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
AcademicYear **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)

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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.

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.

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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.

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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: (25x0.8) + (20x0.2) = 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: (25x0.8) + (0x0.2) =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.

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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.

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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).

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.

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

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.,

$$SGPA = \Sigma (C_i \times G_i)/\Sigma C_i$$

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

$$CGPA = \Sigma (C_i \times S_i)/ \Sigma C_i$$

where "S_i" is the SGPA of the ith semester and C_i is the total numberof 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:

ClassAwarded	CGPASecured
FirstClasswithDistinction	≥ 7.5
First Class	≥ 6.5<7.5
SecondClass	≥ 5.5<6.5
PassClass	≥ 5.0<5.5

CGPA to Percentage conversion Formula –(CGPA–0.5)x10

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:

(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

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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)

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**

I Year I Semester

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S.No.	Course Code	Course Name	L	T	P	Credits
I Year II Semester						
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**

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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-worldproblems 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,HigherEngineeringMathematics,44/e,KhannaPublishers,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, 9thedition, Pearson edn
5. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand,2021

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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

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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 sand 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 appreciatingeading /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 skillscan 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 ideasin a paragraph together.
Writing: Structure of a paragraph - Paragraph writing (specific topics)
Grammar: Cohesive devices -linkers, useof articles and zeroarticle 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: Readingatextin detail by making basic inferences-recognizing and interpreting specific context clues; strategies touse text clues for comprehension.
Writing: Summarizing, Note-making, paraphrasing
Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations
Vocabulary: Compound words, Collocations

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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, 1st Edition,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, anglesand 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 levellingand bearings-Contour mapping.

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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 toUnderstand the different manufacturing processes.
- Explain the basics of thermal engineering and its applications.
- Describe the working of different mechanical power transmission systems and power

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plants.

- 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 theirapplications.

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, Cengagelearning 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, TataMcGraw Hill publications (India) Pvt. Ltd.

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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. BasicLoop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, goto statement.

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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-Practia1 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

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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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		L	T	P	C
I Year I Semester	**ENGINEERING PHYSICS LAB**	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 andspectrometer.
- Estimate the wavelengths of different coloursusing diffraction grating.
- Plot the intensity of the magnetic field of circular coil carrying current withdistance.
- Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively.
- Calculate the band gap of a given semiconductor.
- Identify the type ofsemiconductor 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 Torsionalpendulum.
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'sexperiment.

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 followingfitting 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.

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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 OperatingSystems 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 asWord 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 throughthe 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 bothWindows 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 configuredas dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

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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

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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 sentencesto see how the model completes them.
- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: Whatis the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a storyor a description of a scene, and let the model generate the rest of the content. This can be a funway 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 tosee 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, PearsonEducation, 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 likepointers.
- 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.

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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

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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 on1D 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 memoryallocation value initialization, resizing changing and reordering the contents of an array and memory de-allocation

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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 thedifferences 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

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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.

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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, Wronskean, 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,HigherEngineeringMathematics,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).

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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

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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, Involutes, 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,

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 ofobjects 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).

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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. Bhatacharya, Person Publications, 2018, Second Edition.

Web Resources:
1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

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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 INSTRUMENTTAION

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.

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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/spacecomplexity analysis.
- Create and manage linked lists to efficiently organize and manipulate data, emphasizingmemory efficiency.
- Implement and apply stacks to manage program flow and solve problems involving expressionevaluation 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 usingpriority 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 retrievaland 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 inalgorithms.
- Design, implement, and apply linked lists for dynamic data storage, demonstratingunderstanding of memory allocation.
- Develop programs using stacks to handle recursive algorithms, manage program states, andsolve related problems.
- Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphsand 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 asstacks, queues, Trees
- Recognize scenarios where hashing is advantageous, and design hash-based solutions forspecific 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

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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.
Deques: Introduction to deques (double-ended queues), Operations on deques 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

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				L	T	P	C
I Year II Semester		**CHEMISTRY LAB**		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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		L	T	P	C
I Year II Semester	**DATA STRCTURES LAB**	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, emphasizingmemory 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 dataretrieval 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-Survey in 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

PopulationEducation.
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, DirectorateGeneral of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., ‒Introduction to Environmental Engineering‖, 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 vivavoce on the subject.

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Department of CSE (DATASCIENCE) COURSE STRUCTURE

B.Tech–II Year- I Semester

S.No	Category	Title	L	T	P	Credits
1	DR2321T421	Discrete Mathematics & Graph Theory	3	0	0	3
2	DR2321THS1	UniversalHumanValues2-Understanding Harmony & Ethical Human Conduct	2	1	0	3
3	DR2321T441	Introduction to Data Science	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	DR2321L444	Data Science Lab	0	0	3	1.5
7	DR2321L056	Object-Oriented Programming Through JAVA Lab	0	0	3	1.5
8	DR2321LC44	Python programming	0	1	2	2
9	DR2321M1AC	Environmental Science	2	0	0	-
Total			15	2	10	20

B.Tech–II Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	DR2322TES2	Probability and Statics	2	0	0	2
2	DR2322TES3	Statistical methods for Data science	3	0	0	3
3	DR2322T441	Data Engineering	3	0	0	3
4	DR2322TC51	DBMS	3	0	0	3
5	DR2322TC01	Digital Logic and Computer Organization	3	0	0	3
7	DR2322L442	Data Engineering Lab	0	0	3	1.5
8	DR2322LC51	DBMS Lab	0	0	3	1.5
9	DR2322LCS3	Exploratory Data Analysis with Python	0	1	2	2
10	DR2322LC01	Design Thinking & Innovation	1	0	2	2
Total			15	1	10	21
Mandatory Community Service Project Internship of 08weeks duration during summer Vacation						

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

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, posetsand lattices
- Re call the concepts of algebraic structures, recurrence relations and generating functions
- Use and interprettheconceptsofMathematicallogicandstatement&predicatecalculus
- Use and interpret the concepts of combinatory, set theory, pose sand lattices
- Useandinterprettheconceptsofalgebraicstructures,recurrencerelationsand 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.

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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.TremblayandR.Manohar,DiscreteMathematicalStructureswithApplicationsto CSc, TataMcGrawHill,1997
2. S.SanthaandEVPrasad,MathematicalFoundationsforComputerScience,CENG AGE Publishers

Reference Books:

1. Kenneth.H.Rosen,DiscreteMathematicsanditsApplications,6/e,TataMcGraw-Hill,2009.
2. Dr.DSChandrasekharaiah, Mathematical Foundations of Computer Science ,Prism Book Pvt Ltd.
3. SwapanKumarSarkar,MathematicalFoundationofComputerScience,9thEdition,SChand Publishers.

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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 complementarily 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
Lecture4: 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

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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

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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, JeevanVidyaPrakashan, 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 – PanditSunderlal
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)

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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
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

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II Year I Semester	**Introduction to 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, 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 Scienceusing Python tools", ManningPublications Co, Dreamtech press, 2016
2. PrateekGupta,"DataSciencewithJupyter"BPBpublishers,2019forbasics

Reference Books:

1. JoelGrus,"DataSciencefromScratch",OReilly,2019
2. Doing Data Science: Straight Talk from TheFrontline, 1 st Edition,CathyO'Neil and Rachel Schutt, O'Reilly, 2013.

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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 Bi-connected 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, Sanguthevar Rajasekaran 2nd 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)

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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)

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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.

References Books:
1. The complete Reference Java, 11thedition, 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_01288046454761881 6347_shared/overview

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II Year I Semester	Data Science Lab	L	T	P	C
		0	0	3	1.5

Course Objectives:
- The main objective of the course is to inculcate the basic understanding of Data Science and its practical implementation using Python.

List of Experiments

1. Creating a NumPy Array
   a. Basic ndarray
   b. Array of zeros
   c. Array of ones
   d. Random numbers in ndarray
   e. An array of your choice
   f. Imatrix in NumPy
   g. Evenly spaced ndarray
2. The Shape and Reshaping of NumPy Array
   a. Dimensions of NumPy array
   b. Shape of NumPy array
   c. Size of NumPy array
   d. Reshaping a NumPy array
   e. Flattening a NumPy array
   f. Transpose of a NumPy array
3. Expanding and Squeezing a NumPy Array
   a. Expanding a NumPy array
   b. Squeezing a NumPy array
   c. Sorting in NumPy Arrays
4. Indexing and Slicing of NumPy Array
   a. Slicing 1-D NumPy arrays
   b. Slicing 2-D NumPy arrays
   c. Slicing 3-D NumPy arrays
   d. Negative slicing of NumPy arrays
5. Stacking and Concatenating Numpy Arrays
   a. Stacking ndarrays
   b. Concatenating ndarrays
   c. Broadcasting in Numpy Arrays
6. Perform following operations using pandas
   a. Creating dataframe
   b. concat()
   c. Setting conditions
   d. Adding a new column
7. Perform following operations using pandas
   a. Filling NaN with string
   b. Sorting based on column values
   c. groupby()

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8. Read the following file formats using pandas
   a. Text files
   b. CSV files
   c. Excel files
   d. JSON files
9. Read the following file formats
   a. Pickle files
   b. Image files using PIL
   c. Multiple files using Glob
   d. Importing data from database
10. Demonstrate web scraping using python
11. Perform following preprocessing techniques on loan prediction dataset
    a. Feature Scaling
    b. Feature Standardization
    c. Label Encoding
    d. One Hot Encoding
12. Perform following visualizations using matplotlib
    a. Bar Graph
    b. Pie Chart
    c. Box Plot
    d. Histogram
    e. Line Chart and Subplots
    f. Scatter Plot
13. Getting started with NLTK, install NLTK using PIP
14. Python program to implement with Python Sci Kit-Learn & NLTK
15. Python program to implement with Python NLTK/Spicy/Py NLPI.

Web References:
1. https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners/
2. https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts/
3. https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
4. https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn/
5. https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization-exploration-python/6.
6. https://www.nltk.org/book/ch01.html

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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

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

Course Objectives:
The main objectives of the course are to
- . Introduce core programming concepts of Python programming language.
- a. Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- b. Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

UNTI-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 Operatorsiv) 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.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to perform the given operations on a list:
    i. Addition   ii. Insertion   iii. slicing
12. Write a program to perform any 5 built-in functions by taking any list.

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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. 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

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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

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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-sports 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

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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. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of 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.

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II Year I Semester	PROBABILITY & STATISTICS	L	T	P	C
		2	0	0	2

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.

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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), χ2 - test for goodness of fit, χ2 - test for independence of attributes.

Textbooks:
1. Miller and Freunds, 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

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II Year II Semester	Statistical methods for Data science	L	T	P	C
		3	0	0	3

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

- Understand the basic concepts of Statistics.
- Analyze the data and draw conclusion about collection of data under study using Point estimation
- Analyze data and draw conclusion about collection of data under study using Interval estimation.
- 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 :   Basic Concepts
Random variables (discrete and continuous), probability density functions, properties, mathematical expectation. Probability distributions: Binomial, Poisson and Normal-their properties. Population, sample, parameter and statistic; characteristics of a good estimator; Consistency – Invariance property of Consistent estimator, Sufficient condition for consistency; Unbiasedness; Sufficiency.

UNIT II   Point Estimation
Point Estimation- Estimator, Estimate, Methods of point estimation – Maximum likelihood method (the asymptotic properties of ML estimators are not included), Large sample properties of ML estimator (without proof)-applications, Method of moments, method of least squares, method of minimum chi-square and modified minimum chi-square-Asymptotic Maximum Likelihood Estimation and applications.

UNIT III Interval Estimation
Confidence limits and confidence coefficient; Duality between acceptance region of a test and a confidence interval; Construction of confidence intervals for population proportion (small and large samples) and between two population proportions(large samples); Confidence intervals for mean and variance of a normal population; Difference between the mean and ratio of two normal populations.

UNIT IV   Testing of hypotheses
Types of errors, power of a test, most powerful tests; Neyman-Pearson Fundamental Lemma and its applications; Notion of Uniformly most powerful tests; Likelihood Ratio tests: Description and property of LR tests - Application to standard distributions.

UNIT V   Small sample tests
Student's t-test, test for a population mean, equality of two population means, paired t-test, F-test for equality of two population variances, Chi-square test for goodness of fit and test for independence of attributes, $\chi2$ test for testing variance of a normal distribution.

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Textbooks:
1. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference – Testing of Hypotheses, Prentice Hall of India, 2014

Reference Books:
1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
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.
4. Robert V Hogg, Elliot A Tannis and Dale L.Zimmerman, Probability and Statistical Inference, 9th edition, Pearson publishers,2013.

Online Learning Resources:
1. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
2. https://onlinecourses.nptel.ac.in/noc22_mg31/preview

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II Year II Semester	Data Engineering	L	T	P	C
		3	0	0	3

Course Objectives:
- Explain basic concepts of Data Engineering
- Discuss bout Data Engineering Life Cycle
- How to design Good Data Architecture

UNIT-I

Introduction to Data Engineering: Definition, Data Engineering Life Cycle, Evolution of Data Engineer, Data Engineering Versus Data Science, Data Engineering Skills and Activities,

Data Maturity, Data Maturity Model, Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities, Data Engineers and Other Technical Roles.

UNIT-II

Data Engineering Life Cycle: Data Life Cycle Versus Data Engineering Life Cycle, Generation: Source System, Storage, Ingestion, Transformation, Serving Data.

Major undercurrents across the Data Engineering Life Cycle: Security, Data Management, DataOps, Data Architecture, Orchestration, Software Engineering.

UNIT-III

Designing Good Data Architecture: Enterprise Architecture, Data Architecture, Principles of Good Data Architecture, Major Architecture Concepts.

Data Generation in Source Systems: Sources of Data, Files and Unstructured Data, APIs, Application Databases (OLTP), OLAP, Change Data Capture, Logs, Database Logs, CRUD, Source System Practical Details.

UNIT-IV

Storage: Raw Ingredients of Data Storage, Data Storage Systems, Data Engineering Storage Abstractions, Data warehouse, Data Lake, Data Lakehouse.

Ingestion: Data Ingestion, Key Engineering considerations for the Ingestion Phase, Batch Ingestion Considerations, Message and Stream Ingestion Considerations, Ways to Ingest Data

UNIT-V

Queries, Modeling and Transformation: Queries, Life of a Query, Query Optimizer, Queries on Streaming Data, Data Modelling, Modeling Streaming Data, Transformations, Streaming Transformations and Processing.

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Serving Data for Analytics, Machine Learning and Reverse ETL: General Considerations for serving Data, Business Analytics, Operational Analytics, Embedded Analytics, Ways to serve data for analytics and ML, Reverse ETL.

Text Books:
1. Joe Reis, Matt Housley, Fundamentals of Data Engineering, O'Reilly Media, Inc.,June 2022,ISBN: 9781098108304

Reference Books:

1. Paul Crickard , Data Engineering with Python,Packt Publishing, October 2020.
2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Wiley, 3rd Edition, 2013
3. James Densmore, Data Pipelines Pocket Reference: Moving and Processing Data for Analytics, O'Reilly Media, 1st Edition, 2021

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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 dependency Lossless 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

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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.

Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

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, 8thedition, C J Date, Pearson.
2. Database Management System, 6th edition, RamezElmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Corlos 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

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II Year II Semester	Computer Organization and Architecture	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

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Textbooks:
1. Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 6th edition, McGraw Hill, 2023.
2. Digital Design, 6th Edition, M. Morris Mano, Pearson Education, 2018.
3. Computer Organization and Architecture, William Stallings, 11thEdition, Pearson, 2022.

Reference Books:
1. Computer Systems Architecture, M.Moris Mano, 3rdEdition, Pearson, 2017.
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier, 2004.
3. Fundamentals of Logic Design, Roth, 5thEdition, Thomson, 2003.

Online Learning Resources:
https://nptel.ac.in/courses/106/103/106103068/

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II Year II Semester	Data Engineering Lab	L	T	P	C
		0	0	3	1.5

Course Objective:
- The main objective of this course is to teach how build data engineering infrastructure and data pipelines.

Course Outcomes:
At the end of the course student will be able to:
1. Build our Data Engineering Infrastructure
2. Demonstrate Reading and Writing files
3. Build Data Pipelines and integrate with Dashboard
4. Deploy the Data Pipeline in production

Experiments:
1. Installing and configuring Apache NiFi, Apache Airflow
2. Installing and configuring Elastic search, Kibana, PostgreSQL, pgAdmin 4
3. Reading and Writing files
   a. Reading and writing files in Python
   b. Processing files in Airflow
   c. NiFi processors for handling files
   d. Reading and writing data to databases in Python
   e. Databases in Airflow
   f. Database processors in NiFi
4. Working with Databases
   a. Inserting and extracting relational data in Python
   b. Inserting and extracting NoSQL database data in Python
   c. Building database pipelines in Airflow
   d. Building database pipelines in NiFi
5. Cleaning, Transforming and Enriching Data
   a. Performing exploratory data analysis in Python
   b. Handling common data issues using pandas
   c. Cleaning data using Airflow
6. Building the Data Pipeline
7. Building a Kibana Dash Board
8. Perform the following operations
   a. Staging and validating data
   b. Building idempotent data pipelines
   c. Building atomic data pipelines
9. Version Control with the NiFi Registry
   a. Installing and configuring the NiFi Registry
   b. Using the Registry in NiFi
   c. Versioning your data pipelines
   d. Using git-persistence with the NiFi Registry
10. Monitoring Data Pipelines
    a. Monitoring NiFi in the GUI
    b. Monitoring NiFi using processors

  c. Monitoring NiFi with Python and the REST API

11. Deploying Data Pipelines
  a. Finalizing your data pipelines for production
  b. Using the NiFi variable registry
  c. Deploying your data pipelines

12. Building a Production Data Pipeline
  a. Creating a test and production environment
  b. Building a production data pipeline
  c. Deploying a data pipeline in production

Reference Books:

1. Paul Crickard , Data Engineering with Python,Packt Publishing, October 2020.

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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 droping 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.

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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

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II Year II Semester	Exploratory Data Analysis using Python (Skill Development Course)	L	T	P	C
		0	1	2	2

Course Objectives:

1. This course introduces the fundamentals of Exploratory Data Analysis
2. It covers essential exploratory techniques for understanding multivariate data by summarizing it through statistical methods and graphical methods.

Course Outcomes:

1. Enumerate the fundamentals of Exploratory Data Analysis.
2.Visualize the data using basic graphs and plots.
3. Apply different Data Transformation Techniques.
4. Summarize the data using descriptive statistics.
5. Evaluate the Models and select the best model

UNIT-I
Exploratory Data Analysis Fundamentals: Understanding data science, The significance of EDA, Steps in EDA, Making sense of data, Numerical data, Categorical data, Measurement scales, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA, Getting started with EDA.
Sample Experiments:
1. a) Download Dataset from Kaggle using the following link :
   https://www.kaggle.com/datasets/sukhmanibedi/cars4u
   b) Install python libraries required for Exploratory Data Analysis (numpy, pandas, matplotlib,seaborn)
2. Perform Numpy Array basic operations and Explore Numpy Built-in functions.
3. Loading Dataset into pandas dataframe
4. Selecting rows and columns in the dataframe

UNIT-II
Visual Aids for EDA: Technical requirements, Line chart, Bar charts, Scatter plot using seaborn, Polar chart, Histogram, Choosing the best chart
Case Study:EDA with Personal Email, Technical requirements, Loading the dataset, Data transformation, Data cleansing, Applying descriptive statistics, Data refactoring, Data analysis.
Sample Experiments:
5. Apply different visualization techniques using sample dataset
a) Line Chart b) Bar Chart c) Scatter Plots d)Bubble Plot
6. Generate Scatter Plot using seaborn library for iris dataset
7. Apply following visualization Techniques for a sample dataset
a) Area Plot b) Stacked Plot c) Pie chart d) Table Chart
8. Generate the following charts for a dataset.
a) Polar Chart b)Histogram c)Lollipop chart
9. Case Study: Perform Exploratory Data Analysis with Personal Email Data

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UNIT-III

Data Transformation: Merging database-style data frames, Concatenating along with an axis, Merging on index, Reshaping and pivoting, Transformation techniques, Handling missing data, Mathematical operations with NaN, Filling missing values, Discretization and binning, Outlier detection and filtering, Permutation and random sampling, Benefits of data transformation, Challenges.

Sample Experiments:
10. Perform the following operations
   a) Merging Data frames
   b) Reshaping with Hierarchical Indexing
   c) Data Deduplication
   d) Replacing Values
11. Apply different Missing Data handling techniques
a)NaN values in mathematical Operations
   b) Filling in missing data
   c) Forward and Backward filling of missing values
   d) Filling with index values
   e) Interpolation of missing values
12. Apply different data transformation techniques
   a) Renaming axis indexes
b) Discretization and Binning
   c) Permutation and Random Sampling
   d) Dummy variables

UNIT-IV

Descriptive Statistics: Distribution function, Measures of central tendency, Measures of dispersion, Types of kurtosis, Calculating percentiles, Quartiles, Grouping Datasets, Correlation, Understanding univariate, bivariate, multivariate analysis, Time Series Analysis

Sample Experiments:
13. Study the following Distribution Techniques on a sample data
   a) Uniform Distribution
 b) Normal Distribution
c) Gamma Distribution
d) Exponential Distribution
   e) Poisson Distribution
   f) Binomial Distribution
14. Perform Data Cleaning on a sample dataset.
15. Compute measure of Central Tendency on a sample dataset
  a) Mean b)Median c)Mode
16. Explore Measures of Dispersion on a sample dataset
 a) Variance b) Standard Deviation c) Skewness d) Kurtosis
17. a) Calculating percentiles on sample dataset
   b) Calculate Inter Quartile Range(IQR) and Visualize using Box Plots
18. Perform the following analysis on automobile dataset.
   a) Bivariate analysis b)Multivariate analysis
19. Perform Time Series Analysis on Open Power systems dataset

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UNIT-V

Model Development and Evaluation: Unified machine learning workflow, Data preprocessing, Data preparation, Training sets and corpus creation, Model creation and training, Model evaluation, Best model selection and evaluation, Model deployment

Case Study : EDA on Wine Quality Data Analysis

Sample Experiments:

20. Perform hypothesis testing using statsmodels library
     a) Z-Test   b)T-Test

21.Develop model and Perform Model Evaluation using different metrics such as prediction score, R2 Score, MAE Score, MSE Score.

22. Case Study: Perform Exploratory Data Analysis with Wine Quality Dataset

Text Book:

1. Suresh Kumar Mukhiya, Usman Ahmed, Hands-On Exploratory Data Analysis with Python, Packt Publishing, 2020.

References:

1. Ronald K. Pearson, Exploratory Data Analysis Using R, CRC Press, 2020
2. RadhikaDatar,HarishGarg, Hands-On Exploratory Data Analysis with R: Become an expert in exploratory data analysis using R packages, Ist Edition, Packt Publishing, 2019

Web References:

1. https://github.com/PacktPublishing/Hands-on-Exploratory-Data-Analysis-with-Python
2. https://www.analyticsvidhya.com/blog/2022/07/step-by-step-exploratory-data-analysis-eda-using-python/#h-conclusion

https://github.com/PacktPublishing/Exploratory-Data-Analysis-with-Python-Cookbook

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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)
- Analyze 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.

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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:

1. https://nptel.ac.in/courses/110/106/110106124/
2. https://nptel.ac.in/courses/109/104/109104109/
3. https://swayam.gov.in/nd1_noc19_mg60/preview

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Department of CSE (DATASCIENCE) COURSE STRUCTURE

B.Tech–III Year- I Semester

S.No	Category	Subject Code	Title	L	T	P	Credits
1	PC	DR231CD5T01	Operating System	3	0	0	3
2	PC	DR231CD5T02	Machine Learning	3	0	0	3
3	PC	DR231CD5T03	Introduction to Computer Networks	3	0	0	3
4	PE-I	DR231CD5E11	1. Soft computing	3	0	0	3
		DR231CM5E11	2. Software Engineering				
		DR231CM5E12	3. Digital Twins				
		DR231CD5E12	4. Predictive Analytics				
		DR231CD5E13	5. Any of 12 Week Course Swayam /NPTEL Course suggested by BOS				
5	OE-I	DR231MB5O11	Open elective offered by other department **Managerial Economics & Financial Analysis**	3	0	0	3
6	PC	DR231CD5L01	Machine Learning Lab	0	0	3	1.5
7	PC	DR231CD5L02	Introduction to Computer Networks Lab	0	0	3	1.5
8	SEC	DR231CD5S01	MEAN Stack Technologies	0	1	2	2
9	ES	DR231ES5L01	Tinkering Lab	0	0	2	1
10		DR231CD5P01	Evaluation of Community Service Internship	-	-	-	2
			Total	15	1	10	23

Note: - Managerial Economics & Financial Analysis is Mandatory.

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B.Tech–III Year II Semester

S.No	Category	Subject Code	Title	L	T	P	Credits
1	PC	DR231CD6T01	Massive Data Analytics	3	0	0	3
2	PC	DR231CD6T02	Deep Learning	3	0	0	3
3	PC	DR231CD6T03	Automata Theory & Compiler Design	3	0	0	3
4	PE-II	DR231CD6E21	1. Model Evaluation and Selection	3	0	0	3
		DR231CD6E22	2. Introduction to Internet of Things				
		DR231CD6E23	3. Recommender Systems				
		DR231CD6E21	4. Quantum computing				
			5. 12-Week SWAYAM /NPTEL Course suggested by the BoS				
5	PE-III	DR231CD6E31	1. Computer Vision	3	0	0	3
		DR231CD6E32	2. Cryptography & Network Security				
		DR231CD6E33	3. AI Chatbot				
		DR231CD6E34	4. Cyber security				
		DR231CD6E14	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	DR231CD6L01	Deep Learning Lab	0	0	3	1.5
8	PC	DR231CD6L02	Massive Data Analytics Lab	0	0	3	1.5
9	SEC	DR231CD6S01	Soft skills	0	1	2	2
10	AC	DR231CD6A01	Technical Paper Writing & IPR	2	0	0	-
			Total	19	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	DR231CD7T01	Data Wrangling &Visualization	3	0	0	3
2	MC-II	DR231CD7M01	Entrepreneurship & Incubation	2	0	0	2
3	PE-IV	DR231CD7E41	1. Cloud Computing	3	0	0	3
		DR231CD7E42	2. Software Testing Methodology				
		DR231CD7E43	3. DevOps				
		DR231CD7E44	4. NoSQL databases				
		DR231CD7E15	5. 12-Week SWAYAM /NPTEL Course suggested by the BoS				
4	PE-V	DR231CD7E51	1. Model Evaluation & Selection	3	0	0	3
		DR231CD7E52	2. Expert Systems				
		DR231CD7E53	3. Reinforcement Learning				
		DR231CD7E54	4. High-Performance Computing				
		DR231CD7E16	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	DR231CD7S01	Prompt Engineering	0	1	2	2
8	AC	DR231CD7A01	Gender Sensitization	2	0	0	-
9	Internship	DR231CD7P01	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	DR231CD8P01	Full semester Internship & Project Work	0	0	24	12

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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)

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III Year I Semester	Operating System	L	T	P	C
		3	0	0	3

Course objectives:
- Provide knowledge about the services rendered by operating systems.
- Present detail discussion on processes, threads and scheduling algorithms.
- Expose the student with different techniques of handling deadlocks.
- Discuss various file-system implementation issues and memory management techniques.
- Learn the basics of Linux operating system

Course Outcomes:

- Understand the importance of operating systems and different types of system calls.
- Analyze process scheduling algorithms and various IPC mechanisms.
- Analyze the process synchronization, different ways for deadlocks handling.
- Analyze different page replacement methods, various File management techniques.
- Understand Android environment and behavior

UNIT-I:

Operating Systems Overview: Introduction: what is an operating system, Types of operating systems, operating systems concepts, operating systems services, Introduction to System call, System call types, Operating System Generation?

UNIT–II

Process Management: Process concept: Process Concept, Process Scheduling, Operations on Processes, Inter process Communication. Multithreaded Programming: Overview, Multithreading models, Threading Issues. Process scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

UNIT-III

Synchronization: Process Synchronization, The Critical-Section Problem- Dekker's Solution, Petersons Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization examples. Principles of deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery form Deadlock.

UNIT-IV

Memory Management: Memory Management strategies: Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table. Virtual Memory Management: Virtual Memory, Demand Paging, Page-Replacement Algorithms, Thrashing.

UNIT-V

File system Interface- the concept of a file, Access Methods, Directory and Disk structure, File system mounting. File System implementation: File system structure, allocation methods, Free-space management. Mass-storage structure: overview of Mass-storage structure, Disk scheduling, Device drivers

Android Software Platform: Android Architecture, Operating System Services, Android Runtime Application Development, Application Structure, Application Process management.

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Text Books:

1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9thedition, Wiley, 2013.
2. Tanenbaum A S, Modern Operating Systems, 3rdedition, Pearson Education, 2008.

Reference Books:

1. Tanenbaum A S, Woodhull A S, Operating Systems Design and Implementation, 3rd edition, PHI, 2006.
2. Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill, 2012.
3. Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009.
4. Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004

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III Year I 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 neighbors (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering

Course Outcomes:

After the completion of the course, student will be able to
- Understand the distribution and diversity of Data.
- Extract features useful for building predictive models.
- Gain knowledge on Supervised and unsupervised Learning techniques.
- Analyze Statistical learning techniques and Logistic Regression
- Select appropriate Support Vector Machines and Perception Algorithm
- Compare the performance of different learning models.

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 Discriminats for Machine Learning: Introduction to Linear Discriminats, Linear Discriminants for Classification, Perceptrons Classifier, Perception Learning Algorithm, Support Vector Machines, Linearly Non-

Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Back propagation 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 Edition, 2019.

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III Year I Semester	Introduction to Computer Networks	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to

- To understand the different types of networks
- To discuss the software and hardware components of a network
- To develop an understanding the principles of computer networks.
- To familiarize with OSI model and the functions of layered structure.
- To explain networking protocols, algorithms and design perspectives

Course Outcomes:

After completion of the course, students will be able to

- Identify the software and hardware components of a Computer network. (L1)
- Explain the functionality of each layer of a computer network. (L2)
- Identify and analyze flow control, congestion control, and routing issues. (L4)
- Analyze and interpret the functionality and effectiveness of the routing protocols. (L4)
- Choose the appropriate transport protocol based on the application requirements. (L3)

UNIT I

Introduction: Types of Computer Networks, Broadband Access Networks, Mobile and Wireless Access Networks, Content Provider Networks, Transit networks, Enterprise Networks, Network technology from local to global, Personal Area Networks, Local Area Networks, Home Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network Protocols, Design Goals, Protocol Layering, Connections and Reliability, Service Primitives, The Relationship of Services to Protocols ,Reference Models, The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model and Protocols.

UNIT II

The Data Link Layer: Guided Transmission Media, Persistent Storage, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Data Link Layer Design Issues, Services Provided To The Network Layer, Framing Error Control, Flow Control, Error Detection And Correction, Error-Correcting Codes, Error-Detecting Codes, Elementary Data Link Protocols, Initial Simplifying Assumptions Basic Transmission And Receipt, Simplex Link-Layer Protocols, Improving Efficiency, Bidirectional Transmission, Multiple Frames In Flight, Examples Of Full-Duplex, Sliding Window Protocols.

The Channel Allocation Problem, Static Channel Allocation, Assumptions For Dynamic Channel Allocation, Multiple Access Protocols, Aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols, Ethernet, Classic Ethernet Physical Layer, Classic Ethernet Mac Sub layer Protocol, Ethernet Performance, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10-Gigabit Ethernet,40-And 100-Gigabit Ethernet, Retrospective On Ethernet.

UNIT III

The Network Layer: Network Layer Design Issues, Store-And-Forward Packet Switching, Services Provided To The Transport Layer, Implementation Of Connectionless Service, Implementation Of Connection-Oriented Service, Comparison Of Virtual-Circuit And Datagram Networks, Routing Algorithms In A Single Network, The Optimality Principle, Shortest Path Algorithm, Flooding.

Distance Vector Routing, Link State Routing, Hierarchical Routing Within a Network, Broadcast Routing, Multicast Routing, Any cast Routing, Traffic Management at The Network Layer, The Need for Traffic Management: Congestion, Approaches To Traffic Management, Internetworking, Internetworks: An Overview, How Networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks,

Internetwork Routing: Routing Across Multiple Networks Supporting Different Packet Sizes: Packet Fragmentation, the Network Layer In The Internet.

The IP Version 4 Protocol, IP Addresses, IP. Version 6, Internet Control Protocols, Label Switching and MPLS, OSPF—an Interior Gateway Routing Protocol, BGP—the Exterior Gateway Routing Protocol, Internet Multicasting.

UNIT IV

The Transport Layer: The Transport Service, Services Provided To The Upper Layers, Transport Service Primitives, Berkeley Sockets, An Example Of Socket Programming: An Internet File Server, Elements Of Transport Protocols, Addressing, Connection Establishment, Connection Release, Error Control And Flow Control, Multiplexing, Crash Recovery, Congestion Control, Desirable Bandwidth Allocation, Regulating The Sending Rate, Wireless Issues, The Internet Transport Protocols: UDP, Introduction To UDP, Remote Procedure Call, Real-Time Transport Protocols, The Internet Transport Protocols: TCP, Introduction To TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

UNIT V

The Application Layer: Electronic Mail, Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, The World Wide Web, Architectural Overview, Static Web Objects, Dynamic Web Pages and Web Applications, HTTP and HTTPS, Web Privacy, Content Delivery, Content and Internet Traffic, Server Farms and Web Proxies, Content Delivery Networks, Peer-To-Peer Networks, Evolution of The Internet.

Text Books:
Andrew Tanenbaum, Feamster Wetherall, Computer Networks, 6th Edition, Global Edition.

Reference Books:
1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Publication, 2017.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.
3. Youlu Zheng, Shakil Akthar, "Networks for Computer Scientists and Engineers", Oxford Publishers, 2016.

Online Learning Resources:
- https://nptel.ac.in/courses/106105183/25
- http://www.nptelvideos.in/2012/11/computer-networks.html
- https://nptel.ac.in/courses/106105183/3

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III Year I Semester	Soft Computing Professional Elective-I	L	T	P	C
		3	0	0	3

Course Objectives:
- The main objective of the Soft Computing Techniques to Improve Data Analysis Solutions is to strengthen the dialogue between the statistics and soft computing research communities to cross-pollinate both fields and generate mutual improvement activities.
- Soft Computing is a consortium of methodologies switch collectively provides a body of concepts and techniques for designing intelligent systems.

Course Outcomes:
- Build intelligent systems through soft computing techniques.
- Understand the concept of artificial neural networks, fuzzy arithmetic, and fuzzy logic with their day-to-day applications.
- Understand fuzzy logic and reasoning to handle and solve engineering problems.
- Perform various operations of genetic algorithms, Rough Sets.
- Comprehend various techniques to build model for various applications

UNIT-I

Introduction: What is Soft Computing? Difference between Hard and Soft computing, Requirement of soft computing, Major Areas of Soft Computing, Applications of Soft Computing.

UNIT-II

Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Back propagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications?

UNIT-III

Fuzzy Systems: Fuzzy Set theory, Fuzzy versus Crispest, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification

UNIT-IV

Genetic Algorithm: History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators-Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.

UNIT-V

Hybrid Systems: Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.

GA based Back propagation Networks: GA based Weight Determination, K - factor determination in Columns.
Fuzzy Back propagation Networks: LR type Fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BP, Application of Fuzzy BP Networks

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Text Books:

1. Principles of Soft Computing- SN Sivanandam, S ND eepa, Wiley India, 1st Edition, 2007.

2. Soft Computing and Intelligent System Design-Fakhreddine Karray, Clarence Silva, Pearson Edition, 1st Edition, 2004.

References:

1. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis &Applications, S. Rajasekaran, G. A. Vijayalakshami, PHI.

2. Genetic Algorithms: Search and Optimization, E. Goldberg.

3. Neuro-Fuzzy Systems, Chin Teng Lin, C.S. George Lee, PHI.

4. Build_Neural_Network_With_MS_Excel_sample by Joechoong

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

Course Objectives:

The objectives of this course is to acquire knowledge on the
i. To understand the software life cycle models.
ii. To understand the software requirements and SRS document.
iii. To understand the importance of modeling and modeling languages.
iv. To design and develop correct and robust software products.

Course Outcomes:
i. Define and develop a software project from requirement gathering to implementation.
ii. Obtain knowledge about principles and practices of software engineering.
iii. Focus on the fundamentals of modeling a software project.
iv. Obtain basic knowledge of coding
v. 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

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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.

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 McGraw Hill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, Third Edition, PHI.
3. Software Engineering, Ian Sommerville, Ninth edition, Pearson education

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/10

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III Year I Semester	Digital Twin Professional Elective-I	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.

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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 cyber security in Digital Twin environments.

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	Predictive Analysis Professional Elective-I	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce students to the concepts and techniques of predictive analytics and its applications.
2. To develop a strong foundation in statistical modeling and machine learning for forecasting.
3. To enable students to apply regression, classification, and time-series models for prediction tasks.
4. To familiarize students with tools and libraries used in predictive modeling using Python/R.
5. To equip students to handle real-world datasets for deriving actionable insights using predictive models.

COURSE OUTCOMES:

1. Understand and explain the key concepts and methodologies in predictive analytics.
2. Apply regression and classification techniques to solve prediction problems on real datasets.
3. Build and evaluate time-series models for forecasting applications.
4. Utilize Python/R tools to implement predictive models and interpret results effectively.
5. Analyze real-world data and develop predictive solutions with awareness of ethical considerations.

UNIT I

Introduction to Predictive Analytics: Definition, significance, and applications of predictive analysis in business, healthcare, and technology. Overview of data science lifecycle and role of prediction. Types of predictive models – regression, classification, time-series. Data preparation: data cleaning, transformation, feature engineering, and feature selection. Exploratory data analysis (EDA) techniques**.**

UNIT II

Regression Models: Simple and multiple linear regression, assumptions and diagnostics. Polynomial and logistic regression for binary classification. Evaluation metrics for regression – MAE, MSE, RMSE, R^2 score. Multicollinearity and variable selection techniques. Regularization techniques – Ridge, Lasso, and Elastic Net. Implementation using Python libraries: Scikit-learn, Statsmodels

UNIT III

Classification Models: Decision trees, Random Forest, k-NN, Naïve Bayes, and Support Vector Machines. Model performance evaluation using confusion matrix, precision, recall, F1-score, ROC, and AUC. Cross-validation and hyper parameter tuning using GridSearchCV. Over fitting and under fitting. Model interpretability and explainability (LIME, SHAP).

UNIT IV

 Time-Series Forecasting: Components of time series – trend, seasonality, noise. Time-series data preprocessing and visualization. Forecasting models – AR, MA, ARMA, ARIMA, SARIMA. Exponential smoothing methods – Holt's and Holt-Winters. Advanced models: Prophet, LSTM networks for sequence modeling. Evaluation metrics for forecasting models (MAPE, RMSE).

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UNIT V

Applications and Tools in Predictive Analysis: Industry case studies – predictive maintenance, customer churn prediction, credit scoring, sales forecasting. Introduction to AutoML and deployment of predictive models. Ethical issues in predictive analytics – bias, fairness, and data privacy. Tools: Python (Pandas, Scikit-learn, XGBoost), R, Power BI, Tableau. Capstone project discussion and roadmap**.**

TEXT BOOKS:

1. Galit Shmueli, Nitin R. Patel, and Peter C. Bruce (2017). *Data Mining for Business Analytics: Concepts, Techniques, and Applications in Python*, Wiley.

2. Trevor Hastie, Robert Tibshirani, and Jerome Friedman (2009). *The Elements of Statistical Learning*, Springer.

3. Anasse Bari, Mohamed Chaouchi, and Tommy Jung (2016). *Predictive Analytics for Dummies*, Wiley.

REFERENCE BOOKS:

1. Dean Abbott (2014). *Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst*, Wiley.

2. James, Witten, Hastie, and Tibshirani (2013). *An Introduction to Statistical Learning with Applications in R*, Springer.

3. Sebastian Raschka and Vahid Mirjalili (2019). *Python Machine Learning*, Packt Publishing.

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III Year I Semester	Open Elective -I	L	T	P	C
	Managerial Economics & Financial Analysis	3	0	0	3

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 behavior- 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)

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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 Hl 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

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

Course Objectives:
1. To provide hands-on experience with implementing machine learning algorithms using Python and open-source libraries.
2. To introduce data preprocessing and model evaluation techniques.
3. To enable students to build and evaluate classification, regression, and clustering models.
4. To expose learners to real-time datasets and practical machine learning workflows.
5. To develop skills in selecting appropriate models, tuning hyperparameters, and improving performance.

Course Outcomes:
After completing this lab, students will be able to:
1. Apply data pre-processing techniques such as normalization, handling missing data, and encoding.
2. Implement various supervised learning algorithms including linear regression and decision trees.
3. Construct unsupervised learning models for clustering using algorithms like K-Means.
4. Use scikit-learn and related libraries to build, train, test, and evaluate machine learning models.
5. Analyze real-world datasets and interpret the output for decision-making.

Lab Task List:

1. Implement data pre-processing techniques including normalization, standardization, handling missing values, and encoding categorical variables.
2. Build a Linear Regression model to predict outcomes (e.g., house prices) using a real dataset.
3. Implement Logistic Regression to classify data (e.g., email spam detection).
4. Construct Decision Tree and Random Forest classifiers and evaluate their performance.
5. Use Support Vector Machines (SVM) for binary classification on a suitable dataset.
6. Implement K-Nearest Neighbour's (KNN) algorithm for classification and regression tasks.
7. Perform K-Means clustering and visualize clusters using a 2D dataset.
8. Apply Principal Component Analysis (PCA) for dimensionality reduction and visualize the results.
9. Use Naïve Bayes classifier for text classification (e.g., sentiment analysis).
10. Evaluate models using cross-validation, confusion matrix, precision, recall, F1-score, and ROC-AUC curve.

Text Books:

1. Aurélien Géron, **"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow"**, O'Reilly, 2nd Edition.
2. Tom M. Mitchell, **"Machine Learning"**, McGraw-Hill Education, 1st Edition.
3. Ethem Alpaydin, **"Introduction to Machine Learning"**, MIT Press, 3rd Edition.

Reference Books:

1. Peter Harrington, **"Machine Learning in Action"**, Manning Publications, 1st Edition.
2. Kevin P. Murphy, **"Machine Learning: A Probabilistic Perspective"**, MIT Press, 1st Edition.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, **"The Elements of Statistical Learning"**, Springer, 2nd Edition.

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III Year I Semester	Computer Networks Lab	L	T	P	C
		0	0	3	1.5

Course Objectives:
- To understand the different types of networks
- To discuss the software and hardware components of a network
- To enlighten the working of networking commands supported by operating system
- To impart knowledge of Network simulator 2/3
- To familiarize the use of networking functionality supported by JAVA
- To familiarize with computer networking tools**.**

Course Outcomes:
- 1. Understand working of wired and wireless networks. (L2)
- 2. Develop scripts for Simulating Wired and wireless Networks. (L3)
- 3. Analyze the data traffic using tools. (L4)
- 4. Develop JAVA programs for client-server communication. (L3)
- 5. Utilize networking commands proficiently to diagnose and troubleshoot the network issues (L5)

List of Activities/Experiments:

1. Study different types of Network cables (Copper and Fiber) and prepare cables (Straight and Cross) to connect Two or more systems. Use crimping tool to connect jacks. Use LAN tester to connect the cables.

- Install and configure Network Devices: HUB, Switch and Routers. Consider both manageable and non-manageable switches. Do the logical configuration of the system. Set the bandwidth of different ports.
- Install and Configure Wired and Wireless NIC and transfer files between systems in Wired LAN and Wireless LAN. Consider both adhoc and infrastructure mode of operation.

2. Work with the commands Ping, Tracert, Ipconfig, pathping, telnet, ftp, getmac, ARP, Hostname, Nbtstat, netdiag, and Nslookup

3. Find all the IP addresses on your network. Unicast, Multicast, and Broadcast on your network.

4. Use Packet tracer software to build network topology and configure using Distance vector routing protocol.

5. Use Packet tracer software to build network topology and configure using Link State routing protocol.

6. Using JAVA RMI Write a program to implement Basic Calculator.

7. Implement a Chatting application using JAVA TCP and UDP sockets.

8. Hello command is used to know whether the machine at the other end is working or not. Echo command is used to measure the round-trip time to the neighbor. Implement Hello and Echo commands using JAVA.

9. Using Wireshark perform the following operations:
- Inspect HTTP Traffic
- Inspect HTTP Traffic from a Given IP Address,
- Inspect HTTP Traffic to a Given IP Address,
- Reject Packets to Given IP Address,
- Monitor Apache and MySQL Network Traffic.

10. Install Network Simulator 2/3. Create a wired network using dumbbell topology. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metrics throughput, delay, jitter and packet loss.

11. Create a static wireless network. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss.

12. Create a mobile wireless network. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss.

Text Books:

1. ShivendraS.Panwar, Shiwen Mao, Jeong-dong Ryoo, and Yihan Li, "TCP/IP Essentials:A Lab-Based Approach", Cambridge University Press, 2004.

2. Cisco Networking Academy, "CCNA1 and CCNA2 Companion Guide", Cisco Networking Academy Program, 3rd edition, 2003.

3. Elloitte Rusty Harold, "Java Network Programming", 3rd edition, O'REILLY, 2011.

Online Learning Resources:

https://www.netacad.com/courses/packet-tracer - Cisco Packet Tracer.

Ns Manual, Available at: https://www.isi.edu/nsnam/ns/ns-documentation.html, 2011.

https://www.wireshark.org/docs/wsug_html_chunked/ -Wireshark.

https://nptel.ac.in/courses/106105183/25

http://www.nptelvideos.in/2012/11/computer-networks.html

https://nptel.ac.in/courses/106105183/3

http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php

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III Year I Semester	MEAN Stack Technologies (Skill Enhancement Course)	L	T	P	C
		0	1	2	2

UNIT -I

HTML5 & JavaScript Essentials: HTML5: Structure, Forms, Tables, Media, Security Practices. JavaScript: Syntax, Functions, DOM Manipulation, Async Programming.

Tasks:
1. **Create a static web page** using HTML5 elements (headings, images, lists, forms).
2. **Add validation logic** to the HTML form using JavaScript functions.
3. **Build an interactive component** with DOM manipulation and event handling.
4. **Fetch data from an API** using JavaScript Fetch API and display it on the page.

UNIT II

Node.js & Express.js
Node.js: Core modules, NPM, file system, creating a server.Express.js: Routing, Middleware, API development, Security practices.
Tasks:
1. **Create a simple Node.js web server** that returns a response to browser requests.
2. **Use Express.js** to define RESTful routes and return JSON data.
3. **Connect Express app to MongoDB** and perform basic CRUD operations.
4. **Implement session management** using cookies and Helmet middleware.

UNIT III

MongoDB & Typescript
MongoDB: CRUD, indexing, aggregation, collections. TypeScript: Interfaces, Classes, Generics, Modules.
Tasks:
1. **Install MongoDB and create a cluster** using MongoDB Atlas.
2. **Write MongoDB CRUD queries** to insert, update, delete documents.
3. **Create a TypeScript app** using interfaces, classes, and functions.
4. **Build a module-based project** in TypeScript connecting to a MongoDB collection.

UNIT IV

Angular Basics & Component Development
Angular setup, Components, Templates, Data Binding. Directives (ngIf, ngFor, ngSwitch), Pipes, Forms.
Tasks:
1. **Create a new Angular component** and display content using interpolation.
2. **Implement ngIf and ngFor** to dynamically show/hide elements and list data.
3. **Build a login form** with validation using template-driven approach.
4. **Use built-in pipes** to transform data (uppercase, lowercase, date).

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UNIT V

Angular Advanced Features & Backend Integration

Services, Dependency Injection, HttpClient, RxJS. Routing, Route Guards, Lazy Loading, Nested Routes.
Tasks:
1. **Create an Angular service** to fetch and display data using Http Client.
2. **Implement routing** between components with Router Link and route parameters.
3. **Add a route guard** to restrict access based on login status.
4. **Enable lazy loading** for a module and observe performance improvements.

Textbooks
1. *Programming the World Wide Web*, Robet W Sebesta, Pearson.
2. *Pro MEAN Stack Development*, Elad Elrom, Apress.
3. *Full Stack JavaScript Development with MEAN*, Ihrig & Bretz, SitePoint.
4. *MongoDB – The Definitive Guide*, Kristina Chodorow, O'Reilly.

Online Resources
- Angular: https://infyspringboard.onwingspan.com/...Angular_JS
- MongoDB: https://infyspringboard.onwingspan.com/...MongoDB
- JavaScript: https://infyspringboard.onwingspan.com/...Javascript
- Node.js & Express: https://infyspringboard.onwingspan.com/...Node

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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
- **Expectations from the Lab:**

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- 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	Massive Data Analytics	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

UNIT -I

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

UNIT –II

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

UNIT-IV

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.

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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

Text Books

1. Tom White, "Hadoop:The Definitive Guide", Third Edition, O'reilly Media, Fourth Edition,2015.
2. ChrisEaton, DirkDeRoos, TomDeutsch, GeorgeLapis, PaulZikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw-Hill Publishing, first edition, 2011.
3. Anand Rajaraman and Jeffrey David Ullman, "MiningofMassive Datasets", CUP, first edition, 2011

Reference Books

1. BillFranks,"TamingtheBigDataTidalWave:FindingOpportunitiesinHugeData Streams with Advanced Analytics", John Wiley& sons,2012.
2. PaulZikopoulos, DirkdeRoos, KrishnanParasuraman, ThomasDeutsch, JamesGiles, David Corrigan, "Harness the Power of Big Data: The IBM Big Data Platform", Tata McGrawHillPublications, 2012.

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III Year II Semester	Deep Learning	L	T	P	C
		3	0	0	3

Course Objectives:

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

Course Outcomes:

Students will be able to:

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

Unit-I

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

Unit-II

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-III

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

Unit-IV

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-V

LSTM Networks, Generative Modelling with DL, Variational Auto encoder, 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.

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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 II Semester	Automata Theory & Compiler Design	L	T	P	C
		3	0	0	3

Course Objectives:
- Automata and compiler Design mainly deals with the languages which are formal and regular and also deals with grammar present in the machine.
- An 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:
- Graduate should be able to understand the concept of abstract machines and their power to recognize the languages.
- Attains the knowledge of language classes & grammars relationship among them with the help of chomsky hierarchy.
- 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.

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UNIT V

Code generation : Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.

Text Books:
1. Introduction to Theory of computation. Sipser, 2nd Edition, Thomson.
2. Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.

Reference Books:
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	Model Evaluation and Selection Professional Elective-II	L	T	P	C
		3	0	0	3

Course Objectives:

1. To introduce the need for evaluating machine learning models using appropriate metrics.
2. To explain various performance metrics for classification and regression problems.
3. To provide an understanding of over fitting, under fitting, and model selection techniques.
4. To train students to use cross-validation and hyper parameter tuning to improve model performance.
5. To prepare students for applying model evaluation strategies in real-time applications and competitions.

Course Outcomes:

Upon successful completion of this course, students will be able to:
1. Identify appropriate evaluation metrics for different types of machine learning tasks.
2. Analyze the performance of classification and regression models using precision, recall, RMSE, etc.
3. Detect over fitting and under fitting in machine learning models.
4. Apply cross-validation and model selection techniques effectively.
5. Tune hyper parameters and compare models for optimal selection and deployment.

UNIT – I

Introduction to Model Evaluation – Why Evaluate Models? – Concepts of Training, Validation, and Testing – Generalization, Bias-Variance Trade-off – Under fitting and Over fitting – Model Complexity – Overview of Evaluation Strategies – Role of Evaluation in Model Lifecycle.

UNIT – II

Classification Metrics – Confusion Matrix – Accuracy, Precision, Recall, Specificity, and F1-Score – ROC Curve and AUC – Precision-Recall Curve – Multiclass Evaluation – Imbalanced Dataset Handling – Matthews Correlation Coefficient (MCC) – Use Cases and Metric Selection Guidelines.

UNIT – III

Regression Metrics – Mean Absolute Error (MAE), Mean Squared Error (MSE), Root Mean Squared Error (RMSE), R-Squared (R^2), Adjusted R^2 – When to Use Which Metric – Residual Plots – Metric Analysis on Real Datasets – Error Distribution and Model Interpretation.

UNIT – IV

Model Selection – Hold-out Method, K-Fold Cross-Validation, Stratified K-Folds – Leave-One-Out and Leave-P-Out – Repeated CV – Bootstrap Methods – Nested Cross-Validation – Comparison of Multiple Models – Statistical Significance Testing for Model Comparison – Practical Considerations.

UNIT – V

Hyper parameter Tuning – Grid Search, Random Search, and Bayesian Optimization – Validation Curve and Learning Curve – Model Selection with Pipelines – Feature Selection Impact on Evaluation – Automated Machine Learning (AutoML) and Evaluation – Model Deployment Considerations – Case Studies from Real-world Projects and Competitions.

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Text Books:

1. Aurélien Géron, **"Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow"**, O'Reilly, 2nd Edition.
2. Sebastian Raschka and Vahid Mirjalili, **"Python Machine Learning"**, Packt Publishing, 3rd Edition.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, **"The Elements of Statistical Learning"**, Springer, 2nd Edition.

Reference Books:

1. Ron Kohavi, **"A Study of Cross-Validation and Bootstrap for Accuracy Estimation and Model Selection"**, Morgan Kaufmann.
2. Kevin P. Murphy, **"Machine Learning: A Probabilistic Perspective"**, MIT Press, 1st Edition.
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, **"Deep Learning"**, MIT Press, 1st Edition.

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III Year II Semester	Internet of Things Professional Elective-II	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.

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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.

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

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III Year II Semester	Recommender Systems Professional Elective-II	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of this course are

- To learn techniques for making personalized, content-based, and collaborative filtering
- To automate variety choice making strategies with the goal of providing affordable, personal, and high-quality recommendations

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: 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 –II

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 –III

Collaborative Filtering: User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems.

Unit –IV

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 –V

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	Quantum Computing Professional Elective-II	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:

- Understand under lying principles of Quantum Computing (L2)
- Analyse the matrix operators for universal quantum gate (L4)
- Demonstrate quantum fouriert transformation(L1)
- Analyse quantum algorithms for searching(L4)
- Developaquantumcomputingapplicationformachinelearning/Keydistribution(L6)

Unit-I

INTRODUCTIONTO 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 QUANTUMPROGRAM : Quantum Algorithms, Single Qubit operations, Controlled operations, Measurement, Universal quantum gates, Simulation of quantum systems (4.1 to 4.5, 4.7)

UNIT-III

TENSORPRODUCTS, TELEPORTATION AND SUPERDENSE CODING : Tensor Products, Multi Q-Bit system, Super Position, Entanglement, Decoherence, quantum teleportation, no-cloning theorem super dense coding(10thchapterofBook2),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)

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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)

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,WileyPublisher,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&sou

4. MicrosoftQuantumDevelopmentKit,,https://www.microsoft.com/en-us/quantum/development-kit

5. Forest SDKPyQuil,, https://pyquil.readthedocs.io/en/stable/

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III Year II Semester	Computer Vision Professional Elective-III	L	T	P	C
		3	0	0	3

Course Objective:

- To introduce students the fundamentals of image formation;
- To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition;
- To develop an appreciation for various issues in the design of computer vision and object recognition systems; and to provide the student with programming experience from implementing computer vision and object recognition applications.

Course Outcomes:
 At the end of this course, the student will be able to
- Understand image processing techniques required for computer vision
- Describe image formation models
- Understand feature extraction and motion estimation techniques
- Apply segmentation algorithms for shape analysis
- Implement image classification Applications using object recognition methods.

UNIT-I

Introduction: Image Processing, Computer Vision and Computer Graphics , What is Computer Vision -Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality**.**

UNIT-II

Image Formation Models: Monocular imaging system , Radiosity: The 'Physics 'of Image Formation, Radiance, Irradiance, BRDF, color etc, Orthographic & Perspective Projection,• Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading, Photometric Stereo, Depth from Defocus , Construction of 3D model from images**.**

UNIT-III

Image Processing and Feature Extraction: Image preprocessing, Image representations (continuous and discrete) , Edge detection**.**
Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion**.**

UNIT-IV

Shape Representation and Segmentation: Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, and Multi resolution analysis.

UNIT-V

Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition.

TEXT BOOKS:

1. D.ForsythandJ. Ponce, "Computer Vision-A modern approach, "Pearson, 2ndEdition , 2015.
2. E.TruccoandA.Verri,"IntroductoryTechniquesfor3DComputerVision",Prentice Hall,3rd Edition, 2016

REFERENCEBOOKS:

1. R.C.Gonzalez, R.E.Woods."Digital Image Processing", Addison Wesley Longman, Inc., 2nd Edition 1992.

2. Richard Szeliski, "Computer Vision: Algorithms and Applications(CVAA)",Springer,2nd Edition,2010.

3. Sonka, Hlavac, and Boyle. "Image Processing, Analysis, and Machine Vision". Thomson, 4th Edition,2011.

4. E.R.Davies, "Computer and Machine Vision", Academic Press, 4thEdition,2012.

5. SimonJ. D.Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.

6. Mark Nixon and Alberto S.Aquado, "Feature Extraction& Image Processing for Computer Vision" , Academic Press, 3rd Edition,2012.

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III Year II Semester	Cryptography & Network Security Professional Elective-III	L	T	P	C
		3	0	0	3

Course Objectives:

1. To provide practical exposure to classical and modern encryption techniques.
2. To enable students to implement symmetric and asymmetric cryptographic algorithms.
3. To familiarize students with cryptanalysis and hashing functions.
4. To impart hands-on experience in secure communication using various protocols.
5. To develop skill in the use of tools for network security analysis and simulation.

Course Outcomes:

After successful completion of the course, the student will be able to:
1. Implement classical encryption techniques like Caesar cipher and monoalphabetic cipher.
2. Design and simulate modern cryptographic algorithms like AES, DES, RSA, etc.
3. Use hashing algorithms for data integrity and authentication.
4. Develop secure communication programs using socket programming and cryptographic libraries.
5. Utilize network security tools for detecting and analyzing threats.

Lab Task List:

1. Implement the Caesar Cipher and Monoalphabetic Cipher encryption/decryption algorithms.
2. Write a program for Playfair Cipher and Vigenère Cipher.
3. Develop a Java/Python program for DES algorithm.
4. Implement AES (128, 192, 256-bit) encryption and decryption.
5. Simulate RSA Algorithm for secure communication.
6. Implement MD5 and SHA-1 Hashing Algorithms.
7. Demonstrate Digital Signature creation and verification using RSA.
8. Perform secure file transfer using GPG (GNU Privacy Guard) or OpenSSL.
9. Use Wireshark to analyze and inspect SSL/TLS packets.
10. Configure basic Firewall rules using iptables or Windows Defender Firewall.

Text Books:

1. William Stallings, **"Cryptography and Network Security: Principles and Practice"**, 7th Edition, Pearson Education.
2. Behrouz A. Forouzan, **"Cryptography and Network Security"**, McGraw Hill Education, 2nd Edition.
3. Atul Kahate, **"Cryptography and Network Security"**, Tata McGraw-Hill, 3rd Edition.

Reference Books:

1. Charlie Kaufman, Radia Perlman and Mike Speciner, **"Network Security: Private Communication in a Public World"**, Pearson Education, 2nd Edition.
2. Bruce Schneier, **"Applied Cryptography"**, Wiley India, 2nd Edition.

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III Year II Semester	AI Chatbot	L	T	P	C
	Professional Elective-III	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 chat bots 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.

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. Pre-trained language models and fine-tuning for conversational agents (e.g., GPT, BERT-based models).

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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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III Year II Semester	CYBER SECURITY Professional Elective-III	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn threats and risks within context of the cyber security architecture.
- Student should learn and Identify security tools and hardening techniques.
- To learn types of incidents including categories, responses and timelines for response.

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

- Apply cyber security architecture principles.
- Demonstrate the risk management processes and practices.
- Appraise cyber security incidents to apply appropriate response
- Distinguish system and application security threats and vulnerabilities.
- Identify security tools and hardening techniques

UNIT–I

Introduction to Cyber Security-Cyber security objectives, roles, differences between information security and cyber security, Cyber security principles-confidentiality, integrity, availability, authentication and non-repudiation

UNIT–II

Information Security within Lifecycle Management-Lifecycle management landscape, Security architecture processes, Security architecture tools, Intermediate lifecycle management concepts, **Risks & Vulnerabilities-**Basics of risk management, Operational threat environments, Classes of attacks

UNIT–III

Incident Response-Incident categories, Incident response, Incident recovery, **Operational security protection**-Digital and data assets, ports and protocols, Protection technologies, Identity and access Management, configuration management

UNIT–IV

Threat Detection and Evaluation Monitoring-Vulnerability management, Security logs and alerts, Monitoring tools and appliances, **Analysis-**Network traffic analysis, packet capture and analysis

UNIT–V

Introduction to backdoor System and security-Introduction to metasploit, backdoor, demilitarized zone (DMZ), Digital signature, Brief study on Harding of operating system.

Text Books:
1. NASSCOM: Security Analyst Student Hand Book, Dec 2015
2. Information Security Management Principles, Updated Edition, DavidAlexander, Amanda Finch, David Sutton, BCS publishers, June 2013

Reference Books:
1. Cyber Security Fundamentals-Cyber Security, Network Security and Data Governance Security, 2nd Edition, ISACA Publishers, 2019

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

Course Objective:
- To introduce numerical computing techniques such as matrix operations and given value decomposition for effective data representation and transformation using Python.
- To familiarize students with dimensionality reduction techniques, particularly Principal Component Analysis (PCA), for managing and visualizing high-dimensional data.
- To enable understanding and application of neural network fundamentals, including perception and multilayer feed forward networks, for solving basic and intermediate classification tasks.
- To provide knowledge and hands-on skills for designing and implementing advanced deep learning models like RNNs, LSTMs, BiLSTMs, and Auto encoders in text and anomaly detection contexts.
- To train students in developing and evaluating Convolution Neural Networks (CNNs) for performing effective image classification on benchmark datasets.

Course Outcomes:

- Apply numerical methods, matrix operations, and eigenvalue decomposition techniques using Python for data preparation and feature transformation.
- Analyze and implement dimensionality reduction techniques such as Principal Component Analysis (PCA) to handle high-dimensional data.
- Apply perception and multilayer neural network algorithms to classify basic logic gates and real-world datasets such as MNIST.
- Design and implement advanced deep learning models including RNNs, LSTMs, BiLSTMs, and Auto encoders for text classification and anomaly detection.
- Develop and evaluate convolution neural networks for image classification tasks using datasets like Fashion-MNIST.

List of Experiments

1. Numerical Methods to solve matrix problems in Python
2. Eigen Value decomposition techniques
3. Dimensionality Reduction-PCA
4. Implement perception learning algorithm and attempt to solve two input i) AND gate ii) Or Gate iii) EXOR gate problems.
5. Design and implement a perception learning algorithm and attempt to solve XOR problem
6. Implement a Multilayer Feed Backward Neural network algorithm on MNIT digits dataset. Installing and configuring Apache NiFi, Apache Airflow
7. Build your own recurrent networks and long short-term memory networks on IMDB movie reviews classification data.
8. Design and implement a BiLSTM on given a product review dataset to classify the review rating from 1 to 5 classes
9. Design and implement Auto encoders for credit card fraud detection.
10. Design and implement a Convolution Neural Network for image classification on the Fashion-MNIST dataset.

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Text Books:
1. Reza Zadeh and Bharath Ramsundar, "Tensor flow for Deep Learning", O'Reilly publishers, first edition, March 2018

References:
2. https://github.com/fchollet/deep-learning-with-python-notebooks

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III Year II Semester	Massive Data Analytics Lab	L	T	P	C
		0	0	3	1.5

Course Objectives:
1. To introduce the concepts, characteristics, and technologies of Big Data.
2. To impart knowledge on the Hadoop ecosystem and distributed storage with HDFS.
3. To expose students to data processing frameworks such as MapReduce and Apache Spark.
4. To enable the use of high-level Big Data tools such as Pig, Hive, and Spark SQL.
5. To understand the use of predictive analytics and visual techniques in Big Data contexts.

Course Outcomes
Upon successful completion of the course, students will be able to:
1. Explain Big Data principles and the differences between conventional systems and Big Data systems.
2. Develop applications for Big Data processing using Hadoop and Spark frameworks.
3. Use Pig and Hive to analyze structured and semi-structured data.
4. Perform real-time stream analytics and machine learning using Spark.
5. Apply predictive analytics models and visualize results effectively.

List of tasks

1. Setup and configuration of Hadoop in pseudo-distributed mode.
2. Writing basic MapReduce programs for word count, sorting, etc.
3. Loading data into HDFS and performing operations using shell commands.
4. Writing and executing Pig Latin scripts for data manipulation.
5. Writing HiveQL queries to analyze structured datasets.
6. Installing and running Apache Spark in local mode.
7. Developing Spark applications using RDDs and DataFrames.
8. Implementing stream processing using Spark Streaming and socket/text data.
9. Performing regression and classification using Spark MLlib.
10. Creating dashboards using Power BI / Tableau / Python for Big Data visualization.

TEXT BOOKS:

1. Tom White, *Hadoop: The Definitive Guide*, 4th Edition, O'Reilly Media, 2015.
2. Matei Zaharia, Bill Chambers, *Learning Spark: Lightning-Fast Data Analytics*, 2nd Edition, O'Reilly Media, 2020.
3. Anand Rajaraman, Jeffrey D. Ullman, *Mining of Massive Datasets*, Cambridge University Press, 2011.

REFERENCE BOOKS

1. Bart Baesens, *Analytics in a Big Data World*, Wiley Big Data Series, 2014.
2. Arshdeep Bahga, Vijay Madisetti, *Big Data Science and Analytics: A Hands-On Approach*, VPT, 2016.
3. Bill Franks, *Tam*
4. *ing the Big Data Tidal Wave*, John Wiley & Sons, 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

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,**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,
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

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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

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/1W15961dOEnIxlnMm9BKyO8L9WIa7nPbEfg R-9DT_m Rg/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)

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Activities on Interview Readiness :(10M)

    The external Examiner assesses on Interview readiness

1. **Tell something about Yourself (5M)**

      Assessment Parameters:

        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.

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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	Data Wrangling & Visualization	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:
- To provide knowledge on data collection, preprocessing, and cleaning techniques.
- To understand various tools and methods for effective data wrangling and transformation.
- To learn the fundamentals and techniques of data visualization using modern libraries.
- To gain proficiency in generating meaningful insights from structured and unstructured data.
- To apply visualization principles to real-world datasets for informed decision-making.

COURSE OUTCOMES:
- Understand different types of data and apply appropriate wrangling techniques.
- Clean and preprocess datasets effectively for analytical use.
- Transform and engineer features for improved model performance and data interpretation.
- Design and implement clear, accurate, and engaging data visualizations.
- Build interactive visual dashboards and communicate insights from complex datasets.

UNIT–I

Introduction to Data Wrangling and Data Types: Definition and Importance of Data Wrangling – Data Life Cycle – Types of Data: Structured, Semi-Structured, Unstructured – Introduction to Data Sources: APIs, Files (CSV, JSON, XML), Databases, Web Scraping – Overview of Data Quality Issues – Data Collection Techniques – Tools for Data Wrangling: Python, Pandas, OpenRefine.

UNIT–II

Data Cleaning and Preprocessing: Handling Missing Data – Identifying and Correcting Data Errors – Dealing with Duplicates – Data Type Conversion – Parsing Dates – Normalization and Standardization – Handling Outliers – Encoding Categorical Data – Regular Expressions for Cleaning Text – Data Auditing – Logging and Automation of Cleaning Processes.

UNIT–III

Data Transformation and Feature Engineering: Reshaping Data using Melt and Pivot – Filtering, Sorting, and Grouping Data – Mapping and Replacing Values – Aggregation and Merging Datasets – Binning and Bucketing – Deriving New Features – Time Series Data Wrangling – Data Transformation Techniques using Pandas and NumPy – Introduction to Feature Selection Techniques.

UNIT–IV

Data Visualization Principles and Tools: Importance of Data Visualization – Basic Principles: Clarity, Accuracy, Aesthetics – Chart Types: Bar, Line, Scatter, Pie, Boxplot, Heatmap – Choosing the Right Chart – Color Theory and Labeling – Introduction to Visualization Tools: Matplotlib, Seaborn, Plotly – Plot Customization – Subplots and Multiple Axes – Interactive Plots.

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UNIT–V

Advanced Visualization and Dashboards: Geospatial Visualization using Folium and Plotly – Visualizing Time Series Data – Correlation Plots and Statistical Charts – Dashboards using Tableau/Power BI – Introduction to Streamlit for Python Web Apps – Case Studies: Business, Healthcare, Environment – Storytelling with Data – Best Practices for Dashboard Design – Ethical Issues in Data Representation.

TEXT BOOKS:
1. Jacqueline Kazil and Katharine Jarmul, *Data Wrangling with Python*, O'Reilly Media, 2016.
2. Ben Jones, *Communicating Data with Tableau*, O'Reilly Media, 2nd Edition, 2019.
3. Alberto Cairo, *The Truthful Art: Data, Charts, and Maps for Communication*, New Riders, 2016.

REFERENCE BOOKS:
1. Wes McKinney, *Python for Data Analysis*, O'Reilly Media, 2nd Edition, 2018.
2. Nathan Yau, *Data Points: Visualization That Means Something*, Wiley, 2013.
3. Cole Nussbaumer Knaflic, *Storytelling with Data: A Data Visualization Guide for Business Professionals*, Wiley, 2015.

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IV Year I Semester	Entrepreneurship & Incubation	L	T	P	C
		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)
- Analyze 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 it unique selling proportion.(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

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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

Activity: Business plan final version

Contemporary Topics:

1. Green Business

2. Niche Markets

3. New perspectives in rural enterprises

Text Books:

4. T.V Rao, Donald F.Kuratko, Entrepreneurship, A South-Asian Perspective, Cengage Learning, 1st edition, 2012.

5. 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	Cloud Computing Professional Elective-IV	L	T	P	C
		3	0	0	3

Course Objectives:
- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
- To enable students exploring some important cloud computing driven commercial systems and applications.
- To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research

Course Outcomes:
- After successful completion of this course, student will be able to
- Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
- Apply the fundamental concepts in datacenters to understand the tradeoffs in power, efficiency and cost.
- Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.
- Analyze various cloud programming models and apply them to solve problems on the cloud.

UNIT I

Introduction: Network centric computing, Network centric content, peer-to –peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing .Parallel and Distributed Systems: introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, and model concurrency with Petri Nets.

UNIT II

Cloud Infrastructure: At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Inter cloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing Cloud Computing : Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, The Map Reduce Program model, HPC on cloud, biological research

UNIT III

Cloud Resource virtualization: Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades

Cloud Resource Management and Scheduling: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feed back control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling

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UNIT IV

Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system., Apache Hadoop, Big Table, Megastore (text book 1), Amazon Simple Storage Service(S3) (Text book 2)

Cloud Security: Cloud security risks, security – atop concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks

UNIT V

Cloud Application Development: Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Installing Simple Notification Service on Ubuntu 10.04, Installing Hadoop on Eclipse, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming (Text Book 1)

Google: Google App Engine, Google Web Toolkit (Text Book 2)
Microsoft: Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book 2)

TEXT BOOKS:
1. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH

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IV Year I Semester	Software Testing Methodology Professional Elective-IV	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 test cases.
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 &PathExpression, 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.

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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.

TEXT BOOKS:

1. Software testing techniques – Boris Beizer, Dreamtech, secondedition.
2. Software Testing- Yogesh Singh,Cambridge

REFERENCES:

1. The Craft of software testing - Brian Marick, PearsonEducation.
2. Software Testing, 3rd edition, P.C. Jorgensen, Aurbach Publications (Dist.bySPD).

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IV Year I Semester	DevOps	L	T	P	C
	Professional Elective-IV	3	0	0	3

Course Objectives:
- Understand the principles and practices of DevOps.
- Understand the too lsand techniques used in automation, CI/CD, configuration management, and containerization.
- Develop, test, and deploy software efficiently using DevOps practices.
- Foster collaboration between software development and operations.
- Understand monitoring & security in DevOps

Course Outcomes:
- Understand the process of principles and practices of DevOps
- Analyze the techniques used in automation, CI/CD, configuration management ,and containerization
- Develop, test, and deploy software efficiently using DevOps practices
- Apply the association rule mining to real time applications
- Apply the clustering algorithms to various data sets.

Unit-I

Introduction to DevOps:Introduction to Software Development life cycleandagile software development, DevOps Definition and Benefits and it Goals, differentiate between Traditionalvs .DevOpsIT Infrastructure, Cloud Platforms (AWS, GCP, Azure, IBM), DevOps Principles (CI, CD, CT, CM), DevOps Tools (Git, Jenkins, Docker, Kubernetes, Ansible, Terraform), DevOps Lifecycle (Development → Monitoring), Version Control (SVN, Git, GitHub, GitLab)

Unit-II

Continuous Integration & Delivery (CI/CD): Introduction to CI/CD Concepts (Build, Test, Deploy Automation), CI/CD Tools (Jenkins, GitLab CI, CircleCI)

Unit –III

Containerization & Orchestration:Introduction to Containers: Difference between Containers and Virtual Machines, Benefits**Docker Basics**: Docker Images, Containers, Docker file,

Container Orchestration with Kubernetes: Basic Components (Pods, Services, Deployments), Kubernetes Architecture, Scaling Applications, Kubernetes on Cloud (GKE, EKS, AKS)

Unit –IV

Configuration Management &IaC: Introduction to Configuration Management: Why Configuration Management is Important. Tools: Ansible, Puppet, Chef,

Infrastructure as Code: Definition, Benefits, Tools like Terraform and Cloud Formation

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Unit 5

Monitoring & Security in DevOps :Introduction to DevOps Monitoring: Importance and Overview,
Monitoring Tools: Nagios, Prometheus, Grafana,
Log Management: Centralized logging with ELK(Elastic search ,Logstash, Kibana), **SecurityTools**: Using tools like Sonar Qube for code analysis.

Text Books:
1. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations Paperback – October 6, 2016, 1st Edition.
2. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation (Addison-Wesley Signature Series (Fowler)) 1st Edition by Jez Humble (Author), David Farley (Author), 1st Edition, 2010.

Reference Books:
1. Software Engineering: A Practitioner's Approach" – *Roger S. Pressman*
2. Building a DevOps Culture, 1st Edition, Mandi Walls, O'Reilly publications,2013.

Web References:
1. https://www.tutorialspoint.com/sdlc/sdlc_overview.htm
2. https://www.agilealliance.org/agile101/
3. https://scrumguides.org/
4. https://aws.amazon.com/devops/what-is-devops/
5. What is DevOps? - DevOps Models Explained - Amazon Web Services (AWS)
6. SDLC Overview
7. DevOps Roadmap: Learn to become a DevOps Engineer or SRE
8. Complete DevOps Roadmap 2025 - Master these 4 Levels!
9. Kunal Kushwaha - YouTube
10. https://www.sonarsource.com/products/sonarqube/

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IV Year I Semester	NoSQL databases Professional Elective-IV	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
From the course the student will

- To understand the basic concepts and the applications of database systems. To master the basics of SQL and construct queries using SQL.
- To understand the relational database design principles.
- To become familiar with the basic issues of transaction processing and concurrency control.
- 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.
- Define, compare and use the four types of NoSQL Databases (Document-oriented, Key Value Pairs, Column oriented and Graph).
- Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
- Explain the detailed architecture, define objects, load data, query data and performance tune.Document oriented NoSQL databases.
- 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 Mongodb 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 Mongodb, Creating and UsingIndexes In Mongodb, 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	Model Evaluation & Selection Professional Elective-V	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the need and importance of model evaluation and selection in machine learning.
2. To familiarize students with various performance metrics for classification and regression models.
3. To explore cross-validation techniques and statistical significance testing for model comparison.
4. To understand model complexity, bias-variance tradeoff, and methods to avoid overfitting.
5. To enable students to choose appropriate models for specific tasks through systematic evaluation.

COURSE OUTCOMES:

1. Understand the importance of model evaluation and apply appropriate validation protocols.
2. Use classification and regression metrics effectively to assess model performance.
3. Implement cross-validation techniques to improve model generalization.
4. Conduct statistical tests to compare and select between multiple models.
5. Analyze the trade-off between bias and variance and apply regularization and ensemble techniques.

UNIT I

Introduction to Model Evaluation: Need for evaluating machine learning models. Key concepts: generalization, overfitting, underfitting. Hold-out, random subsampling, and train-test split. Evaluation workflow and protocols. Introduction to performance measures – confusion matrix, accuracy, precision, recall, F1-score, ROC and AUC.

UNIT II

Evaluation Metrics for Classification and Regression: Metrics for classification – specificity, sensitivity, G-mean, Matthews correlation coefficient (MCC). Metrics for regression – mean absolute error (MAE), mean squared error (MSE), root mean squared error (RMSE), R^2 score. Visual evaluation – learning curves, ROC curves, precision-recall curves, residual plots. Choosing appropriate metrics based on problem type and imbalance.

UNIT III

Cross-Validation Techniques-fold cross-validation, stratified k-fold, leave-one-out (LOO), leave-p-out, repeated cross-validation. Nested cross-validation. Time-series specific cross-validation (rolling and expanding window). Use of cross-validation in hyper parameter tuning and model assessment. Trade-offs and computational considerations.

UNIT IV

Model Comparison and Statistical Testing: Comparing multiple models – pair wise and multiple comparisons. Hypothesis testing for model evaluation – paired t-test, McNemar's test, ANOVA, Wilcoxon signed-rank test. Bootstrap methods. Adjusting for multiple comparisons – Bonferroni correction. Practical considerations in interpreting statistical significance.

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UNIT V

Model Selection and Bias-Variance Tradeoff: Understanding the bias-variance decomposition. Regularization techniques – L1, L2, dropout. Model complexity and capacity control. Model selection using information criteria – AIC, BIC. Ensemble methods – bagging, boosting, stacking. Best practices for selecting and validating models for deployment.

TEXT BOOKS:
1. Aurélien Géron (2019). *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, 2nd Edition, O'Reilly.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman (2009). *The Elements of Statistical Learning*, Springer.
3. Jason Brownlee (2020). *Master Machine Learning Evaluation Metrics*, Machine Learning Mastery.

REFERENCE BOOKS:
1. Sebastian Raschka and Vahid Mirjalili (2019). *Python Machine Learning*, 3rd Edition, Packt Publishing.
2. Richard O. Duda, Peter E. Hart, David G. Stork (2001). *Pattern Classification*, 2nd Edition, Wiley.
3. Kevin P. Murphy (2012). *Machine Learning: A Probabilistic Perspective*, MIT Press.

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IV Year I Semester	Expert Systems Professional Elective-V	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the foundational concepts and architecture of expert systems.
2. To understand the knowledge representation techniques used in building expert systems.
3. To explore inference mechanisms and reasoning techniques, including rule-based systems.
4. To study the design, development, and deployment of expert systems for real-world applications.
5. To familiarize students with tools, languages, and frameworks used in expert system development.

COURSE OUTCOMES:

1. Understand the principles and components of expert systems and their applications.
2. Apply appropriate knowledge representation techniques in expert system development.
3. Implement reasoning mechanisms to solve domain-specific problems.
4. Design, develop, and validate expert systems using suitable methodologies and tools.
5. Analyze real-world problems and apply expert systems to support decision-making.

UNIT I

Introduction to Expert Systems: Definition and characteristics of expert systems. Differences between expert systems and conventional programs. Historical evolution and applications. Architecture of expert systems – knowledge base, inference engine, explanation facility, user interface. Role of domain experts and knowledge engineers. Benefits and limitations of expert systems.

UNIT II

Knowledge Acquisition and Representation: Methods of knowledge acquisition – interviews, observations, protocol analysis. Structured and unstructured knowledge. Representation techniques – production rules, semantic nets, frames, decision trees, logic-based representations. Knowledge modeling using ontologies and concept hierarchies. Dealing with uncertain and incomplete knowledge.

UNIT III

Inference Mechanisms and Reasoning: Rule-based systems – forward and backward chaining. Conflict resolution strategies. Non-monotonic reasoning and default logic. Fuzzy reasoning and probabilistic inference. Explanation and justification mechanisms. Control strategies – agenda, data-driven and goal-driven reasoning.

UNIT IV

Expert System Design and Development: Stages in expert system development – problem identification, knowledge acquisition, system design, implementation, testing, and maintenance. Knowledge engineering process. Selection of tools and platforms. Rapid prototyping and iterative refinement. Validation and verification. Case studies of successful expert systems in various domains.

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UNIT V

Expert System Tools and Applications: Programming languages for expert systems – CLIPS, Prolog, Jess. Knowledge-based system shells. Integration with databases and user interfaces. Modern applications in medicine, engineering, agriculture, finance, and cybersecurity. Trends in intelligent systems – web-based expert systems, hybrid systems, and integration with machine learning.

TEXT BOOKS:

1. Peter Jackson (1998). *Introduction to Expert Systems*, 3rd Edition, Addison-Wesley.
2. Durkin, J. (1994). *Expert Systems: Design and Development*, Macmillan Publishing Company.
3. Elias M. Awad (1996). *Building Expert Systems*, 2nd Edition, West Publishing Company.

REFERENCE BOOKS:

1. Giarratano, J. and Riley, G. (2005). *Expert Systems: Principles and Programming*, 4th Edition, Cengage Learning.
2. Dennis Merritt (2000). *Building Expert Systems in Prolog*, Springer.
3. Randall Davis, Howard Shrobe, and Peter Szolovits (1993). *What is a Knowledge-Based System?*, AI Magazine.

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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(link)

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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. Canwriteandanalyzethebehaviorofhighperformanceparallelprogramsforshared memory architectures (using Pthreads and OpenMP).
4. Can writes imple programs for the GPU.
5. Can in dependently study, learn about, and present some aspect of high performance computing.

UNITI: Introduction to Parallel hard ware 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.

UNITV: 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.

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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

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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 - ttps://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	L	T	P	C
	Audit course	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 OutIs 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, DuggiralaVasanta, 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

Schutt, O'Reilly, 2013 .

OPEN ELECTIVE -I	2. Exploratory Data Analysis with Python	L	T	P	C
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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-Excelfiles-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
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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.

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
1. Fundamentals of Data Base Management System 2. Data Wrangling and Pre-processing 3. 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.

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.

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
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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
1. Introduction to Artificial Intelligence 2. Data science applications 3. Java Programming

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OPEN ELECTIVE -III	1. Introduction to Artificial Intelligence	L	T	P	C
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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:

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
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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

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
1. Introduction to Machine Learning 2. Block Chain Technologies 3. 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, Metris 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 seperable 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 Etherium 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

Etherium: Smart Contracts, Introduction to Ethereum, The Ethereum network, Components of the Ethereum ecosystem, Blocks and Blockchain, Fee schedule, Ethereum Development Environment, Solidity.

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

TRACK-1: 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.

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)

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

TRACK-1: WEB FRAMEWORK	DJango Framework	L	T	P	C
		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.

- 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

Year & Semester: III - II

TRACK-1: 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)

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)

- 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

TRACK-1: 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 JDBCD rivers 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).

- 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 Eclispe, 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

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

TRACK-2: 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.

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> **NETWORKS**	**Switching, Routing, and Wireless Essentials**	**L**	**T**	**P**	**C**
		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

<center>Unit-I</center>

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

TRACK-2:	Enterprise Networking, Security, and Automation	L	T	P	C
NETWORKS		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

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

TRACK-2:		L	T	P	C
NETWORKS	**Wireless Sensor Networks.**	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.
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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.

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, KazemS ohraby, Daniel Minoli and TaiebZnati, 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).

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 Williampollock

Reference Books:

1. ErciFiliol, "Computer Viruses: from theory to applications", Springer, 1st edition, 2005.

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II Year & II Semester

TRACK-4 DATA SCIENCE	Introduction to Data Science	L	T	P	C
		3	0	0	3

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 Scienceusing Python tools", ManningPublications Co, Dreamtech press, 2016
2. PrateekGupta,"DataSciencewithJupyter"BPBpublishers,2019forbasics

Reference Books:

1. JoelGrus,"DataSciencefromScratch",OReilly,2019
2. Doing Data Science: Straight Talk from TheFrontline, 1 st Edition,CathyO'Neil and Rachel Schutt, O'Reilly, 2013.

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III Year & I Semester

TRACK-4 DATA SCIENCE	Social Network Analysis	L	T	P	C
		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 DATA SCIENCE	AI for Health Care	L	T	P	C
		3	0	0	3

Course Objective:
- The students should be able to understand how Al 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 Al 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