introduced to dimensionality reduction techniques like Principal Component Analysis (PCA), t-Distributed Stochastic Neighbor Embedding (t-SNE), and Linear Discriminant Analysis (LDA). Feature selection strategies, including filter, wrapper, and embedded methods, are explored to optimize datasets. The unit concludes with approaches for data aggregation and summarization to improve dataset manageability and computational efficiency.

Unit 5: Data Pre-processing for Machine Learning

The final unit addresses the final steps in preparing data for machine learning. It covers how to split datasets effectively using train-test splits and cross-validation. Handling imbalanced datasets is discussed through techniques such as oversampling, under sampling, and Synthetic Minority Over-sampling Technique (SMOTE). Various scaling techniques, including Min-Max, Standard, and Robust Scaling, are explained to bring numerical features into comparable ranges. The concept of automating the pre-processing workflow using pipelines is introduced, allowing for repeatable and efficient pre-processing steps. The unit concludes with the preparation of datasets tailored for both supervised and unsupervised learning scenarios.

Textbooks

1. *Data Wrangling with Pandas* by Jacqueline Kazil and Katharine Jarmul, O'Reilly Media
2. *Python for Data Analysis* by Wes McKinney, O'Reilly Media
3. *Data Pre-processing Techniques* by Salvador García, Julián Luengo, Francisco Herrera, Springer

Reference Books

1. *Hands-On Data Pre-processing in Python* by Roy Jafari
2. *Feature Engineering and Selection* by Max Kuhn and Kjell Johnson
3. *Machine Learning Yearning* by Andrew Ng

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OPEN ELECTIVE -II	3. Social Media Analytics	L	T	P	C
		3	0	0	3

Course Objectives:

- To provide an overview of social media platforms and their relevance to analytics.
- To equip students with the skills for collecting and pre-processing social media data.
- To introduce natural language processing techniques for analyzing textual data.
- To apply network analysis to understand relationships and influence in social networks.
- To develop the ability to visualize, interpret, and derive actionable insights from social media data.

Unit I: Introduction to Social Media and Analytics

This unit introduces the landscape of social media, focusing on platforms like Twitter, Facebook, Instagram, LinkedIn, and YouTube. It covers the types and characteristics of social media data including text, image, and video formats. The unit highlights the importance, challenges, and ethical aspects of social media analytics. Students will also be introduced to various APIs such as Twitter API and Facebook Graph API for data access.

Unit II: Social Media Data Collection and Preprocessing

Students learn about different methods and tools used for data extraction from social media platforms. The unit covers API authentication, rate limiting, and data retrieval in JSON format. Techniques for cleaning and pre-processing text data, handling missing values, and filtering irrelevant content are also discussed, along with storage solutions like NoSQL databases and cloud-based storage for big data handling.

Unit III: Natural Language Processing for Social Media

This unit covers essential NLP techniques including tokenization, stop word removal, stemming, and lemmatization. It discusses part-of-speech tagging, named entity recognition, and syntactic parsing. Emphasis is placed on sentiment analysis, emotion detection, and opinion mining. Word embedding models such as Word2Vec and GloVe are introduced to help in semantic analysis.

Unit IV: Social Network Analysis

The focus of this unit is on understanding the structure and dynamics of social networks using graph theory. Students learn about nodes, edges, and graph representations. Key metrics such as degree centrality, closeness, betweenness, and eigenvector centrality are explored. Concepts like community detection, influencer identification, and information diffusion in networks are also covered using real-world datasets.

Unit V: Visualization and Case Studies

Students will learn to visualize social media data using tools such as Matplotlib, Seaborn, and Plotly. They will build dashboards and visual reports with platforms like Tableau and Power BI. This unit includes practical case studies in brand monitoring, hashtag trend analysis, political sentiment tracking, and crisis communication. Ethical issues such as misinformation and data privacy are also discussed.

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Course Outcomes:

- Understand the landscape and significance of social media analytics.
- Collect, clean, and manage large volumes of social media data.
- Apply natural language processing techniques to analyze textual social media content.
- Perform network-based analysis to identify key users and patterns.
- Visualize social media insights and apply them to real-world problems.

Text Books:

1. Matthew A. Russell, *Mining the Social Web*, O'Reilly Media, 3rd Edition.
2. Charu C. Aggarwal, *Social Network Data Analytics*, Springer.
3. Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, *Social Media Mining: An Introduction*, Cambridge University Press.

Reference Books:

1. Peter Mika, *Social Networks and the Semantic Web*, Springer.
2. Subbarao Kambhampati, *AI Methods for Social Media*, Morgan & Claypool.
3. Pak, A., & Paroubek, P., "Twitter as a Corpus for Sentiment Analysis and Opinion Mining," LREC Proceedings.

e-Resources and other Digital Material

<https://nptel.ac.in/courses/110107129>

<https://emplifi.io/resources/blog/social-media-analytics-the-complete-guide>



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OPEN ELECTIVE -III

- | |
|---|
| <ol style="list-style-type: none">1. Introduction to Artificial Intelligence2. Data science applications3. Java Programming |
|---|

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OPEN ELECTIVE -III	1. Introduction to Artificial Intelligence	L	T	P	C
		3	0	0	3

Pre-requisite:

1. Knowledge in Computer Programming.
2. A course on “Mathematical Foundations of Computer Science”.
3. Background in linear algebra, data structures and algorithms, and probability.

Course Objectives:

1. The student should be made to study the concepts of Artificial Intelligence.
2. The student should be made to learn the methods of solving problems using Artificial Intelligence.
3. The student should be made to introduce the concepts of Expert Systems.
4. To understand the applications of AI, namely game playing, theorem proving, and machine learning.
5. To learn different knowledge representation techniques

UNIT – I: Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT – II: Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions

UNIT – III: Representation of Knowledge: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Bayes’ probabilistic interferences and dempstershafer theory.

UNIT – IV: Logic concepts: First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

UNIT – V: Expert Systems: Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells.

Textbooks:

1. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, SecondEdition, Pearson Education.
2. Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill

Reference Books:

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1. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence: a logical approach", Oxford University Press.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problemsolving", Fourth Edition, Pearson Education.

Online Learning Resources:

1. <https://ai.google/>
2. https://swayam.gov.in/nd1_noc19_me71/preview

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OPEN ELECTIVE -III	2. Data Science Applications	L	T	P	C
		3	0	0	3

Course Objective: To give deep knowledge of data science and how it can be applied in various fields to make life easy.

Course Outcomes: After completion of course, students would:

1. To correlate data science and solutions to modern problems.
2. To decide when to use which type of technique in data science.

UNIT – I

Data Science Applications in various domains, Challenges and opportunities, tools for data scientists, Recommender systems – Introduction, methods, application, challenges.

UNIT - II

Time series data – stock market index movement forecasting. Supply Chain Management – Real world case study in logistics.

UNIT – III

Data Science in Education, Social media.

UNIT - IV

Data Science in Healthcare, Bioinformatics.

UNIT - V

Case studies in data optimization using Python.

TEXT BOOKS:

1. Aakanksha Sharaff, G.K.Sinha , “Data Science and its applications “, CRC Press, 2021.
2. Q. A. Menon, S. A. Khoja, “Data Science: Theory, Analysis and Applications”, CRC Press, 2020.

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OPEN ELECTIVE -III	3. Java Programming	L	T	P	C
		3	0	0	3

Course Objectives:

The learning objectives of this course are:

- To identify Java language components and how they work together in applications
- To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- To understand how to design applications with threads in Java
- To understand how to use Java APIs for program development

Course Outcomes:

By the end of the course, the student will be

- Able to realize the concept of Object Oriented Programming & Java Programming Constructs
- Able to describe the basic concepts of Java such as operators, classes, objects, inheritance, packages, Enumeration and various keywords
- Apply the concept of exception handling and Input/ Output operations
- Able to design the applications of Java & Java applet
- Able to Analyze & Design the concept of Event Handling and Abstract Window Toolkit

UNIT I

Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators: Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if-else Expressions, Ternary Operator?;, Switch Statement, Iteration Statements, while Expression, do-while Loop, for Loop, Nested for Loop, For-Each for Loop, Break Statement, Continue Statement.

UNIT II

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class

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Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three- dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions, Nested try and catch Blocks, Rethrowing Exception, Throws Clause.

UNIT V

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Methods for Comparison of Strings, Methods for Modifying Strings, Methods for Searching Strings, Data Conversion and Miscellaneous Methods, Class String Buffer, Class String Builder.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface, Creating JDBC Application, JDBC Batch Processing, JDBC Transaction Management

Text Books:

- 1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
- 2) The complete Reference Java, 8th edition, Herbert Schildt, TMH.

References Books:

- 1) Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
- 2) Murach's Java Programming, Joel Murach

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e- Resources:

- <https://nptel.ac.in/courses/106/105/106105191/>
- https://www.w3schools.com/java/java_data_types.asp

OPEN ELECTIVE -IV

- | |
|--|
| <ol style="list-style-type: none">1. Introduction to Machine Learning2. Block Chain Technologies3. AI Chabot |
|--|

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OPEN ELECTIVE -IV	1. Introduction to Machine Learning	L	T	P	C
		3	0	0	3

Course Objectives:

- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
- Analyze a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).
- Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).
- Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports

Course Outcomes:

After the completion of the course, student will be able to

- Explain the definition and usage of the term 'the internet of things' in different contexts.
- Demonstrate on various network protocols used in IoT.
- Analyze on various key wireless technologies used in IoT systems, such as WiFi, 6LoWPAN, Bluetooth and ZigBee.
- Illustrate on the role of big data, cloud computing and data analytics in IoT system.
- Design a simple IoT system made up of sensors, wireless network connection, data analytics and display/actuators, and write the necessary control software.

Unit-I

Introduction-Towards Intelligent Machines, Well posed Problems, Example of Applications in diverse fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning, Machine Learning and Data Mining, Basic Linear Algebra in Machine Learning Techniques.

Unit-II

Supervised Learning- Rationale and Basics: Learning from Observations, Bias and Why Learning Works: Computational Learning Theory, Occam's Razor Principle and Over fitting Avoidance Heuristic Search in inductive Learning, Estimating Generalization Errors, Metrics for assessing regression, Metrics for assessing classification.

Unit-III

Statistical Learning- Machine Learning and Inferential Statistical Analysis, Descriptive Statistics in learning techniques, Bayesian Reasoning: A probabilistic approach to inference, K-Nearest Neighbor Classifier. Discriminant functions and regression functions, Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Fisher's Linear Discriminant and Thresholding for Classification, Minimum Description Length Principle.

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Unit-IV

Support Vector Machines (SVM)- Introduction, Linear Discriminant Functions for Binary Classification, Perceptron Algorithm, Large Margin Classifier for linearly separable data, Linear Soft Margin Classifier for Overlapping Classes, Kernel Induced Feature Spaces, Nonlinear Classifier, Regression by Support vector Machines. Learning with Neural Networks: Towards Cognitive Machine, Neuron Models, Network Architectures, Perceptrons, Linear neuron and the Widrow-Hoff Learning Rule, The error correction delta rule.

Unit -V

Multilayer Perceptron Networks and error back propagation algorithm, Radial Basis Functions Networks. Decision Tree Learning: Introduction, Example of classification decision tree, measures of impurity for evaluating splits in decision trees, ID3, C4.5, and CART decision trees, pruning the tree, strengths and weakness of decision tree approach.

Textbooks:

1. Applied Machine Learning, M. Gopal, McGraw Hill Education
2. Machine Learning: A Probabilistic Perspective, Kevin Murphy, MIT Press, 2012
3. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2009 (freely available online)

Reference Books:

1. Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2007
2. Programming Collective Intelligence: Building Smart Web 2.0 Applications - Toby Segaran

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OPEN ELECTIVE -IV	2. Block Chain Technologies	L	T	P	C
		3	0	0	3

Course Objectives

1. To provide conceptual understanding of the function of Block chainsaw method of securing distributed ledgers.
2. To understand he structure of a Block chain and why/when it is better than a simple distributed database
3. To make students understand the technology call under pinning of Blockchain operations as distributed data structures and decision-making systems.
4. To understand “smart” contract and its legal implications.

Course Outcomes

The student will be able to:

1. Illustrate the fundamentals of Blockchain.
2. Summarize decentralization and the role of Blockchain in it.
3. Analyse Bit coin Crypto currency and underlying Blockchain network.
4. Understand Ethereum currency and platform, and develop applications using Solidity.
5. Analyse the challenges and future opportunities in Blockchain technology

UNIT I

Introduction: History and basics, Types of Blockchain, Consensus, CAP Theorem. **Cryptographic Hash Functions:** Properties of hash functions, Secure Hash Algorithm, Merkle trees, Patricia trees.

UNIT II

Decentralization: Decentralization using Blockchain, Methods of decentralization, decentralization framework, Blockchain and full ecosystem decentralization, Smart contracts, Decentralized Organizations, Platforms for decentralization.

UNIT III

Bitcoin: Introduction to Bitcoin, Digital keys and addresses, Transactions, Blockchain, The Bitcoin network, Bitcoin payments, Bitcoin Clients and APIs, Alternatives to Proof of Work, Bitcoin limitations.

UNIT IV

Ethereum: Smart Contracts, Introduction to Ethereum, The Ethereum network, Components of the Ethereum ecosystem, Blocks and Blockchain, Fee schedule, Ethereum Development Environment, Solidity.

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UNIT V

Hyper ledger: Introduction, Hyper ledger Projects, Protocol, Architecture, Hyper ledger Fabric, Saw tooth Lake, Corda.

Challenges and Opportunities: Scalability, Privacy, Blockchain for IoT, Emerging trends

Text Books

1. Mastering Blockchain, Imran Bashir, Second Edition, Packet Publishing, 2nd edition, March 2018.

Reference Books:

1. Mastering Bitcoin: Unlocking Digital Crypto currencies, Andreas Antonopoulos, O'Reilly.
2. Blockchain Blueprint for a New Economy, Melanie Swan, O'Reilly.

Links:

- <https://www.coursera.org/learn/introduction-blockchain-technologies>
- https://onlinecourses.nptel.ac.in/noc22_cs44/preview

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OPEN ELECTIVE -IV	3. AI Chabot	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce students to the foundations and evolution of AI-powered conversational agents.
2. To familiarize students with Natural Language Processing (NLP) techniques essential for chatbot development.
3. To provide hands-on understanding of chatbot frameworks, platforms, and development workflows.
4. To explore machine learning and deep learning models used in building intelligent conversational systems.
5. To equip students with the skills to design, implement, test, and deploy AI chatbots for real-world use cases.

COURSE OUTCOMES:

1. Understand the foundational concepts and architecture of AI-powered chatbots.
2. Apply NLP techniques to extract meaningful information and understand user inputs.
3. Develop and test conversational agents using popular chatbot development frameworks.
4. Integrate machine learning and deep learning models to enhance chatbot intelligence.
5. Design, deploy, and evaluate AI chatbots with awareness of ethical and practical implications.

UNIT I

Introduction to Chatbots and Conversational AI: History and evolution of chatbots. Types of chatbots – rule-based vs AI-based. Key components of a chatbot – NLU, dialogue management, and NLG. Overview of chatbot architecture. Applications in customer service, healthcare, education, and e-commerce. Challenges in chatbot development – language ambiguity, user intent, and dialogue coherence.

UNIT II

Natural Language Processing for Chatbots: Basics of NLP – tokenization, stemming, lemmatization, POS tagging, NER. Intent recognition and entity extraction. Text vectorization – Bag of Words, TF-IDF, and Word Embeddings (Word2Vec, GloVe, BERT). Sentiment analysis and language detection. Introduction to spaCy, NLTK, and Hugging Face Transformers for NLP tasks.

UNIT III

Chatbot Frameworks and Tools: Overview of popular chatbot development platforms – Dialogflow, IBM Watson Assistant, Microsoft Bot Framework, Rasa. Building intents, entities, and actions. Conversation flow design using stories and rules. Integration with messaging platforms like Telegram, Slack, WhatsApp, and web interfaces. Testing and debugging chatbots.

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UNIT IV

Machine Learning and Deep Learning for Chatbots: Supervised learning for intent classification. Sequence-to-sequence models and transformers for response generation. Use of LSTMs and GRUs in dialogue systems. Reinforcement learning for dialogue policy optimization. Pretrained language models and fine-tuning for conversational agents (e.g., GPT, BERT-based models).

UNIT V

Deployment, Ethics, and Applications: Hosting chatbots using cloud services and REST APIs. Logging, analytics, and user feedback loops. Personalization and contextual conversation handling. Ethical considerations – data privacy, hallucinations, bias, and misuse. Case studies: AI chatbots in banking, mental health, education, and e-commerce. Capstone project discussion and roadmap.

TEXT BOOKS:

1. Jason D. Brown (2020). Designing Bots: Creating Conversational Experiences, O'Reilly Media.
2. Sumit Raj (2019). Building Chatbots with Python: Using Natural Language Processing and Machine Learning, Apress.
3. Srini Janarthanam (2017). Hands-On Chatbots and Conversational UI Development, Packt Publishing.

REFERENCE BOOKS:

1. Michael McTear (2020). Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots, Springer.
2. Brad Abrams et al. (2020). Designing Bots with Microsoft Bot Framework and Azure Bot Services, Microsoft Press.
3. Md. Rezaul Karim (2021). Building Smart Chatbots Using Dialogflow, Packt Publishing.

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HONORS COURSES

TRACK1: WEB FRAMEWORK

- 2-2 Angular JS Framework
- 3-1 Django Framework
- 3-2 Dot Net Core
- (3-2 Any Course from SWAYAM NPTEL Suggested by BoS in this track.)**
- 4-1 Java Enterprise Framework

TRACK2: NETWORKS

- 2-2. Introduction to Networks (ITN)
- 3-1. Switching, Routing, and Wireless Essentials
- 3-2. Enterprise Networking, Security, and Automation
- (3-2 Any Course from SWAYAM NPTEL Suggested by BoS in this track.)**
- 4-1. Wireless Sensor Networks.

TRACK3: SECURITY

- 1) 2-2. Cyber Security
- 2) 3-1. Secure Coding
- 3) 3-2. Vulnerability Assessment & Penetration Testing
- 4) Privacy and Security in Online Social Media (THROUGH MOOCS)
- 5) 4-1. Malware Analysis

TRACK4: DATA SCIENCE

- 1) 2-2. Introduction to Data Science
- 2) 3-1. Social Network Analysis
- 3) 3-2 .Deep Learning for Computer Vision
- 4) Bio Informatics/ GPU Architecture and Programming (Through MOOCs)
- 5) 4-1. AI in Health Care

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Year & Semester: II - II

<u>TRACK-1:</u> WEB FRAMEWORK	Angular JS Framework	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand model view framework for building applications.
- To create modules for binding the application.
- To understand dependency injection for implementing services.
- To create and establish routes redirects and navigation.
- To validate forms for the submission of data.

Course Outcomes:

1. Understand the fundamentals of Angular JS and its architecture.
2. Apply data binding objects for implementing modules.
3. Implement service and retrieve rest call data.
4. Understand routes and their configuration in angular.
5. Implement form handling with event driven apps.

Unit 1

Angular JS – Introduction to Angular JS, Java Script vs Angular, MVC Framework, Component Based Model, Setting Up the Environment, Installation of Node and NPM, Angular CLI, Creating and Running Project, Add Dependencies, The Anatomy of an AngularJS app, First Application. What is a Component, Create and Start Component.

Learning Outcomes:

Student will be able to

- Understand MVC framework for building applications. (L2)
- Understand the installations of Node, NPM and angular. (L2)
- Implement Components using angular dependencies. (L3)

Unit 2

Data Binding: Introduction to Data Binding, Types of Binding, Binding Data from Component, Async, Template Interpolation, Looping with ngFor, Condition with ngIf, Passing inputs and variables to Components, ngModel for 2-way binding, ngOnInit, Styling with components, Creating multiple modules. Combine Forms with Data binding.

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Learning Outcomes:

Student will be able to

- Understand data binding for components. (L2)
- Implement looping and decision making for components. (L3)
- Implement components and modules for binding data from the applications. (L3)

Unit 3

Dependency Injection: Understanding Dependency Injection(DI), Services, Creating a Service, Service Injection Context, Rest Calls with HttpClient, Building Angular Project.

Learning Outcomes: Student will be able to

- Understand the dependency injection and its types. (L2)
- Implement rest based calls from client using HttpClient. (L3)
- Implement Angular project by building angular services. (L3)

Unit 4

Routing & Wrap Up: Introduction to Routing, Angular Project with routing, Creating routes, Route redirects and wild cards, Route Configuration, Static Data in Route, Nested Routing, Navigation Controlling.

Learning Outcomes:

Student will be able to

- Understand routing with angular. (L2)
- Implement and redirect routes for navigation. (L3)
- Implement wild cards and wrap up for building angular project. (L3)

Unit 5

Form Handling : Introduction to Form Handling, Template Driven, Form Validation, ng-minlength, ngmaxlength, ng-pattern, ng-required, Submitting Forms, Event Handling with Forms.

Learning Outcomes:

Student will be able to

- Understand the working of forms and its validations. (L2)
- Implement event handling methods for form submissions. (L3)

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CONTEMPORARY TOPICS:

- Pipes
- HTTP Requests
- Authentication
- Angular Modules
- Animations

APPLICATIONS:

- Online Web Applications
- Financial, Banking Applications and Gateways etc
- Online and Social Media Applications

TEXT BOOKS:

1. Angular 6 by Example: Get up and running with Angular by building modern realworld web apps, 3rd Edition, by Chandermani Arora.
2. Pro Angular 6, Apress, by Adam Freeman

REFERENCE BOOKS:

1. Angular JS by Green, Orielly
2. Professional AngularJS (WROX), by Valeri Karpov

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Year & Semester: III - I

<u>TRACK-1:</u>	Django Framework	L	T	P	C
WEB FRAMEWORK		3	0	0	3

Course Objectives:

- Understand the fundamentals of Django Framework.
- Implement Basic Templates for Client-side web pages.
- Implement Django model objects for generating data processing.
- Implement Django Forms for input processing and signals for profiles.
- Implement Serializers and Models using Rest APIs.

Course Outcomes:

1. Understand the environment of Django Web Server Framework. (L2)
2. Implement URL Mappings and Views using Templates. (L3)
3. Implement Django models for processing data from templates. (L3)
4. Implement Django Forms and Signals. (L3)
5. Implement Restfull APIs using Django Rest Framework. (L3)

Unit -1

Django Framework: Introduction to Django, Features of Django, Application areas of Django, Flask vs Django, Django Components, Install and Configure Django Components. The Basics of Dynamic Web Pages.

List of Programs:

1. Implement Django environment setup and installation in Windows/Linux. (L3)
2. Implement Django Project and app structure with django-admin commands. (L3)
3. Deployment of a Project in the Server. (L2)

Learning Outcomes:

Student will be able to

1. Understand the features and applications of Django. (L2)
2. Install Django environment using pip installer. (L3)
3. Understand Components and its structure. (L2)

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Unit 2

Django Templates: MVT Development Pattern, URLs, Views, Static Files, Images, Forms, Application development using Templates, Template Objects, Template Tags & Filters, Loops, Template Loading and Template Inheritance.

List of Programs:

1. Implement template in Django Project to process User Interface. (L3)
2. Implement multiple routes for using Django URLs. (L3)
3. Implement template inheritance with views and images. (L3)

Learning Outcomes:

Student will be able to

1. Understand Django Template objects. (L2)
2. Implement URLs and Views of Django applications. (L3)
3. Implement loops and inheritance in templates. (L3)

Unit 3

Django Models: Introduction to Django Models, Admin Panel, Configuring the Database, Interacting with a Database, Database Relationships: One-One, One-Many, Many-Many, Model Queries, Rendering Data to Templates, Dynamic URLs and Routing, CRUD operations.

List of Programs:

1. Implement database configuration in Django admin with Sqlite3. (L3)
2. Implement CRUD operations using Django models. (L3)
3. Implement database relationships using django models. (L3)
4. Implement data rendering with templates and dynamic routing. (L3)

Learning Outcomes:

Student will be able to

1. Understand the Django Models and Admin Panels (L2)
2. Apply relationships between multiple model objects. (L3)
3. Implement routing for navigating URLs. (L3)

Unit 4

Dynamic Forms & Signals: Form Processing, Inline Form sets, Search Forms, User Registration and User Authentication, User Roles & Permissions, User Profiles, Image Upload, Django Signals, Creating Customer Profiles with Django.

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List of Programs:

1. Implement user registration and login authentication using django forms. (L3)
2. Implement the roles and permissions for user profile. (L3)
3. Implement Django signal for user profiles. (L3)

Learning Outcomes:

Student will be able to

1. Implement dynamic web pages using FormSets (L3)
2. Implement registration and authentication for user profiles (L3)
3. Implement Django signals for creating customer profiles. (L3)

Unit 5

Django Rest Framework: Introduction to Django Rest Framework, Features of Rest APIs, Installation of Django Rest Framework, API_view, Response, JsonResponse, Models and Serializers, PATH and urlpatterns, HTTP methods GET, POST, PUT and DELETE methods

List of Programs:

1. Install and configure Django Rest framework package. (L3)
2. Implement django rest end points using API_view and JsonResponse. (L3)
3. Implement Django rest end points using Serializers and Models. (L3)
4. Implement HTTP rest end points with all CRUD operations. (L3)

Learning Outcomes:

Student will be able to

1. Understand Django Rest framework and its packages. (L2)
2. Implement Models and Serializers for rest api. (L3)
3. Implement GET, POST, PUT and DELETE calls using rest framework package. (L3)

CONTEMPORARY TOPICS:

- Building a Pages Application.
- Building a Message Board Application.
- Building a Blog Application.
- Building a Password Change and Reset.

APPLICATIONS:

- Building enterprise level applications.
- Building Financial, banking applications, gateways etc.

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- Online and Social media applications.

TEXT BOOKS:

- Django RESTful Web Services: The easiest way to build Python RESTful APIs by Gaston C Hillar, Packt
- Building Website with Django, 1 Edition, by Awanish Ranjan

REFERENCE BOOKS:

- Light Weight Django by O'Reilly Media, by Julia Elman and Mark Lavin
- Python Web Development with Django, by O'Reilly – Paul Bissex and Jeff Forcier

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Year & Semester: III - II

<u>TRACK-1:</u> WEB FRAME WORK	.NET Core	L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand Visual Studio Code and .NET Core development tools for an efficient coding environment.
2. Apply OOPS principles effectively within .NET Core applications.
3. Gain practical expertise in manipulating data using collections, LINQ, and generics.
4. Design and deploy secure and responsive web applications using ASP.NET Core and front-end frameworks.
5. Implement secure and efficient web applications with effective state management and persistence strategies in .NET Core.

Course Outcomes:

- Master the basics of C# syntax and structure within the .NET Core framework, ensuring organized and standard-compliant code.
- Apply object-oriented principles and asynchronous programming in .NET Core, focusing on efficient and scalable solutions.
- Utilize collections, LINQ, and generics for data manipulation in .NET Core, adopting a systematic approach to coding and debugging.
- Design dynamic, responsive web applications using ASP.NET Core and front-end frameworks, prioritizing secure and user-friendly interfaces.
- Build secure web applications with effective state management and database integration, committing to high-quality coding practices.

Unit I

The .NET Core Technology & Introduction to C#: Fundamentals of the .NET Core framework and its architecture, Overview of .NET Core vs .NET Framework, Common Type System (CTS), Common Language Specification (CLS), Base Class Library (BCL) and Common Language Runtime (CLR), C# features and basics: Program structure, data types, operators, decision-making statements, loops, arrays, and strings

Learning Outcomes:

- Understand .NET Core program structure (L2)
- Understand decision-making and iterations in C# (L2)

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Unit II

OOP Concepts and Asynchronous Programming: Class, object, inheritance, abstract classes, interfaces, polymorphism, exception handling, Collections in C# and LINQ,

Learning Outcomes:

- Understand object-oriented concepts with real-time applications (L2)
- Implement error and exception handling strategies (L3)
- Utilize asynchronous programming for better performance (L3)

Unit III

ASP.NET Core Web Development: Overview of ASP.NET Core framework, ASP.NET Core page lifecycle, Razor Pages, MVC pattern. Introduction to Tag Helpers, HTML Helpers, Validation, Integrating modern front-end frameworks (React or Angular or Vue) with ASP.NET Core

Learning Outcomes:

- Implement the Model-View-Controller architecture for creating web applications (L4)
- Develop responsive web applications using modern front-end frameworks (L3)
- Implement ASP.NET Core lifecycle through tag helpers and navigation (L4)

Unit IV

ASP.NET Core Session and State Management: Overview of session state, its importance, and the challenges of maintaining user state in web applications, Client-side and server-side session management

Learning Outcomes:

- Understand and identify the challenges associated with maintaining user state (L2)
- Compare client-side and server-side session management techniques in ASP.NET Core (L4)
- Implement both client-side and server-side techniques (L3)

Unit V

Working with Databases in .NET Core (Entity Framework Core): Overview of Entity Framework Core, Connected and Disconnected Architecture, Database connectivity, Integration with cloud databases and services (e.g., Azure SQL, AWS RDS)

Learning Outcomes:

- Describe the components and architecture of Entity Framework Core, including connected and disconnected models (L2)
- Demonstrate database connectivity in Entity Framework Core applications (L3)

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- Analyze connected and disconnected architectures in Entity Framework Core and their impact on application performance (L4)
- Integrate .NET Core applications with cloud databases and services (L3)

Text Books

1. Pro ASP.NET Core 3, by Adam Freeman, Apress, 2019, 1st Edition
2. C# 8.0 and .NET Core 3.0 – Modern Cross-Platform Development, by Mark J. Price, Packt Publishing, 2019, 4th Edition
3. Entity Framework Core in Action, by Jon P Smith, Manning Publications, 2018, 1st Edition

Reference Books

1. ASP.NET Core in Action by Andrew Lock, Manning Publications, 2018, 1st Edition
2. Programming ASP.NET Core, by Dino Esposito, Microsoft Press, 2018, 1st Edition
3. Pro C# 8 with .NET Core: Foundational Principles and Practices in Programming, by Andrew Troelsen, Philip Japikse, Apress, 2019, 9th Edition

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Year & Semester: IV – I

<u>TRACK-1:</u> WEB FRAMEWORK	Java Enterprise Framework	L	T	P	C
		3	0	0	3

Course Objectives:

- Implement CRUD operations using Java APIs
- Understand servers id environment using Servlets.
- Creates riverside web pages using Java Server Pages.
- Understand Object relational mapping using Hibernate.
- Write business logics using Spring MVC and AO Programming.

Course Outcomes:

1. Implement database operations from front end java APIs.
2. Write server side programs for controlling HTTP requests.
3. Create dynamic server side web pages using JSP tags.
4. Create Hibernate objects form aping objects and database relations.
5. Create model based java objects for controlling server based applications.

Unit I

Java Database Connectivity - JDBC Overview & Architecture, JDBC Driver Types, Types of Result Set, Statement, Prepared Statement, Callable Statement, Executing DDL and DML Commands.

Learning Outcomes: Student will be able to

- Understand JDBC drivers for connecting Database.(L2)
- Write complex queries for retrieving data from database.(L4)
- Create callable statements for executing database procedures.(L4)

Unit-II

Servlets: Web Server, Container, Servlet Overview, Life cycle of Servlet, Handling Web Form Data in Servlets., Dynamically including Content in Servlets, Handling Exceptions in Web Applications, Reading and Setting Cookies, Session Tracking, Servlet Filters, Accessing Databases.

Learning Outcomes:

Student will be able to

- Understand Web container for storing server side programs(L2).
- Implement Request and response handlers using Http libraries.(L4).

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- Create Servlet for retrieving data from databases.(L4)

Unit-III

Java Server Pages: Overview of JSP, JSP Architecture & lifecycle, Components of Java Server Pages, Implicit Objects & Standard JSP Tags, Scope of JSP objects ,Dynamically including content in JSPs, Handling Form data in JSPs, Accessing Databases, Tag Libraries.

Learning Outcomes: Student will be able to

- Understand the structure of JSP and its Life Cycle(L2)
- Create dynamic web pages using JSPtaglibraries.L4)
- Implement JSP scope for switching between pages.(L4)

Unit-IV

HIBERNATE: Introduction to Hibernate, Hibernate Architecture, Understanding Object Persistence, Hibernate Basics, Types of Relations, Querying Persistent Objects, Hibernate Query Language (HQL)

Learning Outcomes: Student will be able to

- Understand Hibernate Object relational mapping(L2)
- Create Hibernate objects for implementing relations between tables.(L4)
- Implement Hibernate queries for persisting java objects. (L4)

Unit-V

Spring Framework: Spring Architecture and Container, Spring Setup in Eclipse, Spring Bean Factory, Bean factory VS Application Context, Dependency Injection (DI), Types of DI, Bean Auto wiring, Collections with Spring, Bean Scopes, Event Handling in Spring, Introduction to aspect Oriented Programming(AOP).

Learning Outcomes:

Student will be able to

- Understand architecture of spring container.(L2)
- Implement dependency injection for setting data for beans.(L4)
- Create spring beans for handling events and aspects.(L4)

Applications:

- Building enterprise level applications like IRCTC.
- Building Financial, banking applications, gateways etc
- Online and Social media applications



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Text Books:

1. JDBC, Servlets and JSP Black Book, by Kogent Solutions Inc.SantoshKumarK,DreamtechPublications. 2nd Edition, 2016.
2. Java Servlet &JSP Cook book by Bruce W. Perry Publisher(s): O'Reilly Media, 2004
3. SpringandHibernate-2ed,byK.SantoshKumar, McGraw-Hill Education

Reference Books:

1. SpringinAction,4ed(Manning),by Craig Walls(Author),Dreamtech.
2. JavaPersistencewithHibernate:RevisedofHibernateinAction,Dreamtech,byChristianBauer.

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Year & Semester: II - II

<u>TRACK-2:</u> NETWORKS	Introduction to Networks (ITN)	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the core components that make up a network, such as devices, protocols, and media.
- Learn how to work with IPv4 addresses, understand subnet masks, and perform subnet calculations to divide networks into smaller logical segments.
- Identify the different cable types and connectors used to connect devices in a local area network.
- Gain hands-on experience setting up basic network connections and performing troubleshooting checks on different operating systems (Windows, Linux, macOS, Android, and iOS)
- Learn about network switches and their role in connecting devices within a network segment and forwarding data packets.
- Learn systematic approaches to identify and resolve network issues.

Course Outcomes:

- Understand Key network terminology like bandwidth, throughput, and various network types
- Apply IPv4 addressing and subnet mask concepts to identify network and host information
- Identify and differentiate between various cables and connectors used in local area networks.
- Understand with the fundamental knowledge and hands-on skills necessary to identify and troubleshoot network connectivity problems.
- Implement effective troubleshooting strategies for resolving network connectivity issues.

Unit-I – Standards and Concepts

Identify the fundamental conceptual building blocks of networks - Differentiate between bandwidth and throughput - Differentiate between LAN, WAN, MAN, CAN, PAN, and WLAN - Compare and contrast cloud and on-premises applications and services - Describe common network applications and protocols.

Learning Outcomes:

- Identify and explain the fundamental concepts that form the foundation of computer networks. This includes understanding how devices communicate and share resources over a network.
- Differentiate between various network types based on their scope and functionality over PAN, LAN, MAN, WAN.
- Identify and explain the role of fundamental network protocols in facilitating communication between devices.

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Unit – II: Addressing and Subnet Formats

Compare and contrast private addresses and public addresses - Identify IPv4 addresses and subnet formats
- Identify IPv6 addresses and prefix formats.

Learning Outcomes:

- Understand the purpose and limitations of each type of IP address and how they are used in network configurations
- Perform basic calculations to determine the network address, subnet ID, broadcast address, and usable host range within a subnet based on the provided IP address and subnet mask
- Understand how prefix lengths are used in IPv6 to specify the network portion of the address

Unit – III: Endpoints and Media Types

Identify cables and connectors commonly used in local area network - Differentiate between Wi-Fi, cellular, and wired network technologies - Describe endpoint devices - Demonstrate how to set up and check network connectivity on Windows, Linux, Mac OS, Android, and Apple iOS.

Learning Outcomes:

- Identify and differentiate between common cables and connectors used in local area networks (LANs)
- Understand the characteristics and functionalities of these cables and connectors, including their suitability for different network applications based on factors like speed, distance, and cost
- Demonstrate the basic steps involved in setting up network connectivity on various operating systems

Unit – IV: Infrastructure

Identify the status lights on a Cisco device when given instruction by an engineer - Use a network diagram provided by an engineer to attach the appropriate cables - . Identify the various ports on network devices - Explain basic routing concepts - Explain basic switching concepts.

Learning Outcomes:

- Analyze and apply network knowledge to connect devices based on a provided network diagram
- Identify and differentiate between the various ports commonly found on network devices (e.g., console, Ethernet, serial, USB) and understand their typical uses.
- The fundamental concepts of network switching

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Unit – V: Diagnosing Problems

Demonstrate effective troubleshooting methodologies and help desk best practices, including ticketing, documentation, and information gathering - Perform a packet capture with Wire shark and save it to a file - Run basic diagnostic commands and interpret the results - Differentiate between different ways to access and collect data about network devices - Run basic show commands on a Cisco network device.

Learning Outcomes:

- Utilize Wire shark, a network protocol analyzer, to capture network traffic data
- Distinguish between different methods for accessing and collecting data about network devices, understanding their advantages and limitations
- Execute basic show commands on Cisco network devices to retrieve specific information

Contemporary Topics need to mention (Compulsory)

Security: Describe how firewalls operate to filter traffic - Describe foundational security concepts - Configure basic wireless security on a home router (WPAX).

Text Books:

Introduction to Networks Companion Guide (CCNAv7) Cisco Networking Academy,
ISBN-13: 978-0-13-663366-2 ISBN-10: 0-13-663366-8

References Books:

CCNA : Cisco Certified Network Associate study guide / Todd Lammle. — 7th ed. Wiley Publishing, Inc. ISBN 978-0-470-90107-6

Web links:

- https://www.ccri.edu/faculty_staff/comp/jmowry/CSCO-1850-PP.html
- <https://examscisco.com/ccna-v7-0/ccna-1-v7-introduction-to-networks-v7-02-itn-exam-answers/>

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Year & Semester: III - I

<u>TRACK-2:</u>	Switching, Routing, and Wireless Essentials	L	T	P	C
NETWORKS		3	0	0	3

Course Objectives

- ❖ Understand the concept of Layer 2 switching and how it operates within the OSI model, Configure basic VLANs on a network switch
- ❖ Understanding and configuring redundancy mechanisms in networks, specifically using Spanning Tree Protocol (STP) and EtherChannel technology.
- ❖ Student able to configure basic DHCPv4 servers and explain the functionalities of SLAAC, DHCPv6, and FHRPs in promoting network availability and reliability
- ❖ Students able to configure basic security features on switches and set up secure WLANs
- ❖ Students will gain a solid foundation in routing principles and be able to configure basic static routes on network routers

Course Outcomes:

- ❖ Configuring basic VLANs on a network switch using appropriate methods (port-based, MAC-based, etc.)
- ❖ Understanding the concepts and functionalities of Spanning Tree Protocol (STP) in preventing loops on switched networks
- ❖ Configuring a basic DHCPv4 server to automatically assign IP addresses to network devices
- ❖ Applying security measures to mitigate network vulnerabilities and protect sensitive data
- ❖ Applying static routes to connect different networks and ensure proper traffic flow

Unit-I

Switching Concepts and VLANS : Basic Device Configuration - Switching Concepts – VLANs - Inter-VLAN Routing

Learning Outcomes:

- Identify the process of frame forwarding based on MAC addresses
- Verify VLAN configuration and membership using switch commands
- Comprehend the need for inter-VLAN routing to enable communication across VLANs

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Unit – II

Redundant Networks: STP – Ether channel

Learning Outcomes:

- Explain the purpose and functionalities of Spanning Tree Protocol(STP)
- Configure basic Ether Channel
- Compare and contrast STP with other loop prevention technologies

Unit – III

Available and Reliable Networks : DHCPv4 - SLAAC and DHCPv6 Concepts - FHRP Concepts

Learning Outcomes:

- Verify DHCP server configuration and functionality to ensure successful IP address assignment to clients
- Compare and contrast DHCPv4 and DHCPv6 functionalities for IP address management.
- Understand the functionalities of FHRP as a high availability routing protocol.

Unit – IV

L2 Security and WLANs: LAN Security Concepts - Switch Security Configuration - WLAN Concepts - WLAN Configuration

Learning Outcomes:

- Understand the importance of network segmentation
- Configure basic security features on network switches
- Analyze the challenges associated with wireless security

Unit – V

Routing Concepts and Configuration: Routing Concepts - IP Static Routing - Troubleshoot Static and Default Routes

Learning Outcomes:

- Understand the concept of routing tables and how they direct network traffic
- Configure basic static routes for specific destinations or networks.
- Understand the role of the default route and troubleshoot issues related to missing or incorrect default routes

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Contemporary Topics need to mention (Compulsory)

- Automation
- Cloud integration
- Network security best practices
- Integration of artificial intelligence (AI) within networks

Text Books:

Switching, Routing, and Wireless Essentials Companion Guide, Cisco Networking Academy Published by: Cisco Press Hoboken, New Jersey. ISBN-13: 978-0-13-672935-8 ISBN-10: 0-13-672935-5

References Books:

CCNA : Cisco Certified Network Associate study guide / Todd Lammle. — 7th ed. Wiley Publishing, Inc. ISBN 978-0-470-90107-6

Web links:

➤ <https://itexamanswers.net/ccna-2-v7-exam-answers-switching-routing-and-wireless-essentials-v7-0-srwe.html>

➤ https://examscisco.com/ccna-v7-0/ccna-2-v7-switching-routing-and-wireless-essentials-v7-02-srwe-exam-answers/#google_vignette

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Year & Semester: III - II

<u>TRACK-2:</u> NETWORKS	Enterprise Networking, Security, and Automation	L	T	P	C
		3	0	0	3

Course Objectives

- Configure a single-area OSPFv2 network using a network simulator or real equipment.
- Understand the principles of Network Address Translation (NAT) for IPv4 and its role in network security and addressing.
- Analyze different VPN technologies like PPTP, L2TP/IPsec, and OpenVPN
- Apply network troubleshooting methodologies to identify and resolve common network issues.
- Understand the principles of network automation and its role in automating network configuration and management tasks.

Course Outcomes:

- Apply the different OSPFv2 components like areas, routers, neighbors, and LSAs
- Understand the fundamental concepts of network security, including threats, vulnerabilities, and security controls.
- Apply the various technologies used to connect geographically dispersed locations in a WAN
- Apply network design principles to optimize WAN performance, scalability, and security
- Apply the knowledge to design, implement, and manage automated network solutions.

Unit-I

OSPF Concepts and Configuration: Single-Area OSPFv2 Concepts - Single-Area OSPFv2 Configuration

Learning Outcomes:

- Analyze how link state advertisements and Dijkstra's algorithm work within OSPF.
- Configure a single OSPFv2 network for basic routing functionality.
- Verify OSPF routing table entries and troubleshoot basic configuration issues.

Unit – II

Network Security: Network Security Concepts - ACLs Concepts - ACLS for IPv4 Configuration - NAT for IPv4

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Learning Outcomes:

- Configure basic IPv4 ACLs to control traffic flow through the network.
- Understand the benefits and applications of Network Address Translation (NAT) for IPv4 networks.
- Configure static NAT to translate private network addresses for internet access.

Unit – III

WAN: WAN Concepts - VPN and IPsec Concepts

Learning Outcomes:

- Understand the principles of IPsec (Internet Protocol Security) used to secure VPN tunnels.
- Analyze the functionalities of different VPN technologies (e.g., PPTP, L2TP/IPsec, OpenVPN)
- Configure basic VPN tunnels for secure remote network access

Unit – IV

Optimize, Monitor, and Troubleshoot Networks: QoS Concepts - Network Management - Network Design - Network Troubleshooting

Learning Outcomes:

- Implement basic QoS mechanisms like prioritization and shaping to optimize network traffic flow.
- Utilize network management tools and techniques to monitor network health and performance.
- Analyze network design principles and their impact on network efficiency and scalability.

Unit – V

Network Virtualization and Automation: Network Virtualization - Network Automation

Learning Outcomes:

- Understand the principles and benefits of network automation for managing network tasks efficiently.
- Identify common network automation tools and platforms
- Analyze the advantages and challenges of implementing network automation solutions.

Contemporary Topics

Software-Defined Networking (SDN) , IPv6 Security, Cloud-based VPNs, Cloud-based Network Architectures

Text Books:

Enterprise Networking, Security, and Automation Companion Guide (CCNAv7) Cisco Networking Academy ISBN-13: 978-0-13-663432-4

References Books: A Practical Introduction To Enterprise Network And Security Management. [2 ed.] CRC Press.

ISBN: 978-0-367-64251-8 (hbk), ISBN: 978-1-032-04802-4 (pbk), ISBN: 978-1-003-12369-9 (ebk)

Web links :

https://ptgmedia.pearsoncmg.com/images/9780136634324/samplepages/9780136634324_Sample.pdf

<https://www.oreilly.com/library/view/enterprise-networking-security/9780136634171/>

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Year & Semester: IV – I

<u>TRACK-2:</u> NETWORKS	Wireless Sensor Networks.	L	T	P	C
		3	0	0	3

Course Objectives:

- Define WSN and Dynamic modulation scaling
- Explore working of the MAC protocols
- Demonstrate Routing and Data gathering protocols
- Illustrate working of Embedded OS
- Explore a wide range of WSN applications in different sectors

Course Outcomes:

- Understand the basics, characteristics and challenges of Wireless Sensor Network
- Apply the knowledge to identify appropriate physical and MAC layer protocol
- Apply the knowledge to identify the suitable routing algorithm based on the network and user requirement
- Analysis of OS used in Wireless Sensor Networks and build basic modules
- Analyze specific WSN application using a case study approach
-

Unit-I

CHARACTERISTICS OF WSN :Characteristic requirements for WSN – Challenges for WSNs – WSN vs Adhoc Networks – Sensor node architecture – Commercially available sensor nodes – Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

Learning Outcomes:

- Identify and explain the key characteristics
- Differentiate between Wireless Sensor Networks (WSNs) and Ad-hoc Networks
- Understand the role and functionalities of each component within the sensor node.

Unit – II

MEDIUM ACCESS CONTROL PROTOCOLS: Fundamentals of MAC protocols – Low duty cycle protocols and wakeup concepts – Contention based protocols – Schedule-based protocols – SMAC – BMAC – Traffic adaptive medium access protocol (TRAMA) – The IEEE 802.15.4 MAC protocol.

Learning Outcomes:

- Describe the main challenges of MAC protocols in wireless sensor networks (WSNs)
- Understand the concept of low duty cycle operation and its importance
- Evaluate the performance characteristics of contention-based protocols, including throughput, latency, and energy efficiency.

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Unit – III

ROUTING AND DATA GATHERING PROTOCOLS : Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing – Gradient-based routing – Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing – LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP – Data aggregation - data aggregation operations – Aggregate Queries in Sensor Networks – Aggregation Techniques – TAG, Tiny DB.

Learning Outcomes:

- Identify the key routing challenges in WSNs compared to traditional wired networks
- Analyze popular hierarchical routing protocols
- Analyze location-based routing protocols, Real-Time Routing Protocols

Unit – IV

EMBEDDED OPERATING SYSTEMS Operating Systems for Wireless Sensor Networks – Introduction – Operating System Design Issues – Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS – OSPM – EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules – Configurations and Wiring – Generic Components – Programming in Tiny OS using NesC, Emulator TOSSIM.

Learning Outcomes:

- Understand the role and importance of operating systems in managing the resources and functionalities of Wireless Sensor Networks.
- Compare and contrast prominent WSN operating systems like TinyOS, Mate, MagnetOS, MANTIS, OSPM, EYES OS, SenOS, EMERALDS, and PicOS.
- Understand the strengths and weaknesses of each operating system in terms of features, resource management, and suitability.

Unit – V

APPLICATIONS OF WSN :WSN Applications – Home Control – Building Automation – Industrial Automation – Medical Applications – Reconfigurable Sensor Networks – Highway Monitoring – Military Applications – Civil and Environmental Engineering Applications – Wildfire Instrumentation – Habitat Monitoring – Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard – Target detection and tracking – Contour/edge detection – Field sampling

Learning Outcomes:

- Identify the key characteristics of Wireless Sensor Networks (WSNs) that make them suitable for various applications.
- Analyze a specific WSN application through a Case Study
- Develop a basic understanding of common data analysis techniques used with WSN data

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Contemporary Topics

Wireless Sensor Networks (WSNs) include advancements in energy efficiency, robust security mechanisms, effective data aggregation and management, reliable localization and coverage, and the integration of AI/ML for intelligent decision-making

Text Books:

1. Wireless Sensor Networks Technology, Protocols, and Applications, Kazem S. Oshary, Daniel Minoli and Taieb Znati, John Wiley & Sons, 2007
2. Protocols and Architectures for Wireless Sensor Network, Holger Karl and Andreas Willig John Wiley & Sons, Ltd, 2005.

References Books:

1. A survey of routing protocols in wireless sensor networks, K. Akkaya and M. Younis, Elsevier
2. Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325—349

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II Year & II Semester

TRACK-3 SECURITY	CYBER SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the fundamental concepts and principles of cyber security.
- Understand Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies.
- To provide the importance of Cyber Security and the integral role of Cyber Security professionals.
- Recognize the importance of cyber security in protecting digital assets and information.
- Analyze real-world cyber-attack scenarios and case studies.

Course Outcomes:

- Understand Cyber Security architecture principles
- Analyze the System and application security threats and vulnerabilities
- Estimate operational cyber security strategies and policies.
- Apply security model to handle mobile, wireless devices and related security issues.
- Analyze the functionality of Security Technologies and Controls in Cyber security

UNIT - I

Introduction to Cyber Security: Need for Cyber security - History of Cyber security - Defining Cyberspace and Cyber security, scope of Cyber security, Importance of Cyber security in the modern world, Evolution of cyber threats, Importance of Cyber security in the digital age.

Foundations of Cyber Security: Cyber Security principles, threat models, and cyber laws. Confidentiality, integrity, and availability (CIA) Triad– Cyber security Framework, Security principles and concepts, Risk management to better understand the dynamics of Cyber Security.

Learning Outcomes: student will be able to

- Outline the Importance of Cyber security. (L2)
- Understand the Security architecture principles and concepts. (L2)
- Understand the Design of Cyber security Framework. (L2)

UNIT-II

Common Threats and Attack Vectors: Introduction, Proxy Servers and Anonymizers, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Social Engineering attacks: Introduction, Phishing, spear phishing, pretexting, Identity Theft (ID Theft).

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Learning Outcomes: student will be able to

- Understand about the Cyber security Threats and Attacks. (L2)
- Summarize the various types of application security vulnerabilities(L2)
- Analyze the System and application security threats and vulnerabilities(L4)

UNIT-III

Introduction to Cyber Crime, law and Investigation: Introduction to Cybercrime, Definition and scope of cybercrime, Categories of cybercrimes, Impact of cybercrime, Cybercrime and Information Security, classifications of cybercrimes, Cybercrime: The Legal Perspectives, cybercrime and the Indian IT Act 2000, a Global perspective on Cybercrimes.

Cyber laws: Introduction to Cyber Laws, Need for Cyber laws The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards.

Learning Outcomes: student will be able to

- Extend The Categories of cybercrimes and Impact of cybercrime(L2)
- Understand about the Need for Cyber laws and Cybercrime Scenario in India(L2)
- Estimate operational cyber security strategies and policies(L5)
- Develop an understanding of cybercrimes and various legal perspectives involved(L3)

UNIT-IV

Cybercrime-Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Authentication Service Security, Attacks on Mobile/Cell Phones.

Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Learning Outcomes: student will be able to

- Understand Various devices and related security issues (L2)
- Develop a security model to handle Policies and Measures in Computing era(L3)
- Develop a security model to handle mobile, wireless devices and related security issues of an organization (L3)

UNIT-V

Security Technologies and Controls in Cyber security: Access control mechanisms, Encryption, Firewalls, intrusion detection systems (IDS), intrusion prevention systems (IPS), Network Security, Security Information and Event Management (SIEM), functionality of cyber security tools.

Legal and Ethical Aspects of Cyber Security: Laws and regulations governing cyber security, Ethical considerations in cyber security practices, Privacy issues.

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Learning Outcomes: student will be able to

- Analyze the functionality of Security Technologies and Controls in Cybersecurity(L4)
- Outline the Ethical considerations in cyber security practices(L2)
- Understand the functionality of cyber security tools(L2)

Contemporary Topics Critical infrastructure security, Endpoint security, Application security, Cloud security, Diverse Attack Vectors, Supply Chain Attacks.

Text Books:

1. Computer Security: Principles and Practice, Third Edition, William Stallings, Lawrie Brown, Pearson Education, 2014.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, SunitBelapure, 1st Edition Publication Wiley, 2011.
3. William Stallings, Effective Cybersecurity: A Guide to Using Best Practices and Standards, 1st edition, 2019.
4. Mark Rhodes, Ousley, Information Security, 1st Edition, MGH, 2013.

Reference Books:

1. Principles of Information Security, MichaelE. Whitman and Herbert J. Mattord, CengageLearning.
2. Charles J. Brooks, Christopher Grow, Philip A. Craig, Donald Short, Cybersecurity Essentials, Wiley Publisher, 2018.

Weblinks:

1. <https://www.cybrary.it/course/entry-level-cybersecurity-training>
2. <https://www.professormesser.com/security-plus/sy0-601/sy0-601-video/sy0-601-comptia-security-plus-course/>
3. <https://www.cto.int/strategic-goals/cybersecurity/web-links/>

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III Year & I Semester

TRACK-3 SECURITY	Secure Coding	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the security development process.
2. Knowledge of outline of the techniques for developing a secure application.
3. To handling dynamic memory management effectively.
4. Knowledge on stored procedures and XSS attacks.
5. Acquire knowledge on software architecture and design.

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

1. Analyze secure systems and various security principles.
2. Understand the development of process of software leads to secure coding practices
3. Apply Secure programs and various risk in the dynamic memory management.
4. Understand XSS related attacks and remedies
5. Understand various software architecture models.

UNIT-I

Introduction-Need for secure systems, Proactive security development process, Security principles to live by and threat modeling.

Learning Outcomes: student will be able to

- Understand the need of secure system (L2).
- Analyze security development process(L4).
- Analyze various threats in secure systems (L4).

UNIT-II

Secure Coding in C-Character strings- String manipulation errors, String Vulnerabilities and exploits Mitigation strategies for strings, Pointers, Mitigation strategies in pointer based vulnerabilities Buffer Overflow based vulnerabilities.

Learning Outcomes: student will be able to

- Describe the string manipulation errors (L2).
- Analyze the string buffer overflow Vulnerabilities (L4).
- Analyze mitigation strategies for strings (L4).

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UNIT-III

Secure Coding in C++ and Java-Dynamic memory management, Common errors in dynamic memory management, Memory managers, Double –free vulnerabilities, Integer security, Mitigation strategies.

Learning Outcomes: student will be able to

- Analyze errors in dynamic memory management (L4).
- Analyze double free vulnerabilities (L4).
- Apply integer security to various applications (3).

UNIT-IV

Database and Web Specific Input Issues-Quoting the Input, Use of stored procedures, Building SQL statements securely, XSS related attacks and remedies.

Learning Outcomes: student will be able to

- Understand the stored procedures (L2).
- Implement SQL statements related to security (L5).
- Analyze XSS attacks and remedies (L4).

UNIT-V

Software Security Engineering-Requirements engineering for secure software: Misuse and abuse cases, SQUARE process model Software security practices and knowledge for architecture and design.

Learning Outcomes: student will be able to

- Describe Misuse and abuse cases in requirements engineering (L2).
- Understand software security practices (L2).
- Understand software architecture and design (L2).

Text Book:

1. Michael Howard, David LeBlanc, “Writing Secure Code”, Microsoft Press, 2nd Edition, 2003.

Reference Books:

1. Robert C. Seacord, “Secure Coding in C and C++”, Pearson Education, 2nd edition, 2013.
2. Julia H. Allen, Sean J. Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, “Software Security Engineering: A guide for Project Managers”, Addison-Wesley Professional, 2008.

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III Year & II Semester

TRACK-3 SECURITY	Vulnerability Assessment & Penetration	L	T	P	C
		3	0	0	3

Course Objectives:

1. To identify penetration testing process.
2. To identify the various information gathering and scanning procedures of security systems.
3. To identify various system hacking procedures.
4. To understand the impact of hacking in real time machines.
5. To understand the impact of hacking in wireless networks.

Course Outcomes:

1. Understand Penetration testing process.
2. Understand information gathering methodologies.
3. Analyze various Vulnerabilities assessments.
4. Apply System Hacking Techniques in real time applications.
5. Understand Bypassing WLAN Authentication

UNIT-I

Techniques, Blue/Red Phases of hacking, Introduction: Penetration Testing phases/Testing Process, types and Teaming, Strategies of Testing, Non Disclosure Agreement Checklist, Open-source/proprietary Pentest Methodologies.

Learning outcomes: Student should be able to

1. Understand penetration testing phases. (L2)
2. Understand penetration testing types and strategies. (L2)
3. Understand hacking phases. (L2)

UNIT –II

Information Gathering and Scanning : Information gathering methodologies- Foot printing, Competitive Intelligence- DNS Enumerations- Social Engineering attacks, Port Scanning- Network Scanning- Vulnerability Scanning- NMAP scanning tool- OS Fingerprinting Enumeration.

Learning outcomes: Student should be able to

1. Understand various information gathering methodologies. (L2)
2. Analyze various social engineering attacks. (L4)
3. Analyze Vulnerability Scanning approach. (L4)
4. Analyze operating system based Vulnerabilities. (L4)

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UNIT-III

System Hacking: Password cracking techniques- Key loggers- Escalating privileges- Hiding Files, Double Encoding, Steganography technologies and its Countermeasures. Active and passive sniffing- ARP Poisoning, MAC Flooding- SQL Injection - Error- based, Union-based, Time-based, Blind SQL, Out-of-band, Injection Prevention Techniques.

Learning outcomes: Student should be able to

1. Understand various password cracking techniques. (L2)
2. Analyze various double encoding algorithms. (L4)
3. Analyze various security attacks. (L4)

UNIT IV

Advanced System Hacking: Broken Authentication, Sensitive Data Exposure, XML External Entities, Broken Access Code, XSS - Stored, Reflected, DOM Based.

Learning outcomes: Student should be able to

1. Analyze broken authentication techniques. (L4)
2. Analyze various XML entities. (L4)
3. Develop XML scripts for hacking . (L5)

UNIT V

Wireless Pentest: Wi-Fi Authentication Modes, Bypassing WLAN Authentication, Types of Wireless Encryption, WLAN Encryption Flaws, AP Attack, Attacks on the WLAN Infrastructure, DoS-Layer1, Layer2, Layer 3, DDoS Attack, Client Disassociation, Wireless Hacking Methodology, Wireless Traffic Analysis.

Learning outcomes: Student should be able to

1. Understand bypassing authentication in WLAN. (L2)
2. Analyze DDoS attacks. (L4)
3. Understand how clients are disassociated. (L2)
4. Analyze data patterns in wireless network. (L4)

Textbooks:

Kali Linux 2: Windows Penetration Testing, By Wolf Halton, Bo Weaver , June 2016 PacktPublishing

Reference Books:

- Mastering Modern Web Penetration Testing By Prakhar Prasad, October 2016 PacktPublishing.
- SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress Publication

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IV Year & I Semester

TRACK-3 SECURITY	Malware Analysis	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the purpose of computer infection program.
- To implement the covert channel and mechanisms.
- To test and exploit various malware in open source environment.
- To analyze and design the famous virus and worms.
- Understand the Reverse Engineering (RE) Methodology
- Disassemble products and specify the interactions between its subsystems and their functionality

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

1. Explain the characteristics of Malware and its effects on Computing systems.
2. Predict the given system scenario using the appropriate tools to Identify the vulnerabilities and to perform Malware analysis.
3. Analyze the given Portable Executable and Non-Portable Executable files using Static and dynamic analysis techniques.
4. Demonstrate the Malware functionalities.
5. Apply anti-reverse engineering in different Applications

UNIT-I:

Malware Basics- General Aspect of Computer infection program, Non Self Reproducing Malware, How does Virus Operate, Virus Nomenclature, Worm Nomenclature, Recent Malware Case Studies.

UNIT- II:

Basic Analysis- Antivirus Scanning, x86 Disassembly, Hashing, Finding Strings, Packed Malware, PE File Format, Linked Libraries & Functions, PE Header File & Section.

UNIT-III:

Advanced Static & Dynamic Analysis- IDA Pro, Recognizing C code constructs, Analyzing malicious windows program, Debugging, OllyDbg, Kernel Debugging with WinDbg, Malware Focused Network Signatures.

UNIT-IV:

Malware Functionalities- Malware Behavior, Covert Malware Launch, Data Encoding, Shell code Analysis.

UNIT-V:

Reverse Engineering Malware (REM): REM Methodology, Resources for Reverse-Engineering Malware (REM) Understanding Malware Threats, Malware indicators, Malware Classification, Examining Clam AV-Signatures.

Text books:

1. Michael Sikorski, Andrew Honig "Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software" publisher William Pollock

Reference Books:

1. Erci Filiol, "Computer Viruses: from theory to applications", Springer, 1st edition, 2005.

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II Year & II Semester

TRACK-4	Introduction to Data Science	L	T	P	C
		3	0	0	3

DATA SCIENCE

COURSE OBJECTIVES: From the course the student will learn

6. Knowledge and expertise to become a data scientist.
7. Essential concepts of statistics and machine learning that are vital for data science;
8. Significance of exploratory data analysis (EDA) in data science.
9. Critically evaluate data visualizations presented on the dashboards
10. Suitability and limitations of tools and techniques related to data science process

UNIT I: Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science

Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

Unit II: Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modeling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning

Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

UNIT III: No SQL movement for handling Big data: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling

UNIT IV: Tools and Applications of Data Science: Introducing Neo4j for dealing with graph databases, graph query language Cypher, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts

UNIT V: Data Visualization and Prototype Application Development: Data Visualization options, Cross filter, the JavaScript Map Reduce library, creating an interactive dashboard with dc.js, Dashboard development tools.

Applying the Data Science process for real world problem solving scenarios as a detailed case study.

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Textbook:

1. Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, “Introducing to Data Science using Python tools”, Manning Publications Co, Dreamtech press, 2016
2. Prateek Gupta, “Data Science with Jupyter” BPB publishers, 2019 for basics

Reference Books:

1. Joel Grus, “Data Science from Scratch”, O’Reilly, 2019
2. Doing Data Science: Straight Talk from The Frontline, 1st Edition, Cathy O’Neil and Rachel Schutt, O’Reilly, 2013.

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III Year & I Semester

TRACK-4	Social Network Analysis	L	T	P	C
DATA SCIENCE		3	0	0	3

Course Objective:

- Social network analysis is to understand a community by mapping the relationships that connect them as a network, and then trying to draw out key individuals, groups within the network and/or associations between the individuals

Course Outcomes:

- Understand the importance of social network analysis and various network measures.
- Summarize network growth models and applications of link analysis
- Apply different graph visualization tools on community detection and link predictions.
- Development of models using cascading behavior with promising network effects.
- Development of Recommendation Systems

Unit-I

Introduction to Social Network Analysis, Introduction to Colab, Introduction to NetworkX, **Network Measures**- Basics, Node Centrality, Transitive and Reciprocity, Similarity and Degeneracy.

Unit-II

Network Growth Models-Properties of real world network, Random Network Model, Ring Lattice, Network Model, Watts Strogatz Model, **Link Analysis**- Applications, Signal Networks, Strong and Weak Ties.

Unit –III

Graph Visualization Tools. Community Detection - Applications, Types of communities, Detection Methods, Overlapping, Community Detection Vs Community v's Search. **Link Prediction**-Applications, Temporal changes in network, Prediction Networks and Heuristic Models.

Unit-IV

Cascade Behavior- Models, Probabilistic Cascades, Epidemic Models, Independent Models, Cascade Prediction. **Network Effects Anomaly Detection**- Outliers and Network Based Anomalies, Challenges Anomaly detection in static and dynamic models.,

Unit-V

Graph Representation Learning, Coding on Graph Representation Learning- Criteria on GRL, Representation Learning Methods, **Applications and Case Studies**- Malicious activities on OSNs and

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Recommendation Systems.

Books and References

1. Social Network Analysis, Tanmoy Chakraborty, Wiley, 2021
2. Network Science, Albert-Lazzlo Barabasi
3. Social Network Analysis: Methods and Applications, Stanley Wasserman, Katherine Faus

Link:

https://onlinecourses.nptel.ac.in/noc22_cs117/preview

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III Year & II Semester

TRACK-4	Deep Learning for Computer Vision	L	T	P	C
DATA SCIENCE		3	0	0	3

Course Objective:

- Recognise and describe how mathematical and scientific concepts are applied in computer vision.
- Identify and interpret appropriate sources of information relating to computer vision.
- Apply knowledge of computer vision to real life scenarios.

Course Outcomes:

- Describe how mathematical and scientific concepts are applied in computer vision through images.
- Identify appropriate sources of information and architecture relating to computer vision.
- Understand the concept of visualization using CNN.
- Apply the concepts of advanced CNN and RNN techniques for computer vision problems.
- Apply knowledge of computer vision to real life scenarios.

Unit-I

Introduction and Overview: Introduction to Image Formation: Capture and Representation; Linear Filtering, Correlation and Convolution. **Visual Features and Representations:** Edge, Blobs, Corner Detection; Scale Space and Scale Selection; SIFT, SURF; HoG, LBP, etc.

Unit-II

Visual Matching: Bag-of-words, VLAD; RANSAC, Hough transform; Pyramid Matching; Optical Flow.
Deep Learning Review- Review of Deep Learning, Multi-layer Perceptions, Back propagation.
Convolutional Neural Networks (CNNs)- Introduction to CNNs; Evolution of CNN Architectures: AlexNet, ZFNet, VGG, InceptionNets, ResNets, DenseNets

Unit-III

Visualization and Understanding CNNs: Visualization of Kernels; Backprop-to-image/Deconvolution Methods; Deep Dream, Hallucination, Neural Style Transfer; CAM, Grad-CAM, Grad-CAM++; Recent Methods (IG, Segment-IG, SmoothGrad)

Unit-IV

CNNs for Recognition and Verification (Siamese Networks, Triplet Loss, Contrastive Loss, Ranking Loss); CNNs for Detection: Background of Object Detection, R-CNN, Fast R-CNN, Faster R-CNN, YOLO, SSD, RetinaNet; CNNs for Segmentation: FCN, SegNet, U-Net, Mask-RCNN.

Recurrent Neural Networks (RNNs): Review of RNNs; CNN + RNN Models for Video Understanding:

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Spatio-temporal Models, Action/Activity Recognition

Unit-V

Attention Models: Introduction to Attention Models in Vision; Vision and Language: Image Captioning, Visual QA, Visual Dialog; Spatial Transformers; Transformer Networks. **Deep Generative Models:** Deep Generative Models: GANs, VAEs; Other Generative Models: PixelRNNs, NADE, Normalizing Flows. Applications.

Books and references

- Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, 2016
- Michael Nielsen, Neural Networks and Deep Learning, 2016
- Yoshua Bengio, Learning Deep Architectures for AI, 2009
- Richard Szeliski, Computer Vision: Algorithms and Applications, 2010.
- Simon Prince, Computer Vision: Models, Learning, and Inference, 2012.
- David Forsyth, Jean Ponce, Computer Vision: A Modern Approach, 2002.

Link:

https://onlinecourses.nptel.ac.in/noc20_cs88/preview

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IV Year & I Semester

TRACK-4	AI for Health Care	L	T	P	C
		3	0	0	3
DATA SCIENCE					

Course Objective:

- The students should be able to understand how AI is transforming the practice of medicine.
- The students should learn the practical experience in applying machine learning to concrete problems in medicine

Course Outcomes:

After completion of course, students would be able to:

- Apply tree-based machine learning to estimate patient survival rates.
- Analyse convolutional neural network image classification and segmentation models to make diagnoses of lung and brain disorders.
- Apply natural language processing to extract information from unstructured medical data.
- Apply survival models to build realistic applications.
- Understand different types of prognosis models related to different diseases.

Unit-I

Disease detection with computer vision- Medical Image Diagnosis, Eye Disease and Cancer Diagnosis, Building and Training a Model for Medical Diagnosis, Training, prediction, and loss, Image Classification and Class Imbalance, Generating More Samples, Model Testing

Unit-II

Evaluating models- Sensitivity, Specificity, and Evaluation Metrics, Accuracy in terms of conditional probability, Confusion matrix, ROC curve and Threshold. **Image segmentation on MRI images-** Medical Image Segmentation, MRI Data and Image Registration, Segmentation, 2D U-Net and 3D U-Net Data augmentation and loss function for segmentation, Different Populations and Diagnostic Technology, External validation

Unit-III

Linear prognostic models- Medical Prognosis, Atrial fibrillation, Liver Disease Mortality, Risk of heart disease, Evaluating Prognostic Models, Concordant Pairs, Risk Ties, Permissible Pairs. **Prognosis with Tree-based models-** Decision trees for prognosis, fix overfitting, Different distributions, Missing Data example, Imputation

Unit-IV

Survival Models and Time- Survival Model, Survival function, collecting time data, Estimating the survival function. Build a risk model using linear and tree-based models. Hazard Functions, Relative risk,

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Individual vs. baseline hazard, Survival Trees, Nelson Aalen estimator.

Unit-V

Medical Treatment Effect Estimation- Analyze data from a randomized control trial, Average treatment effect, Conditional average treatment effect, T-Learner, S-Learner, C-for-benefit.

Books and References

- Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again, Eric Topol, Basic Books, 1st edition 2019.
- Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes, Arjun Panesar, Apress, 1st ed. Edition, 2019.
- Artificial Intelligence in Healthcare, 2020, ISBN 978-0-12-818438-7, Elsevier Inc.

Links

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>