



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJADA
VIZIANAGARAM-535 003, A.P
(Established by Andhra Pradesh Act No.22 of 2021)

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Academic Regulations (R23) for B. Tech (Regular-Full time)

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

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Academic Regulations (R23) for B.Tech.(Lateral Entry Scheme)

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

Academic Regulations (R23) 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

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.

Credit Definition:

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

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 (Total 160)	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%
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 undergraduate 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. Project or 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.
- xvi. Each college shall take measures to implement Virtual Labs (<https://www.vlab.co.in>) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.
- xvii. Each college shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.
- xviii. Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

9. Evaluation Process

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

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

Theory Courses

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

- i) For theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.
- ii) For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.
- iii) If any course contains two different branch subjects, the syllabus shall be written in two parts with 3 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.
- iv) If any subject is having both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given same subject code with an extension of 'T' for theory subject and 'P' for practical subject.

a) Continuous Internal Evaluation

- i) For theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.
- ii) Objective paper shall contain for 05 short answer questions with 2 marks each or maximum of 20 bits for 10 marks. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type of questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

Note:

- The objective paper shall be prepared in line with the quality of competitive examinations questions.
 - The subjective paper shall contain 3 either or type questions of equal weightage of 10 marks. Any fraction shall be rounded off to the next higher mark.
 - The objective paper shall be conducted by the respective institution on the day of subjective paper test.
 - Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester and the average marks shall be considered.
- iii) If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.
 - iv) First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the

units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.

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

For Example:

Marks obtained in first mid: 25

Marks obtained in second mid: 20

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

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

Marks obtained in first mid: Absent

Marks obtained in second mid: 25

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

b) End Examination Evaluation:

End examination of theory subjects shall have the following pattern:

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

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

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

Practical Courses

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

- b) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.
- c) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the record/viva and 15 marks for the internal test.
- d) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.
 - Procedure: 20 marks
 - Experimental work & Results: 30 marks
 - 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.
- ii) Out of the five skill courses two shall be skill-oriented courses from the same domain. Of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.
- iii) The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.
- iv) The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The marks/grades shall be assigned to the students by the above committee based on their performance.
- v) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.
- vi) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the University at the beginning of the semester. The principal of the respective college shall forward such proposals to the University for approval.
- vii) If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the University.

11. Massive Open Online Courses (MOOCs):

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

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

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

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

12. Credit Transfer Policy

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

- i) The University shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses.
- ii) Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.
- iii) Credit transfer policy will be applicable to the Professional & Open Elective courses only.
- iv) The concerned department shall identify the courses permitted for credit transfer.
- v) The University/institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.
- vi) The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.
- vii) The university shall ensure no overlap of MOOC exams with that of the university examination schedule. In case of delay in results, the university will re-issue the marks sheet for such students.
- viii) Student pursuing courses under MOOCs shall acquire the required credits only

after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.

- ix) The institution shall submit the following to the examination section of the university:
 - a) List of students who have passed MOOC courses in the current semester along with the certificate of completion.
 - b) Undertaking form filled by the students for credit transfer.
- x) The universities shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

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

13. Academic Bank of Credits (ABC)

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

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

14. Mandatory Internships

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

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

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

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

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

where “ S_i ” is the SGPA of the i^{th} semester and C_i is the total number of credits up to that semester.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

Award of Class:

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

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

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

20. With-holding of Results

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

21. Multiple Entry / Exit Option

(a) Exit Policy:

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

- i) **UG Certificate in (Field of study/discipline)** - Programme duration: First year (first two semesters) of the undergraduate programme, 40 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.
- ii) **UG Diploma (in Field of study/discipline)** - Programme duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.
- iii) **Bachelor of Science (in Field of study/discipline) i.e., B.Sc. Engineering in (Field of study/discipline)**- Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits.

(b) Entry Policy:

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

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

22. Gap Year Concept:

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

23. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations 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 (R23) 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 fulfil 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).



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJADA
VIZIANAGARAM-535 003, A.P
(Established by Andhra Pradesh Act No.22 of 2021)

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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)

&

B.Tech. (Lateral Entry Scheme)

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

B.TECH. - COURSE STRUCTURE – R23

(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

I Year I Semester						
S.No	Course Code	Course Name	L	T	P	Credits
1.	R23BS01	Linear Algebra & Calculus	3	0	0	3
2.	R23BS03	Engineering Physics	3	0	0	3
3.	R23HS01	Communicative English	2	0	0	2
4.	R23ES01	Basic Civil & Mechanical Engineering	3	0	0	3
5.	R23ES07	Introduction to Programming	3	0	0	3
6.	R23HS01	Communicative English Lab	0	0	2	1
7.	R23BS03	Engineering Physics Lab	0	0	2	1
8.	R23ES02	Engineering Workshop	0	0	3	1.5
9.	R23ES06	IT Workshop	0	0	2	1
10.	R23ES07	Computer Programming Lab	0	0	3	1.5
11.	R23MC01	Health and Wellness, Yoga and Sports	0	0	1	0.5
		Total				20.5

I Year II Semester						
S.No	Course Code	Course Name	L	T	P	Credits
1.	R23BS02	Differential Equations and Vector calculus	3	0	0	3
2.	R23BS05	Chemistry	3	0	0	3
3.	R23ES03	Engineering Graphics	1	0	4	3
4.	R23ES04	Basic Electrical & Electronics Engineering	3	0	0	3
5.	R23PC04	Data Structures	3	0	0	3
6.	R23BS05	Chemistry Lab	0	0	2	1
7.	R23ES05	Electrical & Electronics Engineering workshop	0	0	3	1.5
8.	R23PC04	Data Structures Lab	0	0	3	1.5
9.	R23MC02	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5
		Total				19.5

I Year-I Semester

L	T	P	C
3	0	0	3

LINEAR ALGEBRA & CALCULUS
(Common to All Branches of Engineering)

Course Objectives:

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

Course Outcomes:

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

- develop matrix algebra techniques that is needed by engineers for practical applications.
- to find the eigen values and eigen 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, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Text books:

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

Reference Books:

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

L	T	P	C
3	0	0	3

I Year-I Semester**ENGINEERING PHYSICS**

(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:

- CO1: Analyze the intensity variation of light due to polarization, interference and diffraction.
 CO2: Familiarize with the basics of crystals and their structures.
 CO3: Explain fundamentals of quantum mechanics and apply it to one dimensional motion of particles.
 CO4: Summarize various types of polarization of dielectrics and classify the magnetic materials.
 CO5: Explain the basic concepts of Quantum Mechanics and the band theory of solids.
 CO6: 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 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 Diffractometer – crystal structure determination by Laue's and powder methods

UNIT III Dielectric and Magnetic Materials

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation

polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

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

UNIT IV Quantum Mechanics and Free electron Theory

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

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

UNIT V Semiconductors

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

Textbooks:

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

Reference Books:

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

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

I Year-I Semester

L	T	P	C
2	0	0	2

COMMUNICATIVE ENGLISH

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

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

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

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.

UNITII

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

- Listening:** Answering a series of questions about main ideas and supporting ideas after listening to audio texts.
- Speaking:** Discussion in pairs/small groups on specific topics followed by short structure talks.
- Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
- Writing:** Structure of a paragraph - Paragraph writing (specific topics)
- Grammar:** Cohesive devices -linkers, use of articles and zero article prepositions.
- Vocabulary:** Homonyms, Homophones, Homographs.

UNITIII

Lesson: BIOGRAPHY: Steve Jobs

- Listening:** Listening for global comprehension and summarizing what is listened to.
- Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed
- Reading:** Reading a text in detail by making basic inferences-recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
- Writing:** Summarizing, Note-making, paraphrasing
- Grammar:** Verbs - tenses; subject-verb agreement; Compound words, Collocations
- Vocabulary:** Compound words, Collocations

UNIT IV

Lesson: INSPIRATION: The Toys of Peace by Saki

- Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
- Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
- Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.
- Writing:** Letter Writing: Official Letters, Resumes
- Grammar:** Reporting verbs, Direct & Indirect speech, Active & Passive Voice
- Vocabulary:** Words often confused, Jargons

UNIT V

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

- Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
- Speaking:** Formal oral presentations on topics from academic contexts
- Reading:** Reading comprehension.
- Writing:** Writings structured essays on specific topics.
- Grammar:** Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject-verb agreement)
- Vocabulary:** Technical Jargons

Textbooks:

1. Pathfinder: Communicative English for Undergraduate Students, 1stEdition, Orient Black Swan, 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, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Web Resources:

GRAMMAR:

1. www.bbc.co.uk/learningenglish
2. <https://dictionary.cambridge.org/grammar/british-grammar/>

3. www.eslpod.com/index.html
4. <https://www.learngrammar.net/>
5. <https://english4today.com/english-grammar-online-with-quizzes/>
6. <https://www.talkenglish.com/grammar/grammar.aspx>

VOCABULARY

1. <https://www.youtube.com/c/DailyVideoVocabulary/videos>
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

L	T	P	C
3	0	0	3

I Year-I Semester
BASIC CIVIL & MECHANICAL ENGINEERING
(Common to All branches of Engineering)
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:

CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.

CO2: Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.

CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.

CO4: Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.

CO5: Understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.

UNIT I

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

UNIT II

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

UNIT III

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

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

Textbooks:

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

Reference Books:

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

PART B: BASIC MECHANICAL ENGINEERING

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

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

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

CO1: Understand the different manufacturing processes.

CO2: Explain the basics of thermal engineering and its applications.

CO3: Describe the working of different mechanical power transmission systems and power plants.

CO4: Describe the basics of robotics and its applications.

UNIT I

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

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

UNIT II

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

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

UNIT III

Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants.

Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

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

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

Textbooks:

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

Reference Books:

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

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I Year-I Semester**INTRODUCTION TO PROGRAMMING****(Common to All branches of Engineering)****Course Objectives:****The objectives of this course is to acquire knowledge on the**

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

UNIT-I Introduction to Computer Problem Solving:

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

UNIT-II Introduction to C Programming:

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

UNIT-III Arrays:

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

UNIT-IV Functions:

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

UNIT-V

Structures, Unions, Bit Fields:Introduction, Nested Structures, Arrays of Structures, Structures

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

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

Course Outcomes:

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

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

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-Practial 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.
4. Programming In C, Ashok Kamthane, Second Edition, Pearson Publication.
5. Let us C ,YaswanthKanetkar, 16th Edition,BPB Publication.
6. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008

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/>

I Year-I Semester

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COMMUNICATIVE ENGLISH LAB
(Common to All Branches of Engineering)

Course Objectives:

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
4. Jayashree, M Let's Hear them Speak: Developing Listening-Speaking skills in English. Sage Publications

5. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012. (That is for reading and writing and can be used in theory classes but not in Lab)
6. T.Balasubramanyam, A Textbook of English Phonetics for Indian Students,(3rd Ed) Trinity Press. (This is all theory and can be for MA English students but not for B.Tech students)

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/UCNfm92h83W2i2jic5Xwp_IA

I Year-I Semester

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ENGINEERING PHYSICS LAB (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

CO1: Operate optical instruments like travelling microscope and spectrometer. CO2: Estimate the wavelengths of different colours using diffraction grating.

CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance. CO4: Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively.

CO5: Calculate the band gap of a given semiconductor. CO6: Identify the type of semiconductor using Hall effect.

List of Experiments:

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

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

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

References:

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

Web Resources

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

I Year-I Semester

L	T	P	C
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ENGINEERING WORKSHOP
(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:

CO1: Identify workshop tools and their operational capabilities.

CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.

CO3: Apply fitting operations in various applications.

CO4: 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 Bridle joint
3. **Sheet Metal Working:** Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
 - a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
 - a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring:** Familiarity with different types of basic electrical circuits and make the following connections.
 - a) Parallel and series b) Two-way switch c) Godown lighting
 - d) Tube light e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop:** Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

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, Media Promoters 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.; Atul Prakashan, 2021-22.

I Year-I Semester

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IT WORKSHOP**(Common to all branches of Engineering)****Course Objectives:**

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

Course Outcomes:

CO1: Perform Hardware troubleshooting.

CO2: Understand Hardware components and inter dependencies.

CO3: Safeguard computer systems from viruses/worms.

CO4: Document/ Presentation preparation.

CO5: Perform calculations using spreadsheets.

PC Hardware & Software Installation

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

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

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

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

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

Internet & World Wide Web

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

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

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

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

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

LaTeX and WORD

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

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

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

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

EXCEL

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

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

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

LOOKUP/VLOOKUP

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

POWER POINT

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

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

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

AI TOOLS – Chat GPT

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

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

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

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

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

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

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition

I Year-I Semester

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COMPUTER PROGRAMMING LAB

(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:

CO1: Read, understand, and trace the execution of programs written in C language.

CO2: Select the right control structure for solving the problem.

CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers.

CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

UNIT I

WEEK 1

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

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

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

WEEK 2

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

Suggested Experiments /Activities:

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

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

Developing the algorithms/flowcharts for the following sample programs

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

WEEK 3

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

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

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

UNIT II**WEEK 4**

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

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:

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

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

WEEK 5

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

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

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

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

WEEK 6

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and

for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

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

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

UNIT III

WEEK 7:

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

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7: 1D Array manipulation, linear search

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

WEEK 8:

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

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort

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

UNIT IV

WEEK 9:

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

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

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

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

WEEK 10:

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

Suggested Experiments/Activities:

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

Lab10 : Bitfields, linked lists

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

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

UNIT V

WEEK 11:

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

Suggested Experiments/Activities:

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

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

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

WEEK 12:

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

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

WEEK 13:

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

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

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

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

WEEK14:

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

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

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

Textbooks:

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

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

I Year-I Semester

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HEALTH AND WELLNESS, YOGA AND SPORTS

(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

CO1: Understand the importance of yoga and sports for Physical fitness and sound health.

CO2: Demonstrate an understanding of health-related fitness components.

CO3: Compare and contrast various activities that help enhance their health.

CO4: Assess current personal fitness levels.

CO5: Develop Positive Personality

UNIT I

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

Activities:

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

UNIT II

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

Activities:

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

UNIT III

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

Activities:

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

Reference Books:

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

General Guidelines:

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

Evaluation Guidelines:

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

I Year-II Semester

L	T	P	C
3	0	0	3

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (Common to All Branches of Engineering)

Course Objectives:

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

Course Outcomes:

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

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

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

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

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

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

UNIT – III : Partial Differential Equations

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

UNIT - IV : Vector differentiation

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

UNIT –V : Vector integration

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

Textbooks:

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

Reference Books:

1. Dennis G.Zill and Warren S.Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
5. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2017

I Year-II Semester

L	T	P	C
3	0	0	3

CHEMISTRY

(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:**CO1:** Compare the materials of construction for battery and electrochemical sensors.**CO2:** Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.**CO3:** Explain the principles of spectrometry, slc in separation of solid and liquid mixtures.**CO4:** Apply the principle of Band diagrams in the application of conductors and semiconductors.**CO5:** 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.

Supercapacitors: Introduction, Basic Concept-Classification – Applications.

Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphines nanoparticles.

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, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries

including cell reactions; Fuel cells, hydrogen-oxygen fuel 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. Billmeyer Jr, 3rd Edition

I Year-II Semester

L	T	P	C
1	0	4	3

ENGINEERING GRAPHICS

(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:

CO1: Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.

CO2: Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.

CO3: Understand and draw projection of solids in various positions in first quadrant.

CO4: Explain principles behind development of surfaces.

CO5: 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, Involutives, 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 of objects including PCB and Transformations using Auto CAD (*Not for end examination*).

Textbook:

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

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kanniah, 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.

I Year-II Semester

L	T	P	C
3	0	0	3

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common to All branches of Engineering)

Course Objectives

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

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

Course Outcomes:

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

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

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

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

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

PART A: BASIC ELECTRICAL ENGINEERING**UNIT I DC & AC Circuits**

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

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

UNIT II Machines and Measuring Instruments

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

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

UNIT III Energy Resources, Electricity Bill & Safety Measures

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

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

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

Textbooks:

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

Reference Books:

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

Web Resources:

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

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

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

UNIT I SEMICONDUCTOR DEVICES

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

UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION

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

UNIT III DIGITAL ELECTRONICS

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

Textbooks:

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

Reference Books:

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

I Year-II Semester

L	T	P	C
3	0	0	3

DATA STRUCTURES

(Common to CSE, IT & allied branches)

Course Objectives:

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

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.

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
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick

L	T	P	C
0	0	2	1

I Year-II Semester**CHEMISTRY LAB**

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

I Year-II Semester

L	T	P	C
0	0	3	1.5

ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP

(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.
3. Components:
 - Familiarization/Identification of components (Resistors, Capacitors, Inductors, 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.
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.

I Year-II Semester

L	T	P	C
0	0	3	1.5

DATA STRUCTURES LAB**(Common to CSE, IT & allied branches of Engineering)****Course Objectives:**

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

List of Experiments:**Exercise 1: Array Manipulation**

- 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.

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.

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
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms by Robert Sedgewick.

I Year-II Semester

L	T	P	C
0	0	1	0.5

NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE (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, career guidance.

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-releasing road map etc.
- iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
- iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II Nature & Care

Activities:

- 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 Service

Activities:

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

Reference Books:

- 1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol:I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
- 2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
- 3. Davis M. L. and Cornwell D. A., “Introduction to Environmental Engineering”, McGraw Hill, New York 4/e 2008
- 4. Masters G. M., Joseph K. and Nagendran R. “Introduction to Environmental Engineering and Science”, Pearson Education, New Delhi. 2/e 2007
- 5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

General Guidelines:

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

Evaluation Guidelines:

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

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Course Sture of - B.Tech-AI & DS**B.Tech.– II Year I Semester**

S.No.	Category	Title	L	T	P	Credits
1	Basic Science	Discrete Mathematics & Graph Theory	3	0	0	3
2	HSMC	Universal Human Values - Understanding Harmony & Ethical Human Conduct	2	1	0	3
3	Engineering Science	Database Management Systems	3	0	0	3
4	Professional Core	Advanced Data Structures Algorithms Analysis	3	0	0	3
5	Professional Core	Object Oriented Programming Through Java	3	0	0	3
6	Professional Core	Advanced Data Structures and Algorithms Analysis Lab	0	0	3	1.5
7	Professional Core	Object Oriented Programming Through Java Lab	0	0	3	1.5
8	SEC	Python Programming	0	1	2	2
9	Audit Course	Environmental Science	2	0	0	-
Total			16	2	8	20

B.Tech.– II Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Management Course- I	Managerial Economics & Financial Analysis	2	0	0	2
2	Engineering Science / Basic Science	Statistical Methods for Data Science	3	0	0	3
3	Professional Core	Principles of Artificial Intelligence	3	0	0	3
4	Professional Core	Introduction to Data Science	3	0	0	3
5	Professional Core	Digital Logic& Computer Organization	3	0	0	3
6	Professional Core	Artificial Intelligence Lab	0	0	3	1.5
7	Professional Core	Data Science using Python Lab	0	0	3	1.5
8	SEC	Full Stack Development-1	0	1	2	2
9	Engineering Science	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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DISCRETE MATHEMATICS & GRAPH THEORY

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, semigroups, monoids.
- To introduce generating functions and recurrence relations.

Course Outcomes:

- Recall the concepts of Mathematical logic and statement & predicate calculus
- Recall the concepts of combinatorics, set theory, posets and lattices
- Recall the concepts of algebraic structures, recurrence relations and generating functions
- Use and interpret the concepts of Mathematical logic and statement & predicate calculus
- Use and interpret the concepts of combinatorics, set theory, posets and lattices
- Use and interpret the concepts of algebraic structures, recurrence relations and generating functions
- Apply the concepts of discrete 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, contrapositives & 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



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

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

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

Unit-IV:**Algebraic Structures**

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

Unit-V:**Recurrence Relations & Generating Functions**

Recurrence Relations: Formation, iterative method of solving recurrence relations, solving homogeneous and non-homogeneous recurrence relations by characteristic roots method;

Generating Functions: Generating functions of sequences, calculation of coefficients of expansions, solving recurrence relations by generating functions

Textbooks:

1. J.P.Tremblay and R.Manohar, Discrete Mathematical Structures with Applications to CSc, TataMcGrawHill,1997
2. S. Santha and EV Prasad, Mathematical Foundations for Computer Science, CENG AGE Publishers

Reference Books:

1. Kenneth. H.Rosen,Discrete Mathematics and itsApplications,6/e, Tata McGraw-Hill, 2009.
2. Dr.DSChandrasekharaiah, Mathematical Foundations of Computer Science ,Prism Book Pvt Ltd.
3. Swapan Kumar Sarkar, Mathematical Foundation of Computer Science,9th Edition, SChand Publishers.



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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 fulfil 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



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

Practice Sessions for UNIT I – Introduction to Value Education

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness

PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body

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

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

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

PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

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

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

Readings:

Textbook and Teachers Manual

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

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

Reference Books

1. JeevanVidya: 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



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DATABASE MANAGEMENT SYSTEMS**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,



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Boyce-Codd normal form (BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V:

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

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, 8th edition, 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_0127580666728202_2456_shared/overview



ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS

Course Objectives:

The main objectives of the course is to

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

UNIT – I:

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations.

AVL Trees – Creation, Insertion, Deletion operations and Applications

B-Trees – Creation, Insertion, Deletion operations and Applications

UNIT – II:

Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications

Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications

Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull

UNIT – III:

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths

Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths – General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem

UNIT – IV:

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem

Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

UNIT – V:

NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem

NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP)

NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

Textbooks:

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



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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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OBJECT-ORIENTED PROGRAMMING THROUGH JAVA**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.



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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, Result Set Interface

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

Text Books:

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

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_012880464547618816347_shared/overview



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ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB

Course Objectives:

The objectives of the course is to

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

Experiments covering the Topics:

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

Sample Programs:

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

Reference Books:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2ndEdition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2ndEdition, University Press
3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia



4. An introduction to Data Structures with applications, Trembley& Sorenson,
McGraw Hill

Online Learning Resources:

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



OBJECT-ORIENTED PROGRAMMING THROUGH JAVA LAB

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:

- a) Write a JAVA program to display default value of all primitive data type of JAVA
- b) 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

- a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
- b) Write a JAVA program to sort for an element in a given list of elements using bubble sort
- c) Write a JAVA program using StringBuffer to delete, remove character.

Exercise - 3

- a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
- b) Write a JAVA program implements method overloading.
- c) Write a JAVA program to implement constructor.
- d) Write a JAVA program to implement constructor overloading.

Exercise - 4

- a) Write a JAVA program to implement Single Inheritance
- b) Write a JAVA program to implement multi-level Inheritance
- c) Write a JAVA program for abstract class to find areas of different shapes

Exercise - 5

- a) Write a JAVA program give example for “super” keyword.
- b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
- c) Write a JAVA program that implements Runtime polymorphism

Exercise - 6

- a) Write a JAVA program that describes exception handling mechanism



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- b) Write a JAVA program Illustrating Multiple catch clauses
- Write a JAVA program for creation of Java Built-in Exceptions
 - Write a JAVA program for creation of User Defined Exception

Exercise - 7

- a) 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)
- b) Write a program illustrating **is Alive** and **join ()**
- c) Write a Program illustrating Daemon Threads.
- d) Write a JAVA program Producer Consumer Problem

Exercise – 8

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

Exercise – 9

4. Write a java program that connects to a database using JDBC
- b) Write a java program to connect to a database using JDBC and insert values into it.
- c) Write a java program to connect to a database using JDBC and delete values from it



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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.

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.



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Sample Experiments:

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

Reference Books:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2ndEdition, 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>

**Environmental Science
(Audit Course)**

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



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

UNIT II

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

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

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

UNIT III

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

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

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



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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 ErachBharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.AzeemUnnisa, “Environmental Studies” Academic Publishing Company
4. K.RaghavanNambiar, “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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MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course Objectives:

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

Course Outcomes:

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

UNIT - I Managerial Economics

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

UNIT - II Production and Cost Analysis

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

UNIT - III Business Organizations and Markets

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

UNIT - IV Capital Budgeting

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



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

Online**Learning****Resources:**

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

**STATISTICAL METHODS FOR DATA SCIENCE
(COMMON TO CSE (DATA SCIENCE), AI & DS, CSE (AI&DS))****Course Objectives:**

This course aims at providing knowledge on basic concepts of Statistics, Estimation and testing of hypotheses for large and small samples.

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



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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.



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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, χ^2 test for testing variance of a normal distribution.

Textbooks:

1. Miller and Freund, 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
https://onlinecourses.nptel.ac.in/noc22_mg31/preview



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PRINCIPLES OF ARTIFICIAL INTELLIGENCE

Course Objectives:

The student will be able to

- Know the methodology of problem solving
- Implement basic AI algorithms
- Design and carry out an empirical evolution of different algorithms on a problem formalization

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

- Understand the fundamental concepts in Artificial Intelligence
- Analyze the applications of search strategies and problem reductions
- Apply the mathematical logic concepts.
- Develop the Knowledge representations in Artificial Intelligence.
- Explain the Fuzzy logic systems.

UNIT I:

Introduction to artificial intelligence: Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, development of AI languages, current trends in AI.

UNIT II:

Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem

Search Strategies: exhaustive searches, heuristic search techniques, iterative-deepening A*, constraint satisfaction

UNIT III:

Logic concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in propositional logic, predicate logic

UNIT IV:

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR

Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure.

UNIT V:

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools.



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TextBooks:

1. ArtificialIntelligence,SarojKaushik,CENGAGELearning,
2. Artificialintelligence, AmodernApproach, 2nded, StuartRussel,PeterNorvig, PEA
3. ArtificialIntelligence,Rich, KevinKnight,ShivShankar BNair,3rded,TMH
4. IntroductiontoArtificialIntelligence, Patterson,PHI

ReferenceBooks:

1. Artificial intelligence, structures and Strategies for Complex problem solving, - George F Luger, 5thed,PEA
2. IntroductiontoArtificialIntelligence,Ertel,WolfGang,Springer
ArtificialIntelligence,AnewSynthesis,NilsJNilsson,Elsevier

1. J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers.
2. Artificial Intelligence, SarojKaushik, CENGAGE Learning.

Online Learning Resources:

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



INTRODUCTION TO DATA SCIENCE

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, modelling 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: NoSQL movement for handling Bigdata: 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



DIGITAL LOGIC & COMPUTER ORGANIZATION

Course Objectives:

The main objectives of the course is to

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

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

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

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

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

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

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

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

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

Textbooks:

1. Computer Organization, Carl Hamacher, 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.



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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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ARTIFICIAL INTELLIGENCE LAB

Pre-requisite:

1. Knowledge in Computer Programming.
2. 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 and machine learning.

List of Experiments

1. Pandas Library
 - a) Write a python program to implement Pandas Series with labels.
 - b) Create a Pandas Series from a dictionary.
 - c) Creating a Pandas Data Frame.
 - d) Write a program which makes use of the following Pandas methods
 - i) describe ()
 - ii) head ()
 - iii) tail ()
 - iv) info ()
2. Pandas Library: Visualization
 - a) Write a program which use pandas inbuilt visualization to plot following graphs:
 - i. Bar plots
 - ii. Histograms
 - iii. Line plots
 - iv. Scatter plots
- 3.
4. Write a Program to Implement Breadth First Search using Python.
5. Write a program to implement Best First Searching Algorithm
6. Write a Program to Implement Depth First Search using Python.
7. Write a program to implement the Heuristic Search
8. Write a python program to implement A* and AO* algorithm. (Ex: find the shortest path)
9. Write a Program to Implement Water-Jug problem using Python.
10. Write a Program to Implement Alpha-Beta Pruning using Python.
11. Write a Program to implement 8-Queens Problem using Python.
12. Write a program to schedule a meeting among a 5 busy people using Default Reasoning the output should give the time, place and day of the meeting.
13. Write a program to implement the Unification algorithm



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14. Develop a knowledge base system consisting of facts and rules about some specialized knowledge domain
15. Write a program to implement 8 puzzle programs using different heuristics. Using it play the game Tic-Tac-Toe at the end the game the program should display the no. of nodes generated, cutoff values at each stage in the form of a table.

Textbooks:

1. Prateek Joshi, Artificial Intelligence with Python, Packt Publishing, 2017.
2. Xiao, Perry. Artificial intelligence programming with Python: from zero to hero. John Wiley & Sons, 2022.

Reference Books:

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach, Fourth Edition, Pearson, 2020
2. Martin C. Brown (Author), “Python: The Complete Reference” McGraw Hill Education, Fourth edition, 2018
3. R. NageswaraRao , “Core Python Programming” Dreamtech Press India Pvt Ltd 2018.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs40/preview
2. https://onlinecourses.nptel.ac.in/noc19_cs41/preview



DATA SCIENCE USING PYTHON LAB

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()
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>



Full Stack Development 1 (Skill Enhancement Course)

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Course Objectives:

The main objectives of the course are to

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

Experiments covering the Topics:

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

Sample Experiments:

1. Lists, Links and Images

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

2. HTML Tables, Forms and Frames

- Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)
- Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
- Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).
- Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame image, second frame paragraph,

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third frame hyperlink. And also make sure of using “no frame” attribute such that frames to be fixed).

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

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

4. Selector forms

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

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

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

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

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

7. JavaScript Pre-defined and User-defined Objects

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

8. JavaScript Conditional Statements and Loops



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- a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".
- b. Write a program to display week days using switch case.
- c. Write a program to print 1 to 10 numbers using for, while and do-while loops.
- d. Write a program to print data in object using for-in, for-each and for-of loops
- e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e., $13 + 53 + 33 = 153$]
- f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's)

9. Javascript Functions and Events

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

Text Books:

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

Web Links:

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



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DESIGN THINKING & INNOVATION

Course Objectives:

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

Course Outcomes:

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

UNIT I Introduction to Design Thinking

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

UNIT II Design Thinking Process

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

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

UNIT III Innovation

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

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

UNIT IV Product Design

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

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

UNIT V Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs-



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Design thinking for Startups- Defining and testing Business Models and Business Cases-
Developing & testing prototypes.

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

Textbooks:

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

Reference Books:

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

Online Learning Resources:

<https://nptel.ac.in/courses/110/106/110106124/>
<https://nptel.ac.in/courses/109/104/109104109/>
https://swayam.gov.in/nd1_noc19_mg60/preview

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)**(Applicable from the academic year 2024-25 and onwards)****B.Tech_(Artificial Intelligence & Data Science)****B.Tech. – III Year I Semester**

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Automata Theory & Compiler Design	3	0	0	3
2	Professional Core	Machine Learning	3	0	0	3
3	Professional Core	Operating System	3	0	0	3
4	Professional Elective-I	1.Software Engineering 2.ObjectOrientedAnalysisandDesign 3.DevOps 4.Predictive Analytics	3	0	0	3
5	Open Elective- I	Open Electives offered by other departments	3	0	0	3
6	Professional Core	Machine Learning lab	0	0	3	1.5
7	Professional Core	Operating System &Compiler design Lab	0	0	3	1.5
8	Skill Enhancement course	Nodejs	0	1	2	2
9	ES	Tinkering Lab	0	0	2	1
10	Evaluation of Community Service Internship		-	-	-	2
Total			15	1	10	23



B.Tech.– III Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Computer Networks	3	0	0	3
2	Professional Core	Deep Learning	3	0	0	3
3	Professional Core	Natural Language Processing	3	0	0	3
4	Professional Elective-II	1. Software Testing Methodology 2. Cryptography & Network Security 3. Internet of Things 4. Data Ethics and Privacy 5. 12-week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Professional Elective-III	1. Computer Vision 2. Quantum Computing 3. Software Project Management 4. Ethical AI 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
6	Open Elective – II	Open elective offered by other department	3	0	0	3
7	Professional Core	Deep Learning Lab	0	0	3	1.5
8	Professional Core	Natural Language Processing Lab	0	0	3	1.5
9	Skill Enhancement course	Soft skills OR IELTS	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	-
Total			19	1	06	23
Mandatory Industry Internship of 08 weeks duration during summer vacation						



B.Tech. – IV Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Data visualization	3	0	0	3
2	Management Course- II	Entrepreneurship & Incubation	2	0	0	2
3	Professional Elective-IV	1. AI Chatbot 2. Blockchain Technology 3. Generative AI 4. NoSQL databases 5. 12-week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
4	Professional Elective-V	1. Agile methodologies 2. Cloud Computing 3. Reinforcement Learning 4. High-Performance Computing 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Open Elective-III	Open elective offered by other department	3	0	0	3
6	Open Elective-IV	Open elective offered by other department	3	0	0	3
7	Skill Enhancement Course	Prompt Engineering	0	1	2	2
8	Audit Course	Gender Sensitization	2	0	0	-
9	Internship	Evaluation of Industry Internship	-	-	-	2
Total			19	1	02	21

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

OPEN ELECTIVES OFFERED BY AI & DS TO OTHER BRANCHES:

OPEN ELECTIVE -I	OPEN ELECTIVE -II
<ol style="list-style-type: none">1. Introduction to Artificial Intelligence2. Exploratory Data Analysis with Python3. Social Media Analytics	<ol style="list-style-type: none">1. Fundamentals of Data Base Management System2. JAVA Programming3. Fundamentals of Cloud Computing
OPEN ELECTIVE -III	OPEN ELECTIVE -IV
<ol style="list-style-type: none">1. Introduction to Machine Learning2. AI Chabot3. Data Wrangling and Pre-processing	<ol style="list-style-type: none">1. Internet of Things2. Cyber Security3. Block Chain Technologies



III Year I 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.

UNIT - I:

Formal Language and Regular Expressions: Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools.

Context Free grammars and parsing : Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing

UNIT - II:

Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification.

Semantics : Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements.

UNIT - III:

Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.

UNIT - IV:

Run time storage : Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation.

Code optimization : Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.

UNIT - V:

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

TEXT BOOKS:

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

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VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2024-25 and onwards)

B.Tech_(Artificial Intelligence & Data Science)

REFERENCES:

1. Modern Compiler Construction in C , Andrew W.Appel Cambridge University Press.
2. Compiler Construction, LOUDEN, Thomson.
3. Elements of Compiler Design, A. Meduna, Auerbach Publications, Taylor and Francis Group.
4. Principles of Compiler Design, V. Raghavan, TMH.
5. Engineering a Compiler, K. D. Cooper, L. Torczon, ELSEVIER.

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.



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 neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

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

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

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

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

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

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

Text Books:

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

Reference Books:

- 1.“Machine Learning”, Tom M. Mitchell, McGraw-Hill Publication, 2017
- 2.“Machine Learning in Action”,Peter Harrington, DreamTech
- 3.“Introduction to Data Mining”, Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.



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

COURSE OBJECTIVES:

- Understand the fundamental principles of the operating system, its services and functionalities.
- Illustrate the concepts of processes, inter-process communication, synchronization and scheduling.
- Understand different types of memory management viz. virtual memory, paging and segmentation.
- Identify the reasons for deadlock and understand the techniques for deadlock detection, prevention and recovery.
- Understand the need of protection and security mechanisms in computer systems.

UNIT I:

OPERATING SYSTEMS OBJECTIVES AND FUNCTIONS:

Computer system architecture, operating systems structure, operating systems operations; Evolution of operating systems: Simple batch, multi programmed, time shared, personal computer, parallel distributed systems, real time systems, special purpose systems, operating system services, user operating systems interface; Systems calls: Types of systems calls, system programs, protection and security, operating system design and implementation.

UNIT II:

PROCESS CONCEPTS:

The process, process state, process control block, threads; Process scheduling: Scheduling queues, schedulers, context switch, pre-emptive scheduling, dispatcher, scheduling criteria, scheduling algorithms, multiple processor scheduling; Real time scheduling; Thread scheduling; Case studies Linux windows; Process synchronization, the critical section problem; Peterson's solution, synchronization hardware, semaphores and classic problems of synchronization, monitors.

UNIT III:

SYSTEM MODEL:

Deadlock characterization, methods of handling deadlocks, deadlock prevention, dead lock avoidance, dead lock detection and recovery form deadlock system protection, goals of protection.



UNIT IV:

LOGICAL AND PHYSICAL ADDRESS SPACE:

Swapping, contiguous memory allocation, paging, structure of page table. Segmentation: Segmentation with paging, virtual memory, demand paging; Performance of demand paging: Page replacement, page replacement algorithms, allocation of frames, thrashing.

UNIT V:

FILE SYSTEM IMPLEMENTATION AND DISK SCHEDULING:

The concept of a file, access methods, directory structure, file system mounting, file sharing, protection, file system structure, file system implementation, allocation methods, free space management, directory implementation, efficiency and performance; Overview of mass storage structure: Disk structure, disk attachment, disk scheduling, disk management, swap space management; Dynamic memory allocation: Basic concepts.

COURSE OUTCOMES:

1. Describe the structure of operating system and basic architectural components involved in operating system design.
2. Understand the objectives and functions of modern operating systems.
3. Analyze and design the applications to run in parallel either using process or thread models of different operating system.
4. Understand and analyze implementation of virtual memory.
5. Describe the mutual exclusion, deadlock detection in operating system.

TEXT BOOK:

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 9th Edition, John Wiley and Sons Inc., 2012.
2. William Stallings, Operating Systems: Internals and Design Principles, 8th edition Pearson Education Limited, 2014 ISBN: 1292061944, 9781292061948
3. Operating Systems-S Halder, Alex A Aravind Pearson Education Second Edition 2016 .

REFERENCE BOOKS:

1. D.M Dhamdhare: Operating systems –A concept-based Approach, 3rd Edition, Tata McGrawHill,2012.
2. P.C.P. Bhatt: Introduction to Operating Systems Concepts and Practice, 3rd Edition, PHI, 2010.
3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 2011.



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 modelling languages.
- iv. To design and develop correct and robust software products.

UNIT – I:

Software and Software Engineering: The Nature of Software, The Unique Nature of Web Apps, Software Engineering, Software Process, Software Engineering Practice, Software Myths.

Process Models: A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Terminology, Product and Process.

UNIT - II:

Requirements Analysis And Specification: Requirements Gathering and Analysis, Software Requirement Specification (SRS), Formal System Specification.

Software Design: Overview of the Design Process, How to Characterize of a Design, Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design

UNIT – III:

Function-Oriented Software Design: Overview of SA/SD Methodology, Structured Analysis, Developing the DFD Model of a System, Structured Design, Detailed Design, Design Review, over view of Object Oriented design.

User Interface Design: Characteristics of Good User Interface, Basic Concepts, Types of User Interfaces, Fundamentals of Component-based GUI Development, A User Interface Design Methodology.

UNIT - IV:

Coding And Testing: Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tool, Integration Testing, Testing Object-Oriented Programs, System Testing, Some General Issues Associated with Testing

UNIT - V:

Software Reliability And Quality Management: Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model.

Software Maintenance: Software maintenance, Maintenance Process Models, Maintenance Cost, Software Configuration Management.

Software Reuse: what can be reused? Why almost No Reuse So Far? Basic Issues in Reuse Approach, Reuse at Organization Level



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 modelling a software project.
- iv. Obtain basic knowledge of coding
- v. Obtain knowledge about estimation maintenance and reuse of software systems.

Text Books:

1. Software engineering A practitioner's Approach, Roger S. Pressman, Seventh Edition McGrawHillInternationalEdition.
2. Fundamentals of Software Engineering, Rajib Mall, Third Edition,PHI.
3. Software Engineering, Ian Sommerville, Ninth edition, Pearsoneducation

References:

1. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill,2008
2. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
3. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
4. Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition,2006.

Web References:

<https://nptel.ac.in/courses/10>



III Year I Semester	Object Oriented Analysis and Design Professional Elective-I	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the fundamental principles of object-oriented systems and their design.
2. To equip students with skills to perform analysis and modeling of software systems using UML.
3. To provide understanding of object-oriented design patterns and architectural principles.
4. To teach how to translate object-oriented models into implementation using modern tools.
5. To prepare students to develop maintainable, reusable, and scalable software solutions.

UNIT I:

Object-Oriented Fundamentals and Modeling Concepts: Introduction to object-oriented software engineering. Principles of object orientation – abstraction, encapsulation, inheritance, and polymorphism. Introduction to the Unified Process. Software development lifecycle – phases and activities. Modeling as a design technique. Overview of UML – use case, class, object, sequence, collaboration, state, activity, component, and deployment diagrams.

UNIT II:

Requirements Modeling with Use Cases: Capturing functional requirements using use case diagrams. Use case elements – actors, use cases, relationships (include, extend, generalization). Writing effective use case specifications. Identifying scenarios and flows of events. Use case realization using sequence and collaboration diagrams. Identifying classes from use cases.

UNIT III:

Class and Interaction Modeling: Class diagram – classes, attributes, operations, and associations. Generalization, aggregation, and composition. Class responsibilities and relationships. CRC cards. Sequence diagrams – object lifelines, messages, activations. Collaboration diagrams – interaction links and message flows. Modeling visibility and navigability. Refining interaction models for system behavior.

UNIT IV:

State Modeling and Advanced Design Concepts: Statechart diagrams – states, transitions, events, and actions. Modeling dynamic behavior of objects. Activity diagrams – control flow, swimlanes, and concurrency. Object design – refining attributes and methods, design patterns (Factory, Singleton, Observer, Strategy). Package diagrams and layered architecture. Applying GRASP principles – High Cohesion, Low Coupling, Controller, Creator.

UNIT V:

Object-Oriented Design to Implementation: Mapping object-oriented design to code – classes and relationships in programming languages. Implementation using UML tools (e.g., StarUML, Enterprise Architect). Testing strategies – unit testing, integration testing, and use case-based testing. Design metrics and software quality. Case studies of end-to-end OOAD applications.

COURSE OUTCOMES:

1. Understand object-oriented principles and apply them to software analysis and design.
2. Model functional requirements using use cases and represent system behavior with UML diagrams.
3. Design class and interaction diagrams that capture system structure and dynamics.



4. Apply state modeling, design principles, and patterns to develop robust software designs.
5. Translate object-oriented models to implementation and validate through appropriate testing methods.

TEXT BOOKS:

1. Grady Booch, James Rumbaugh, and Ivar Jacobson (2005). *The Unified Modeling Language User Guide*, 2nd Edition, Addison-Wesley.
2. Craig Larman (2004). *Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development*, 3rd Edition, Pearson.
3. Bernd Bruegge and Allen H. Dutoit (2010). *Object-Oriented Software Engineering Using UML, Patterns, and Java*, 3rd Edition, Pearson.

REFERENCE BOOKS:

1. Simon Bennett, Steve McRobb, Ray Farmer (2010). *Object-Oriented Systems Analysis and Design Using UML*, 4th Edition, McGraw-Hill.
2. Ali Bahrami (1999). *Object Oriented Systems Development*, McGraw-Hill.
3. Martin Fowler (2003). *UML Distilled: A Brief Guide to the Standard Object Modeling Language*, 3rd Edition, Addison-Wesley.



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

Course Objectives:

- Understand the principles and practices of DevOps.
- Understand the tools and 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 1: Introduction to DevOps

Introduction to Software Development life cycle and agile software development, DevOps Definition and Benefits and its Goals, differentiate between Traditional vs .DevOps IT 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 2: Continuous Integration & Delivery (CI/CD)

Introduction to CI/CD Concepts (Build, Test, Deploy Automation), CI/CD Tools (Jenkins, GitLab CI, CircleCI)

Unit 3: 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 4: 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



Unit 5: Monitoring & Security in DevOps

Introduction to DevOps Monitoring: Importance and Overview, **Monitoring Tools:** Nagios, Prometheus, Grafana, **LogManagement:** 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.
3. Docker Deep Dive Paperback – July 12, 2017 by Nigel Poulton (Author), 1st Edition.
4. Terraform: Up & Running, 2nd Edition by Yevgeniy Brikman Released September 2019 Publisher(s): O'Reilly Media, Inc.
5. The entire Pro Git book, written by Scott Chacon and Ben Straub and published by Apress, first edition, 2014.
6. What is Devops? Infrastructure as code, 1st Edition, Mike Loukides, O'Reilly publications, 2012.

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.
3. The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline With Containerized Micro services, 1st Edition, Viktor Farcic, CreateSpace Independent Publishing Platform publications,2016
4. Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, 1st Edition, Jez Humble and David Farley,2010.
5. Achieving DevOps: A Novel About Delivering the Best of Agile,DevOps

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/>



III Year I Semester	Predictive Analytics 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.

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 hyperparameter tuning using GridSearchCV. Overfitting and underfitting. 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).



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.

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.

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.



III Year I Semester	Open Electives offered by other departments	L	T	P	C
		3	0	0	3

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 preprocessing 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 preprocessing 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 Neighbors (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.

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VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2024-25 and onwards)

B.Tech_(Artificial Intelligence & Data Science)

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.



III Year I Semester	Operating System & Compiler design Lab	L	T	P	C
		0	0	3	1.5

Course Objectives:

1. To provide practical understanding of operating system functionalities such as process scheduling, memory management, and file systems.
2. To explore the working of lexical analysis and parsing techniques in compiler design.
3. To implement core operating system algorithms for real-time problem-solving.
4. To gain experience in designing and simulating compiler phases using programming languages like C or Python.
5. To bridge theoretical concepts of OS and compiler design with practical implementation and testing.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Simulate and analyze CPU scheduling algorithms and memory management techniques.
2. Implement system-level programs to manage files, processes, and synchronization mechanisms.
3. Develop lexical analyzers and parsers using tools like LEX and YACC.
4. Apply theoretical compiler design principles to build various phases of a simple compiler.
5. Demonstrate skills in integrating OS concepts and compiler logic for building system software.

Lab Task List (Any 10 Experiments):

1. Simulate First-Come-First-Served (FCFS), Shortest Job First (SJF), and Round Robin CPU Scheduling Algorithms.
2. Implement Banker's Algorithm for Deadlock Avoidance.
3. Simulate Page Replacement Algorithms: FIFO, LRU, and Optimal.
4. Implement File Allocation Techniques: Contiguous, Linked, and Indexed.
5. Create a Multi-threaded Program using POSIX Threads to Demonstrate Process Synchronization using Semaphores.
6. Implement Lexical Analyzer using LEX Tool.
7. Implement Arithmetic Expression Parser using YACC.
8. Develop Symbol Table Management using Hashing.
9. Simulate Intermediate Code Generation for Simple Arithmetic Expressions.
10. Implement Code Optimization Techniques such as Constant Folding and Dead Code Elimination.

Text Books:

1. Silberschatz, Galvin, and Gagne, "**Operating System Concepts**", Wiley, 9th Edition.
2. A.V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "**Compilers: Principles, Techniques and Tools**", Pearson, 2nd Edition.
3. Andrew S. Tanenbaum, "**Modern Operating Systems**", Pearson Education, 4th Edition.

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(Applicable from the academic year 2024-25 and onwards)

B.Tech_(Artificial Intelligence & Data Science)

Reference Books:

1. William Stallings, "**Operating Systems: Internals and Design Principles**", Pearson, 7th Edition.
2. Alfred V. Aho and Jeffrey D. Ullman, "**The Theory of Parsing, Translation, and Compiling**", Prentice Hall, Volumes 1 and 2.
3. D.M. Dhamdhere, "**System Programming and Operating Systems**", Tata McGraw-Hill, 2nd Edition.



III Year I Semester	Nodejs Skill oriented course	L	T	P	C
		0	1	2	2

Course Objectives:

- To understand the Node’s Web Server Development.
- To understand npm and NodeJS Modules.
- To create NodeJS applications using Express.JS.
- To deploy NodeJS applications.

Course Outcomes:

- Understand the Node’s unique approach to asynchronous development.
- Understand the Node Package Manager (npm) and Modules.
- Implement NodeJS applications with the Express frame work and Connect Middleware.
- Learning-depth practices for debugging and testing NodeJS applications.
- Deploy NodeJS applications in the cloud or on your own system.

Unit I

Node JS – Introduction, What is Node JS? Advantages of Node JS, Traditional Web Server Model, Node.Js Process Model. **Setup Dev Environment:** Install Node.json Windows/Linux, Working in REPL, Node JS Console.

Unit II

Node JS Modules: Functions, Buffer, Module, Module Types, Core Modules, Local Modules, Module. Exports, **Node Package Manager:** What is NPM? Installing Packages Locally. Adding the dependency in package.json, installing packages globally, Updating packages. **Web server:** Creating web server, Handling HTTP requests, Sending requests

Unit III

File System: Synchronous vs Asynchronous, Open a File, Get File Information, Writing a File, Reading a File, Closing a File, Delete a File, Other IO Operations. **Callbacks:** What is Callback? Blocking Code Example, Non-Blocking Code. **Events:** Event Emitter Class, Methods, Events, Returning event emitter, Inhering events.



Unit IV

Express.JS: Configuring routes, Working with express, **Serving Static Resources:** Serving static files, Working with middleware. **Debugging Node JS Application:** Core Node JS debugger. Debugging with Visual Studio.

Unit V

Database Connectivity: Introduction to MongoDB, Connecting Node.Js to Database, Connection string, Configuring, working with the select command, updating records, deleting records, Creating Rest APIs.

TEXT BOOKS:

1. NodeJS Book: Learning Node by Shelley Powers, O'Reilly, second edition, May 2016.
2. Learning Node.js Development: Learn the fundamentals of Node.js, and deploy and test Node.js applications on the web By Andrew Mead, Packet, first edition, January 2018.

REFERENCEBOOKS:

- Mastering Node.js: Build robust and callable real-time server-side web applications efficiently, Second Edition, Packet



III Year I Semester	Tinkering Lab	L	T	P	C
		0	0	2	1

Course Objective

A small unique idea can become a big changer when it gets the suitable platform and transformed into a product or re-define existing products with better enhancement.

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 are 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 robotic arm
- Smart Traffic System
- Vehicle Accident Alarm System
- Smart dustbin
- Surveillance BOT



(Applicable from the academic year 2024-25 and onwards)

B.Tech_(Artificial Intelligence & Data Science)

- Automatic Water Gardening System
- e-Mirror
- Smart Parking System
- Service Bot
- Drone Surveillance
- Wallpaintingrobot
- Home automation
- Automated wheelchair
- AnyInnovativeIdea–RealTime application

Expectations from the Lab:

- Workshop on empathy, ideation, and identifying real-world problems.
- Understanding the basic logics with interaction as teams.
- Working Hand-on using present tools available
- Students form teams, plan their mini project and starts working with the help of the mentor
- Students do Hands-on building, troubleshooting, testing
- Finalize, document, and prepare for demonstration

III Year I Semester	Evaluation of Community Service Internship	L	T	P	C
		-	-	-	2



III Year II Semester

III Year II Semester	Computer Networks	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

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

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

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

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

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

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

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

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



TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES:

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



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.

Unit1: Introduction to Deep Learning, Bayesian Learning, Decision Surfaces

Linear Classifiers, Linear Machines with Hinge Loss, Optimization Techniques, Gradient Descent, Batch Optimization

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

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

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

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

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.

Text Books:

- 1) "Deep Learning (Adaptive Computation and Machine Learning series)", Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2017.

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(Applicable from the academic year 2024-25 and onwards)

B.Tech_(Artificial Intelligence & Data Science)

- 2) Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.
- 3) “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, Nikhil Buduma, Nicholas Locascio, O'Reilly Media, 2017.

Reference Books:

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



III Year II Semester	Natural Language Processing	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Teach students the leading trends and systems in natural language processing.
- Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate the above mentioned concepts.
- Teach them to recognize the significance of pragmatics for natural language understanding.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

SYLLABUS:

Unit-I

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

Unit-II

Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues

Unit-III

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

Unit-IV

Predicate-Argument Structure

Predicate-Argument Structure, Meaning Representation Systems, Software.

Unit-V

Discourse Processing: Cohension, Reference Resolution, Discourse Cohension and Structure **Language Modeling:** Introduction, N-Gram Models, Language Model Evaluation,

Parameter Estimation, Language Model Adaptation, Types of Language Models, Language Specific Modeling Problems, Multilingual and Crosslingual Language Modeling .

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(Applicable from the academic year 2024-25 and onwards)

B.Tech_(Artificial Intelligence & Data Science)

COURSE OUTCOMES:

1. Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
2. Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
3. Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
4. Able to design, implement, and analyze NLP algorithms
5. Able to design different language modeling Techniques.

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel

M.Bikel and Imed Zitouni, Pearson Publication

2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

REFERENCE BOOKS:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications



III Year II Semester	Software Testing Methodology Professional Elective-II	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on the

- i. Describe the principles and procedures for designing testcases.
- ii. Provide supports to debugging methods.
- iii. Acts as the reference for software testing techniques and strategies.

UNIT-I:

Introduction: Purpose of Testing, Dichotomies, Model for Testing, Consequences of Bugs, Taxonomy of Bugs. **FLOW GRAPHS AND PATH TESTING:** Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing.

UNIT-II:

Transaction Flows Testing: Transaction Flows, Transaction Flow Testing Techniques. **Dataflow Testing:** Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing. **Domain Testing:** Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interfaces Testing, Domain and Interface Testing, Domains and Testability.

UNIT-III:

Paths, Path Products and Regular Expressions:

Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection.

Syntax Testing: Why, What and How, A Grammar for formats, Test Case Generation, Implementation and Application and Testability Tips.

Based Testing: Overview, Decision Tables, Path Expressions, KV Charts, and Specifications.

UNIT-IV:

State, State Graphs And Transition Testing: State Graphs, Good & Bad State Graphs, State Testing, and Testability Tips.

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm.



UNIT-V:

Software Testing Tools: Introduction to Testing, Automated Testing, Concepts of Test Automation, Introduction to list of tools like Win Runner, LoadRunner, 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.

Course Outcomes: The students should be able to:

- i. Define Software testing terminology and methodology
- ii. Discuss and classify various testing techniques for conducting different types of software testing
- iii. Apply different software testing techniques.
- iv. Construct test cases by understanding test suite management and software quality management.
- v. Demonstrate modern software testing tools and testing of Object-Oriented Software and Webbased software

Text Books:

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

References:

1. The Craft of software testing - Brian Marick, Pearson Education.
2. Software Testing, 3rd edition, P.C. Jorgensen, Aurbach Publications (Dist.by SPD).
3. Software Testing, N.Chauhan, Oxford University Press.
4. Introduction to Software Testing, P.Ammann & J. Offutt, Cambridge Univ. Press.
5. Effective methods of Software Testing, Perry, John Wiley, 2nd Edition, 1999.
6. Software Testing Concepts and Tools, P.Nageswara Rao, dreamtech Press
7. Win Runner in simple steps by Hakeem Shittu, Genixpress, 2007.
8. Foundations of Software Testing, D.Graham & Others, Cengage Learning.



III Year II Semester	Cryptography & Network Security Professional Elective-II	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.

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B.Tech_(Artificial Intelligence & Data Science)

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.
3. Eric Rescorla, "**SSL and TLS: Designing and Building Secure Systems**", Addison-Wesley.



III Year II Semester	Internet of Things (IOT) Professional Elective-II	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Learns about various types of sensors, actuators and different network protocols.
- Construction of wireless sensor networks and communication using different connectivity technologies
- To Know about how m2M communication performs and communication between user and the device
- Learns about how data is handled generated by IOT application how IoT is used for industrial purpose , able to builds viors IoT applications

UNIT- I: Introduction to IOT:Sensing: Sensors, Transducers, Sensor Classes and sensor types. Actuation: Actuator, Actuator Types: Hydraulic Actuators, Pneumatic Actuators, Electric Actuators, Thermal or Magnetic Actuators, Mechanical Actuators, Soft Actuators.

Basic of Networking: IoT Components, IoT Categories, N/w Protocols: MQTT(Message Queue Telemetry Transport), CoAP(Constrained Application Protocol), XMPP(Exte nsible Messaging and Presence Protocol), AMQP(Advanced Message Queuing Protocol).

UNIT- II: Communication protocols: Zigbee, 6LoWPAN, Z-Wave, NFC,RFID, IEEE 802.15.4.

Sensor Networks: Wireless Sensor Networks (WSNs), Sensor Nodes,Basic Components of a Sensor Node,Challenges, Node Behavior in WSNs,Applications of WSNs, Types of sensor networks: Static WSN's and Dynmaic WSN's.

UNIT- III: Machine to Machine communication: Introduction, M2M Overview, M2M Applications, M2M Features, M2M Node Types

Interoperability in IOT: Definition, Types of Interoperability: User Interoperability, Device Interoperability

IoT Platforms: Introduction to Arduino Programming, Integration ofSensors and Actuators with Arduino.

UNIT- IV:

Introduction to Python programming, Introduction to Raspberry Pi: Specifications, Basic Architecture, Raspberry Pi OS Setup, Implementation of IoT with Raspberry Pi.

Software-Defined Networking: Overview of Current Network, Current Network to SDN, SDN Architecture, Basic Concepts of SDN,Components/Attributes of SDN, Challenges

Platforms for data collection and storage:

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Cloud Computing: Characteristics, Components of Cloud Computing, Service Models, Deployment Models and sensor clouds: Introduction, Actors in Sensor-cloud, Architecture, and Work Flow of Sensor-Cloud. Introduction to fog computing.

UNIT- V:

Introduction to IOE: Sensing & actuation, Communication-Part I, PartII, Networking-Part I, Part II, Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories.

COURSE OUTCOMES:

- Aware about how sensors and actuators are connected by using different network protocols node behavior in wireless sensor networks and known about which connectivity technology was used according to the application.
- Knows about Arduino boards and their connection with sensors and actuators
- Learns about how Pi os is installed and how code is embedded into the board
- Came to know about how data is stored using cloud computing and knows about sensor clouds.
- Construction various IOT applications using various sensors and Actuators

TEXT BOOKS:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
3. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015

REFERENCE BOOKS:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
2. Getting Started with the Internet of Things CunoPfister , Oreilly
3. Industry 4.0: The Industrial Internet of Things”, by Alasdair Gilchrist (Apress)
4. “Industrial Internet of Things: Cybermanufacturing Systems “by Sabina Jeschke, Christian



III Year II Semester	Data Ethics and Privacy Professional Elective-II	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand ethical and legal responsibilities in handling data in digital environments.
2. To explore the concepts of privacy, consent, and data protection in the context of technology.
3. To examine real-world case studies involving data misuse, surveillance, and algorithmic bias.
4. To study data governance, privacy-enhancing technologies, and global privacy regulations like GDPR.
5. To prepare students for ethical decision-making and responsible use of AI and big data.

SYLLABUS

UNIT – I:

Introduction to Data Ethics: Evolution of ethical thinking in technology, foundational ethical principles (autonomy, justice, beneficence, non-maleficence), ethics in computing, data ethics in AI and big data. Ethical concerns in algorithmic decision-making, profiling, and predictive analytics. Role of ethics in product and system design.

UNIT – II:

Privacy Concepts and Principles: Definition of privacy – types (bodily, territorial, informational, decisional), contextual integrity, the right to be forgotten. Data minimization, informed consent, notice and choice. Threats to privacy – tracking, surveillance, identity theft, behavioral profiling.

UNIT – III:

Legal and Regulatory Frameworks: Overview of data protection laws – GDPR (EU), CCPA (California), IT Act (India), HIPAA, COPPA. Responsibilities of data controllers and processors. Cross-border data transfer, data localization. Privacy policies and impact assessments. Case laws and enforcement actions.

UNIT – IV:

Data Governance and Security: Data lifecycle management, classification, and anonymization. Data breach prevention, incident response, encryption, pseudonymization, role-based access control. Privacy by Design and by Default. Organizational data governance policies and ethical auditing.

UNIT – V:

Ethics in Emerging Technologies: Ethical implications of AI, machine learning, facial recognition, IoT, biometrics, and blockchain. Algorithmic bias and fairness, explainable AI, autonomous decision-making. Data monetization ethics, corporate social responsibility (CSR) in the digital age. Case studies on ethical dilemmas in tech.

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Course Outcomes:

Upon completion of this course, students will be able to:

1. Identify ethical issues and implications related to data collection, sharing, and analysis.
2. Analyze privacy concerns and understand the trade-offs between utility and confidentiality.
3. Apply ethical frameworks and compliance models in the design and use of data systems.
4. Interpret and follow global data protection laws and industry best practices.

Evaluate the ethical impact of emerging technologies such as AI, surveillance, and data monetization

Text Books:

1. Luciano Floridi, “**The Ethics of Information**”, Oxford University Press.
2. Mike Chapple and David Seidl, “**Privacy and Data Protection Essentials**”, Wiley, 2020.
3. Carissa Véliz, “**Privacy Is Power**”, Bantam Press, 2020.

Reference Books:

1. Solove, Daniel J., “**Understanding Privacy**”, Harvard University Press.
2. Cathy O’Neil, “**Weapons of Math Destruction**”, Crown Publishing Group.
3. OECD Guidelines on the Protection of Privacy and Transborder Flows of Personal Data, OECD Publications.



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

Course Educational 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.

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.



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.

TEXT BOOKS:

1. D.Forsyth and J. Ponce, “Computer Vision-A modern approach,” Pearson, 2nd Edition, 2015.
2. E.Trucco and A.Verri, “Introductory Techniques for 3D Computer Vision”, Prentice Hall, 3rd Edition, 2016

REFERENCE BOOKS:

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, 4th Edition, 2012.
5. Simon J. 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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(Applicable from the academic year 2024-25 and onwards)

B.Tech_ (Artificial Intelligence & Data Science)

III Year II Semester	Quantum Computing Professional Elective-III	L	T	P	C
		3	0	0	3

Course Educational 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

Unit-I: INTRODUCTION TO QUANTUM COMPUTING

Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.), Origin of Quantum Computing, Overview of major concepts in Quantum Computing: Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation(1.1., 1.2., 1.3.,)

Math Foundation for Quantum Computing (Matrix Algebra): basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors (2.1)

UNIT-II: QUANTUM CIRCUITS BUILDING BLOCKS FOR QUANTUM PROGRAM

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

UNIT-III: TENSOR PRODUCTS, TELEPORTATION AND SUPERDENSE CODING

Tensor Products, Multi Q-Bit system, Super Position, Entanglement, Decoherence, quantum teleportation, no-cloning theorem super dense coding(10th chapter of Book 2), Quantum Fourier transformations and its applications (5.1., 5.2., 5.3.)

UNIT-IV: QUANTUM ALGORITHMS

Hadamard Gates, phase gate, Quantum interference, Quantum parallelism a function evaluation, Deutsch-Jozsa Algorithm, Phase Estimation, Shor's algorithm, Quantum Searching and Grover's Algorithm (9th chapter of Book 2)



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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)

Course Outcomes:

1. Understand underlying principles of Quantum Computing (L2)
2. Analyse the matrix operators for universal quantum gate (L4)
3. Demonstrate quantum fourier transformation(L1)
4. Analyse quantum algorithms for searching(L4)
5. Develop a quantum computing application for machine learning/Key distribution(L6)

Textbook(s):

1. Michael A. Nielsen, Quantum Computation and Quantum Information,, Cambridge University Press, , 2013 ,ISBN:978-1107619197,10th edition.
2. David McMahon, Quantum Computing Explained, Wiley Publisher, 2008, ISBN:978-0470096994, 1st edition.

Reference(s):

1. Introduction to Quantum Computing: Quantum Algorithms and Qiskit,
2. ,<https://nptel.ac.in/courses/106106232>
3. IBM Experience:,
<https://www.coursera.org/programs/gitam-open-learning-7qv77/learn/introduction-to-quantum-information?authProvider=gitam&source=ibm>
4. Microsoft Quantum Development Kit, ,<https://www.microsoft.com/en-us/quantum/development-kit>
5. Forest SDK PyQuil, , <https://pyquil.readthedocs.io/en/stable/>



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B.Tech_ (Artificial Intelligence & Data Science)

III Year II Semester	Software Project Management Professional Elective-III	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on the

- i. To study how to plan and manage projects at each stage of the software development life cycle(SDLC)
- ii. To train software project managers and other individuals involved in software project planning and tracking and oversight in the implementation of the software project management process.
- iii. To understand successful software projects that support organization's strategic goals.

UNIT-I:

Conventional Software Management: The Waterfall Model, Conventional Software Management Performance.

Evolution Of Software Economics: Software Economics, Pragmatic Software CostEstimation.

Improving Software Economics: Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation through Software Economics.

UNIT-II:

The Old Way and the New: The Principles of Conventional Software Engineering, The Principles of Modern Software Management, Transitioning to an Iterative Process.

Life Cycle Phases: Engineering and Production Stages, Inception Phase, Elaboration Phase, Construction Phase, Transition Phase.

UNIT-III:

Model Based Software Architectures: A Management Perspective, A Technical Perspective.

Workflows of the Process: Software Process Workflows, Iteration Workflows.

Iterative Process Planning: Work Breakdown Structures, Planning Guidelines, The Cost and Schedule Estimating Process, The Iteration Planning Process.



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UNIT-IV:

Project Organization and Responsibilities: Line-Of-Business Organizations, Project Organizations, Evolution of Organizations. **Project Control and Process Instrumentation:** The Seven Core Metrics, Management Indicators, Quality Indicators Modern Project Profiles. The COCOMO Cost Estimation Model: COCOMO.

UNIT-V:

Effort Estimation and Scheduling: Effort Estimation, Scheduling.

Quality Planning: Quality Concepts, Quantitative Quality Management Planning. **RISK MANAGEMENT:** Risk Assessment, Risk Control.

Course Outcomes: The students should be able to:

- i. Estimate overall cost of a software project.
- ii. Explain software development process.
- iii. Distinguish workflows of process.
- iv. Design project organization structure & analyze quality.
- v. Estimate effort and schedule needed for project.

Text Books:

1. 1.Walker Royce, “Software Project Management – A Unified Framework”, 1st Edition, Pearson Education, 2002.
2. Pankaj Jalote, “Software Project Management in Practice”, 1st Edition, Pearson Education, 2005.
3. Software Project Management, Bob Hughes & Mike Cotterell, TATA McGraw-Hill.

References:

1. Bob Hughes, “Mike Cotterell, Rajib Mall, Software Project Management”, 5th Edition, McGraw-Hill Higher Education, 2011.
2. Joel Henry, “Software Project Management”, 1st Edition, Pearson Education, 2006.
3. Norman E. Fenton, Shari Lawrence Pfleeger, “Software Metrics: A Rigorous and Practical Approach”, 1st Edition, PWS Publishing Company, 1997



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B.Tech_ (Artificial Intelligence & Data Science)

III Year II Semester	Ethical AI Professional Elective-III	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the core concepts of ethics and moral reasoning relevant to Artificial Intelligence.
2. To explore the ethical challenges in the design, development, and deployment of AI systems.
3. To familiarize students with fairness, accountability, transparency, and privacy issues in AI.
4. To study legal, societal, and philosophical implications of AI across different domains.
5. To enable students to critically assess AI systems using ethical frameworks and case studies.

UNIT I:

Introduction to Ethics and AI:

Overview of ethics – types of ethics: descriptive, normative, applied. Relevance of ethics in AI systems. Understanding moral agency in artificial systems. Foundations of machine ethics. Importance of responsible AI. Introduction to professional codes of conduct and IEEE/EU ethical AI guidelines.

UNIT II:

Fairness, Bias, and Discrimination:

Understanding algorithmic bias and its societal impact. Sources of bias – data, model, and usage. Fairness metrics and approaches. Case studies on biased AI systems (e.g., facial recognition, credit scoring). Strategies to mitigate discrimination in AI applications. Inclusive and equitable AI design.

UNIT III:

Transparency, Explainability, and Accountability:

Black-box nature of AI models. Importance of explainability in AI decisions. Techniques for interpretability (e.g., LIME, SHAP). Concepts of accountability and responsibility in AI errors. AI auditing frameworks. Legal accountability and liability of AI-driven decisions.

UNIT IV:

Privacy, Surveillance, and Consent:

Data privacy principles and AI implications. Informed consent in AI applications. Ethical concerns in surveillance systems, facial recognition, and biometric data use. Privacy-preserving AI – federated learning, differential privacy. General Data Protection Regulation (GDPR) and other global standards.



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UNIT V:

Societal Impacts and Future of Ethical AI:

Autonomous systems – ethical issues in self-driving cars, military drones, and robotics. Employment and economic disruption due to AI. Misinformation and deepfakes. AI and human rights. Global perspectives on AI ethics. Future challenges – general AI and superintelligence. Designing for trust in AI systems.

COURSE OUTCOMES:

1. Understand key ethical theories and their application to artificial intelligence systems.
2. Identify and address bias, fairness, and discrimination in AI algorithms and datasets.
3. Analyze AI systems for transparency, explainability, and accountability.
4. Evaluate privacy concerns and regulatory frameworks relevant to AI deployment.
5. Critically assess the societal implications of AI and develop ethically responsible AI solutions.

TEXT BOOKS:

1. Markus D. Dubber, Frank Pasquale, Sunit Das (2020). *The Oxford Handbook of Ethics of AI*. Oxford University Press.
2. Virginia Dignum (2019). *Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way*. Springer.
3. Wendell Wallach and Colin Allen (2008). *Moral Machines: Teaching Robots Right from Wrong*. Oxford University Press.

REFERENCE BOOKS:

1. Cathy O’Neil (2016). *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy*. Crown Publishing.
2. Nick Bostrom and Eliezer Yudkowsky (2014). *The Ethics of Artificial Intelligence*. Cambridge Handbook of Artificial Intelligence. Luciano Floridi (2013). *The Ethics of Information*. Oxford University Press

III Year II Semester	Open elective offered by other department	L	T	P	C
		3	0	0	3



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B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

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B.Tech_ (Artificial Intelligence & Data Science)

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

Course Objectives:

- To introduce numerical computing techniques such as matrix operations and eigenvalue 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.

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.



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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.

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	Natural Language Processing Lab	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To introduce foundational concepts and methods in Natural Language Processing.
- To provide an understanding of statistical language modelling using n-grams, smoothing techniques, and methods for Part-of-Speech tagging such as the Hidden Markov Model and Viterbi algorithm.
- To enable students to explore and construct syntactic parsing techniques using Context-Free Grammars (CFGs).
- To equip students with the ability to design and implement deep learning models.
- To develop analytical skills for handling advanced NLP applications including Word Sense Disambiguation (WSD), Named Entity Recognition (NER), Relation Extraction, and speech technologies like ASR and TTS.

Course Outcomes:

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

- Apply text pre-processing techniques such as tokenization, stemming, lemmatization, and compute edit distance to prepare and analyze text data.
- Construct n-gram language models with smoothing, compute perplexity, and implement POS tagging using HMM and Viterbi algorithm for sequence labelling tasks.
- Develop syntactic parsing solutions using Context-Free Grammars, PCFGs, and dependency parsing approaches for sentence structure analysis.
- Implement neural models such as RNNs, LSTMs, and attention-based Seq2Seq architectures for tasks like next-word prediction and machine translation.
- Analyze and evaluate semantic and speech-related tasks using Word Sense Disambiguation, Named Entity Recognition, Relation Extraction, ASR, and TTS systems.

Experiments:

1. To implement text preprocessing techniques such as tokenization, case folding, stemming, lemmatization, and calculate the edit distance between text strings.
2. Create unigram, bigram, and trigram language models. Apply smoothing techniques to handle unseen data. Compute the perplexity of a given test sentence.



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3. To construct a Part-of-Speech (POS) tagger using the Hidden Markov Model (HMM) and implement the Viterbi algorithm to decode the most probable sequence of tags for a given sentence.
4. Implement Recurrent Neural Network (RNN) architectures for next-word prediction using pre-trained word embeddings such as Word2Vec or GloVe.
5. Construct Context-Free Grammars (CFGs) to generate sentences applying top-down and bottom-up parsing algorithms for syntactic analysis.
6. To implement Probabilistic Context-Free Grammars (PCFGs) for statistical parsing and explore dependency parsing using graph-based and transition-based methods for syntactic analysis.
7. Implement and compare two approaches to Word Sense Disambiguation (WSD):
Supervised Approach: Using a Decision Tree classifier for WSD and Unsupervised Approach: Using the Lesk Algorithm for WSD.
8. To implement Information Extraction using Named Entity Recognition (NER) and Relation Extraction.
9. Construct Automatic Speech Recognition (ASR) and Text-to-Speech (TTS) Systems using Deep Learning Techniques.
10. Build a Neural Machine Translation model using sequence-to-sequence (Seq2Seq) architecture with attention mechanisms.

Text Books:

Bharath Ramsundar, Reza Bosagh Zadeh, “Tensorflow for Deep Learning”, O’Reilly publishers, 1st Edition, 2018.

References:

<https://github.com/fchollet/deep-learning-with-python-notebooks>



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VIZIANAGARAM**

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2024-25 and onwards)

B.Tech_ (Artificial Intelligence & Data Science)

III Year II Semester	Soft skills (Skill oriented lab)	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 in 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 1 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.



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B.Tech_ (Artificial Intelligence & Data Science)

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

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 2 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)



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Unit 3 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 organising ideas in a text, Learn the different ways of organising ideas, practice organising ideas while writing **Writing an introduction:** Know the importance of a good introduction, understand the different ways in which writers catch the attention of readers, **Developing supporting ideas:** Learn how to develop your ideas in a paragraph, discuss a variety of supporting ideas, **Writing a conclusion:** Learn the different parts of a conclusion, Practice writing an effective conclusion **Using linkers:** Learn the different types of Linkers or cohesive devices, Discuss why it is important to use connectors in writing, **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 analysing 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 4 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, Synthesising & Challenging, Roles & Functions:



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(Applicable from the academic year 2024-25 and onwards)

B.Tech_ (Artificial Intelligence & Data Science)

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 5 Interview Skills [6 Hours]

Purpose of interviews: Know what recruiters looking for during Interviews, Become familiar with the process of career search, understand your skills, interests, achievements and attitude better
Preparing a Resume: Understand what a job application is, know the details to be included in a CV, Know how to lay out details of a CV & prepare CV on your own
Writing a Cover Letter: Study the information which is included in a cover letter. Learn how to organise information in a cover letter
Before and at the interview: Learn how to prepare for an interview, learn how to behave during the interview, discuss what the interviewer might assess you on
Answering FAQs about yourself & your families: Learn how to answer questions about yourself & family, Learn how to identify & talk about your strengths and Weaknesses
Answering FAQs about Likes & Dislikes: Learn to choose interests which will be relevant to your Interview. learn to speak about your likes & Dislikes
Answering FAQs about Justifying your candidature: Know what you need to say to answer a question about yourself, Be able to answer questions about your suitability for a job
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)



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- 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/1W15961dOEnIxlnMm9BKyo8L9Wla7nPbEfgR-9DT_mRg/edit?usp=sharing

GD:(10 M)

1. Each student has to perform 5 Group Discussions during the course on a peer evaluation basis which fetches them 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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B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2024-25 and onwards)

B.Tech_ (Artificial Intelligence & Data Science)

III Year II Semester	Technical Paper Writing & IPR	L	T	P	C
		2	0	0	-

COURSE OBJECTIVES:

1. To enable students to understand the process of writing quality technical papers and research articles.
2. To familiarize students with effective strategies for literature survey, organization, and scientific writing.
3. To introduce the basics of Intellectual Property Rights (IPR), including patents, copyrights, and trademarks.
4. To provide insights into patent filing procedures, laws, and the role of IPR in academia and industry.
5. To encourage ethical writing practices and awareness of plagiarism, authorship, and publication ethics.

UNIT I:

Introduction to Technical Writing:

Characteristics of technical writing – clarity, precision, formality, and structure. Types of technical documents – journal papers, conference papers, technical reports, theses. Components of a research paper – title, abstract, keywords, introduction, literature review, methodology, results, discussion, conclusion, and references. Importance of audience and purpose. Common errors in writing.

UNIT II:

Research Process and Writing Tools:

Understanding the research process – problem formulation, hypothesis, research design, and data interpretation. Conducting effective literature review using databases (IEEE Xplore, Scopus, Google Scholar). Citation and referencing styles – IEEE, APA, MLA. Use of tools such as LaTeX, Grammarly, Mendeley, and Zotero. Best practices in editing and proofreading.

UNIT III:

Publication Ethics and Plagiarism:

Ethics in research and authorship. Understanding plagiarism and how to avoid it. Tools for plagiarism detection. Roles of authors, co-authors, reviewers, and editors. Ethics in peer review. Predatory journals and conferences. Guidelines from COPE (Committee on Publication Ethics).

UNIT IV:

Introduction to Intellectual Property Rights (IPR):

Overview of IPR – need, scope, and types: patents, copyrights, trademarks, and trade secrets. Concept of novelty, utility, and non-obviousness in patents. Indian and international IPR frameworks (WIPO, TRIPS). Role of IPR in academia, startups, and innovation ecosystems.

UNIT V:

Patent Filing and Case Studies: Patent search and patentability criteria. Process of patent application – drafting, filing, prosecution, and grant. Role of patent attorneys and patent offices. Infringement and litigation. Case studies of IPR in technology and research. Role of IP in commercialization and technology transfer.



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B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2024-25 and onwards)

B.Tech_ (Artificial Intelligence & Data Science)

COURSE OUTCOMES:

1. Understand the components and structure of technical research papers.
2. Develop skills in literature review, referencing, and use of writing tools.
3. Apply ethical principles in academic writing and avoid plagiarism.
4. Gain knowledge of various types of intellectual property and related legal aspects.
5. Understand patent filing procedures and their importance in innovation and entrepreneurship.

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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B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2024-25 and onwards)

B.Tech_ (Artificial Intelligence & Data Science)

B.Tech. – IV Year I Semester

IV Year I Semester	Data visualization	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. This course is all about data visualization, the art and science of turning data into readable graphics. Will explore how to design and create data visualizations based on data available and tasks to be achieved.
2. This process includes data modeling, data processing (such as aggregation and filtering), mapping data attributes to graphical attributes, and strategic visual encoding based on known properties of visual perception as well as the task(s) at hand.
3. Students will also learn to evaluate the effectiveness of visualization designs, and think critically about each design decision, such as choice of color and choice of visual encoding.
4. Students will create their own data visualizations, and learn to use Open Source data visualization tools, especially D3.js.
5. Students will also read papers from the current and past visualization literature and create video presentations of their findings.

Unit 1: INTRODUCTION TO VISUALIZATION

Visualizing Data-Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes- Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Color Scales-Color as a Tool to Distinguish, Color to Represent Data Values, Color as a Tool to Highlight, Directory of Visualizations- Amounts, Distributions, Proportions, x-y relationships, Geospatial Data

UNIT 2: VISUALIZING DISTRIBUTIONS

Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heatmaps, Visualizing Distributions: Histograms and Density Plots- Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots-Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile Quantile Plots, Visualizing Many Distributions at Once-Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis

UNIT 3: VISUALIZING ASSOCIATIONS & TIME SERIES

Visualizing Proportions-A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total, Visualizing Nested Proportions- Nested Proportions Gone Wrong, Mosaic Plots and Treemaps, Nested Pies, Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatterplots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an



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B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

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B.Tech_ (Artificial Intelligence & Data Science)

Independent Variable-Individual Time Series, Multiple Time Series and Dose-Response Curves, Time Series of Two or More Response Variable

UNIT 4: VISUALIZING UNCERTAINTY

Visualizing Trends-Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series Decomposition, Visualizing Geospatial Data-Projections, Layers, Choropleth Mapping, Cartograms, Visualizing Uncertainty-Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Visualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plots

UNIT 5: PRINCIPLE OF PROPORTIONAL INK

The Principle of Proportional Ink-Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations, Handling Overlapping Points-Partial Transparency and Jittering, 2D Histograms, Contour Lines, Common Pitfalls of Color Use- Encoding Too Much or Irrelevant Information, Using Nonmonotonic Color Scales to Encode Data Values, Not Designing for Color-Vision Deficiency

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- 1. Understand basics of Data Visualization**
2. Implement visualization of distributions
3. Write programs on visualization of time series, proportions & associations
4. Apply visualization on Trends and uncertainty
5. Explain principles of proportions

TEXTBOOKS

1. Claus Wilke, “Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures,” 1st edition, O’Reilly Media Inc, 2019.

REFERENCE BOOKS

1. Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization, O’Reilly,2016
2. Ossama Embarak, Data Analysis, and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems, Apress, 2018

EBOOKS

1. <https://www.netquest.com/hubfs/docs/ebook-data-visualization-EN.pdf>

MOOC

2. <https://www.coursera.org/learn/data-visualization>
3. <https://www.coursera.org/learn/python-for-data-visualization#syllabus>



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B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2024-25 and onwards)

B.Tech_ (Artificial Intelligence & Data Science)

IV Year I Semester	Entrepreneurship & Incubation	L	T	P	C
		3	0	0	3

Course Objectives:

- Outline an environment to inculcate entrepreneurial skills.(L2)
- Develop innovative products, services, processes and techniques.(L3)
- Plan to prepare financial proposals and start-ups.(L3)
- Analyse the ideas to collaborate entrepreneur skills in establishment of start-ups.(L3)
- Explain the financial resource existing in government and private sectors.(L2)

Course outcomes:

- Explain the knowledge of Entrepreneurial behavior and skill development.(L2)
- Choose business ideas that have value in the end-market.(L2)
- Identify the validity of idea and its unique selling proposition.(L3)
- Comprehend opportunity and challenges of-startup(L2)
- Analyze various Government and non-Government financial resource.(L3)

Unit-I: Fundamentals of Entrepreneurship

Entrepreneurship- Concept, Importance, Characteristics –Myths of Entrepreneurship -Role of Entrepreneurs in Indian economy–Distinguish between professional entrepreneurs Vs Family entrepreneurs - Social and Ethical Perspectives of Entrepreneurship.

Application: Case lets: Business cases of young entrepreneurs.

Unit-II: Ideation and Evaluation of Business Ideas

Opportunity identification–Ideations process- Sources of business ideas –Role of creativity– Sources of Innovation –Technological Innovation and Entrepreneurship - Product/ Service design – Design Thinking.

Case lets : Business cases of OYO.

Activity: Collection of novel business ideas.

Unit-III: Feasibility Analysis and Business plan

Thrust areas of entrepreneurship- Techno-economic feasibility assessment- Financial feasibility – Market feasibility – Preparation of Business plan – Business canvas & Lean canvas.

Activity:

- Preparation of business plan(draft)
- Analysis on TED program Talks



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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
3. Rajeev Roy, Entrepreneurship, Oxford Higher Education.2011
H.Nandan, Fundamentals of Entrepreneurship, PHIL earning(P)Ltd,201



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B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2024-25 and onwards)

B.Tech_ (Artificial Intelligence & Data Science)

IV Year I Semester	AI Chatbot Professional Elective-IV	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.

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. 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.



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B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2024-25 and onwards)

B.Tech_(Artificial Intelligence & Data Science)

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.

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. Srinu 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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B.Tech_ (Artificial Intelligence & Data Science)

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

Course Objectives

- To provide conceptual understanding of the function of Block chainsaw method of securing distributed ledgers.
- To understand the structure of a Block chain and why/when it is better than a simple distributed database
- To make students understand the technology call under pinning of Blockchain operations as distributed data structures and decision-making systems.
- To understand “smart” contract and its legal implications.

Course Outcomes

The student will be able to:

- Illustrate the fundamentals of Blockchain.
- Summarize decentralization and the role of Blockchain in it.
- Analyse Bit coin Crypto currency and underlying Blockchain network.
- Understand Ethereum currency and platform, and develop applications using Solidity.
- 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.



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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.
3. Mastering Bitcoin: Programming the Open Blockchain, Antonopoulos, Andreas M. O'Reilly.
4. BlockchainTechnology: Crypto currency and Applications, S.Shukla, M.Dhawan, S. Sharma, S. Venkatesan, Oxford UniversityPress.

Links:

- <https://www.coursera.org/learn/introduction-blockchain-technologies>
https://onlinecourses.nptel.ac.in/noc22_cs44/preview



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B.Tech_ (Artificial Intelligence & Data Science)

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

COURSE OBJECTIVE:

1. To introduce the foundational concepts and evolution of Generative AI and its significance in artificial intelligence.
2. To provide an understanding of various generative models such as VAEs, GANs, Autoregressive, and Diffusion Models.
3. To analyze and apply deep learning techniques for creating synthetic data including images, audio, and text.
4. To gain hands-on experience with tools and frameworks used in building generative models.
5. To explore ethical considerations, limitations, and real-world applications of Generative AI technologies.

UNIT–I: Introduction to Generative AI and Fundamentals:

Definition and scope of Generative AI – History and Evolution – Discriminative vs Generative Models – Probability Theory Basics – Latent Variables – Introduction to Unsupervised Learning – Applications of Generative AI in Art, Media, and Science – Overview of Common Generative Models – Tools and Libraries: TensorFlow, PyTorch, Hugging Face.

UNIT–II: Variational Autoencoders (VAEs):

Autoencoders: Basic Architecture – Limitations of Basic Autoencoders – Variational Autoencoders (VAEs) – Latent Space and Sampling – KL Divergence – Evidence Lower Bound (ELBO) – Reparameterization Trick – Applications in Image Generation – Conditional VAEs – Implementation using PyTorch/TensorFlow.

UNIT–III: Generative Adversarial Networks (GANs):

Introduction to GANs – Generator and Discriminator Networks – Adversarial Training – Loss Functions – Issues in GAN Training – DCGAN, Conditional GANs, CycleGAN, StyleGAN – Image-to-Image Translation – Text-to-Image Generation – Evaluation Metrics for GANs (FID, IS) – Hands-on Projects using GAN frameworks.

UNIT–IV: Autoregressive and Diffusion Models:

Autoregressive Models – PixelRNN, PixelCNN – Introduction to Transformers in Generative Modeling – Language Models (GPT family) – Attention Mechanism – Training and Sampling – Introduction to Diffusion Models – Denoising Diffusion Probabilistic Models (DDPMs) – Sampling Steps – Comparison with GANs – Use Cases in Art, Video, and Biology.



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UNIT–V: Applications and Ethics in Generative AI:

Applications in Image Synthesis, Text Generation, Audio/Music Creation, Drug Discovery – Ethics of Synthetic Media – Deepfakes and Misinformation – Legal Implications – Bias in Generative Models – Security Concerns – Frameworks for Responsible AI – Future of Generative AI – Case Studies from Industry (OpenAI, Google DeepMind, Adobe).

TEXT BOOKS:

1. David Foster, *Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play*, O'Reilly, 2nd Edition, 2022.
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, *Deep Learning*, MIT Press, 2016.
3. Francesco Coreia, *An Introduction to Generative AI*, Springer, 2023.

REFERENCE BOOKS:

1. Sebastian Raschka and Yuxi Liu, *Machine Learning with PyTorch and Scikit-Learn*, Packt Publishing, 2022.
2. Aurélien Géron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, O'Reilly, 3rd Edition, 2022.
3. Delip Rao and Brian McMahan, *Natural Language Processing with PyTorch*, O'Reilly Media, 2019.

COURSE OUTCOMES:

1. Understand the theoretical foundation and architecture of various generative models.
2. Apply generative AI techniques for data synthesis and creative content generation.
3. Design and implement VAEs, GANs, and diffusion models using industry tools.
4. Analyze the performance and limitations of generative models in practical scenarios.
5. Evaluate the ethical, legal, and societal impacts of synthetic media and generative systems.



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(Applicable from the academic year 2024-25 and onwards)

B.Tech_(Artificial Intelligence & Data Science)

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.

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, Querying Redis Data Stores, Changing Document Databases, Schema Evolution In Column-Oriented Databases, Hbase Data Import And Export, Data Evolution In Key/Value Stores.



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B.Tech_ (Artificial Intelligence & Data Science)

UNIT V

Indexing and Ordering Data Sets: Essential Concepts Behind A Database Index, Indexing And Ordering In MongoDB, Creating and Using Indexes In MongoDB, Indexing And Ordering In Couchdb, Indexing In Apache Cassandra.

Course Outcomes:

After the completion of the course, student will be able to do the following.

1. Define, compare and use the four types of NoSQL Databases (Document-oriented, Key Value Pairs, Column oriented and Graph).
2. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
3. Explain the detailed architecture, define objects, load data, query data and performance tune. Document oriented NoSQL databases.
4. Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data

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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(Applicable from the academic year 2024-25 and onwards)

B.Tech_ (Artificial Intelligence & Data Science)

IV Year I Semester	Agile methodologies Professional Elective-V	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce students to various software development methodologies,
- To familiarize students with popular Agile frameworks
- To enable students to apply Agile planning and estimation techniques.
- To train students in modern Agile development practices
- To develop students' ability to analyze Agile project performance using metrics

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

- Understand various software development methodologies
- Explain and compare different Agile frameworks like Scrum, XP, and Kanban, and identify appropriate practices for different software project scenarios.
- Apply Agile planning techniques such as release planning, iteration planning, and user story mapping,
- Demonstrate Agile development practices including TDD, BDD, CI/CD, refactoring, and pair programming,
- Analyze Agile project management metrics, team dynamics

UNIT I

Introduction to Agile Development- Overview of Software Development Methodologies, Traditional vs Agile: Waterfall vs Iterative vs Agile, Agile Manifesto and Principles, Benefits and Challenges of Agile, Agile vs Lean vs DevOps

UNIT II

Agile Frameworks and Practices- Scrum: Roles as Scrum Master, Product Owner, Dev Team , Artifacts, Ceremonies, Extreme Programming (XP): Practices and Values, Kanban: Workflow Visualization and WIP Limits, Agile Modelling and Crystal Methods, Choosing the Right Framework

UNIT III

Agile Project Planning and Estimation- Release Planning, Iteration Planning, User Stories and Story Mapping, Product Backlog and Sprint Backlog, Estimation Techniques: Planning Poker, T-Shirt Sizing, Velocity, Burn-down and Burn-up Charts



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UNIT IV

Agile Design, Development and Testing- Test-Driven Development (TDD), Behaviour Driven Development (BDD), Continuous Integration and Delivery (CI/CD), Refactoring and Pair Programming, Acceptance Testing and Agile Test Automation

UNIT V

Agile Project Management and Scaling-Agile Metrics and KPIs, Agile Team Dynamics and Roles, Scaling Agile: Safe, Less, Spotify Model, Agile in Distributed Teams, Agile Tools: JIRA, Trello, Azure DevOps.

TEXT BOOKS :

1. Robert C. Martin and Micah Martin, "Agile Software Development: Principles, Patterns, and Practices", Pearson Education, 1st edition, 2002.
2. Andrew Stellman, Jill Alison Hart, Learning Agile, O'Reilly, 1st edition, 2015.

REFERENCEBOOKS:

3. "Essential Scrum: A Practical Guide to the Most Popular Agile Process"
Kenneth S. Rubin
4. "User Stories Applied: For Agile Software Development"
Mike Cohn
5. "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation" Jez Humble & David Farley
6. "Large-Scale Scrum: More with Less" – Bas Vodde & Craig Larman



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B.Tech_ (Artificial Intelligence & Data Science)

IV Year I Semester	Cloud Computing Professional Elective-V	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.

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

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



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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)

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.

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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(Applicable from the academic year 2024-25 and onwards)

B.Tech_ (Artificial Intelligence & Data Science)

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.

UNIT-I:

Introduction and Basics of RL:

Defining RL Framework and Markov Decision Process, Policies, Value Functions and Bellman Equations, Exploration vs. Exploitation, Code Standards 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 .



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UNIT-V:

Meta-learning:

Multi-Agent Reinforcement Learning. Partially Observable Markov Decision Process . Ethics in RL .
Applying RL for real-world problem

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.

Recognize current advanced techniques and applications in RL

Text Books:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2nd edition, 2018
2. Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv:1810.06339 (2018).
3. Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning." Adaptation, learning, and optimization 12 (2012):

Reference books:

1. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach ." Pearson Education Limited, 2016.
2. Good fellow, Ian, Yoshua Bengio, and Aaron Courville. "Deep learning." MIT press, 2016. David Silver's course on Reinforcement Learning (link)



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B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

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B.Tech_ (Artificial Intelligence & Data Science)

IV Year I Semester	High-Performance Computing Professional Elective-V	L	T	P	C
		3	0	0	3

Course Objectives

This course covers the design of advanced modern computing systems. In particular, the design of modern microprocessors, characteristics of the memory hierarchy, and issues involved in multi-threading and multi-processing are discussed. The main objective of this course is to provide students with an understanding and appreciation of the fundamental issues and trade offs involved in the design and evaluation of modern computers

Course Outcomes

1. Understand the concepts and terminology of high performance computing
2. Can write and analyze the behavior of high performance parallel programs for distributed memory architectures (using MPI).
3. Can write and analyze the behavior of high performance parallel programs for shared memory architectures (using Pthreads and OpenMP).
4. Can write simple programs for the GPU.
5. Can independently study, learn about, and present some aspect of high performance computing.

UNIT I: Introduction to Parallel hardware and software, need for high performance systems and Parallel Programming, SISD, SIMD, MISD, MIMD models, Performance issues.

UNIT II: Processors, PThreads, Thread Creation, Passing arguments to Thread function, Simple matrix multiplication using Pthreads, critical sections, mutexes, semaphores, barriers and conditional variables, locks, thread safety, simple programming assignments.

UNIT III: Open MP Programming: introduction, reduction clause, parallel for-loop scheduling, atomic directive, critical sections and locks, private directive, Programming assignments, n body solvers using openMP.

UNIT IV: Introduction to MPI programming: MPI primitives such as MPI_Send, MPI_Recv, MPI_Init, MPI_Finalize, etc., Application of MPI to Trapezoidal rule, Collective Communication primitives in MPI, MPI derived data types, Performance evaluation of MPI programs, Parallel sorting algorithms, Tree search solved using MPI, Programming Assignments.

UNIT V: Introduction to GPU computing, Graphics pipelines, GPGPU, Data Parallelism and CUDA C Programming, CUDA Threads Organization, Simple Matrix multiplication using CUDA, CUDA memories. Benchmarking and Tools for High Performance Computing Environments, Numerical Linear Algebra Routines BLAS for Parallel Systems evaluation.



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Text Books

1. Michael J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill Education, 1st edition, 2003
2. Ananth Grama, An Introduction to Parallel Programming, 2nd Edition, Pearson Education, 2nd edition, 2003
3. David R. Butenhof, “Programming with POSIX Threads”, Addison-Wesley, 1st edition, 1997.

Reference Books

1. Programming Massively Parallel Processors, Kirk &Hwu,Elsevier,4th Edition, 2022.
2. Barbara Chapman “Using OpenMP: Portable Shared Memory Parallel Programming”, MIT Press, ,21st edition ,2007

IV Year I Semester	Open elective offered by other department	L	T	P	C
		3	0	0	3

IV Year I Semester	Open elective offered by other department	L	T	P	C
		3	0	0	3



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B.Tech_ (Artificial Intelligence & Data Science)

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)



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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

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



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Week-10

Capstone Project

Design a prompt-based solution for a real-world problem:

- Examples: résumé optimizer, content generator, legal contract explainer

TEXT BOOKS:

- You Look Like a Thing and I Love You by Janelle Shane – fun intro to how AI interprets prompts, Online Guide, 2019
- How to Talk to ChatGPT: The Art of Prompting by OpenAI , Online Guide, 2023
- The Art of Prompt Engineering with ChatGPT by Nathan Hunter, Online Guide, 2023
- **OpenAI Cookbook** – Prompt evaluation with GPT-4, Online, 2024

REFERENCEBOOKS:

- *Designing Bots: Creating Conversational Experiences* by Amir Shevat
- *Building Intelligent Systems: A Guide to Machine Learning Engineering* by Geoff Hulten

WEB REFERENCES

- Prompt Engineering Guide – <https://www.promptingguide.ai/>
- OpenAI Cookbook (Introduction to prompting) – <https://github.com/openai/openai-cookbook>
- Article: Anthropic’s Claude Prompting Guide – <https://docs.anthropic.com/claude/docs/prompting-best-practices>
- Notion Prompt Library – <https://www.notion.so/promptlibrary>
- **AI Text Generation Handbook (online)** – <https://textgeneration.com/>
- **OpenAI Cookbook** (Prompt examples: summarization, extraction, classification)
- **Deep Learning Prompt Engineering Course** by Andrew Ng & OpenAI – <https://learn.deeplearning.ai/chatgpt-prompt-eng/>
- **OpenAI API Docs** – <https://platform.openai.com/docs>
- **LangChain Documentation** – <https://docs.langchain.com>
- **Prompt Injection Guide** – <https://promptingguide.ai/risk/prompt-injection>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA
VIZIANAGARAM**

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2024-25 and onwards)

B.Tech_ (Artificial Intelligence & Data Science)

IV Year I Semester	Gender Sensitization Audit course	L	T	P	C
		2	0	0	-

Course: Objectives

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To introduce students to information about some key biological aspects of genders.
4. To expose the students to debates on the politics and economics of work.
5. To help students reflect critically on gender violence.
6. To expose students to more egalitarian interactions between men and women.

UNIT - I: UNDERSTANDING GENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men

- Preparing for Womanhood. Growing up Male. First lessons in Caste.

UNIT – II: GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences- Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary

UNIT – III: GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- “My Mother doesn’t Work.” “Share the Load.”-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. - Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

UNIT – IV: GENDER - BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: “*Chupulu*”.

Domestic Violence: Speaking Out/Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-“I Fought for my Life....”



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B.Tech_(Artificial Intelligence & Data Science)

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.

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.

☞ **ESSENTIAL READING:** The Textbook, “*Towards a World of Equals: A Bilingual Textbook on Gender*” written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu **published by Telugu Akademi, Telangana Government in 2015.**



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(Applicable from the academic year 2024-25 and onwards)

B.Tech_ (Artificial Intelligence & Data Science)

IV Year I Semester	Evaluation of Industry Internship	L	T	P	C
		-	-	-	2

B.Tech.– IV Year II Semester

IV Year II Semester	Full semester Internship & Project Work	L	T	P	C
		0	0	24	12