# NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

## B.Tech.

## Computer Science and Engineering

## (Artificial Intelligence)

## (4 Year Program)

**(Applicable for the Batches admitted from 2023-24)**

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
Kotappakonda Road, Yellamanda (Post), Narasaraopet – 522601, Guntur District, AP
Approved by AICTE, New Delhi & Permanently affiliated to JNTUK, Kakinada, Code: 47,
Accredited by NBA & NAAC A+, RTA Approved Pollution test Centre, ISO 9001: 2015 Certified Institution
Phone: 08647-239905 Website: www.nrtec.in

# Institute's Vision, Mission & Values

**Vision:**

To emerge as a Centre of excellence in technical education with a blend of effective student centric teaching learning practices as well as research for the transformation of lives and community.

**Mission:**

**M1:** Provide the best class infra-structure to explore the field of engineering and research.

**M2:** Build a passionate and a determined team of faculty with student centric teaching, imbibing experiential, innovative skills.

**M3:** Imbibe lifelong learning skills, entrepreneurial skills and ethical values in students for addressing societal problems.

**Values:**

- **Student-centric education:** Meeting the community's and student's needs by developing a world-class educational environment with cultural values.
- **Excellence:** Giving special attention towards the standards of integrity and performance to help the institute in leading academic achievements and professional goals.
- **Collaboration:** Seeking the latest input and working closely with all the industrial sectors and Society for the continuous upgradation of the quality of education.
- **Diversity:** Creating a favourable on-campus environment in which the goals and learning styles of all students are recognised and nurtured.
- **Continuous Development:** Encouraging enthusiastic, innovative thinkers and learners to strive for personal growth in the world of inventions and start-ups.
- **Technological Advancement:** Keeping pace with evolving technology and professional trends to prepare all its students to achieve success in the workplace.

# Department Vision, Mission, PSOs & PEOs

**Vision:**

To be a centre of excellence in Artificial Intelligence education, research and innovation by nurturing competent professionals capable of developing intelligent and ethical solutions for the advancement of society and industry.

**Mission:**

**M1:** Promote innovation, interdisciplinary research and industry collaboration through advanced infrastructure and a culture of continuous learning.

**M2:** Provide a strong foundation in Artificial Intelligence, computing, mathematics and data sciences through student-centric and experiential learning.

**M3:** Develop socially responsible professionals with ethical values, leadership qualities and entrepreneurial mindset to address real-world challenges using Artificial Intelligence.

## PROGRAM SPECIFIC OBJECTIVES (PSOs)

**PSO1:** Apply knowledge of human cognition, AI, ML, and Data Engineering to analyze and solve complex real-world problems.

**PSO2:** Design solutions using computational skills and innovative tools in AI, ML and DL to meet specific needs for societal needs.

**PSO3:** Demonstrate acquired knowledge to lead teams or projects and involve in research and development problems.

## PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

**PEO1:** Be engaged as an engineer with a strong foundation in modern computing and engineering fields such as research, design and development.

**PEO2:** Apply AI concepts and multidisciplinary knowledge to design effective engineering solutions while demonstrating technical skills and teamwork.

**PEO3:** Develop professional competence, ethical values, communication skills, and a commitment to lifelong learning to contribute to society and adapt to emerging technologies.

# Academic Regulations (R23) for B.Tech. (Regular)

**(Effective for the students admitted into I year from the Academic Year 2023-2024 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 Gapyear facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted forgraduation (Eight years).
      (ii) Registers for 160 credits and secures all 160 credits.

   **(b) Award of B.Tech. degree with Honors**
   A student will be declared eligible for the award of the B.Tech. with Honors ifhe/she fulfils the following:
      (i) Student secures additional 15 credits fulfilling all the requisites of aB.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 inB.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 studentin 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 hoursof 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

studentsto 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) | Percentag eof total credits | AICTE Recommend ation(%) |
|---|---|---|---|---|
| 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 Core 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 andIndustry 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 NCC /NSS /Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduatestudents.
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 creditcourses for all the undergraduate students.
viii. Increased flexibility for students through an increase in the elective componentof 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 canlead 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 relevantto 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 fiveskill 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 eightweeks 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 College for the students having good academic record.
xvi. College will plan 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. College will 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. Incase 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 70marks for the End-Examination.

ii) For practical subject, the distribution shall be 30 marks for Internal Evaluation and70 marks for the End- Examination.

iii) If any course contains two different branch subjects, the syllabus shall be written intwo 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 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 weightageof 10 marks. Any fraction shall be rounded off to the next higher mark.
- The objective paper shall be conducted either online or offline by the respectivedepartment on the day of subjective paper test.
- If conducted offline, the midterm examination shall be conducted first by distribution of the Objective paper, simultaneously marking the attendance, after 20 minutes the answered objective paper shall be collected back. The student is not allowed to leave the examination hall.
  Then the descriptive question paper and the answer booklet shall be distributed.After 90 minutes the answered booklets are collected back.
- Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuousassessment throughout the semester and the average marks shall be considered.
- Assignment Test if conducted like slip tests, the following procedure may be followed: Two assignment tests may be conducted before first and second mid examinations for 5 marks. First assignment test may be conducted after the 1st Unit of syllabus. 5 or 6 questions may be announced in advance. On the day of test, 2 questions will be given to each student randomly. The test may be conducted in the first hour for 30 minutes. Second assignment test may be conducted in the similar way after the completion of 3rd Unit of syllabus.

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

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

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

For Example:

Marks obtained in first mid: 25 Marks obtained in second mid: 20
Final mid semester Marks: (25x0.8) + (20x0.2) = 24

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

Marks obtained in first mid: AbsentMarks obtained in second mid: 25
Final mid semester Marks: (25x0.8) + (0x0.2) =20

**b) End Examination Evaluation:**

End examination of theory subjects shall have the following pattern:

i) There shall be 6 questions and all questions are compulsory.

ii) Question I shall contain 10 compulsory short answer questions for a total of20 marks such that each question carries 2 marks.
iii) There shall be 2 short answer questions from each unit.
iv) 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.
v) The questions from 2 to 6 shall be set by covering one unit of the syllabus for eachquestion.

End examination of theory subjects consisting of two parts of different subjects, forExample: 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 35marks each.
ii) In each part, question 1 shall contain 5 compulsory short answer questions for a totalof 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 markseach. 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 eachquestion.

**PRACTICAL COURSES**

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

a) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.
b) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concernedlaboratory teacher based on the regularity/record/viva and 15 marks for the internaltest.
c) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and External examiner from the other reputed Institutions.
   - 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 singlelaboratory 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.

d) 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 teacherbased 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 withweightage of 80% to better mid marks and 20% for the other. The subjective papershall contain 3 either or type questions of equal weightage of 5 marks. There shallbe no objective paper in mid semester examination. The sum of day-to-dayevaluation 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 othersubjects related to design/drawing, multiple branches, etc is mentioned along withthe syllabus.

**10.** 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. 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 thecourse. 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 abovecommittee 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 theagency. 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 equivalentmarks/grades.

vi) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the concerted department's HOD at the beginning of the semester.

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 Principal.

**11. Massive Open Online Courses (MOOCs):**

A Student has to pursue and complete one course compulsorily through MOOCs approved by the HOD. 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) offeredthrough 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 studentneeds 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 MOOCsplatform 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 College.

Necessary amendments in rules and regulations regarding adoption of MOOC courseswould 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 College 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 College shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learningcourses.

ii) Student registration for the MOOCs shall be only through the respective department, 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 concerned department shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.
vi) The department's HOD will designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.
vii) The College will ensure no overlap of MOOC exams with that of the End Semester examination schedule.
viii) Student pursuing courses under MOOCs shall acquire the required credits onlyafter successful completion of the course and submitting a certificate issued bythe competent authority along with the percentage of marks and grades.
ix) The Department shall submit the following to the examination section:
    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 College 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 respective Department from time to time.

**13. Academic Bank of Credits (ABC)**

The College 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 digitalplatforms.
iii. facilitate award of certificate/diploma/degree in line with the accumulatedcredits in ABC
iv. Execute Multiple Entry and Exit system with credit count, credit transfer andcredit acceptance from student's account.

**14. Mandatory InternshipsSummer 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 theend of second year (Community Service Project) shall be society oriented and shall be completed in collaboration with government organizations/NGOs & others.

The other internship at the end of third year is Industry Internship and shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The guidelines issued by the APSCHE / University shall be followed for carrying out and

evaluation of Community Service Project and Industry Internship.

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior facultymember 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% weightageeach. 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 College.

**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 is 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 showcasedat the department for the benefit of all students and staff and the same is to be evaluatedby 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-VoceExamination conducted in the presence of internal examiner and external examiner appointed by the Principal and is evaluated for 140 marks.

The HOD shall facilitate and monitor the student internship programs. Completion ofinternships is mandatory, if any student fails to complete internship, he/she will not beeligible 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 intoB.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 may be waived for students who have done similar/equivalentcourses. 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 within the 160 credits 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 andresearch.

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 (4 theory courses of 3 credits each **And** One MOOC course of 3 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 one subject per semester pertaining to the Honors from IV Semester onwards.

iv) The college will 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 MOOC course in online platforms like SWAYAM with a minimum duration of 12 weeks for 3-credits satisfying the criteria for credit mobility. Student can register for online MOOC course in any semester starting from the 4$^{th}$ Semester. Should submit the MOOC certificate before the commencement of 7$^{th}$ Semester End Examinations. For the 4 theory courses offered by the college, 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. Honors courses should be completed in a single attempt otherwise the registration for honors stands cancelled.

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

sheetmentioning 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.

xii) Student who registered for Honors should pass all subsequent regular semester courses in a single attempt with a minimum of 7 SGPA.

**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 SGPA obtained in each semester in the major degree program. 7 SGPA shall be maintained in all semesters up to III semester in case of regularentry students and only III semester in case of lateral entry students. Students having 7 SGPA(in all semesters) 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. 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. Anadvisor/mentor from parent department shall be assigned to a group of studentsto monitor the progress.

iv) There is no fee for registration of subjects for Honors program offered in offlinemode.

**17. Attendance Requirements:**

i) A student shall be eligible to appear for the University external examinations ifhe/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 attendanceto the College.

iv) Students whose shortage of attendance is not condoned in any semester are noteligible 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.

viii) For induction programme attendance shall be maintained as per AICTEnorms.

**18. 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 College 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 maybe 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 usingthe following Letter Grades and corresponding percentage of marks shall be followed:

**A**fter each course is evaluated for 100 marks, the marks obtained in each course will beconverted 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 | S (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 andwill be required to reappear for that subject when it is offered in 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 GradePoint Average (CGPA):

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

$$SGPA = \Sigma (Ci \times Gi)/\Sigma Ci$$

where, Ci is the number of credits of the ith subject and Gi is the grade point scored by the student in the ith course.

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

$$CGPA = \Sigma (Ci \times Si)/ \Sigma Ci$$

where "Si" is the SGPA of the ith semester and Ci is the total numberof credits up to that semester.

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

Semester Grade Point Average(SGPA) for a semster will be computed only for those students, who have successfully passed all the courses of that semester. Similarly Cumulative Grade Point Average(CGPA) will be computed for the current semester only for those candidates who successfully completed all the courses starting from the 1st Semester to the Current Semester.

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 ,E 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 oneof the following four classes:

| Class Awarded | CGPA Secured |
|---|---|
| First Class with Distinction | ≥ 7.5 (Without any supplementaryappearance) |
| First Class | ≥ 6.5 < 7.5 |
| Second Class | ≥ 5.5 < 6.5 |
| Pass Class | ≥ 5.0 < 5.5 |

- **Note:** Students who have written supplementary examinations to fulfil the credit requirement will not be awarded First Class with Distinction. For such students thehighest degree that is awarded will be First Class Only.

**CGPA to Percentage conversion Formula – (CGPA – 0.5) x 10**

**20. With–holding of Results**

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

**21. Multiple Entry / Exit Option**

**(a) Exit Policy:**

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

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 acquirejob-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 acquirejob-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 ofMultiple 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 outstandingstudents 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 mostand these two years would not be counted for the time for the maximum time for graduation. The HOD of the respective department shall forward such proposals submitted by the students to the Principal. An evaluation committee constituted by the Principal 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 orequivalent 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 arereadmitted.

**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:**

a. The academic regulations should be read as a whole for purpose of any interpretation.
b. Malpractices rules-nature and punishments are appended.
c. Where the words “he”, “him”, “his”, occur in the regulations, they also include

"she", "her", "hers", respectively.

d. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
e. The Universities may change or amend the academic regulations or syllabi at any timeand the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Universities.
f. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decisionof the Vice-Chancellor / Head of the institution is final.

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## ACADEMIC REGULATIONS (R23) FOR B.TECH. (LATERAL ENTRY SCHEME)

*(Effective for the students getting admitted into II year through Lateral Entry Schemefrom the Academic Year **2024-2025** 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 notmore 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 forgraduation (Six years).
      (ii) Registers for 120 credits and secures all 120 credits.

   **(c) Award of B.Tech. degree with Honors**
   A student will be declared eligible for the award of the B.Tech. with Honors ifhe/she fulfils the following:
      (i) Student secures additional 15 credits fulfilling all the requisites of aB.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).

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# MALPRACTICES RULES

## DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

- The Principal shall refer the cases of Malpractices in Internal Assessment Test and Semester end examinations to a malpractice prevention committee constituted by him for the purpose. Such committee shall follow the approved levels of punishment. The Principal shall take necessary action against the students based on the recommendations of the committee.

- Any action by the candidate trying to get undue advantage in the performance or trying
  to help another, or derive the same through unfair means is punishable according to the provisions contained here under

| | **Nature of Malpractices/ Improper conduct** | **Punishment** |
|---|---|---|
| | *If the candidate:* | |
| 1(a) | Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination). | Expulsion from the examination hall and cancellation of the performance in that subject only. |
| 1(b) | Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter. | Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him. |
| 2. | Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the college. |

| | | |
|---|---|---|
| 3. | Impersonates any other candidate in connection with the examination. | The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and to be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him. |
| 4. | Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination. | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 5. | Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks. | Cancellation of the performance in that subject. |
| 6. | Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent /any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of | In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the<br>Police and a police case is registered against them. |

| | | |
|---|---|---|
| | his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination. | |
| 7. | Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall. | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 8. | Possess any lethal weapon or firearm in the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. |
| 9. | If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8. | Student of the college expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. |

| | | |
|---|---|---|
| | | The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to police and, a police case will be registered against them. |
| 10. | Comes in a drunken condition to the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. |
| 11. | Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny. | Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations. |
| 12. | If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the college for further action to award suitable punishment. | |

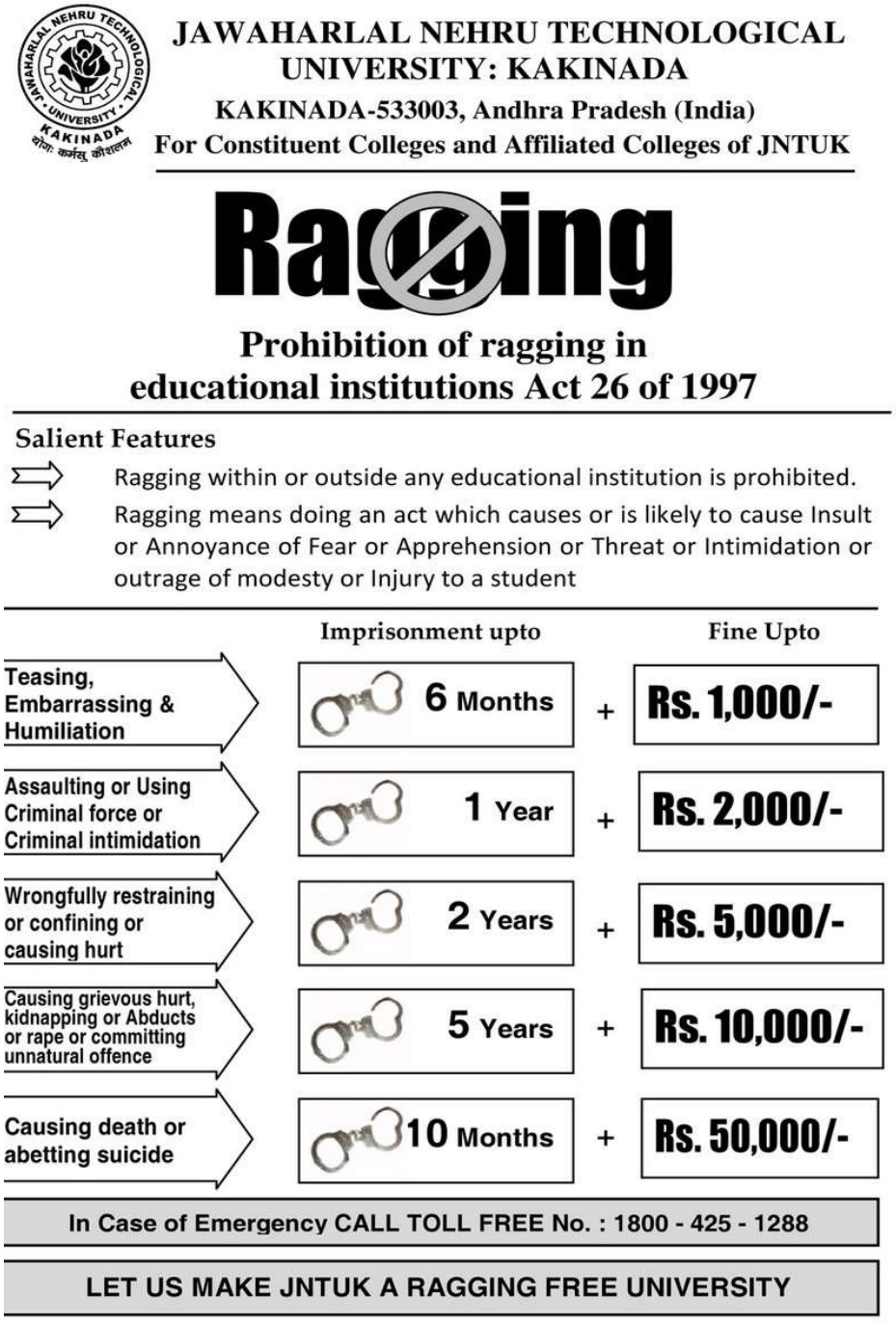
**OTHER MATTERS:**

1. Physically challenged candidates who have availed additional examination time and a scribe during their intermediate / EAPCET examinations will be given similar concessions on production of relevant proof / documents.
2. The Principal shall deal in an appropriate manner with any academic problem which is not covered under these rules and regulations, in consultation with the Controller of Examinations and Heads of the departments and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of regulation, approved in the meetings of the Heads of the departments shall be reported to the Academic Council for ratification.

**GENERAL**:

1. The academic council may, from time to time, revise, amend or change the regulations, schemes of examinations and / or syllabi.
2. Where ever the words “he’’, “him’’, “his’’ occur in the regulations, they include “she’’, “her’’, “hers’’.

3. The academic regulation should be read as a whole for the purpose of any interpretation.
4. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.
5. Malpractice cases will be indicated in the grade card with letters 'MP'.



## ANNEXURE-I

## COMMUNITY SERVICE PROJECT

Experiential learning through community engagement

As per the decision of the concerned department BOS

### Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
- Community Service Project involves stusdents in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

### Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.
- Implementation of Community Service Project
- Every student should put in a minimum of **180 hours** for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.

- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The log book has to be countersigned by the concerned mentor/faculty incharge.
- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

**Procedure**

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
- First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
- Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –

    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology

- Energy
- Internet
- Free Electricity
- Drinking Water

# EXPECTED OUTCOMES

## BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

**Learning Outcomes**

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

**Personal Outcomes**

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development.
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

**Social Outcomes**

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

**Career Development**

- Connections with professionals and community members for learning and career opportunities.
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity.

**Relationship with the Institution**

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

**Benefits of community service project to faculty members**

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

**Benefits of community service project to colleges and universities**

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

**Benefits of community service project to community**

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm and perspectives applied to community work
- Enhanced community-university relations.

## Suggestive list of programmes under community Service project

The following is the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

**For Engineering Students**

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries

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# B.TECH. – R23 COURSE STRUCTURE

# INDUCTION PROGRAMME

| S.No | Course Name | Category | L | T | P | CREDITS |
|---|---|---|---|---|---|---|
| 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 B.TECH - I SEMESTER

| S.No | Subject Code | Subject | Cat. Code | Internal Marks | External Marks | Total Marks | L | T | P | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | R23CC1101 | LINEAR ALGEBRA & CALCULUS | BS&H | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 2 | R23CC1102 | INTRODUCTION TO PROGRAMMING | ES | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 3 | R23CC1103 | COMMUNICATIVE ENGLISH | BS&H | 30 | 70 | 100 | 2 | 0 | 0 | 2 |
| 4 | R23CC1104 | BASIC CIVIL AND MECHANICAL ENGINEERING | ES | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 5 | R23CC1105 | CHEMISTRY | BS&H | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 6 | R23CC11L1 | COMPUTER PROGRAMMING LAB | ES | 30 | 70 | 100 | 0 | 0 | 3 | 1.5 |
| 7 | R23CC11L2 | COMMUNICATIVE ENGLISH LAB | BS&H | 30 | 70 | 100 | 0 | 0 | 2 | 1 |
| 8 | R23CC11L3 | ENGINEERING WORKSHOP | ES | 30 | 70 | 100 | 0 | 0 | 3 | 1.5 |
| 9 | R23CC11L4 | CHEMISTRY LAB | BS&H | 30 | 70 | 100 | 0 | 0 | 2 | 1 |
| 10 | R23CC11MC1 | HEALTH AND WELLNESS, YOGA AND SPORTS | BS&H | 30 | 70 | 100 | - | - | 1 | 0.5 |
| **TOTAL** | | | | | | | | | | **19.5** |

## I B.TECH - II SEMESTER

| S.No | Subject Code | Subject | Cat. Code | Internal Marks | External Marks | Total Marks | L | T | P | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | R23CC1201 | DIFFERENTIAL EQUATIONS & VECTOR CALCULUS | BS&H | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 2 | R23CC1202 | DATA STRUCTURES | PC | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 3 | R23CC1203 | BASIC ELECTRICAL & ELECTRONICS ENGINEERING | ES | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 4 | R23CC1204 | ENGINEERING GRAPHICS | ES | 30 | 70 | 100 | 1 | 0 | 4 | 3 |
| 5 | R23CC1205 | ENGINEERING PHYSICS | BS&H | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 6 | R23CC12L1 | DATA STRUCTURES LAB | PC | 30 | 70 | 100 | 0 | 0 | 3 | 1.5 |
| 7 | R23CC12L2 | IT WORKSHOP | ES | 30 | 70 | 100 | 0 | 0 | 2 | 1 |
| 8 | R23CC12L3 | ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP | ES | 30 | 70 | 100 | 0 | 0 | 3 | 1.5 |
| 9 | R23CC12L4 | ENGINEERING PHYSICS LAB | BS&H | 30 | 70 | 100 | 0 | 0 | 2 | 1 |
| 10 | R23CC12A1 | NSS/NCC/SCOUTS & GUIDES/ COMMUNITY SERVICE | BS&H | 30 | 70 | 100 | - | - | 1 | 0.5 |
| **TOTAL** | | | | | | | | | | **20.5** |

## B.Tech.– II Year I Semester

| S.No. | Subject Code | Cat. Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | R23CC2101 | BS&H | Discrete Mathematics & Graph Theory | 3 | 0 | 0 | 3 |
| 2 | R23CC2102 | BS&H | Universal Human Values 2- Understanding Harmony | 2 | 1 | 0 | 3 |
| 3 | R23CC2103 | ES | Artificial Intelligence | 3 | 0 | 0 | 3 |
| 4 | R23CC2104 | PC | Advanced Data Structures & Algorithms Analysis | 3 | 0 | 0 | 3 |
| 5 | R23CC2105 | PC | Object-Oriented Programming Through Java | 3 | 0 | 0 | 3 |
| 6 | R23CC21L1 | PC | Advanced Data Structures and Algorithms Analysis Lab | 0 | 0 | 3 | 1.5 |
| 7 | R23CC21L2 | PC | Object-Oriented Programming Through Java Lab | 0 | 0 | 3 | 1.5 |
| 8 | R23CC21L3 | SC | Python Programming | 0 | 1 | 2 | 2 |
| 9 | R23CC21MC | AC | Environmental Science | 2 | 0 | 0 | - |
| | | **Total** | | **15** | **2** | **10** | **20** |

## B.Tech.– II Year II Semester

| S.No. | Subject Code | Cat. Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | R23CC2208 | MC | Optimization Techniques | 2 | 0 | 0 | 2 |
| 2 | R23CC2202 | ES | Probability & Statistics | 3 | 0 | 0 | 3 |
| 3 | R23CC2206 | PC | Machine Learning | 3 | 0 | 0 | 3 |
| 4 | R23CC2204 | PC | Database Management Systems | 3 | 0 | 0 | 3 |
| 5 | R23CC2207 | PC | Digital Logic and Computer Organization | 3 | 0 | 0 | 3 |
| 6 | R23AI22L4 | PC | AI & ML Lab | 0 | 0 | 3 | 1.5 |
| 7 | R23CC22L1 | PC | Database Management Systems Lab | 0 | 0 | 3 | 1.5 |
| 8 | R23CC22L2 | SC | Full Stack Development-1 | 0 | 1 | 2 | 2 |
| 9 | R23CC22L3 | BS&H | Design Thinking & Innovation | 1 | 0 | 2 | 2 |
| | | **Total** | | **15** | **1** | **12** | **21** |
| | | Mandatory Community Service Project Internship of 08 weeks duration during summer vacation | | | | | |

## B.Tech.– III Year I Semester

| S.No. | Subject Code | Cat. Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | R23AI3104 | PC | Deep Learning | 3 | 0 | 0 | 3 |
| 2 | R23CC3101 | PC | Computer Networks | 3 | 0 | 0 | 3 |
| 3 | R23CC3115 | PC | Operating Systems | 3 | 0 | 0 | 3 |
| 4 | R23CC3102<br>R23CC3103<br>R23AI3106<br>R23AI3107 | PE-1 | 1. Object Oriented Analysis and Design<br>2. Automata Theory & Compiler Design<br>3. Soft computing<br>4. Internet of Things | 3 | 0 | 0 | 3 |
| 5 | | OE-1 | Course offered by other departments<br>OR<br>Entrepreneurship Development & Venture Creation | 3 | 0 | 0 | 3 |
| 7 | R23AI31L1 | PC | Deep learning Lab | 0 | 0 | 3 | 1.5 |
| 8 | R23AI31L2 | PC | Computer Networks Lab | 0 | 0 | 3 | 1.5 |
| 9 | R23AI31L3 | SC | Full Stack development-2 / SWAYAM Plus – Data Engineer / AI Engineer / | 0 | 1 | 2 | 2 |
| 10 | R23AI31L4 | ES | Tinkering Lab (*User Interface Design using Flutter*) / SWAYAM Plus - Android Application Development (with Flutter) | 0 | 0 | 2 | 1 |
| 11 | R23CC31CSP | Evaluation of Community Service Project Internship | | - | - | - | 2 |
| | | | **Total** | **15** | **1** | **10** | **23** |
| MC | | Student may select from the Same Minor Pool | | 3 | 0 | 3 | 4.5 |
| MC | | Minor Course through SWAYAM / NPTEL (Minimum 12 Week, 3 credit course) | | 3 | 0 | 0 | 3 |
| HC | | Student may select from the Same Honors Pool | | 3 | 0 | 0 | 3 |
| HC | | Student may select from the Same Honors Pool | | 3 | 0 | 0 | 3 |

## B. Tech – III Year II Semester

| S.No. | Subject Code | Cat. Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | R23CC3212 | PC | Software Engineering | 3 | 0 | 0 | 3 |
| 2 | R23CC3210 | PC | Generative A.I. | 3 | 0 | 0 | 3 |
| 3 | R23CC3211 | PC | Data Visualization | 3 | 0 | 0 | 3 |
| 4 | R23AM3204<br>R23AM3205<br>R23AM3207<br>R23CC3209<br>R23CC32MOOC1 | PE-II | 1. Software Testing Methodology<br>2. Cryptography & Network Security<br>3. Recommender Systems<br>4. DevOps<br>5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS | 3 | 0 | 0 | 3 |
| 5 | R23CS3204<br>R23CC3204<br>R23AI3207<br>R23CC3203<br>R23CC32MOOC2 | PE-III | 1. Software Project Management<br>2. Mobile Adhoc Networks<br>3. Computer Vision<br>4. Cloud Computing<br>5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS | 3 | 0 | 0 | 3 |
| 6 | | OE-II | Introduction to Embedded Systems offered by Dept. of ECE) | 3 | 0 | 0 | 3 |
| 7 | R23AI32L1 | PC | Generative A.I. Lab | 0 | 0 | 3 | 1.5 |
| 8 | R23AI32L2 | PC | Data Visualization Lab | 0 | 0 | 3 | 1.5 |
| 9 | R23AI32L3 | SC | Soft skills / SWAYAM Plus - 21st Century Employability Skills | 0 | 1 | 2 | 2 |
| 10 | R23AI32MC | AC | Technical Paper Writing & IPR | 2 | 0 | 0 | - |
| **Total** | | | | **20** | **1** | **8** | **23** |
| *Mandatory Industry Internship/Mini Project of 08 weeks duration during summer vacation | | | | | | | |
| MC | | Student may select from the same minors pool | | 3 | 0 | 3 | 4.5 |
| MC | | Minor Course<br>(Student may select from the same specialized minors pool) | | 3 | 0 | 0 | 3 |
| HC | | Student may select from the same honors pool | | 3 | 0 | 0 | 3 |
| HC | | Honors Course<br>( Student may select from the honors pool) | | 3 | 0 | 0 | 3 |

## B. Tech– IV Year I Semester

| S.No. | Subcode | Cat. Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | R23AM4109 | PC | Natural Language Processing | 3 | 0 | 0 | 3 |
| 2 | R23CC4101 | MC - II | Human Resources & Project Management | 2 | 0 | 0 | 2 |
| 3 | 1. R23AI4168<br>2. R23AI4169<br>3. R23AI4170<br>4. R23AI4171<br>5. R23CC41MOOC | PE-IV | 1. Software Architecture & Design Patterns<br>2. Block Chain Technology<br>3. Quantum Computing<br>4. Augmented Reality and Virtual Reality<br>5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS | 3 | 0 | 0 | 3 |
| 4 | 1. R23CC4102<br>2. R23AI4172<br>3. R23AI4173<br>4. R23AI4174 | PE-V | 1. Agile Methodologies<br>2. Architecture for Management of Large Datasets<br>3. Reinforcement Learning<br>4. High Performance Computing<br>5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS | 3 | 0 | 0 | 3 |
| 5 | 1. R23OE4110<br>2. R23OE4108 | OE - III | 1. Object Oriented Programming Through Java<br>2. Introduction to Smart Manufacturing | 3 | 0 | 0 | 3 |
| 6 | 1. R23OE4106<br>2. R23OE4112<br>3. R23OE4151 | OE - IV | 1. Computer Networks<br>2. Software Engineering<br>3. Data Structures for Data Science | 3 | 0 | 0 | 3 |
| 7 | R23CC41L1 | SC | Prompt Engineering / SWAYAM Plus – Certification program in Prompt Engineering and ChatGPT | 0 | 1 | 2 | 2 |
| 8 | R23CC41MC | AC | Constitution of India | 2 | 0 | 0 | - |
| 9 | R23CC41IN | Internship | Evaluation of Industry Internship / Mini Project | - | - | - | 2 |
| | | | **Total** | **19** | **1** | **2** | **21** |
| MC | Student may select from the same minors pool | | | 3 | 0 | 3 | 3 |
| HC | Student may select from the same honors pool | | | 3 | 0 | 0 | 3 |
| HC | Student may select from the same honors poo | | | 3 | 0 | 0 | 3 |

* Under Industry Internship interested students can pursue SWAYAM Plus courses viz., Hands-on Masterclass on Data Analytics OR Artificial Intelligence for Real-World Application

## B. Tech– IV Year II Semester

| S.No. | Subcode | Category | Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | | Internship / Project Work | Full Semester Internship & Project Work | 0 | 0 | 24 | 12 |

***Note: Student need to do at least ONE MOOC Course (3 credits out of 160 credits) to meet the mandatory requirement (11th criteria, as per R23 Regulations)***

**Open Electives, offered to other department students:**

Open Elective I:

- Entrepreneurship Development & Venture Creation
- Operating Systems
- Computer Organization and Architecture

Open Elective II:

- Database Management Systems

Open Elective III:

- Object Oriented Programming Through Java
- Quantum Science & Technology

Open Elective IV:

- Computer Networks
- Software Engineering
- Data Structures for Data Science

## Minor Engineering

*Note:*

1. *To obtain Minor Engineering, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.*
2. *During Minor/Honors Course selection, there should not be any overlapping with Regular/Major/OPEN Electives*

| **For Minor in AI:** | **L-T-P-C** |
|---|---|
| 1. Database Management Systems | 3-0-3-4.5 (II-II) |
| 2. Introduction to Artificial Intelligence | 3-0-0-3 (III-I) |
| 3. Advanced Data Structures & Algorithm Analysis | 3-0-3-4.5 (III-II) |
| 4. Mathematics for Machine Learning * | 3-0-0-3 (IV-I) |

**Any of the following 12 Week 3 credit NPTEL MOOC Courses**

5. Object Oriented Programming Through Java
6. Computer Networks and Internet Protocol
7. Advanced Data Structures & Algorithm Analysis
8. Operating Systems
9. Software Engineering
10. Deep Learning

**Note**: As per AICTE APH 2023-24 student can opt any one of the following streams:

1. Honors in CSE
2. Honors in AI&ML
3. Honors in Data Science

**Suggested MOOC Courses for HONORS in CSE**

**Student need to obtain 18 Credits by successfully completing the following**

**Mandatory Course(s)**

1. Parallel Computer Architecture (MOOCS- SWAYAM / NPTEL 12W)
2. Quantum Algorithms and Cryptography (MOOCS- SWAYAM / NPTEL 12W)

**Any of the following for remaining 12 Credits**

3. Deep Learning for Computer Vision (MOOCS- SWAYAM / NPTEL 12W)
4. Applied Linear Algebra in AI & ML (MOOCS- SWAYAM / NPTEL 12W)
5. Applied Time-Series Analysis (MOOCS- SWAYAM / NPTEL 12W)
6. Machine Learning for Engineering and Science Applications (MOOCS- SWAYAM / NPTEL 12W)
7. Practical High-Performance Computing (MOOCS- SWAYAM / NPTEL 12W)
8. Deep Learning for Natural Language Processing (MOOCS- SWAYAM / NPTEL 12W)
9. Privacy and Security in Online Social Media (MOOCS- SWAYAM / NPTEL 12W)
10. Natural Language Processing (MOOCS- SWAYAM / NPTEL 12W)

## I B.TECH - I SEMESTER

| S.No | Subject Code | Subject | Cat. Code | Internal Marks | External Marks | Total Marks | L | T | P | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | R23CC1101 | LINEAR ALGEBRA & CALCULUS | BS&H | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 2 | R23CC1102 | INTRODUCTION TO PROGRAMMING | ES | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 3 | R23CC1103 | COMMUNICATIVE ENGLISH | BS&H | 30 | 70 | 100 | 2 | 0 | 0 | 2 |
| 4 | R23CC1104 | BASIC CIVIL AND MECHANICAL ENGINEERING | ES | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 5 | R23CC1105 | CHEMISTRY | BS&H | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 6 | R23CC11L1 | COMPUTER PROGRAMMING LAB | ES | 30 | 70 | 100 | 0 | 0 | 3 | 1.5 |
| 7 | R23CC11L2 | COMMUNICATIVE ENGLISH LAB | BS&H | 30 | 70 | 100 | 0 | 0 | 2 | 1 |
| 8 | R23CC11L3 | ENGINEERING WORKSHOP | ES | 30 | 70 | 100 | 0 | 0 | 3 | 1.5 |
| 9 | R23CC11L4 | CHEMISTRY LAB | BS&H | 30 | 70 | 100 | 0 | 0 | 2 | 1 |
| 10 | R23CC11MC1 | HEALTH AND WELLNESS, YOGA AND SPORTS | BS&H | 30 | 70 | 100 | - | - | 1 | 0.5 |
| **TOTAL** | | | | | | | | | | **19.5** |

| I B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC1101 | **LINEAR ALGEBRA AND CALCULUS (Common to All Branches)** | | | | | | |

**COURSE OBJECTIVES:**

- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

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

**CO1:** Develop and use of matrix algebra techniques that are needed by engineers for practical applications.

**CO2:** Utilize mean value theorems to real life problems.

**CO3:** Familiarize with functions of several variables which is useful in optimization.

**CO4:** Learn important tools of calculus in higher dimensions.

**CO5:** Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.

**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, Jacobi and Gauss Seidel Iteration Methods.

**UNIT II: Eigenvalues, Eigenvectors and Orthogonal Transformation**

Eigenvalues, Eigenvectors and their properties, 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)**

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Directional derivative, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

**UNIT V: Multiple Integrals (Multi variable Calculus)**

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

**TEXTBOOKS:**

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

**REFERENCE BOOKS:**

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition(9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9th edition
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, Third Edition (Reprint 2021)

| I B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC1102 | **INTRODUCTION TO PROGRAMMING** | | | | | | |

**COURSE OBJECTIVES:**

- To introduce students to the fundamentals of computer programming.
- To provide hands-on experience with coding and debugging.
- To foster logical thinking and problem-solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- To encourage collaborative learning and teamwork in coding projects.

**COURSE OUTCOMES: A student after completion of the course will be able to**

**CO1:** Understand basics of computers, the concept of algorithm and algorithmic thinking.

**CO2:** Analyse a problem and develop an algorithm to solve it.

**CO3:** Implement various algorithms using the C programming language.

**CO4:** Understand more advanced features of C language.

**CO5:** Develop problem-solving skills and the ability to debug and optimize the code.

**UNIT I**

**Introduction to Programming and Problem Solving:** History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

**Problem solving techniques:** Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

**UNIT II**

**Control Structures:** Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do- while) Break and Continue.

**UNIT III**

**Arrays and Strings:** Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.

**UNIT IV**

**Pointers & User Defined Data types:** Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

**UNIT V**

**Functions & File Handling:** Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

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

**TEXTBOOKS:**

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

**REFERENCE BOOKS:**

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

| I B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 2 | 0 | 0 | 30 | 70 | 100 | 2 |
| SUBCODE: R23CC1103 | **COMMUNICATIVE ENGLISH** | | | | | | |

**COURSE OBJECTIVES:**

- The main objective of introducing this course, *Communicative English,* is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

**COURSE OUTCOMES:**

**CO1**: Understand the context, topic, and pieces of specific information from social or Transactional dialogues.

**CO2:** Apply grammatical structures to formulate sentences and correct word forms.

**CO3:** Analyze discourse markers to speak clearly on a specific topic in informal discussions.

**CO4:** Evaluate reading / listening texts and to write summaries based on global comprehension of these texts.

**CO5:** Create a coherent paragraph, essay, and resume.

**UNIT I**

**Lesson: HUMAN VALUES:** Gift of Magi **(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.

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

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

**UNIT II**

**Lesson: NATURE: The Brook by Alfred Tennyson (Poem)**

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

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

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

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

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

**Vocabulary:** Homonyms, Homophones, Homographs.

**UNIT III**

**Lesson: BIOGRAPHY: Elon Musk**

**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:** Readinga 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:** Writing structured essays on specific topics.

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

**Vocabulary:** Technical Jargons

**TEXTBOOKS:**

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

**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

| I B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC1104 | **BASIC CIVIL AND MECHANICAL 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.

| I B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC1105 | **CHEMISTRY** | | | | | | |

C**OURSE 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 $\Psi$ and $\Psi^2$, particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O2 and CO, etc. $\pi$-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 batteriesincluding cell reactions; Fuel cells, hydrogen-oxygenfuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

**UNIT IV**

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

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

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

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

**UNIT V**

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

**TEXTBOOKS:**

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

**REFERENCE BOOKS:**

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

| I B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 3 | 30 | 70 | 100 | 1.5 |
| SUBCODE: R23CC11L1 | **COMPUTER PROGRAMMING LAB** | | | | | | |

**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 on1D array.

iii) The reverse of a 1D integer array

iv) Find 2's complement of the given binary number.

v) Eliminate duplicate elements in an array.

**WEEK 8:**

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

**Suggested Experiments/Activities:**

**Tutorial 8:** 2 D arrays, sorting and Strings.

**Lab 8:** Matrix problems, String operations, Bubble sort

i) Addition of two matrices

ii) Multiplication two matrices

iii) Sort array elements using bubble sort

iv) Concatenate two strings without built-in functions

v) Reverse a string using built-in and without built-in string functions

**UNIT IV: WEEK 9**

**Objective:** Explore pointers to manage a dynamic array of integers, including 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.

**WEEK 14:**

**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 B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 2 | 30 | 70 | 100 | 1 |
| SUBCODE: R23CC11L2 | **COMMUNICATIVE ENGLISH LAB** | | | | | | |

**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. The students will get trained in basic communication skills and also make them ready to face job interviews.

**COURSE OUTCOMES:**

**CO1:** Understand the different aspects of the English language proficiency with emphasis on LSRW skills.

**CO2:** Apply communication skills through various language learning activities.

**CO3:** Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.

**CO4:** Evaluate and exhibit professionalism in participating in debates and group discussions.

**CO5:** Create effective Course Objectives:

**LIST OF TOPICS:**

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

**SUGGESTED SOFTWARE:**

- Walden Infotech
- Young India Films

**REFERENCE BOOKS:**

1. Raman Meenakshi, Sangeeta-Sharma. *Technical Communication*. Oxford Press. 2018.
2. Taylor Grant: *English Conversation Practice,* Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. Cambridge *Academic English* (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. *A Course in Phonetics and Spoken English*, (2nd Ed), Kindle, 2013 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

**VOICE & ACCENT:**

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

| I B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 3 | 30 | 70 | 100 | 1.5 |
| SUBCODE: R23CC11L3 | **ENGINEERING WORKSHOP** | | | | | | |

**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.; AtulPrakashan, 2021-22.

| I B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 2 | 30 | 70 | 100 | 1 |
| SUBCODE: R23CC11L4 | **CHEMISTRY LAB** | | | | | | |

**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 B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | - | - | 1 | 30 | 70 | 100 | 0.5 |
| SUBCODE: R23CC11MC1 | **HEALTH AND WELLNESS, YOGA AND SPORTS** | | | | | | |

**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 B.TECH - II SEMESTER

| S.No | Subject Code | Subject | Cat. Code | Internal Marks | External Marks | Total Marks | L | T | P | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | R23CC1201 | DIFFERENTIAL EQUATIONS & VECTOR CALCULUS | BS&H | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 2 | R23CC1202 | DATA STRUCTURES | PC | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 3 | R23CC1203 | BASIC ELECTRICAL & ELECTRONICS ENGINEERING | ES | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 4 | R23CC1204 | ENGINEERING GRAPHICS | ES | 30 | 70 | 100 | 1 | 0 | 4 | 3 |
| 5 | R23CC1205 | ENGINEERING PHYSICS | BS&H | 30 | 70 | 100 | 3 | 0 | 0 | 3 |
| 6 | R23CC12L1 | DATA STRUCTURES LAB | PC | 30 | 70 | 100 | 0 | 0 | 3 | 1.5 |
| 7 | R23CC12L2 | IT WORKSHOP | ES | 30 | 70 | 100 | 0 | 0 | 2 | 1 |
| 8 | R23CC12L3 | ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP | ES | 30 | 70 | 100 | 0 | 0 | 3 | 1.5 |
| 9 | R23CC12L7 | ENGINEERING PHYSICS LAB | BS&H | 30 | 70 | 100 | 0 | 0 | 2 | 1 |
| 10 | R23CC12MC2 | NSS/NCC/SCOUTS & GUIDES/ COMMUNITY SERVICE | BS&H | 30 | 70 | 100 | - | - | 1 | 0.5 |
| **TOTAL** | | | | | | | | | | **20.5** |

| I B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC1201 | **DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (Common to All Branches)** | | | | | | |

**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 into advanced level by handling various real-world applications.

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

**CO1:** Solve the differential equations related to various engineering fields.

**CO2:** Identify solution methods for partial differential equations that model physical processes.

**CO3:** Interpret the physical meaning of different operators such as gradient, curl and divergence.

**CO4:** 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 solution, 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, Directional derivative, del applied to vector point functions- Divergence and Curl, vector identities.

**UNIT V**

**Vector integration:** LWithoutegral-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 related problems.

**TEXTBOOKS:**

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

**REFERENCE BOOKS:**

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

| I B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC1202 | **DATA STRUCTURES** | | | | | | |

## COURSE OBJECTIVES:

- To provide the knowledge of basic data structures and their implementations.
- To understand importance of data structures in context of writing efficient programs.
- To develop skills to apply appropriate data structures in problem solving.

## COURSE OUTCOMES: After completion of the course, student will be able to:

**CO1:** Analyze the role of linear data structures in organizing and accessing data efficiently[K4].

**CO2:** Design, implement, and apply linked lists for dynamic data storage[K6].

**CO3:** Make use of Stack to handle recursive algorithms and other applications [K3].

**CO4:** 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 [K3].

**CO5:** Identify and implement novel solutions to small scale programming challenges involving data structures such as Graphs and Trees [K3].

**CO6:** Identify scenarios where hashing is advantageous, and design hash-based solutions for specific problems [K3].

## UNIT I

**Introduction to Data Structures:** Definition and importance of data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity, analysis of data structures. Searching Techniques: Linear, Binary & Fibonacci 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.

**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 IV

**Trees:** Introduction to Trees, Binary Tress- Tree traversals, Binary Search Tree – Insertion, Deletion & Traversal, AVL Tree and operations on AVL Tree, Heap Tree, Heap Sort.

## UNIT V

**Graphs:** Introduction to Graphs, representation of graphs, Graph traversals.

**Hashing:** Brief introduction to hashing and hash functions, Hash tables: basic implementation and operations, Collision resolution techniques: chaining and open addressing.

## 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 DavidRanum
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 B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC1203 | **BASIC ELECTRICAL & ELECTRONICS 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:**

**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. Bhatacharya, 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 INSTRUMENTTAION**

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

**UNIT III: DIGITAL ELECTRONICS**

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

**TEXTBOOKS:**

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

**REFERENCE BOOKS:**

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

| I B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 1 | 0 | 4 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC1204 | **ENGINEERING GRAPHICS** | | | | | | |

**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, Involutes, Normal and tangent to Curves.

**Scales:** Plain scales, diagonal scales and vernier scales.

**UNIT II**

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

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

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

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

**UNIT III**

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

**UNIT IV**

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

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

**UNIT V**

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

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

**TEXTBOOK:**

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

**REFERENCE BOOKS:**

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

| I B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC1205 | **ENGINEERING PHYSICS (Common to All Branches)** | | | | | | |

**COURSE OBJECTIVES:**

- To bridge the gap between the Physics in school at 10+2 level and UG level engineering coursesby 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 Rings, Determination of wavelength and refractive index.

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

**UNIT II: Crystallography and X-ray diffraction**

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

X- ray diffraction: Bragg's law - X-ray 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 B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 3 | 30 | 70 | 100 | 1.5 |
| SUBCODE: R23CC12L1 | **DATA STRUCTURES LAB** | | | | | | |

**COURSE OBJECTIVES:**

- The course aims to strengthen the ability of the students to identify and apply the suitable data structure for the given real-world problem. It enables them to gain knowledge in practical applications of data structures.

**COURSE OUTCOMES: At the end of the course, Student will be able to**

**CO1:** Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.

**CO2:** Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.

**CO3:** Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.

**CO4:** 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.

**CO5:** Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

**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.

**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 B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 2 | 30 | 70 | 100 | 1 |
| SUBCODE: R23CC12L2 | **IT WORKSHOP** | | | | | | |

**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. Finallystudents 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 TeXand 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 B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 3 | 30 | 70 | 100 | 1.5 |
| SUBCODE: R23CC1101 | **ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP** | | | | | | |

**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, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.

- Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

**PART A: ELECTRICAL ENGINEERING LAB LIST OF EXPERIMENTS:**

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

**REFERENCE BOOKS:**

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

**NOTE:** Minimum Six Experiments to be performed.

## PART B: ELECTRONICS ENGINEERING LAB

**COURSE OBJECTIVES:**

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

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

**CO1:** Identify & testing of various electronic components.

**CO2:** Understand the usage of electronic measuring instruments.

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

**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 B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 2 | 30 | 70 | 100 | 1 |
| SUBCODE: R23CC12L4 | **ENGINEERING PHYSICS LAB** | | | | | | |

**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 TWOexperiments may be conducted in virtual mode.

**REFERENCES:**


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


**WEB RESOURCES**

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

| I B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 1 | 30 | 70 | 100 | 0.5 |
| SUBCODE: R23CC12MC2 | **NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE** | | | | | | |

**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) Organizing 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, totaling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva Rvoce on the subject.

**B.Tech.– II Year I Semester**

| S.No. | Subject Code | Cat. Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | R23CC2101 | BS&H | Discrete Mathematics & Graph Theory | 3 | 0 | 0 | 3 |
| 2 | R23CC2102 | BS&H | Universal Human Values 2- Understanding Harmony | 2 | 1 | 0 | 3 |
| 3 | R23CC2103 | ES | Artificial Intelligence | 3 | 0 | 0 | 3 |
| 4 | R23CC2104 | PC | Advanced Data Structures & Algorithms Analysis | 3 | 0 | 0 | 3 |
| 5 | R23CC2105 | PC | Object-Oriented Programming Through Java | 3 | 0 | 0 | 3 |
| 6 | R23CC21L1 | PC | Advanced Data Structures and Algorithms Analysis Lab | 0 | 0 | 3 | 1.5 |
| 7 | R23CC21L2 | PC | Object-Oriented Programming Through Java Lab | 0 | 0 | 3 | 1.5 |
| 8 | R23CC21L3 | SC | Python Programming | 0 | 1 | 2 | 2 |
| 9 | R23CC21MC | AC | Environmental Science | 2 | 0 | 0 | - |
| | | **Total** | | **15** | **2** | **10** | **20** |

| II B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC2101 | **DISCRETE MATHEMATICS & GRAPH THEORY** | | | | | | |

**COURSE OBJECTIVES:**

- To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning.
- To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science.

**COURSE OUTCOMES: At the end of the course students will be able to**

**CO1:** Apply the logical statements, connectivity among the statements and different types of normal forms. [K3]
**CO2:** Analyze the operations, properties and functions of sets. [K4].
**CO3:** Solve mathematical problems with recurrence relations using different methods. [K3].
**CO4:** Classify the types of graphs to formulate and solve computational problems. [K4].

**UNIT–I: Mathematical Logic:**

**Propositional Calculus:** Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

**UNIT-II: Set Theory:**

**Sets:** Operations on Sets, Principle of Inclusion-Exclusion, **Relations:** Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, **Functions:** Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties.

**UNIT-III: Combinatorics and Recurrence Relations:**

Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems.
**Recurrence Relations:** Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, and Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations.

**UNIT-IV: Graph Theory:**

Basic Concepts, Graph Theory and its Applications, Subgraphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs.

**UNIT-V: Multi Graphs:**

Multigraphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

**TEXT BOOKS:**

1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L.Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
3. Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.

**REFERENCE BOOKS:**

1. Discrete Mathematics for Computer Scientists and Mathematicians, J. L.Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India publishers.
2. Discrete Mathematics, S. K. Chakraborthy and B. K. Sarkar, Oxford press, 2011.
3. Discrete Mathematics and its Applications with Combinatorics and GraphTheory, K.H. Rosen, 7th Edition, Tata McGraw Hill.

| II B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 2 | 1 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC2102 | **UNIVERSAL HUMAN VALUES UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT** | | | | | | |

## COURSE OBJECTIVES:

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

## COURSE OUTCOMES:

At the end of the course students will be able to

**CO1:** Analyze various Value Education methods. [K2]
**CO2:** Compare and Contrast various types of Harmony in the Human Being. [K4]
**CO3:** Compare and Contrast various types of Harmony in the Family and Society [K4]
**CO4:** Compare and Contrast various types of Harmony in the Nature/Existence. [K4]
**CO5:** Analyze the various consequences of professional ethics. [K2**]**

## COURSE TOPICS

- The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1- hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.
- The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

## UNIT I

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

**Lecture 1:** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
**Lecture 2:** Understanding Value Education
**Tutorial 1:** Practice Session PS1 Sharing about Oneself
**Lecture 3:** Self-exploration as the Process for Value Education
**Lecture4:** Continuous Happiness and Prosperity – the Basic Human Aspirations
**Tutorial 2:** Practice Session PS2 Exploring Human Consciousness
**Lecture 5:** Happiness and Prosperity – Current Scenario
**Lecture 6:** Method to Fulfill the Basic Human Aspirations

**Tutorial 3:** Practice Session PS3 Exploring Natural Acceptance

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

**b. The Teacher's Manual**
R R Gaur, R Asthana, G P Bagaria,Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 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
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)


## MODE OF CONDUCT:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.
Tutorial hours are to be used for practice sessions.
While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting. Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

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

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

## ONLINE RESOURCES:

1. https://fdp-si.aicte-india.org/UHV II%20Class%20Notes%20&%20Handouts/UHV%20Handout%2 01- Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV II%20Class%20Notes%20&%20Handouts/UHV%20Handout%2 02- Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV II%20Class%20Notes%20&%20Handouts/UHV%20Handout%2 03- Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV %201%20Teaching%20Material/D3- S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV II%20Class%20Notes%20&%20Handouts/UHV%20Handout%2 05- Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3- S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%20 23- 25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human values/chapter-5- holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

| II B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC2106 | **ARTIFICIAL INTELLIGENCE** | | | | | | |

## PRE-REQUISITE:

- Knowledge in Computer Programming.
- A course on "Mathematical Foundations of Computer Science".
- Background in linear algebra, data structures and algorithms, and probability.

## COURSE OBJECTIVES:

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

## COURSE OUTCOMES: At the end of the course students will be able to

**CO1:** Analyze and Design Intelligent Agents **[K4]**
**CO2:** Apply Search Algorithms to Problem Solving **[K3]**
**CO3:** Apply techniques for constraint propagation and reasoning under uncertainty **[K3]**
**CO4:** Utilize inductive learning, decision trees, and explanation-based learning for learning from observation **[K3]**
**CO5:** Analyze and compare typical expert systems such as MYCIN, DART, and XCON **[K4]**

## UNIT - I

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

## UNIT - II

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

## UNIT - III

**Representation of Knowledge:** Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Bayes' probabilistic interferences and dempstershafer theory.

## UNIT - IV

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

## UNIT - V

**Expert Systems:** Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells.

## TEXT BOOKS:


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


## REFERENCE BOOKS:


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


## ONLINE LEARNING RESOURCES:

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

| II B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC2104 | **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

**COURSE OUTCOMES: At the end of the course students will be able to**

**CO1:** Apply asymptotic notations to measure the performance of algorithms [K3]
**CO2:** Appling divide and conquer parading when an algorithmic design situation calls for it. [K3]
**CO3:** Construct greedy algorithms and dynamic programming techniques to solve problems [K3]
**CO4:** Utilize backtracking and branch and bound algorithms to solve combinatorial problems construct [K3]
**CO5:** Classifying computational problems into NP, NP-Hard, and NP-Complete. [K4]

## SYLLABUS:

### UNIT – I:

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations. AVL Trees – Creation, Insertion, Deletion operations and Applications
Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications

### UNIT – II:

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.

### 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, 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
**NP Hard Graph Problems**: Clique Decision Problem (CDP), Traveling Salesperson Decision Problem (TSP)
**NP Hard Scheduling Problems:** 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, Sanguthevar Rajasekaran 2nd Edition University Press

## REFERENCE BOOKS:

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

## ONLINE LEARNING RESOURCES:

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

| II B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC2105 | **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

**COURSE OUTCOMES: After completion of this course, the students would be able to:**

**CO1:** Interpret the syntax and semantics of java programs language and OOPs concepts. [K2]
**CO2:** Make use of different predefined classes and packages and interfaces to develop programs using OOPs concepts. [K3]
**CO3:** Apply exception handling and FILE I/O operations on java programs. [K3]
**CO4:** Make use of Multithreading and String handling Functions on java. [K3]
**CO5:** Make use of Java FX and Event-Handling to in the design of GUI Applications. [K3]

**SYLLABUS:**

**UNIT I**:

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

**Data Types, Variables, and Operators** :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator ( = ), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

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

**UNIT II**:

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

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

**UNIT III**:

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

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

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

**UNIT IV:**

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

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

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

**UNIT V:**

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

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

**Java 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_01288046454761881634 7_shared/overview

| II B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 3 | 30 | 70 | 100 | 1.5 |
| SUBCODE: R23CC21L1 | **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

## COURSE OUTCOMES: After the completion of this course the student should be able to

**CO 1:** Analyze different operations of tree traversal techniques. [K4]
**CO 2:** Analyze time complexity of algorithms to solve problems on graph [K4]
**CO 3**: Apply divide and conquer approaches for sorting the given elements [K3]
**CO 4**: Analyze the complexity of algorithms to evaluate the efficiency and effectiveness of greedy, dynamic programming, backtracking branch and bound techniques. [K4]

## SAMPLE PROGRAMS:

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

## REFERENCE BOOKS:


1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2nd Edition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2nd Edition, University Press
3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
4. An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill


## ONLINE LEARNING RESOURCES:

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

| II B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 3 | 30 | 70 | 100 | 1.5 |
| SUBCODE: R23CC21L2 | **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

**COURSE OUTCOMES: At the end of the course students will be able to**

**CO1**: Develop Java program, by using OOP concepts. [K3]
**CO2**: Make use of inheritance and interface concepts in Java programs. [K3]
**CO3**: Make use of Exception handling and Multithreading concepts in Java Programs. [K3]
**CO4**: Develop GUIs with JavaFX and JDBC programs. [K3]

**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 implement 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
**b)** Write a JAVA program Illustrating Multiple catch clauses
**c)** Write a JAVA program for creation of Java Built-in Exceptions
**d)** 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

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

## Exercise – 9

**a)** 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

**Virtual Lab:** http://ps-iiith.vlabs.ac.in/, www.w3schools.com

Any three programs must be submitted with result from the above link.

| II B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 30 | 70 | 100 | 2 |
| SUBCODE: R23CC21L3 | **PYTHON PROGRAMMING (SKILL ENHANCEMENT COURSE)** | | | | | | |

**COURSE OBJECTIVES: The main objectives of the course are to**

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

**COURSE OUTCOMES: At the end of the course students will be able to**

**CO1:** Make use of control flow statements and functions to develop python programs. [K3].
**CO2:** Develop Python programs using strings, Lists, dictionaries, tuples and sets. [K3].
**CO3:** Develop Python programs on object oriented programming and regular expressions. [K3].
**CO4:** Develop Python programs using Nuimpy and Pandas. [K3].

## UNTI-I:

**History of Python Programming Language**, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

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

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

## Sample Experiments:

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

## UNIT-II:

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

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

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

## Sample Experiments:

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
   **i.** Addition **ii.** Insertion **iii.** Slicing
6. Write a program to perform any 5 built-in functions by taking any list.

## UNIT-III:

**Dictionarie**s: 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:

1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string (No control flow allowed).
3. Write a program to check if a given key exists in a dictionary or not.
4. Write a program to add a new key-value pair to an existing dictionary.
5. 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:

1. 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.
2. Python program to print each line of a file in reverse order.
3. Python program to compute the number of characters, words and lines in a file.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.
5. Write a program to add, transpose and multiply two matrices.
6. 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.

## Sample Experiments:

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array () function.
3. Python program to demonstrate use of ndim, shape, size, dtype.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. Python program to find min, max, sum, cumulative sum of array
6. 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:
    1. Apply head () function to the pandas data frame
    2. Perform various data selection operations on Data Frame
7. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

### REFERENCE BOOKS:

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

### ONLINE LEARNING RESOURCES / VIRTUAL LABS:

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

| II B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 2 | 0 | 0 | | | | |
| SUBCODE: R23CC21MC | **ENVIRONMENTAL STUDIES** | | | | | | |

**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.

**COURSE OUTCOMES:**

**CO1:** Understand multi-disciplinary nature of environmental studies and analyze the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources. [L2]

**CO2:** Explain the concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web. Explain the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity. [L2]

**CO3:** Distinguish various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management [L2]

**CO4:** Understand the rainwater harvesting, watershed management, ozonelayer depletion and waste land reclamation. [L2]

**CO5:** Illustrate the causes of population explosion, value education and welfare programmes. [L3]

## UNIT – I

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

**Natural Resources :** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems –

**Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

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

## UNIT – III

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

**a.** Air Pollution.
**b.** Water pollution
**c.** Soil pollution
**d.** Marine pollution
**e.** Noise pollution

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

## UNIT – IV

**Social Issues and the Environment:** From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies –

**Environmental ethics:** Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

## UNIT – V

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

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

## TEXTBOOKS:

**1.** Erach Bharucha,Text book of Environmental Studies for Undergraduate Courses, Universities Press

(India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.
3. S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", SciTech Publications (India), Pvt. Ltd, 2010.

## REFERENCE BOOKS:

1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2. M.Anji Reddy, "Textbook of Environmental Sciences and Technology", BSPublication, 2014.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
4. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering,Prentice Hall of India Private limited, 1988.
5. G.R. Chatwal, a Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

## ONLINE LEARNING RESOURCES:

- https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science+Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental- science
- http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science- I/Data%20Files/pdf/lec07.pdf
- https://www.youtube.com/watch?v=5QxxaVfgQ3k

## B.Tech.– II Year II Semester

| S.No. | Subject Code | Cat. Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | R23CC2208 | MC | Optimization Techniques | 2 | 0 | 0 | 2 |
| 2 | R23CC2202 | ES | Probability & Statistics | 3 | 0 | 0 | 3 |
| 3 | R23CC2206 | PC | Machine Learning | 3 | 0 | 0 | 3 |
| 4 | R23CC2204 | PC | Database Management Systems | 3 | 0 | 0 | 3 |
| 5 | R23CC2207 | PC | Digital Logic and Computer Organization | 3 | 0 | 0 | 3 |
| 6 | R23AI22L4 | PC | AI & ML Lab | 0 | 0 | 3 | 1.5 |
| 7 | R23CC22L1 | PC | Database Management Systems Lab | 0 | 0 | 3 | 1.5 |
| 8 | R23CC22L2 | SC | Full Stack Development-1 | 0 | 1 | 2 | 2 |
| 9 | R23CC22L3 | BS&H | Design Thinking & Innovation | 1 | 0 | 2 | 2 |
| | **Total** | | | **15** | **1** | **12** | **21** |
| | Mandatory Community Service Project Internship of 08 weeks duration during summer vacation | | | | | | |

| II B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC2208 | OPTIMIZATION TECHNIQUES | | | | | | |

**PRE-REQUISITE:**

**COURSE OBJECTIVES:**

- To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
- To state single variable and multi variable optimization problems, without and with constraints.
- To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
- To state transportation and assignment problem as a linear programming problem to determine Simplex method.
- To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.

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

**CO1**: Apply the optimization problem, without and with constraints, by using design variables from an engineering design problem. [K3]

**CO2**: Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution. [K3]

**CO3**: Apply and Solve transportation and assignment problem by using Linear programming Simplex method. [K3]

**CO4**: Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions. [K3]

**CO5**: Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution. [K3]

**SYLLABUS:**

**UNIT I: Introduction and Classical Optimization Techniques:**

Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems.

**Classical Optimization Techniques:** Single variable Optimization, multi variable Optimization without constraints, necessary and sufficient conditions for minimum/maximum, multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers, multivariable Optimization with inequality constraints, Kuhn–Tucker conditions.

**UNIT II: Linear Programming:**
Standard form of a linear programming problem, geometry of linear programming problems, definitions and theorems, solution of a system of linear simultaneous equations, pivotal reduction of a general system of equations, motivation to the simplex method, simplex algorithm

**UNIT III: Transportation Problem:**
Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method, testing for optimality of balanced transportation problems, Special cases in transportation problem.

**UNIT IV: Nonlinear Programming:**
Unconstrained cases, one – dimensional minimization methods: Classification, Fibonacci method, Univariate method, steepest descent method. Constrained cases– Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method, Basic approaches of Interior and Exterior penalty function methods,

**UNIT V: Dynamic Programming:**
Dynamic programming multistage decision processes, types, concept of sub optimization and the principle of optimality, computational procedure in dynamic programming, examples illustrating the calculus method of solution, examples illustrating the tabular method of solution.

**TEXTBOOKS:**
**1.** "Engineering optimization: Theory and practice", S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
**2.** "Introductory Operations Research", H.S. Kasene & K.D. Kumar, Springer (India), Pvt. LTd.

**REFERENCE BOOKS:**
**1.** "Optimization Methods in Operations Research and systems Analysis", by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
**2.** Operations Research, Dr.S.D.Sharma, Kedarnath, Ramnath & Co

| II B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC2202 | **PROBABILITY & STATISTICS** | | | | | | |

**COURSE OBJECTIVES:**

- To familiarize the students with the foundations of probability and statistical methods.
- To impart probability concepts and statistical methods in various applications engineering.

**COURSE OUTCOMES:** After completion of this course, the students would be able to
**CO1:**.Classify the concepts of data science and its importance [K2].
**CO2:** Interpret the association of characteristics and through correlation and regression tools [K4]
**CO3:** Apply discrete and continuous probability distributions [K3]
**CO4:** Design the components of a classical hypothesis test [K6]
**CO5:** Infer the statistical inferential methods based on small and large sampling tests [K4].

**SYLLABUS:**

**UNIT– I: Descriptive statistics and methods for data science:**
Data science, Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Type of variable: dependent and independent Categorical and Continuous variables, Data visualization, Measures of Central tendency, Measures of Variability , Skewness, Kurtosis.

**UNIT – II: Correlation and Regression:**
**Correlation:** Correlation coefficient, Rank correlation.
**Linear Regression:** Straight line, Multiple Linear Regression, Regression coefficients and properties.
**Curvilinear Regression:** Parabola, Exponential, Power curves.

**UNIT – III: Probability and Distributions:**
Probability, Conditional probability and Baye's theorem.
**Random variables:** Discrete and Continuous random variables.
**Distribution functions:** Probability mass function, Probability density function and Cumulative distribution functions, Mathematical Expectation and Variance, Binomial, Poisson, Uniform and Normal distributions.

**UNIT – IV: Sampling Theory:**
Introduction, Population and Samples, Sampling distribution of Means and Variance (definition only), Point and Interval estimations, Maximum error of estimate, Central limit theorem (without proof), Estimation using t- test.

**UNIT – V: Tests of Hypothesis:**
Introduction, Hypothesis, Null and Alternative Hypothesis, Type I and Type II errors, Level of significance, one tail and two-tail tests. Test of significance for large samples and Small Samples: Single and difference means, Single and two proportions, Student's t- test, F-test, $\chi^2$-test.

**TEXT BOOKS:**

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

**REFERENCE BOOKS**:

1. Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists,8th Edition, Pearson 2007.
2. Jay l. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage publishers.
3. Sheldon M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011.
4. Johannes Ledolter and Robert V. Hogg, Applied statistics for Engineers and Physical Scientists, 3rd Edition, Pearson, 2010.

| II B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC2206 | MACHINE LEARNING | | | | | | |

**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.

**COURSE OUTCOMES: After completion of this course, the students would be able to:**

**CO1**: **Summarize** machine learning paradigms, workflow, feature engineering & evaluation. [K2]
**CO2**: **Apply** KNN & proximity-based models for classification & regression. [K3]
**CO3**: **Analyze** Decision Trees, Random Forests & Bayes Classifier. [K4]
**CO4**: **Evaluate** ML classification models developed using SVM, Logistic Regression, MLP & backprop. [K5]
**CO5**: **Evaluate** clustering approaches — K-Means, Hierarchical, Fuzzy C-Means, EM & Spectral methods. [K5]

**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.

| II B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC2204 | 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

**COURSE OUTCOMES: After Completion of the course, Students are able to:**

**CO 1:** Interpret the fundamentals of DBMS. [K2]
**CO 2:** Analyzing relational database designing. [K4]
**CO 3:** Developing queries in RDBMS [K3]
**CO 4:** Analyzing database design methodology and normalization process [K4].
**CO 5:** Analyze transaction concepts and File indexing. [K2]

**SYLLABUS:**

**UNIT I:**

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

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

**UNIT II**:

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

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

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

**UNIT V**:
**Transaction Concept:** Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm. Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

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

## WEB-RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066672820224 56_shared/overview

| II B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC2207 | **DIGITAL LOGIC AND 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

**COURSE OUTCOMES: After Completion of the course, Students are able to:**

**CO1:** Analyze the data representation and digital logic circuits. [K4]
**CO2:** Analyze the basic structure of computers. [K4]
**CO3:** Analyze the computer arithmetic algorithms. [K4]
**CO4:** Analyze the processor, memory and input – output organizations. [K4]

**UNIT – I:**

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

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

**UNIT – II:**

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

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

**UNIT – III:**

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

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

**UNIT – IV:**

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

**UNIT – V:**

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

**TEXTBOOKS:**

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

**REFERENCE BOOKS:**

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

**ONLINE LEARNING RESOURCES:**

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

| II B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 3 | 30 | 70 | 100 | 1.5 |
| SUBCODE: R23AI22L4 | **AI & ML LAB** | | | | | | |

**Course Objectives:** The objectives of the course is to

- The student should be made to study the concepts of Artificial Intelligence.
- The student should be made to learn the methods of solving problems using Artificial Intelligence.
- The student should be made to introduce the concepts of Expert Systems and machine learning.
- To learn about computing central tendency measures and Data preprocessing techniques.
- To learn about classification and regression algorithms 6. To apply different clustering algorithms for a problem.

**COURSE OUTCOMES:** After Completion of the course, Students are able to:

**CO1:** Analyze the use of the Pandas library to create and manipulate Series and Data Frames. [K4]
**CO2:** Develop various search algorithms in Python. [K3]
**CO3:** Apply preprocessing techniques for preparing datasets for machine learning process. [K3]
**CO4:** Develop machine learning models using algorithms. [K3]

**SOFTWARE REQUIRED:**

Python / Jupiter Note Book. Lab should cover the concepts studied in the course work,

**Sample 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 Apply KNN algorithm for classification and regression
3. Implement Breadth First Search using Python.
4. Implement Best First Searching Algorithm
5. Implement Depth First Search using Python.
6. Implement the Heuristic Search
7. Python program to implement A* and AO* algorithm. (Ex: find the shortest path)
8. Apply the following Pre-processing techniques for a given dataset. a) Attribute selection b) Handling Missing Values c) Discretization d) Elimination of Outliers
9. Apply KNN algorithm for classification and regression

10. Demonstrate decision tree algorithm for a classification problem and perform tuning for better results
11. Apply Random Forest algorithm for classification and regression measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.
12. Demonstrate Naïve Bayes Classification algorithm.
13. Apply Support Vector algorithm for classification
14. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.

**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

| II B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 3 | 30 | 70 | 100 | 1.5 |
| SUBCODE: R23CC22L1 | **DATABASE MANAGEMENT SYSTEMS LAB** | | | | | | |

**COURSE OBJECTIVES: This Course will enable students to**

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

**EXPERIMENTS COVERING THE TOPICS:**

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

**COURSE OUTCOMES: After Completion of this course student must be able to**

**CO1:** Apply SQL commands like DDL, DML, DCL and Indexing to perform different Database operations [K3].
**CO2:** Develop PL/SQL block statements, control statements and cursors. [K3]
**CO3:** Develop PL/SQL programs using functions and procedures. [K3]
**CO4:** Develop PL/SQL programs using packages and Triggers. [K3]
**CO5:** Develop a Java Program to connect to a database. [K3].

**SAMPLE EXPERIMENTS:**

**1.** Creation, altering and droping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
**2.** Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
**3.** Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
**4.** Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
**5.**
**i.** Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)

**ii.** Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.

**6.** Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.

**7.** Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.

**8.** Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.

**9.** Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.

**10.** Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.

**11.** Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

**12.** Create a table and perform the search operation on table using indexing and no indexing techniques.

**13.** Write a Java program that connects to a database using JDBC

**14.** Write a Java program to connect to a database using JDBC and insert values into it

**15.** Write a Java program to connect to a database using JDBC and delete values from it

**TEXT BOOKS / SUGGESTED READING:**

**1.** Oracle: The Complete Reference by Oracle Press

**2.** Nilesh Shah, "Database Systems Using Oracle", PHI, 2007

**3.** Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

| II B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 30 | 70 | 100 | 1.5 |
| SUBCODE: R23CC22L2 | **FULL STACK DEVELOPMENT- I LAB (SKILL ORIENTED COURSE)** | | | | | | |

**COURSE OBJECTIVES: The main objectives of the course are to**

1. Make use of HTML elements and their attributes for designing static web pages
2. Build a web page by applying appropriate CSS styles to HTML elements
3. 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

**COURSE OUTCOMES: After Completion of this course student will be able to:**

**CO1:** Develop static html pages by using HTML5 elements and attributes. [K3].
**CO2**: Construct a static html pages by using Cascading Style Sheets [K3].
**CO3**: Build webpages using Java Script [K3].
**CO4:** Develop a Web pages Using JQuery [K3].

**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

- **a.** Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)
- **b.** 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.).
- **c.** 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).
- **d.** Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame image, second frame paragraph, third frame hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

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

- **a.** Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, ,  tags.
- **b.** Write a HTML program, to embed audio and video into HTML web page.
- **c.** 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

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

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

- **a.** Write a program to demonstrate the various ways you can reference a color in CSS.
- **b.** 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.
- **c.** Write a program using the following terms related to CSS font and text:
  **i.** Font-size **ii.** Font-weight **iii.** font-style
  **iv.** text-decoration **v.** text-transformation **vi.** Text-alignment
- **d.** Write a program, to explain the importance of CSS Box model using
  **i.** Content **ii.** Border **iii.** Margin **iv.** padding

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

- **a.** Write a program to embed internal and external JavaScript in a web page.
- **b.** Write a program to explain the different ways for displaying output.
- **c.** Write a program to explain the different ways for taking input.

**d.** 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

**a.** Write a program using document object properties and methods.
**b.** Write a program using window object properties and methods.
**c.** Write a program using array object properties and methods.
**d.** Write a program using math object properties and methods.
**e.** Write a program using string object properties and methods.
**f.** Write a program using regex object properties and methods.
**g.** Write a program using date object properties and methods.
**h.** Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

**8.** JavaScript Conditional Statements and Loops

**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 aprogram 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
- Factorial of that number
- Fibonacci series up to that number
- Prime numbers up to that number
- Is it palindrome or not

**c.** Write a program to validate the following fields in a registration page
- Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
- 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, Robet W Sebesta, Pearson, 2013.
2. Web Programming with HTML5, CSS and Java Script, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.


**WEB LINKS:**

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

| II B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 1 | 0 | 2 | 30 | 70 | 100 | 2 |
| SUBCODE: R23CC22L3 | **DESIGN THINKING & INNOVATION** | | | | | | |

**COURSE OBJECTIVES: The objectives of the course are to**

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

**COURSE OUTCOMES: After Completion of the course, Students are able to:**

**CO1:** Define the concepts related to design thinking. [L1]
**CO2:** Explain the fundamentals of Design Thinking and innovation. [L2]
**CO3:** Apply the design thinking techniques for solving problems in various sectors. [L3]
**CO4:** Analyze to work in a multidisciplinary environment. [L4]
**CO5:** Evaluate the value of creativity. [L5]

**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 modeling, how to set specifications, Explaining their own product design.

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

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

**TEXTBOOKS:**

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

**REFERENCE BOOKS:**

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

**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
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

## B. Tech. – III Year I Semester

| S.No. | Subject Code | Cat. Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | R23AI3104 | PC | Deep Learning | 3 | 0 | 0 | 3 |
| 2 | R23CC3101 | PC | Computer Networks | 3 | 0 | 0 | 3 |
| 3 | R23CC3115 | PC | Operating Systems | 3 | 0 | 0 | 3 |
| 4 | R23CC3102<br>R23CC3103<br>R23AI3106<br>R23AI3107 | PE-1 | 1. Object Oriented Analysis and Design<br>2. Automata Theory & Compiler Design<br>3. Soft computing<br>4. Internet of Things | 3 | 0 | 0 | 3 |
| 5 | | OE-1 | Course offered by other departments<br>OR<br>Entrepreneurship Development & Venture Creation | 3 | 0 | 0 | 3 |
| 7 | R23AI31L1 | PC | Deep learning Lab | 0 | 0 | 3 | 1.5 |
| 8 | R23AI31L2 | PC | Computer Networks Lab | 0 | 0 | 3 | 1.5 |
| 9 | R23AI31L3 | SC | Full Stack development-2 /<br>SWAYAM Plus – Data Engineer / AI Engineer / | 0 | 1 | 2 | 2 |
| 10 | R23AI31L4 | ES | Tinkering Lab<br>(*User Interface Design using Flutter*) /<br>SWAYAM Plus - Android Application Development (with Flutter) | 0 | 0 | 2 | 1 |
| 11 | R23CC31CSP | Evaluation of Community Service Project Internship | | - | - | - | 2 |
| | | **Total** | | **15** | **1** | **10** | **23** |
| MC | | Student may select from the Same Minor Pool | | 3 | 0 | 3 | 4.5 |
| MC | | Minor Course through SWAYAM / NPTEL (Minimum 12 Week, 3 credit course) | | 3 | 0 | 0 | 3 |
| HC | | Student may select from the Same Honors Pool | | 3 | 0 | 0 | 3 |
| HC | | Student may select from the Same Honors Pool | | 3 | 0 | 0 | 3 |

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23AI3104 | **DEEP LEARNING** | | | | | | |

**COURSE OBJECTIVES:**

The objective of this course is to cover the fundamentals of neural networks as well as some advanced topics such as recurrent neural networks, long short-term memory cells and convolution neural networks.

**COURSE OUTCOMES: After completion of course, students would be able to:**

**CO1:** Explore feed forward networks and Deep Neural networks [K3]
**CO2:** Mathematically understand the deep learning approaches and paradigms [K2]
**CO3:** Apply the deep learning techniques for various applications [K3]
**CO4:** Implement various deep learning models. [K3]
**CO5:** Analyze recent advances in Deep Learning, including Variational Autoencoders, Transformers, and GPT models [K4]

**SYLLABUS**

**UNIT-I:**

Basics- Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability, Convergence theorem for Perceptron Learning Algorithm.

**UNIT-II:**

Feed forward Networks- Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization, auto encoders. Deep Neural Networks: Difficulty of training deep neural networks, Greedy layer wise training.

**UNIT-III:**

Better Training of Neural Networks –Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).

**UNITIV:**

Recurrent Neural Networks- Back propagation through time, Long Short-Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.

Convolutional Neural Networks: LeNet, AlexNet. Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.

**UNITV:**

Recent trends - Variational Autoencoders, Transformers, GPT Applications: Vision, NLP, Speech

**Text Books:**

1. Deep Learning, Ian Good fellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016

**Reference Books:**

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007
3. Deep Learning with Python, François Chollet, Manning Publications, 2017

**E-References:**

1. https://onlinecourses.nptel.ac.in/noc20_cs62/preview
2. https://onlinecourses.nptel.ac.in/noc25_cs106/preview

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC3101 | **COMPUTER NETWORKS** | | | | | | |

**COURSE OBJECTIVES:**

- To provide insight about networks, topologies, and the key concepts.
- To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
- To understand the principles, key protocols, design issues, and significance of each layers in ISO and TCP/IP.
- To know the basic concepts of network services and various network applications.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1:** Explain the structure, functions, and types of computer networks, and compare the OSI and TCP/IP models **[K2].**

**CO2:** Analyze the data link layer design issues, functionalities and protocols **[K4]**.

**CO3:** Analyze various media access methods such as Random Access, Controlled Access protocols and compare various Ethernet Standards **[K4]**.

**CO4:** Apply routing algorithms and congestion control techniques in the network layer and understand internetworking concepts **[K3]**.

**CO5:** Describe the functionalities of transport and application layer protocols **[K2].**

**SYLLABUS**

**UNIT I: Introduction**

Types of Computer Networks, Reference Models- The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model. History of Internet.

**UNITII: The Data Link Layer**

Transmission Media, Guided and Un-guided media, Data Link Layer Design Issues, Services Provided to the Network Layer, Error detecting and Error Correcting codes, Elementary Data Link Protocols, Sliding Window Protocols, HDLC, PPP. Multiple Access Protocols Wired Lans: Ethernet, Fast Ethernet, Gigabit Ethernet

**UNITIII: The Network Layer**

Network LayerDesign Issues, Routing Algorithms, Congestion, Congestion control algorithms. The Network Layer in the Internet, The IP Version 4 Protocol, IP Addresses- Classful, CIDR, NAT, IP Version 6 Protocol, Transition from IPV4 to IPV6

**UNITIV: The Transport Layer**

The Transport Layer Services, Transport Layer Protocols: UDP, TCP and SCTP

**UNITV: The Application Layer**

The World Wide Web, HTTP, Domain Name Space, Remote Loging, Electronic Mail and File Transfer

**Text Books:**

1. "Computer Networks", Andrew S Tanenbaum, David J Wetherall, 5th Edition, Pearson
2. "Data Communications and Networking", Behrouz A Forouzan, 4th Edition, Tata McGraw Hill Education

**Reference Books**:

1. "Data and Computer Communication", William Stallings, Pearson
2. "TCP/IP Protocol Suite", Behrouz Forouzan, McGraw Hill.

**E-References:**

1. https://nptel.ac.in/courses/106105183
2. https://www.geeksforgeeks.org/computer-networks/basics-computer-networking/

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC3115 | **OPERATING SYSTEMS** | | | | | | |

**COURSE OBJECTIVES:**

The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for dead lock and their possible solutions.

**COURSE OUTCOMES:**

After completion of the course, students will be able to

**CO 1:** Classify various operating system generations and functionalities **[K2].**
**CO 2:** Interpret process management and apply various process scheduling algorithms **[K3].**
**CO 3:** Analyze different process synchronization various deadlock Techniques **[K4].**
**CO 4:** Compare and contrast various memory management techniques and Disk scheduling algorithms **[K4].**
**CO 5:** Analyze the concepts of file system **[K2].**

**SYLLABUS**

**UNIT-I:**

**Operating Systems Overview:** Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

**UNIT-II:**

**Processes:** Process Concept, Process scheduling, Operations on processes, Inter-process communication. Threads and Concurrency: Multi-threading models, Thread libraries, threading issues. CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, multiple processor scheduling.

**UNIT–III:**

**Synchronization Tools:** The Critical Section Problem, Peterson's Solution, Mutex Locks, semaphores, Monitors, Classic problems of Synchronization. Deadlocks: system Model, Dead lock characterization, Methods for handling Dead locks,Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

**UNIT-IV:**

**Memory-Management Strategies:** Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. Virtual Memory Management: Introduction, Demandpaging, Copy-on-write, Pagereplacement Allocation of frames, Thrashing Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

**UNIT-V:**

**File System:** File System Interface: Fileconcept, Accessmethods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File-System Mounting, Partitions and Mounting, File Sharing. Protection: Goalso of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix

**Text Books:**

1. Operating System Concepts, SilberschatzA, GalvinPB, GagneG, 10th Edition,Wiley, 2018.
2. Modern Operating Systems, TanenbaumAS, 4thEdition, Pearson, 2016.

**Reference Books:**

1. Operating Systems -Internals and Design Principles, Stallings W, 9thEdition, Pearson, 2018
2. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rdEdition, McGraw- Hill, 2013

**E-References:**

1. https://nptel.ac.in/courses/106/106/106106144/
2. http://peterindia.net/OperatingSystems.html

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC3102 | **OBJECT ORIENTED ANALYSIS AND DESIGN (PROFESSIONAL ELECTIVE-I)** | | | | | | |

**COURSE OBJECTIVES:** The main objective is the students to

- Become familiar withal phases of OOAD.
- Master the main features of the UML.
- Master the main concepts of Object Technologies and how to apply them at work and develop the ability to analyze and solve challenging problem in various domains.
- Learn the Object design Principles and understand how to apply them towards Implementation.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1:** Explain the fundamental concepts, principles, and process of Object-Oriented Analysis and Design. [K2]

**CO2:** Analyze software requirements and identify objects, classes, relationships, and use cases for system modeling. [K4]

**CO3:** Apply UML modeling techniques to represent structural and behavioral aspects of software systems. [K3]

**CO4:** Design object-oriented solutions using design principles, patterns, and architectural concepts. [K6]

**CO5:** Evaluate object-oriented designs based on quality attributes such as reusability, maintainability, scalability, and performance. [K5]

**SYLLABUS**

**UNIT I:**

**Introduction:** The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems.

**Case Study:** System Architecture: Satellite Based Navigation

**UNIT II:**

**Introduction to UML:** Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle.

**Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams.

**Case Study:** Control System: Traffic Management.

**UNIT III:**

**Class & Object Diagrams:** Terms, concepts, modeling techniques for Class & Object Diagrams.

**Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages.

**Case Study:** AI: Cryptanalysis.

**UNIT IV:**

**Basic Behavioral Modeling-I:** Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams.

**Case Study:** Web Application: Vacation Tracking System

**UNIT V:**

**Advanced Behavioral Modeling:** Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

**Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams

**Case Study:** Weather Forecasting.

**Text Books:**

1. Grady BOOCH, RobertA. Maksimchuk, Michael W.ENGLE, BobbiJ. Young, Jim Conallen, Kellia Houston, "Object- Oriented Analysis and Design with Applications", 3rd edition, 2013, PEARSON.
2. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.

**Reference Books:**

1. Meilir Page-Jones: Fundamentals of Object-Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dream tech India Pvt. Ltd.
3. Atul Kahate: Object Oriented Analysis &Design, The McGraw-Hill Companies.
   Appling UML and Patterns: An introduction to Object–Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

**E-References:**

1. https://onlinecourses.nptel.ac.in/noc20_cs59/preview
2. https://en.wikipedia.org/wiki/Object-oriented_analysis_and_design

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC3103 | **AUTOMATA THEORY AND COMPILER DESIGN (PROFESSIONAL ELECTIVE-I)** | | | | | | |

**COURSE OBJECTIVES:**

- Introduce the notion of formal languages and grammars
- Design of Grammars, FAs and PDAs
- To become familiar with the underlying theory and methods used in compiler design
- To Introduce the parsing techniques, code optimization techniques and generate code

**COURSE OUTCOMES:** After completion of the course, students will be able to

**CO1:** Understand and apply formal language theory.
**CO2:** Design and implement parsers.
**CO3:** Understand the phases of a compiler.
**CO4:** Apply semantic analysis and error handling.
**CO5:** Optimize intermediate and target code.

**SYLLABUS**

**UNIT – I:**

Introduction to Finite Automata: Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems. Nondeterministic Finite Automata: Formal Definition, an application, Text Search, Finite Automata with Epsilon-Transitions. Deterministic Finite Automata: Definition of DFA, How A DFA Process Strings, The language of DFA, Conversion of NFA with €-transitions to NFA without €-transitions. Conversion of NFA to DFA

**UNIT – II:**

Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions. Pumping Lemma for Regular Languages: Statement of the pumping lemma, Applications of the Pumping Lemma. Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Parse Trees, Ambiguity in Grammars and Languages.

**UNIT – III:**

Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state Turing Machines: Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine Undecidability: Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Undecidable Problems about Turing Machines

**UNIT - IV** Introduction: The structure of a compiler, Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical- Analyzer Generator Lex, Syntax

Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom- Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers R18 B.Tech. CS&D Syllabus JNTU Hyderabad

**UNIT - V** Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, SyntaxDirected Translation Schemes, Implementing L-Attributed SDD's. Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code Run-Time Environments: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management

**Text Books:**

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Compilers: Principles, Techniques and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, 2nd Edition, Pearson.
3. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd Edition, PHI.

**Reference Books:**

1. Introduction to Formal languages Automata Theory and Computation, Kamala Krithivasan, Rama R, Pearson.
2. Introduction to Languages and The Theory of Computation, John C Martin, TMH.
3. lex &yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly
4. Compiler Construction, Kenneth C. Louden, Thomson. Course Technology.

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23AI3106 | **SOFT COMPUTING (PROFESSIONAL ELECTIVE-I)** | | | | | | |

**COURSE OBJECTIVES:**
To introduce the concepts in Soft Computing such as Artificial Neural Networks, Fuzzylogic-based systems, genetic algorithm-based systems and their hybrids.

**COURSE OUTCOMES:** After completion of the course, students will be able to
**CO1:** Learn soft computing techniques and their applications.
**CO2:** Analyze various neural network architectures.
**CO3:** Define the fuzzy systems.
**CO4:** Understand the genetic algorithm concepts and their applications.
**CO5:** Identify and select a suitable Soft Computing technology to solve the problem; construct a solution and implement a Soft Computing solution

**SYLLABUS**

**UNIT-I:**
Introduction to Soft Computing, Artificial neural networks, biological neurons, Basic models of artificial neural networks, Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.

**UNIT-II:**
Perceptron networks, learning rule, Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network, Architecture, Training algorithm

**UNIT-III:**
Fuzzy logic, fuzzy sets, properties, operations on fuzzy sets, fuzzy relations, operations on fuzzy relations, Fuzzy membership functions, fuzzification, Methods of membership, value assignments, intuition, inference, rank ordering, Lambda –
Cuts for fuzzy sets, Defuzzification methods

**UNIT-IV:**
Truth values and Tables in Fuzzy Logic, Fuzzy propositions, Formation of fuzzy rules, Decomposition of rules, Aggregation of rules, Fuzzy Inference Systems, Mamdani and Sugeno types, Neuro-fuzzy hybrid systems, characteristics, classification

**UNIT-V:**
Introduction to genetic algorithm, operators in genetic algorithm, coding, selection, crossover,

mutation, stopping condition for genetical gorithmflow, Genetic-neuro hybrid systems, Genetic Fuzzy rule-based system

**Text Books:**

1. S.N.Sivanandamand S.N.Deepa, Principles of soft computing–JohnWiley & Sons, 2007.
2. Timothy J.Ross, Fuzzy Logic with engineering applications, John Wiley &Sons, 2016.

**Reference Books:**

1. N.K.Sinhaand M.M.Gupta, Soft Computing &Intelligent Systems: Theory & Applications-Academic Press /Elsevier. 2009.
2. Simon Haykin, Neural Network- A Comprehensive Foundation-Prentice Hall International, Inc.1998
3. R. Eberhart and Y. Shi, ComputationalIntelligence:
4. Concepts to Implementation, Morgan Kaufman/Elsevier, 2007.
5. DriankovD., HellendoornH. And ReinfrankM. An Introduction to Fuzzy Control Narosa Pub., 2001.
6. BartKosko,NeuralNetworkandFuzzySystems-PrenticeHall,Inc.,Englewood Cliffs, 1992
7. GoldbergD.E.,Genetic Algorithms in Search, Optimization, and Machine Learning Addison Wesley, 1989

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23AI3107 | **INTERNET OF THINGS (PROFESSIONAL ELECTIVE-I)** | | | | | | |

**COURSE OBJECTIVES:**

- Vision and Introduction to Internet of Things (IoT).
- Understand IoT Market perspective.
- Data and Knowledge Management and use of Devices in IoT Technology.
- Understand State of the Art – IoT Architecture.
- Understand Real World IoT Design Constraints, Industrial Automation and Commercial.

**COURSE OUTCOMES**: After completion of the course, students will be able to

**CO1:** Explain in a concise manner how the general Internet as well as Internet of Things work.
**CO2:** Understand constraints and opportunities of wireless and mobile networks for Internet of Things.
**CO3:** Use basic sensing and measurement and tools to determine the real-time performance of network of devices.
**CO4:** Develop prototype models for various applications using IoT technology.

**SYLLABUS**

**UNIT-I:**

The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles For Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

**UNIT-II:**

Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High- level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability

**UNIT-III:**

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

**UNIT-IV:**

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

**UNIT-V:**

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.

**Text Books:**

1. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A.Bahgya and V.Madisetti, University Press, 2015

**Reference Books:**

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally,WileyGetting Started with the Internet of Things, Cuno Pfister, Oreilly

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 3 | 30 | 70 | 100 | 1.5 |
| SUBCODE: R23AI31L1 | **DEEP LEARNING LAB** | | | | | | |

**COURSE OUTCOMES:** On completion of this course, the student will be able to
**CO1:** Implement deep neural networks to solve real world problems
**CO2:** Choose appropriate pre-trained model to solve real time problem
**CO3:** Interpret the result soft different deep learning models

**SOFTWARE PACKAGES REQUIRED:**

- Keras
- Tensorflow
- PyTorch

**LIST OF EXPERIMENTS:**

1. Implement multi-layer perceptron algorithm for MNISTH and written Digit Classification.
2. Design neural network for classifying movie reviews (Binary Classification) using IMDB dataset.
3. Design a neural Network for classifying news wires (Multiclass classification) using Reuters dataset.
4. Design neural network for predicting house prices using Boston Housing Price dataset.
5. Build a Convolution Neural Network for MNISTH and written Digit Classification.
6. Build a Convolution Neural Network for simple image (dogs and Cats) Classification
7. Use a pre-trained convolution neural network (VGG16) for image classification.
8. Implement one hot encoding of words or characters.
9. Implement word embeddings for IMDB dataset.
10. Implement a Recurrent Neural Network for IMDB movie review classification problem.

**Text Books:**

1. Reza Zadeh and Bharath Ramsundar,“Tensor flow for Deep Learning”, O’Reilly publishers, 2018

**References:**

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

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 3 | 30 | 70 | 100 | 1.5 |
| SUBCODE: R23AI31L2 | **COMPUTER NETWORKS LAB** | | | | | | |

**COURSE OBJECTIVES:**

Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work

**COURSE OUTCOMES:**

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

**CO1:** Identify and configure basic networking devices and construct a Local Area Network (LAN) [K3].

**CO2:** analyze and Implement error detection and correction techniques [K4].

**CO3:** Develop and simulate data link layer and routing protocols [K3].

**CO4:** Utilize network analysis tools to monitor, simulate, evaluate the network performance and security [K3]**.**

**LIST OF EXPERIMENTS:**

1. Study of Network devices in detail and connect the computers in Local Area Network.
2. Write a Program to implement the data link layer farming methods such as
   i) Character stuffing ii) bit stuffing.
3. Write a Program to implement data link layer farming method checksum.
4. Write a program for Hamming Code generation for error detection and correction.
5. Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
6. Write a Program to implement Sliding window protocol for Goback N.
7. Write a Program to implement Sliding window protocol for Selective repeat.
8. Write a Program to implement Stop and Wait Protocol.
9. Write a program for congestion control using leaky bucket algorithm
10. Write a Program to implement Dijkstra‘s algorithm to compute the Shortest path through a graph.
11. Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).
12. Write a Program to implement Broadcast tree by taking subnet of hosts.

13. Wireshark
    i. Packet Capture Using Wire shark
    ii. Starting Wire shark
    iii. Viewing Captured Traffic
    iv. Analysis and Statistics & Filters.
14. How to run Nmap scan
15. Operating System Detection using Nmap
16. Do the following using NS2 Simulator
    i. NS2 Simulator-Introduction
    ii. Simulate to Find the Number of Packets Dropped
    iii. Simulate to Find the Number of Packets Dropped by TCP/UDP
    iv. Simulate to Find the Number of Packets Dropped due to Congestion
    v. Simulate to Compare Data Rate& Throughput.

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 30 | 70 | 100 | 2 |
| SUBCODE: R23AI31L3 | **FULL STACK DEVELOPMENT -II (SKILL ENHANCEMENT COURSE)** | | | | | | |

**COURSE OBJECTIVES:** The main objectives of the course are to
- Make use of router, template engine and authentication using sessions to develop application in ExpressJS.
- Build a single page application using RESTful APIs in ExpressJS
- Apply router and hooksin designing ReactJS application
- Make use of MongoDB queries to perform CRUD operations on document database

**EXPERIMENTS COVERING THE TOPICS:**
- ExpressJS – Routing, HTTP Methods, Middleware, Templating, Form Data
- ExpressJS – Cookies, Sessions, Authentication, Database, RESTful APIs
- ReactJS – Render HTML, JSX, Components – function & Class, Props and States, Styles, Respond to Events
- ReactJS – Conditional Rendering, Rendering Lists, React Forms, React Router, Updating the Screen
- ReactJS – Hooks, Sharing data between Components, Applications – To-do list and Quiz
- MongoDB – Installation, Configuration, CRUD operations, Databases, Collections and Records

**COURSE OUTCOMES:**
After successful completion of this course, the students will be able to:
**CO1:** Build dynamic server-side applications by using ExpressJS [K3].
**CO2:** Construct responsive client-side applications using ReactJS [K3].
**CO3:** Experiment with NoSQL using MongoDB [K3].
**CO4:** Design and implement full-stack web applications [K4].

**SAMPLE EXPERIMENTS:**

**1. ExpressJS – Routing, HTTP Methods, Middleware.**

a. Write a program to define a route, Handling Routes, Route Parameters, Query Parameters and URL building.

b. Write a program to accept data, retrieve data and delete a specified resource using http methods.

c. Write a program to show the working of middleware.

**2. ExpressJS – Templating, Form Data**

a. Write a program using templating engine.

b. Write a program to work with form data.

**3. ExpressJS – Cookies, Sessions, Authentication**

a. Write a program for session management using cookies and sessions.

b. Write a program for user authentication.

**4. ExpressJS – Database, RESTful APIs**

a. Write a program to connect MongoDB database using Mangoose and perform CRUD operations.
b. Write a program to develop a single page application using RESTful APIs.

**5. ReactJS – Render HTML, JSX, Components – function & Class**

a. Write a program to render HTML to a web page.
b. Write a program for writing markup with JSX.
c. Write a program for creating and nesting components (function and class).
d.

**6. ReactJS – Props and States, Styles, Respond to Events**

a. Write a program to work with props and states.
b. Write a program to add styles (CSS & Sass Styling) and display data.
c. Write a program for responding to events.

**7. ReactJS – Conditional Rendering, Rendering Lists, React Forms**

a. Write a program for conditional rendering.
b. Write a program for rendering lists.
c. Write a program for working with different form fields using react forms.

**8. ReactJS – React Router, Updating the Screen**

a. Write a program for routing to different pages using react router.
b. Write a program for updating the screen.

**9. ReactJS – Hooks, Sharing data between Components**

a. Write a program to understand the importance of using hooks.
**b.** Write a program for sharing data between components.

**10. MongoDB – Installation, Configuration, CRUD operations**

a. Install MongoDB and configure ATLAS
b. Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()

**11. MongoDB – Databases, Collections and Records**

a. Write MongoDB queries to Create and drop databases and collections.
b. Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate().

**12. Augmented Programs: (Any 2 must be completed)**

a. Design a to-do list application using NodeJS and ExpressJS.
b. Design a Quiz app using ReactJS.
c. Complete the MongoDB certification from MongoDB University website.

**Text Books:**

1. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.
2. Node.Js in Action, Mike Cantelon, Mark Harter, T.J. Holowaychuk, Nathan Rajlich,Manning Publications. (Chapters 1-11)
3. React Quickly, AzatMardan,Manning Publications(Chapters 1-8,12-14)

**Web Links:**

1. ExpressJS - https://www.tutorialspoint.com/expressjs
2. ReactJS - https://www.w3schools.com/REACT (and) https://react.dev/learn#
3. MongoDB -https://learn.mongodb.com/learning-paths/introduction-to-mongodb

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 2 | 30 | 70 | 100 | 1 |
| SUBCODE: R23AI31L4 | **User Interface Design using Flutter** | | | | | | |

**COURSE OBJECTIVES:**

- Learns to Implement Flutter Widgets and Layouts
- Understands Responsive UI Design and with Navigation in Flutter
- Knowledge on Widgets and customize widgets for specific UI elements, Themes
- Understand to include animation apart from fetching data

**COURSE OUTCOMES:**

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

**CO1:** Install Flutter and DART SDK **[K2].**
**CO2:** Experiment various Flutter Widgets **[K3].**
**CO3:** Create an application to navigate between screens **[K4].**
**CO4:** Apply animation on UI elements **[K3].**
**CO5:** Utilize REST API for retrieving data **[K3].**

**LIST OF EXPERIMENTS:**

Students need to implement the following experiments

1. a) Install Flutter and Dart SDK.
   b) Write a simple Dart program to understand the language basics.

2. a) Explore various Flutter widgets (Text, Image, Container, etc.).
   b) Implement different layout structures using Row, Column, and Stack widgets.

3. a) Design a responsive UI that adapts to different screen sizes.
   b) Implement media queries and breakpoints for responsiveness.

4. a) Set up navigation between different screens using Navigator.
   b) Implement navigation with named routes.

5. a) Learn about stateful and stateless widgets.
   b) Implement state management using set State and Provider.

6. a) Create custom widgets for specific UI elements.
   b) Apply styling using themes and custom styles.

7. a) Design a form with various input fields.
   b) Implement form validation and error handling.

8. a) Add animations to UI elements using Flutter's animation framework.
   b) Experiment with different types of animations (fade, slide, etc.).

9. a) Fetch data from a REST API.
b) Display the fetched data in a meaningful way in the UI.

10. a) Write unit tests for UI components.
b) Use Flutter's debugging tools to identify and fix issues.

**Text Books:**

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.
2. Rap Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile Apps 1st Edition, Apres
3. Richard Rose, Flutter & Dart Cookbook, Developing Full stack Applications for the Cloud, Oreilly.

# OPEN ELECTIVE-I

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: | **COMPUTER ORGANIZATION AND ARCHITECTURE** | | | | | | |

**COURSE OBJECTIVES:**

- Comprehensive knowledge of computer system including the analysis and design of components of the system.
- Describes different parameters of a memory system, organization and mapping of various types of memories.
- Illustrates algorithms for basic arithmetic operations using binary representation.
- Describes the means of interaction of devices with CPU, their characteristics and operating modes.

**COURSE OUTCOMES: After completion of this course, the students would be able to**

**CO 1**: Interpret the computer system from user's perspective and can explain how Arithmetic Logic Unit works. **[K2]**

**CO 2**: Explain of basic components of the system and illustrate data paths and control flow for sequencing in CPUs. **[K2]**

**CO 3**: Interpret the Micro operations and Microprogramming for design of control unit of CPU. **[K2]**

**CO 4:** Develop Main Memory Interfacing Circuit and can apply various cache memory mapping techniques. **[K3]**

**CO 5:** Apply algorithms to perform arithmetic operations on binary representation of fixed point data. **[K3]**

**CO 6:** Interpret various I/O interface devices. **[K2]**

**SYLLABUS:**

**UNIT - I**

**Introduction:** Types of Computers, Functional units of Basic Computer (Block diagram of Micro Computer). Register Transfer and Micro-operations: Register Transfer language, Register Transfer, Bus and memory transfers - Three-State Bus Buffers, Memory Transfer; Arithmetic micro operations, Binary Adder, Binary Adder _Subtractor, Binary Incrementer, Arithmetic Circuit; Logical micro operations- List of Logic Microoperations, Hardware Implementation, Some Applications; Shift micro operations-Hardware Implementation, Arithmetic logic shift unit.

**UNIT - II**

**Basic Computer Organization and Design:** Instruction codes – Stored Program Organization, Indirect Address, Computer Registers – Common Bus Systems, Computer instructions – Instruction Set Completeness, Timing and control, Instruction cycle – Fetch and Decode, Determine the Type of Instruction, Register Reference Instructions, Memory – Reference Instructions – AND to AC, ADD to AC, LDA :Load to AC,STA: Store AC, BUN: Branch Unconditionally, BSA: Branch and Save Return Address, ISZ: Increment and Skip if Zero, Control Flow Chart, Input – Output Instructions and Interrupt – Input – Output Configuration, Input-Output Instructions.

**UNIT - III**

**Central Processing Unit:** Instruction formats – Three Address Instructions, Two Address Instructions, One Address Instructions, Zero Address Instructions, RISC Instructions, Addressing modes – Numerical Example, Data Transfer and manipulation – Data Transfer Instructions, Data Manipulation Instructions, Arithmetic Instructions, Logical and Bit Manipulation Instructions, Shift Instructions, Program control – Status Bit Conditions, Conditional Branch Instructions, Subroutine Call and Return, Program Interrupt, Types of Interrupts, Reduced Instruction Set Computer – CISC Characteristics, RISC Characteristics. Micro Programmed Control Unit: Control memory, Address sequencing – Conditional Branching, Mapping of Instructions, Subroutines, Micro program example – Computer Configuration, Microinstruction Format, Symbolic Microinstructions, The Fetch Routine, Symbolic Microprogram, Design of control unit – Microprogram Sequencer.

**UNIT - IV**

**The Memory System:** Memory Hierarchy, Main memory - RAM and ROM Chips, Memory Address Maps, Memory Connection to CPU, Auxiliary memory – Magnetic Disks, Magnetic Tape, Associative Memory – Hardware Organization, Match Logic, Cache Memory – Associative Mapping, Direct Mapping, Set- Associative Mapping, Writing into Cache. Computer Arithmetic: Addition and subtraction – Addition and Subtraction with Signed Magnitude Data, Hardware Implementation, Hardware Algorithm, Addition and Subtraction with Signed 2's Complement Data, Multiplication Algorithms –Booth Multiplication Algorithm.

**UNIT – V**

**Input-Output Organization:** Peripheral Devices – ASCII Alphanumeric Characters, Input Output Interface – I/O Bus and Interface Modules, I/O vs Memory Bus, Isolated vs Memory Mapped I/O, Example of I/O Interface, Asynchronous data transfer – Strobe Control, Handshaking, Asynchronous Serial Transfer, Modes of Transfer – Example of Programmed I/O, Interrupt Initiated I/O, Priority Interrupts – Daisy Chaining Priority, Parallel Priority Interrupt, Priority Encoder, Interrupt Cycle, Direct memory Access – DMA Controller, DMA Transfer.

**TEXT BOOKS:**

1. M. Morris Mano, "Computer System Architecture", Third Edition, Pearson.2008

**REFERENCE BOOKS:**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", McGraw Hill, 5/e, 2002.
2. William Stallings, "Computer Organization and Architecture", Pearson 6/e, 2006.
3. Structured Computer Organization, Andrew S. Tanenbaum, Pearson, 4/e, 2005.
   Sivarama P. Dandamudi, "Fundamentals of Computer Organization and Design", Springer, 2006.

**WEB REFERENCES:**

1. nptel.ac.in/courses/106106092
2. nptel.ac.in/courses/106103068

**B. Tech – III Year II Semester**

| S.No. | Subject Code | Cat. Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | R23CC3212 | PC | Software Engineering | 3 | 0 | 0 | 3 |
| 2 | R23CC3210 | PC | Generative A.I. | 3 | 0 | 0 | 3 |
| 3 | R23CC3211 | PC | Data Visualization | 3 | 0 | 0 | 3 |
| 4 | R23AM3204<br>R23AM3205<br>R23AM3207<br>R23CC3209<br>R23CC32MOOC1 | PE-II | 1. Software Testing Methodology<br>2. Cryptography & Network Security<br>3. Recommender Systems<br>4. DevOps<br>5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS | 3 | 0 | 0 | 3 |
| 5 | R23CS3204<br>R23CC3204<br>R23AI3207<br>R23CC3203<br>R23CC32MOOC2 | PE-III | 1. Software Project Management<br>2. Mobile Adhoc Networks<br>3. Computer Vision<br>4. Cloud Computing<br>5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS | 3 | 0 | 0 | 3 |
| 6 | | OE-II | Introduction to Embedded Systems offered by Dept. of ECE) | 3 | 0 | 0 | 3 |
| 7 | R23AI32L1 | PC | Generative A.I. Lab | 0 | 0 | 3 | 1.5 |
| 8 | R23AI32L2 | PC | Data Visualization Lab | 0 | 0 | 3 | 1.5 |
| 9 | R23AI32L3 | SC | Soft skills / SWAYAM Plus - 21st Century Employability Skills | 0 | 1 | 2 | 2 |
| 10 | R23AI32MC | AC | Technical Paper Writing & IPR | 2 | 0 | 0 | - |
| | | **Total** | | **20** | **1** | **8** | **23** |
| *Mandatory Industry Internship/Mini Project of 08 weeks duration during summer vacation | | | | | | | |
| MC | | Student may select from the same minors pool | | 3 | 0 | 3 | 4.5 |
| MC | | Minor Course<br>(Student may select from the same specialized minors pool) | | 3 | 0 | 0 | 3 |
| HC | | Student may select from the same honors pool | | 3 | 0 | 0 | 3 |
| HC | | Honors Course<br>( Student may select from the honors pool) | | 3 | 0 | 0 | 3 |

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC3212 | **SOFTWARE ENGINEERING** | | | | | | |

**COURSE OBJECTIVES:** The objectives of this course are to introduce

- Software life cycle models, Software requirements and SRS document.
- Project Planning, quality control and ensuring good quality software.
- Software Testing strategies, use of CASE tools, Implementation issues, validation &verification procedures.

**COURSE OUTCOMES: After completion of this course, the students would be able to:**

**CO 1:** Make use of Software Life Cycle models to. **[K4]**
**CO 2:** Emphasize the importance of software requirement and project management **[K4]**
**CO 3:** Analyze various types of software design techniques **[K4]**
**CO 4:** practice various Software testing methodologies **[K4].**
**CO 5:** Analyze various CASE tools and software maintenance process models. **[K4]**

**SYLLABUS**

**UNIT-I:**

**Introduction:** Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.

**Software Life Cycle Models:** Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

**UNIT-II:**

**Software Project Management:** Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.

**Requirements Analysis and Specification:** Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

**UNIT-III:**

**Software Design:** Overview of the design process, how to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design.

**Agility:** Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)

**Function-Oriented Software Design:** Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.
**User Interface Design:** Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

**UNIT-IV:**

**Coding And Testing:** Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing**,** testing object-oriented programs, Smoke testing, and some general issues associated with testing.

**Software Reliability and Quality Management:** Software reliability. Statistical testing, Software quality, Software quality management system,ISO9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma**.**

**UNITV:**

**Computer-Aided Software Engineering (Case):** CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.
**Software Maintenance:** Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.
**Software Reuse:** Reuse-definition, introduction, reason behind noreusesofar, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

**Text Books:**

1. Fundamentals of Software Engineering, Rajib Mall, 5$^{th}$Edition,PHI.
2. Software Engineering: A Practitioner's Approach, Roger S. Pressman, 9$^{th}$Edition, McGraw Hill International Edition.

**Reference Books:**

1. Software Engineering, IanSommerville, 10$^{th}$Edition, Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

**e- Resources:**

1) https://nptel.ac.in/courses/106/105/106105182/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview
3) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC3210 | **GENERATIVE AI** | | | | | | |

**COURSE OBJECTIVES:**

- Understand the basics of Generative AI.
- Know the basics of Text Generation.
- Understand the process of generating videos.
- Know about GAN and its variants.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1:** Explain the fundamentals, evolution, architectures, and applications of Generative AI. [K2]

**CO2:** Analyze and compare various Generative AI models such as LLMs, GANs, VAEs, and Diffusion Models. [K4]

**CO3:** Apply prompt engineering techniques and Generative AI tools for content generation and problem-solving. [K3]

**CO4:** Develop and deploy Generative AI applications using APIs, frameworks, and pre-trained models. [K6]

**CO5:** Evaluate the performance, ethical implications, limitations, and societal impact of Generative AI systems. [K5]

**SYLLABUS**

**UNIT-I:**

Introduction To Gen AI: Historical Overview of Generative modelling, Difference between Gen AI and Discriminative Modeling, Importance of generative models in AI and Machine Learning, Types of Generative models, GANs, VAEs, autoregressive models and Vector quantized Diffusion models, understanding if probabilistic modeling and generative process, Challenges of Generative Modeling, Future of Gen AI, Ethical Aspects of AI, Responsible AI, Use Cases.

**UNIT-II:**

Generative Models for Text: Language Models Basics, building blocks of Language models, Transformer Architecture, Encoder and Decoder, Attention mechanisms, Generation of Text, Models like BERT and GPT models, Generation of Text, Autoencoding, Regression Models, Exploring ChatGPT, Prompt Engineering: Designing Prompts, Revising Prompts using Reinforcement Learning from Human Feedback (RLHF), Retrieval Augmented Generation, Multimodal LLM, Issues of LLM like hallucination.

**UNIT-III:**

Generation of Images: Introduction to Generative Adversarial Networks, Adversarial Training Process, Nash Equilibrium, Variational Autoencoders, Encoder-Decoder Architectures, Stable Diffusion Models, Introduction to Transformer-based Image Generation, CLIP, Visual Transformers ViT- Dall-E2 and Dall-E3, GPT-4V, Issues of Image Generation models like Mode Collapse and Stability.

**UNIT-IV:**
Generation of Painting, Music, and Play: Variants of GAN, Types of GAN, Cyclic GAN, Using Cyclic GAN to Generate Paintings, Neural Style Transfer, Style Transfer, Music Generating RNN, MuseGAN, Autonomous agents, Deep Q Algorithm, Actor-critic Network.

**UNIT-V:**
Open-Source Models and Programming Frameworks: Training and Fine tuning of Generative models, GPT4All, Transfer learning and Pretrained models, Training vision models, Google Copilot, Programming LLM, LangChain, Open-Source Models, Llama, Programming for TimeSformer, Deployment, Hugging Face.

**Text Books:**
1. Denis Rothman, "Transformers for Natural Language Processing and Computer Vision", Third Edition,Packt Books, 2024

**Reference Books:**
1. David Foster," Generative Deep Learning", O'Reily Books, 2024.
2. Altaf Rehmani, "Generative AI for Everyone", BlueRose One, 2024.

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC3211 | **DATA VISUALIZATION** | | | | | | |

**PRE-REQUISITES: COMPUTER GRAPHICS, IMAGE PROCESSING**

**COURSE OBJECTIVE:**

- familiarize students with the basic and advanced techniques of information visualization and scientific visualization
- learn key techniques of the visualization process
- a detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1:** Explain Visualization and representation of data. [**K6]**
**CO2:** Creating visual representations and visualization reference model of applications. [**K3]**
**CO3:** Classify the visualization systems in a data representation. [**K4]**
**CO4:** Identify Visualization of groups and trees. [**K3]**
**CO5:** Determin**e** the visualization of volumetric different data sets in applications. [**K6]**

**SYLLABUS**

**UNIT-I:**

**Introduction**: What Is Visualization? History of Visualization, Relationship between Visualization and Other Fields. The Visualization Process, Introduction of visual perception, visual representation of data, Gestalt principles, information overloads.

**UNIT-II:**

Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications

**UNIT-III:**

Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

**UNIT-IV:**

Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization

**UNIT-V:**

Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, evaluating visualizations

**Recent trends** in various perception techniques, various visualization techniques, data structures used in data visualization.

**Textbook:**

1. WARD, GRINSTEIN, KEIM. Interactive Data Visualization: Foundations, Techniques, and Applications. Natick: A K Peters, Ltd.
2. E. Tufte, the Visual Display of Quantitative Information, Graphics Press.

**Resources:**

1. https://kdd.cs.ksu.edu/Courses/CIS536/Lectures/Slides/Lecture-34-Main_6up.pdf

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
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| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23AM3204 | **SOFTWARE TESTING METHODOLOGY (PROFESSIONAL ELECTIVE -II)** | | | | | | |

**COURSE OBJECTIVES**

- To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.
- To develop skills in software test automation and management using the latest tools.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:
**CO 1:** Outline the software testing terminology. **[K1]**
**CO 2:** Compare and contrast various behavioral testing methodologies. **[K4]**
**CO 3:** Summarize various dynamic testing techniques **[K2]**
**CO 4:** Interpret various validation activities and Software quality models **[K2]**
**CO 5:** Analyze debugging techniques and testing tools. **[K4]**

**SYLLABUS**

**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 Flow Testing: transaction flows, transaction flow testing techniques.
Data Flow testing: Basics of data flow testing, strategies in data flow testing, application of data flow 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.
Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications.

**UNIT – IV:**
State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.

**UNIT – V:**
Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like Jmeter / selenium / soapUI / Catalon).

**Text Books:**

1. Software Testing techniques - BarisBeizer, Dreamtech, second edition.
2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.

**Reference Books**:

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing Techniques – SPD(Oreille)
3. Software Testing in the Real World – Edward Kit, Pearson.
4. Effective methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing – Meyers, John Wiley.

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23AM3205 | **CRYPTOGRAPHY & NETWORK SECURITY (PROFESSIONAL ELECTIVE -II** | | | | | | |

**COURSE OBJECTIVES:**

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand the basic categories of threats to computers and networks
- Discusses the Mathematics of Cryptography
- Discuss the fundamental ideas of Symmetric and Asymmetric cryptographic Algorithms
- Discusses the Network layer, Transport Layer and Application layer Protocols Enhanced security mechanisms

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1:** Student will be able to understand security issues related to computer networks and learn different symmetric key techniques. [**K2]**

**CO2:** Students will be able learn mathematic of cryptography for symmetric and Asymmetric algorithms and apply this knowledge to understand the Cryptographic algorithms. [**K3]**

**CO3:** Students will be able learn different types of symmetric and Asymmetric algorithms. [**K3]**

**CO4:** Students will be able learn different algorithms of Hash functions, message authentication and digital signature and their importance to the security. [**K4]**

**CO5:** Students will be able learn different Enhanced security protocols of Application Layer, Transport Layer and Network layer. [**K4]**

**#Based on suggested Revised BTL**

**SYLLABUS:**

**UNIT – I:**

**Security Concepts:** Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Steganography.

**UNIT – II:**

**Introduction to Symmetric Cryptography: Algebraic Structures**-Groups, Rings, Fields, GF($2^n$) fields, Polynomials.**Mathematics of Asymmetric cryptography:** Primes, Checking for Primness, Eulers phi-functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation and Logarithm.

**UNIT – III:**

**Symmetric key Ciphers:** Block Cipher principles, DES, AES, Blowfish, IDEA, Block cipher operation, Stream ciphers: RC4, RC5

**Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

**UNIT – IV:**

**Cryptographic Hash Functions:** Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithms (SHA)

**Message Authentication Codes:** Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MAC'S, MAC'S Based on Hash Functions: HMAC, MAC'S Based on Block Ciphers: DAA and CMAC

**Digital Signatures:** Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.

**UNIT – V:**

**Network and Internet Security: Transport-Level Security:** Web Security Considerations, Transport Level Security, HTTPS, SSH.

**IP Security:** IP Security Overview, IP Security Policy, Encapsulating Security Payload, Authentication Header Protocol.

**Electronic-Mail Security:** Internet-mail Security, Email Format, Email Threats and Comprehensive Email Security, S/MIME, PGP.

**Text Books:**

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017
2. Cryptography and Network Security: Behrouz A. Forouzan Debdeep, Mc Graw Hill, 3rd Edition, 2015

**Reference Books:**

1. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
2. Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C. Washington, Pearson.
3. Modern Cryptography: Theory and Practice byWenbo Mao. Pearson

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
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| SUBCODE: R23AM3207 | **RECOMMENDER SYSTEMS (PROFESSIONAL ELECTIVE -II)** | | | | | | |

**COURSE OBJECTIVES:**
This course covers the basic concepts of recommender systems, including personalization algorithms, evaluation tools, and user experiences

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:
**CO1:** Describe basic concepts behind recommender systems.
**CO2:** Explain a variety of approaches for building recommender systems
**CO3:** Describe system evaluation methods from both algorithmic and users' perspectives
**CO4:** Describe applications of recommender systems in variCOous domains

**SYLLABUS**

**UNIT-I:**
**Introduction:** Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

**UNIT-II:**
**Collaborative Filtering**: User-based nearest neighbor recommendation, Item-based nearest neighbor recommendation, Model based and pre-processing based approaches, Attacks on collaborative recommender systems.

**UNIT-III:**
**Content-based recommendation:** High level architecture of content-based systems, Advantages and drawbacks of content-basedfiltering, Item profiles, discovering features of documents, obtaining item features from tags, representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.
**Knowledge based recommendation:** Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders.

**UNIT-IV:**
**Hybrid approaches:** Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies.

**UNIT-V:**
**Evaluating Recommender System:** Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centered metrics.

**Recommender Systems and communities:** Communities, collaboration and recommender systems in personalized web search, Social tagging recommender systems, Trust and recommendations

**Text Books:**

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1st ed.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st ed.

**References:**

1. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed.

| III B.TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
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| | 3 | 0 | 3 | 30 | 70 | 100 | 4.5 |
| SUBCODE: R23CC3209 | **DEVOPS (PROFESSIONAL ELECTIVE -II)** | | | | | | |

**COURSE OBJECTIVES:** The main objectives of this course are to:

- Describe the agile relationship between development and IT operations.
- Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
- Implement automated system update and DevOps lifecycle.

**COURSE OUTCOMES:** On successful completion of this course, students will be able to:
**CO1:** Identify the DevOps Concepts and Tools for effective project management.
**CO2: U**tilize GIT to keep track of different versions of the source code.
**CO3:** Build and Automate Testusing Jenkins.
**CO4:** Implement containerization with Docker.
**CO5:** Use ANSIBLE,Kubernetes for automation and deployment.

**SYLLABUS**

**UNIT-I:**

**Introduction to DevOps:** Introduction to SDLC, Agile Model. Introduction to Devops. DevOps Features, DevOps Architecture, DevOps Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation, Understanding Code Quality, Automation of CI/ CD. Release management, Scrum, Kanban, delivery pipeline,bottlenecks, examples

**UNIT-II:**

**Source Code Management (GIT):** The need for source code control, the history of source code management, Roles and code, source code management system and migrations. What is Version Control and GIT, GIT Installation, GIT features, GIT workflow, working with remote repository, GIT commands, GIT branching, GIT staging and collaboration. Unittesting-Code Coverage: Junit, Nunit & Code Coverage with Sonar Qube, Sonar Qube - Code Quality Analysis.

**UNIT-III:**

**Build Automation - Continuous Integration (CI):**Build Automation, what is CI Why Cl is Required, CI tools, Introduction to Jenkins (With Architecture), jenkins workflow, jenkins master slave architecture, Jenkins Pipelines, PIPELINE BASICS - Jenkins Master, Node, Agent, and Executor Freestyle Projects& Pipelines, Jenkins for Continuous Integration, Create and Manage Builds, User Management in Jenkins Schedule Builds, Launch Builds on Slave Nodes.

**UNIT-IV:**

**Continuous Delivery:** Importance of Continuous Delivery, Continuous Deployment CD Flow, Containerization with Docker: Introduction to Docker, Docker installation, Docker commands, Images & Containers, Docker File, running containers, working with containers and publish to Docker Hub.Testing Tools: Introduction to Selenium and its features, Java Script testing.

**UNIT-V:**

**Configuration Management - ANSIBLE:** Introduction to Ansible, Ansible tasks Roles, Jinja2 templating, Vaults, Deployments using Ansible.

Containerization Using Kubernetes (Openshift): Introduction to Kubernetes Namespace& Resources, CI/CD - On OCP, BC, DC& Config Maps, Deploying Apps on Openshift Container Pods. Introduction to Puppet master and Chef.

**Text Books:**

1. Joyner, Joseph, Devops for Beginners: Devops Software Development Method Guide for Software Developers and It Professionals, 1st Edition Mihails Konoplows, 2015.
2. Alisson Machado de Menezes., Hands-on DevOps with Linux, 1st Edition, BPB Publications, India, 2021.

**Reference Books:**

1. LenBass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10
2. Gene Kim Je Humble, Patrick Debois, John Willis. The DevOps Handbook, 1st Edition, IT Revolution Press, 2016.
3. Verona, Joakim Practical DevOps, 1st Edition, Packet Publishing, 2016.
4. Joakim Verona. Practical Devops, Second Edition. Ingramshorttitle; 2nd edition (2018). ISBN10: 1788392574
5. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications.ISBN:9788126579952

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
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| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CS3204 | **SOFTWARE PROJECT MANAGEMENT (PROFESSIONAL ELECTIVE -III)** | | | | | | |

**COURSE OBJECTIVES:**

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

- Todescribeanddeterminethepurposeandimportanceofprojectmanagementfromtheperspectivesofplanning,trackingandcompletionofproject
- Tocompareanddifferentiateorganizationstructuresandprojectstructures
- To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

**COURSE OUTCOMES:**

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

**CO1:** Outline the key concepts and objectives of software project management **[K1].**

**CO2:** Interpret the phases of the software development life cycle and their relevance to project management **[K2].**

**CO3:** Apply software estimation and planning techniques to manage project timelines and costs **[K3].**

**CO4:** Analyze different software process workflows and identify appropriate methodologies for given scenarios **[K4].**

**CO5:** Compare conventional and agile project management approaches in terms of efficiency and adaptability **[K4].**

**SYLLABUS**

**UNIT-I:**

**Conventional Software Management:** The water fall model, conventional software Management performance.

**Evolution of Software Economics:** Software Economics, pragmatic software costestimation.

**Improving Software Economics:** Reducing Software product size, improvings oft ware processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

**The oldway and the new:** The principles of conventional software Engineering, principles of modern software management, transitioning to aniterativeprocess.

**UNIT-II:**

**Life cycle phases:** Engineering and production stages, inception, Elaboration, construction, transition phases.

**Artifacts of the process:** The artifactsets, Management artifacts, engineering artifacts, program aticartifacts.

**UNIT-III:**

**Model based software architectures:** A Management perspective and technical perspective.

**Work Flows of the process:** Software process workflows, Iteration workflows.

**Checkpoints of the process: Major** milestones, Minor Milestones, Periodic status assessments.
**Iterative Process Planning:** Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

**UNIT-IV:**
**Project Organizations and Responsibilities:** Line-of-Business Organizations, Project Organizations, evolution of Organizations.
**Process Automation:** Automation Building blocks, The Project Environment.
**Project Control and Process instrumentation:** The sevencore Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

**UNIT-V:**
Agile Methodology, ADAPTing to Scrum, Patterns for Adopting Scrum, Iterating towards Agility.
**Fundamentals of DevOps**: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps ecosystem. DevOps adoption inprojects: Technology aspects, Agiling capabilities, Toolstack implementation, People aspect, processes

**Text Books:**
1. Software Project Management, Walker Royce, PEA, 2005.
2. Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
3. The DevOps Handbook: How to Create World – Class Agility, Reliability, and Security in Technology Organizations, Gene Kim, John Willis, Patrick Debois, Jez Humb,1st Edition, O'Reilly publications,2016.

**Reference Books:**
1. Software Project Management, BobHughes,3/e,Mike Cotterell, TMH
2. Software Project Management, JoelHenry, PEA
3. Software Project Management inpractice, PankajJalote, PEA, 2005,
4. Effective Software Project Management, RobertK. Wysocki, Wiley, 2006.
5. Project Management in IT,KathySchwalbe, Cengage

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
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| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC3204 | **MOBILE ADHOC NETWORKS (PROFESSIONAL ELECTIVE -III)** | | | | | | |

**COURSE OBJECTIVES:** From the course the student will learn

- Architect sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model links cost.
- Understanding of the fundamental concepts of wireless sensor networks and has a basic knowledge of the various protocols at various layers.
- Evaluate the performance of sensor networks and identify bottlenecks.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1:** Understand the characteristics and design issues of Mobile Ad Hoc Networks (MANETs). **[K2]**
**CO2:** Analyze routing and transport protocols in ad hoc networks. **[K4]**
**CO3:** Identify and apply security solutions in MANETs. **[K3]**
**CO4:** Demonstrate knowledge of Wireless Sensor Network (WSN) architecture, clustering, and applications. **[K2]**
**CO5:** Apply knowledge of key management, WSN operating systems, and simulation tools. **[K3]**

**SYLLABUS**

**UNIT I:**

**Introduction to Ad Hoc Wireless Networks-** Cellular and Ad Hoc Wireless Networks, Characteristics of MANETs, Applications of MANETs, Issues and Challenges of MANETs, Ad Hoc Wireless Internet, MAC protocols for Ad hoc Wireless Networks-Issues, Design Goals and Classifications of the MAC Protocols.

**UNIT II:**

**Routing Protocols for Ad Hoc Wireless Networks-** Issues in Designing a Routing Protocol, Classifications of Routing Protocols, Topology-based versus Position-based Approaches, Issues and design goals of a Transport layer protocol, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks, Solutions for TCP over Ad Hoc Wireless Networks, Other Transport layer protocols.

**UNIT III:**

**Security protocols for Ad hoc Wireless Networks-** Security in Ad hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad hoc Wireless Networks, Cooperation in MANETs, Intrusion Detection Systems.

**UNIT IV:**

**Basics of Wireless Sensors and Applications-** The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications, Data Retrieval in Sensor Networks-Classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

**UNIT V:**

**Security in WSNs-** Security in WSNs, Key Management in WSNs, Secure Data Aggregation in WSNs, Sensor Network Hardware-Components of Sensor Mote, Sensor Network Operating Systems–TinyOS, LA-TinyOS, SOS, RETOS, Imperative Language-nesC, **Dataflow Style Language**-TinyGALS, Node-Level Simulators, NS-2 and its sensor network extension, TOSSIM.

**Text Books:**

1. Ad Hoc Wireless Networks – Architectures and Protocols, 1st edition, C. Siva Ram Murthy, B. S. Murthy, Pearson Education, 2004
2. Ad Hoc and Sensor Networks – Theory and Applications, 2nd edition *Carlos Corderio Dharma P.Aggarwal*, World Scientific Publications / Cambridge University Press, March 2006

**Reference Books:**

1. Wireless Sensor Networks: An Information Processing Approach, 1st edition, *Feng Zhao, Leonidas Guibas*, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009
2. Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, 1st edition, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008
3. Ad hoc Networking, 1st edition,*Charles E.Perkins*, Pearson Education, 2001
4. Wireless Ad hoc Networking, 1st edition, *Shih-Lin Wu, Yu-Chee Tseng,* Auerbach Publications, Taylor & Francis Group, 2007
5. Wireless Sensor Networks – Principles and Practice, 1st edition, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
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| SUBCODE: R23AI3207 | **COMPUTER VISION (PROFESSIONAL ELECTIVE -III)** | | | | | | |

**COURSE OBJECTIVES:**

- To understand the Fundamental Concepts related to sources,shadows and shading
- To understand the Geometry of Multiple Views

**COURSE OUTCOMES:**

**CO1:** Implement fundamental image processing techniques required for computer vision
**CO2:** Implement boundary tracking techniques
**CO3:** Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections.
**CO4:** Apply 3Dvision techniques and Implement motion related techniques.
**CO5:** Develop applications using computer vision techniques.

**SYLLABUS**

**UNIT–I:**

Cameras: Pinhole Cameras Radiometry– Measuring Light: Lightin Space, Light Surfaces, Important Special Cases Sources, Shadows, and Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application:PhotometricStereo,interreflections:GlobalShadingModelsColor: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

**UNIT-II:**

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges Texture0:Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

**UNIT-III:**

The Geometry of Multiple Views: Two Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering: What is Segmentation? Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

**UNIT-IV:**

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods:

Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking with Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples

**UNIT-V:**

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry,

Case study: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Case study: Registration in Medical Imaging Systems, Curved Surfaces and Alignment.

**Text Books:**

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

**Reference Books:**

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R. C. Gonzalez and R. E. Woods “Digital Image Processing” Addison Wesley 2008. 3. Richard Szeliski “Computer Vision: Algorithms and Applications” Springer-Verlag London Limited 2011.

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
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| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC3203 | **CLOUD COMPUTING (PROFESSIONAL ELECTIVE -III)** | | | | | | |

**COURSE OBJECTIVES:**

- To explain the evolving utility computing model called cloud computing.
- To introduce the various levels of services offered by cloud.
- To discuss the fundamentals of cloud enabling technologies such as distributed computing, service-oriented architecture and virtualization.
- To emphasize the security and other challenges in cloud computing.
- To introduce the advanced concepts such as containers, server less computing and cloud-centric Internet of Things.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1:** Analyze the fundamentals of cloud computing [K4].

**CO2:** Examine the technologies that enable cloud computing such as distributed systems, parallel computing, SOA, web services and virtualization [K4].

**CO3:** Analyze the architecture and management of virtual machines and containers [K4].

**CO4:** Analyze the major challenges in cloud computing such as security, scalability, interoperability and energy efficiency [K4].

**CO5:** Explore and assess advanced topics in cloud computing including server less architectures, cloud-based IoT, edge/fog computing, DevOps and quantum cloud computing [K4].

**SYLLABUS**

**UNIT -I**:

Introduction to Cloud Computing Fundamentals Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google AppEngine).

**UNIT-II**:

Cloud Enabling Technologies: Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributed computing, Inter-process communication, technologies for distributed computing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.

**UNIT-III**:

Virtualization and Containers: Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware),building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes, public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings.

**UNIT-IV**:
Cloud computing challenges: Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

**UNIT -V**:
Advanced concepts in cloud computing: Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS) serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.

**Text Books:**
1. Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, Shivananda Poojara, Satish N. Srirama, Mc Graw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

**Reference Books:**
1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.
3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
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| SUBCODE: R23AI32L1 | **GENERATIVE AI LAB** | | | | | | |

**COURSE OBJECTIVES:**

- To learn Python and TensorFlow skills for Generative AI.
- To study techniques for cleaning and preparing data for Generative AI tasks.
- To implement generative AI models
- To develop innovative applications using generative AI tools and techniques.

**COURSE OUTCOMES:** After learning the course, students will be able to:

**CO1:** Implement Python and TensorFlow basics, including data handling and preprocessing techniques.

**CO2:** Implement Generative AI models such as GANs, VAEs, LSTM networks, and Transformer models for image text, and music generation tasks.

**CO3:** Evaluate model performance and experiment with hyperparameters and optimization techniques to enhance Generative AI outcomes.

**CO4:** Develop innovative applications in image, text, and music generation, showcasing practical skills

**List of Experiments:**

1. Write Python scripts to implement basic operations and Tensor Flow 2 tensors
2. Implement a Generative Adversarial Network (GAN) architecture using Tensor Flow 2. Train the GAN model on a dataset such as MNIST or CIFAR-10 for image generation tasks.
3. Train a GAN model on a custom dataset for image generation. Experiment with hyper parameters, loss functions, and optimization techniques to optimize GAN training.
4. Explore advanced techniques such as Wasserstein GANs, Progressive GANs, or Style GANs for image generation. Implement and compare these techniques for generating high-quality images.
5. Develop applications for image and video generation using trained Generative AI models. Use the models to generate art, create deep fakes, or synthesize video content.
6. **Text Generation:** Implement a Long Short-Term Memory (LSTM) network using Tensor Flow 2 for text generation tasks. Train the LSTM model on a dataset of text sequences and generate new text samples.
7. **Text generation:** Implement a Transformer-based language model (e.g., GPT) using Tensor Flow 2for text generation. Fine-tune the model on a text corpus and generate coherent and contextually relevant text.
8. **Text generation:** Fine-tune a pre-trained language model (e.g., GPT, BERT) using transfer learning techniques. Fine-tune the model on a domain-specific dataset and evaluate its performance for text generation tasks.

9. **Text generation:** Develop applications for text generation tasks such as story generation, dialogue generation, or code generation using trained Generative AI models.
10. **Music Generation:** Preprocess music data and represent it in a suitable format for music generation tasks. Explore MIDI or audio representations for training Generative AI models.
11. **Music Generation:** Implement a Long Short-Term Memory (LSTM) network using Tensor Flow 2 for music generation. Train the LSTM model on a dataset of music sequences and generate new musical compositions.
12. **Generate Novel Music Compositions:** Transformer-based Music Generation: Implement a Transformer-based architecture (e.g.,Music BERT, Music GPT) using Tensor Flow 2 for music generation. Fine-tune the model on a music dataset and generate novel music compositions.

**References:**

1. Responsible AI: Implementing Ethical and Unbiased Algorithms, by Shashin Mishra and Sray Agarwal
2. Generative AI in Practice: 100+ Amazing Ways Generative Artificial Intelligence is Changing Business and Society, Bernard Marr
3. “Generative AI with Python and Tensor Flow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models”, Joseph Babcock and Raghav Bali
4. "Generative Adversarial Networks: An Overview" by Vinod Nair and Geoffrey E. Hinton.
5. "Hands-On Generative Adversarial Networks with PyTorch 1.x" by Stefano Bosisio and Vijayabhaskar J.

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 3 | 30 | 70 | 100 | 1.5 |
| SUBCODE: R23AI32L2 | **DATA VISUALIZATION LAB** | | | | | | |

**COURSE OBJECTIVES:**

- To visualize the different datasets using histograms, line charts.
- To understand the use of bar charts and box plots.
- To understand Scatter plots, mosaic plots
- To understand different Map visualizations
- To learn advanced graphs such as correlogram, heatmap and 3D graphs.

**COURSE OUTCOMES: At the end of the course student will be able to**

**CO1:** Visualize the different datasets using histograms, line charts.
**CO2:** Make use of bar charts and box plots on different datasets
**CO3:** Apply Scatter plots, mosaic plots in R for different datasets
**CO4:** Apply different Map visualizations in R
**CO5:** Create advanced graphs such as correlogram, heatmap and 3D graphs.

**LIST OF EXPERIMENTS:**

1. a) Load VADeaths(Death Rates in Virginia)dataset in R and visualize the data using different histograms.
   b) Load air quality dataset in R and visualize La Guardia Airport's daily maximum temperature using histogram.
2. Load Air Passengers dataset in R and visualize the data using line chart that shows increase in air passengers over given time period.
3. a) Load iris dataset in R, visualize the data using different Bar Charts and also demonstrate the use of stacked plots.
   b) Load air quality dataset in R and visualize ozone concentration in air.
4. a) Load iris dataset in R, visualize the data using different Box plots including group by option and also use color palette to represent species.
   b) Load air quality dataset in R and visualize air quality parameters using box plots.
5. Visualize iris dataset using simple scatter, multivariate scatter plot and also visualize scatter plot matrix to visualize multiple variables across each other.
6. Load diamonds dataset in R and visualize the structure in datasets with large data points using hexagon binning and also add color palette then use the
7. Load Hair Eye Color dataset in R and plot categorical data using mosaic plot.
8. Load mtcars dataset in R and visualize data using heat map.
9. Install leaflet library in R and perform different map visualizations.
10. Visualize iris dataset using 3d graphs such as scatter3d, cloud, xyplot.
11. Make use of correlogram to visualize data in correlation matrices for iris dataset.
12. Install maps library in R and draw different map visualizations.

**Web References:**

1. https://www.analyticsvidhya.com/blog/2015/07/guide-data-visualization-r/
2. https://www.geeksforgeeks.org/data-visualization-in-r/

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | | | | 2 |
| SUBCODE: R23AI32L3 | **SOFT SKILLS (SKILL ENHANCEMENT COURSE)** | | | | | | |

**COURSE OBJECTIVES:**

- To equip the students with the skills to effectively communicate in English
- To train the students in interview skills, group discussions and presentation skills
- To motivate the students to develop confidence
- To enhance the students' interpersonal skills
- To improve the students' writing skills

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1:** Demonstrate effective verbal and non-verbal communication skills in academic and professional settings **[K3]**

**CO2:** Apply appropriate techniques interviews, group discussions and overall presentations with increased confidence **[K3]**

**CO3:** Exhibit enhanced interpersonal and team work skills in collaborative Environment **[K4]**

**CO4:** Produce clear, coherent and professional written content such as e-mails, reports and resumes **[K6]**

**SYLLABUS**

**UNIT – I**

**Analytical Thinking & Listening Skills:** Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

**Communication Skills:** Verbal Communication; Non-Verbal Communication (Body Language)

**UNIT – II**

**Self-Management Skills:** Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

**Etiquette:** Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

**UNIT – III**

**Standard Operation Methods:** Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

**UNIT-IV**

**Job-Oriented Skills:** Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews

**UNIT-V**

**Interpersonal relationships**: Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships

**Text books:**

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.

**Reference books:**

1. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018.
2. Raman, Meenakshi& Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

**E-resources:**

1. https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 2 | 0 | 0 | 30 | 70 | 100 | - |
| SUBCODE: R23AI32MC | **TECHNICAL PAPER WRITING & IPR** | | | | | | |

**COURSE OBJECTIVE:**

The course will explain the basic related to writing the technical reports and understanding the concepts related to formatting and structuring the report. This will help students to comprehend the concept of proofreading, proposals and practice

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1:** Apply the principles of effective technical writing, including correct sentence formation and appropriate use of tenses.

**CO2:** Analyze the needs and expectations of different types of readers to tailor the report's content, tone, and style accordingly.

**CO3:** Apply effective verbal presentation skills for delivering technical information clearly and confidently.

**CO4:** Apply different types of formatting tools on word processing documents and Index to enhance, navigation and structure to collaborate effectively on document drafts.

**CO5:** Analyze the role of international cooperation and agreements in the protection and enforcement of Intellectual Property rights globally.

**SYLLABUS**

**UNIT I:**

**Introduction:** An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.

**Planning and Structuring:** Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing.

**UNIT II:**

**Drafting report and design issues:** The use of drafts, Illustrations and graphics.

**Final edits:** Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

**UNIT III:**

**Proofreading and summaries:** Proofreading, summaries, Activities on summaries. **Presenting final reports:** Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

**UNIT IV:**

**Using word processor:** Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes, Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,

**UNIT V**:

**Nature of Intellectual Property:** Patents, Designs, Trade and Copyright.

**Process of Patenting and Development:** Technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property

**Text Books:**

1. Kompal Bansal & Parshit Bansal, "Fundamentals of IPR for Beginner's", 1st Ed., BS Publications, 2016.
2. William S. Pfeiffer and Kaye A. Adkins, "Technical Communication: A Practical Approach", Pearson.
3. Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015.

**Reference Books:**

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.
2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press(2006)

**E-resources:**

1. https://www.udemy.com/course/reportwriting/
2. https://www.udemy.com/course/professional-business-english-and-technical-report-writing/
3. https://www.udemy.com/course/betterbusinesswriting/

# OPEN ELECTIV-II

| III B.TECH | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| II SEMESTER | 3 | - | - | 30 | 70 | 100 | 3 |
| SUBCODE: | **OBJECT ORIENTED THROUGH JAVA** | | | | | | |

**COURSE OBJECTIVE:**
The course provides fundamentals of object-oriented programming in Java and development of user interface.

**COURSE OUTCOMES: After successful completion of this course, the student will be able to:**
**CO1:** Summarize the basic concepts of Object Oriented Programming.
**CO2:** Illustrate various programming paradigms of Object Oriented Programing.
**CO3:** Analyze inheritance, packages and Exception handling concepts.
**CO4:** Apply multi-threading concepts and Applets.
**CO5:** Apply Event Handling and AWT concepts in various UI Applications.

**SYLLABUS:**
**UNIT - I**
**Introduction to OOP:** Introduction, Need of Object Oriented Programming, Principles of Object-Oriented Languages(Classes, Objects, Abstraction, Encapsulation, Inheritance, Polymorphism), Procedural languages Vs. OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features(Platform Independence, Object-Oriented, Both Java compiled and interpreted, Robust, Security, Multithreaded, other features), and Program structures, Installation of JDK1.8(Getting started with JDK, JDK Installation notes, Exploring the JDK).

**UNIT - II**
**Programming Constructs:** Variables, Primitive Data types, Identifiers (Naming Conventions, Keywords), Literals, Operators (Binary, Unary and ternary), Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control (Branching, Conditional, loops).**Classes and Objects:** classes, Objects, Creating Objects, Methods (method types, method overloading), constructors (Parameterized Constructors, Constructor overloading), Cleaning up unused objects (Garbage collector, Finalization), Static keyword (static variables, methods, blocks), this keyword, Arrays, Recursion, Command line arguments and String handling.

**UNIT - III**
**Inheritance:** Types of Inheritance, Deriving classes using extends keyword, Method overriding, super keyword, final keyword, Abstract class.
**Interfaces, Packages and Enumeration:** Interface (Variables in interface, Extending interface), Interface vs. Abstract classes, Packages (Creating packages, using Packages, Access protection), Understanding CLASSPATH, java. lang package (Object class, String class), enumeration.
**Exceptions:** Introduction, Exception handling techniques (try...catch, throw, throws, finally block), user defined exception.

**UNIT - IV**

**Multi-Threading:** java.lang.Thread, Thread life cycle, main Thread, Creation of new threads (by inheriting Thread class, Implementing the Runnable interface), Thread priority, Multithreading using isAlive () and join (), Synchronization (Synchronizing Methods, Statements), Suspending and Resuming threads, Communication between Threads.

**Applets:** Applet class, Applet structure, An Example Applet Program, Applet Life Cycle (init (), start (), stop (), destroy ()), paint (), update () and repaint (), passing parameters to the Applet.

**UNIT - V**

**Event Handling:** Introduction, Event Delegation Model, java.awt.event Description, Sources of Events, Event Listeners, Adapter classes, Inner classes.

**Abstract Window Toolkit:** Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons, List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar.

## TEXT BOOK:

1. The Complete Reference Java, 8ed, Herbert Schildt, TMH.

**REFERENCE BOOKS:**

1. JAVA Programming, K. Rajkumar, Pearson.
2. Core JAVA, Black Book, Nageswara Rao, Wiley, Dream Tech.

**ONLINE REFERENCES:**

1. https://www.coursera.org/learn/object-oriented-java
2. https://www.youtube.com/watch?v=3u1fu6f8Hto

| III B.TECH II SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | CREDITS |
|---|---|---|---|---|---|---|---|
| | 2 | 0 | 0 | 30 | 70 | 100 | - |
| SUBCODE: | **PRINCIPLES OF OPERATING SYSTEMS** | | | | | | |

**COURSE OBJECTIVES:**
To gain knowledge about the Operating Systems concepts such as process, main memory management, secondary memory management, Deadlocks, CPU and disk scheduling etc.,

**COURSE OUTCOMES:** After completion of this course, the students would be able to
**CO 1:** Classify various operating system functionalities and generations. **[K2]**
**CO 2:** Interpret process management and exemplify the process synchronization techniques. **[K2]**
**CO 3:** Apply various process scheduling algorithms. **[K3]**
**CO 4:** Distinguish various memory management techniques and apply various deadlock techniques. **[K4]**
**CO 5:** Compare and contrast various disk scheduling algorithms and can interpret the file system implementations. **[K2]**

**SYLLABUS:**

**UNIT - I**
**Computer System and Operating System Overview:** Overview of Operating System - What operating systems do, User view, System view, defining operating systems; Operating Systems functions- Process Management, Memory Management, Storage Management, File- System Management, Mass-Storage Management, Caching, Protection and security; Distributed systems, Special purpose systems, Real-Time Embedded Systems, Multimedia Systems, Handheld Systems, Operating Systems Structures, Simple Structure, Layered Approach, Micro Kernels, Modules; Systems Calls- Process control, File management, Device management, Information maintenance, Communication; Operating systems generation.

**UNIT - II**
**Process Management:** Process, Process States, Process Control Block, Process Scheduling- Scheduling Queues, Schedulers; Operations- Process Creation, Process termination; Inter process communication- Shared-Memory Systems, Message-Passing Systems, Naming, Synchronization, Buffering; Multi Thread programming models- Many to one, One to one, Many to Many model;
Process Scheduling Criteria- CPU scheduler, Preemptive scheduling, Dispatcher, Scheduling Criteria; CPU Scheduling Algorithms- First Come First Serve, Shortest job first, Priority Scheduling, Round robin scheduling

**UNIT - III**
**Concurrency:** Process Synchronization, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware. Semaphores- Usage, Implementation, Deadlock and Starvation; Classic Problems of Synchronization- Bounded buffer problem, Readers writers' problem, Dining-Philosophers problem; Monitors- Usage, Dining-Philosophers solution using monitors.
**Memory Management:** Swapping, Contiguous Memory Allocation- Memory Allocation, Fragmentation; Paging-

Basic Method, Hardware Method, Protection, shared pages; Structure of the Page table- Hierarchical Paging, Hashed Page Tables. Segmentation- Basic Method, hardware.

**UNIT - IV**

**Virtual Memory Management:** Virtual Memory. Demand Paging- Basic concept, copy on write; Page-Replacement Algorithms- Basic page replacement, FIFO page replacement, optimal page replacement, LRU page replacement, LFU page replacement; Thrashing- Cause of Thrashing, Working set model, Page fault frequency Principles of Deadlock: Deadlock System Model. Deadlock Characterization- Necessary Conditions, Resource allocation graph; Deadlock Prevention- Mutual exclusion, Hold and wait, No preemption, Circular wait; Deadlock Detection and Avoidance- Resource allocation Graph algorithm, Banker's algorithm, Single instance of each resource type, several instances of each resource type; Recovery Form Deadlock- Process termination, Resource preemption

**UNIT - V**

**File System:** The Concept of a File- file attributes, file operations, file types, file structures; Access Methods- sequential access, direct access, other access methods; Directory Structure- single level directory, two level directories, tree structured directory, general graph directory; File Sharing- multiple users, remote file systems; Protection- types of access, access control.

**Implementing File System:** File System Structure. File System Implementation- overview, partitions and mounting, virtual file systems; Allocation Methods- contiguous allocation, linked allocation, indexed allocation; Free-Space Management- linked list, grouping, counting.

**Disk Scheduling**- FCFS scheduling, SSTF scheduling, SCAN scheduling, C-SCAN scheduling, LOOK scheduling.

**TEXT BOOKS:**

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", John Wiley, 7/e, 2016.

**REFERENCE BOOKS:**

1. William Stallings, "Operating Systems – Internal and Design Principles", Pearson Education, 6/E, 2005.
2. D.M.Dhamdhere, "Operating Systems – A Concept based Approach" –, TMH, 2/e, 2005.
3. Crowley, "Operating System a Design Approach", TMH, 1/e, 2005.
4. Andrew S Tanenbaum, "Modern Operating Systems", PHI, 3/e, 2013.

**WEB REFERENCES:**

1. nptel.ac.in/courses/106108101
2. nptel.ac.in/courses/106106144

## B. Tech– IV Year I Semester

| S.No. | Subcode | Cat.Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | R23AM4109 | PC | Natural Language Processing | 3 | 0 | 0 | 3 |
| 2 | R23CC4101 | MC - II | Human Resources & Project Management | 2 | 0 | 0 | 2 |
| 3 | 1. R23AI4168<br>2. R23AI4169<br>3. R23AI4170<br>4. R23AI4171<br>5. R23CC41MOOC | PE-IV | 1. Software Architecture & Design Patterns<br>2. Block Chain Technology<br>3. Quantum Computing<br>4. Augmented Reality and Virtual Reality<br>5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS | 3 | 0 | 0 | 3 |
| 4 | 1. R23CC4102<br>2. R23AI4172<br>3. R23AI4173<br>4. R23AI4174 | PE-V | 1. Agile Methodologies<br>2. Architecture for Management of Large Datasets<br>3. Reinforcement Learning<br>4. High Performance Computing<br>5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS | 3 | 0 | 0 | 3 |
| 5 | 1. R23OE4110<br>2. R23OE4108 | OE - III | 1. Object Oriented Programming Through Java<br>2. Introduction to Smart Manufacturing | 3 | 0 | 0 | 3 |
| 6 | 1. R23OE4106<br>2. R23OE4112<br>3. R23OE4151 | OE - IV | 1. Computer Networks<br>2. Software Engineering<br>3. Data Structures for Data Science | 3 | 0 | 0 | 3 |
| 7 | R23CC41L1 | SC | Prompt Engineering / SWAYAM Plus – Certification program in Prompt Engineering and ChatGPT | 0 | 1 | 2 | 2 |
| 8 | R23CC41MC | AC | Constitution of India | 2 | 0 | 0 | - |
| 9 | R23CC41IN | Internship | Evaluation of Industry Internship / Mini Project | - | - | - | 2 |
| | | **Total** | | **19** | **1** | **2** | **21** |
| MC | Student may select from the same minors pool | | | 3 | 0 | 3 | 3 |
| HC | Student may select from the same honors pool | | | 3 | 0 | 0 | 3 |
| HC | Student may select from the same honors poo | | | 3 | 0 | 0 | 3 |

| IV B.Tech. I Semester | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23AM4109 | NATURAL LANGUAGE PROCESSING | | | | | | |

**Course Objectives:**

This course introduces the fundamental concepts and techniques of natural language processing (NLP).

- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

**Course Outcomes**: After completion of this course

**CO1:** Demonstrate a given text with basic Language features [K3]

**CO2:** Analyze and implement NLP components to develop an application for a given problem domain. [K4]

**CO3:** Explain a rule based system to tackle morphology/syntax of a language [K2]

**CO4:** Analyze the requirements of real-time NLP applications and formulate an appropriate tag set for statistical processing. [K4]

**CO5:** To compare and contrast the use of different statistical approaches for different types of NLP applications. [K4]

**SYLLABUS:**

**UNIT I:**

**Introduction**: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

**UNIT II:**

**Word Level Analysis:** Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part- of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum, Word embedding's and associated techniques.

**UNIT III:**

**Syntactic Analysis:** Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures

**UNIT IV:**

**Semantics And Pragmatics:** Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

**UNIT V:**

**Discourse Analysis and Lexical Resources:** Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

**Text Books**:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Daniel Jurafsky, James H. Martin -Pearson Publication, 2014.
2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, OReilly Media,2009.

**Reference Books:**

1. Language Processing with Java and Ling Pipe Cookbook, 1st Edition, Breck Baldwin, Atlantic Publisher, 2015.
2. Natural Language Processing with Java, 2nd Edition, Richard M Reese, OReilly Media, 2015.
3. Handbook of Natural Language Processing, Second, Nitin Indurkhya and Fred J. Damerau, Chapman and Hall/CRC Press, 2010.Edition
4. Natural Language Processing and Information Retrieval, 3rd Edition, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press, 2008.

| IV B.Tech. I Semester | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC4101 | HUMAN RESOURCES & PROJECT MANAGEMENT | | | | | | |

**Course Objectives**: The main objectives of the course are to

- Provide knowledge about HR planning, recruitment, selection, and job design.
- Develop skills in managing HR functions such as performance appraisal, compensation, and employee relations.
- Emphasize the importance of ethical practices and HR audits in maintaining organizational health.
- Understand the HRD framework and its impact on organizational success.
- Improve group interaction and team dynamics for better collaboration and performance.
- Understand the Fundamentals of Project Management and Project Networks
- Implement appropriate management strategies tailored to specific challenges in different project types.

**Course Outcomes**: After completion of this course

**CO1:** Understand HRM concepts, functions, planning, recruitment, selection, and ethics.
**CO2:** Appreciate HRD, training, appraisal, and career development processes effectively.
**CO3:** Realize project management concepts and effectively plan, monitor, and appraise.
**CO4:** Analyze project types and apply appropriate management strategies effectively.
**CO5:** Apply project planning, control, evaluation, and implementation principles effectively.

**SYLLABUS:**

**UNIT –I:**

HRM: Nature, Scope, Concept of HRM, Functions of HRM, Role of HR manager, emerging trends in HRM, E-HRM, HR audit models, ethical aspects of HRM. HR Planning, Demand and Supply forecasting of HR, Job Design, Recruitment, Sources of recruitment, Selection- Selection Procedure.

**UNIT –II:**

HRD, HR accounting, Models, Concept of Training and Development, Methods of Training. Performance Appraisal: Importance Methods of performance appraisal, Career Development and Counselling, group interaction.

**UNIT –III:**

Basics of Project Management, Concept, resource management, Project environment, Types of Projects, project networks-DPR, Project life cycle, Project proposals, Monitoring project progress, Project appraisal and Project selection, 80-20 rules, production technology, communication matrix

**UNIT-IV:**
Identify various project types and their unique management challenges and apply appropriate management strategies for each. Project Implementation and Review: Forms of project organization, project planning, project control, human aspects of project management, prerequisites for successful project implementation, project review, performance evaluation, abandonment analysis

**UNIT-V:**
Project Implementation and Review: Forms of project organization, project planning, project control, human aspects of project management, prerequisites for successful project implementation, project review, performance evaluation, abandonment analysis

**Text Books:**
1. Robert L. Mathis, John H. Jackson, Manas Ranjan Tripathy, Human Resource Management, Cengage Learning 2016.
2. Sharon Pande and Swapnalekha Basak, Human Resource Management, Text and Cases, Vikas Publishing, 2e, 2016.
3. Stewart R. Clegg, Torgeir Skyttermoen, Anne Live Vaagaasar, Project Management, Sage Publications, 1e, 2021.
4. K. Nagarajan, Project Management, New Age International Publishers, 8e, 2017.

**Reference Books:**
1. Subba Rao P, “Personnel and Human Resource Management-Text and Cases”, Himalaya Publications, Mumbai, 2013.
2. K Aswathappa, “Human Resource and Personnel Management”, Tata McGraw Hill, New Delhi, 2013.
3. Prasanna Chandra, “Projects, Planning, Analysis, Selection, Financing, Implementation and Review”, Tata McGraw Hill Company Pvt. Ltd., New Delhi, 1998.
4. Vasanth Desai, “Project Management”, 4th edition, Himalaya Publications, 2018.
5. Lalitha Balakrishnan, Gowri, “Project Management”, Himalaya publishing house, New Delhi, 2022.

| IV B.Tech. I Semester | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| P.E. IV | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23AI4168 | SOFTWARE ARCHITECTURE & DESIGN PATTERNS | | | | | | |

**Course Objectives:**

- To understand basic object-oriented concepts and state behavior of real-world objects.
- To apply Object-Oriented Analysis and Design techniques to solve problems.
- To learn UML notations and create models for given problems.
- To understand the importance of systems analysis and design using case studies.
- To gain knowledge of pattern-oriented approaches for real-world problems.

**Course Outcomes:**

**CO1:** Understand the basic concepts to identify state behavior of real world objects [K2]
**CO2:** Apply Object Oriented Analysis and Design concepts to solve complex problems [K3]
**CO3:** Construct various UML models using the appropriate notation for specific problem context [K4]
**CO4:** Demonstrate the importance of systems analysis and design in solving complex problems using case studies. [K4]
**CO5:** Study and analyze pattern-oriented approaches for solving real-world problems. [K4]

**SYLLABUS:**

**UNIT – I**:

**Introduction:** design pattern, Describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern what is object oriented development? Key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm

**UNIT – II**:

**Analysis a System:** Overview of the analysis phase, stage 1 gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain Design and Implementation, discussions and further reading

**UNIT – III:**

**Design Pattern Catalog:** Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.

**UNIT – IV**:

**Interactive systems and the MVC architecture:** Introduction the MVC architectural pattern, analyzing a simple drawing program designing the system, designing of the subsystems, getting into implementation,

implementing undo operation drawing incomplete items, adding a new feature pattern based solutions

**UNIT – V:**

**Designing with Distributed Objects:** Client server system, java remote method invocation, implementing an object oriented system on the web, Web services (SOAP, Restful), Enterprise Service Bus

**Text Books:**

1. Object oriented analysis, design and implementation, brahma dathan, sarnath rammath , universities press,2013
2. Design patterns, Erich Gamma, Richard helan , Ralph johman , john vlissides, PEARSON Publication,2013

**Reference Books:**

1. Frank Bachmann, Regine Meunier , Hans Rohnert “Pattern Oriented Software Architecture” Volume 1, 1996.
2. William J Brown et al., "Anti Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998

| IV B.Tech. I Semester | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| P.E. IV | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23AI4169 | BLOCK CHAIN TECHNOLOGY | | | | | | |

**Course Objectives:**

This course aims to provide a strong foundation in blockchain technology, including its evolution, cryptographic principles, Bitcoin, consensus mechanisms, and distributed ledger concepts. It also enables learners to understand and analyze platforms such as Ethereum and Hyperledger Fabric, smart contracts, and real-world blockchain applications along with their limitations and challenges.

**Course Outcomes:**

**CO1:** Discuss the Cryptographic primitives used in Blockchain (K2)
**CO2:** Discuss about various technologies borrowed in blockchain (K2)
**CO3:** Illustrate various models for blockchain (K2)
**CO4:** Discuss about Ethereum (K2)
**CO5:** Discuss about Hyperledger Fabric (K2)

**SYLLABUS:**

**UNIT I**

**Introduction To Blockchain:** Introduction, history of Bitcoin and origins of Blockchain, Fundamentals of Blockchain and key components (Chapter 1-book1), Permission and Permission-less platforms(Chapter 1-book2), Introduction to Cryptography, SHA256 and ECDSA, Hashing and Encryption, Symmetric/ Asymmetric keys, Private and Public Keys(Chapter 3-book2).

**UNIT II**

**Technologies Borrowed In Blockchain:** Technologies Borrowed in Blockchain –hash pointers- - Digital cash etc.- Bitcoin blockchain - Wallet – Blocks Merkley Tree - hardness of mining - Transaction verifiability - Anonymity - forks - Double spending - Mathematical analysis of properties of Bitcoin - Bitcoin- the challenges and solutions. (Chapter 3-book2).

**UNIT III**

**Consensus Mechanisms:** Consensus Algorithms: Proof of Work (PoW) as random oracle - Formal treatment of consistency- Liveness and Fairness - Proof of Stake (PoS) based Chains -Hybrid models (PoW + PoS), Byzantine Models of fault tolerance. ((Chapter 1-book2))

**UNIT IV**

**Ethereum:** Ethereum -Ethereum Virtual Machine (EVM) -Wallets for Ethereum -Solidity - Smart Contracts (Chapter 5-book1), - The Turing Completeness of Smart Contract Languages and verification challenges- Using smart contracts to enforce legal contracts- Comparing Bitcoin scripting vs. Ethereum Smart Contracts-Some attacks on smart contracts (Chapter 6 and Chapter 7-book2)

**UNIT V**

**Hyperledger Fabric :** Hyperledger fabric- the plug and play platform and mechanisms in permissioned blockchain - Beyond Crypto currency – applications of blockchain in cyber security-integrity of information- E-Governance and other contract enforcement mechanisms - Limitations of blockchain as a technology and myths vs reality of blockchain technology (Chapter 16-book1), (Chapter 9 -book2)

**TEXT BOOKS:**

1. Blockchain Technology Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan, University Press, 2020.
2. Mastering Blockchain - Distributed ledger technology, decentralization, and smart contracts explained, Imran Bashir,2nd ed. Edition,2018, pakct publication

**REFERENCES:**

1. S.Shukla, M.Dhawan, S.Sharma,S. Venkatesan “Blockchain Technology: Cryptocurrency and Applications” ,Oxford University Press 2019 .
2. Cryptography and network security principles and practice, William Stallings, Pearson, 8th edition.

**WEB REFERENCES:**

1. https://drive.google.com/file/d/1PtYaDmWYaqPVGjKDnMYGWO5eoI5wMPtJ/view
2. https://archive.nptel.ac.in/courses/106/104/106104220/
3. https://www.tutorialspoint.com/blockchain/index.htm

| IV B.Tech. I Semester P.E. IV | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23AI4170 | QUANTUM COMPUTING | | | | | | |

**Course Objectives:**

- To introduce the fundamentals of quantum computing, the problem-solving approach using finite dimensional mathematics

**Course Outcomes:**

**CO1:** Differentiate between classical and quantum computing paradigms, including bits vs. qubits and logical operations. [K4]

**CO2:** Apply foundational concepts of linear algebra, quantum mechanics, and biology to understand the principles of quantum computing. [K3]

**CO3:** Apply single and multi-qubit gates to build quantum circuits and *demonstrate* qubit representation on the Bloch sphere. [K3]

**CO4:** Analyze key quantum algorithms such as Deutsch's, Shor's, and Grover's to understand their efficiency over classical algorithms. [K4]

**CO5:** Explain quantum error correction techniques and *compare* classical and quantum approaches to information security and cryptography. [K2]

**SYLLABUS:**

**UNIT - I**

History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations

**UNIT - II**

**Background Mathematics:** Basics of Linear Algebra, Hilbert space, Probabilities and measurements.
**Background Physics:** Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

**UNIT - III**

**Qubit:** Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

**UNIT - IV**

**Quantum Algorithms**: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.

**UNIT - V**

**Noise and error correction:** Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

**Text Books:**

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge

**Reference Books:**

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol.I: Basic Concepts, Vol II
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms

| IV B.Tech. I Semester P.E. IV | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23AI4171 | AUGMENTED REALITY AND VIRTUAL REALITY | | | | | | |

**Course Objectives:**

- Provide a foundation to the fast growing field of AR and make the students aware of the various AR concepts.
- To give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

**Course Objectives:**

**CO1:** Explain the fundamentals of Augmented Reality, display technologies, and tracking systems used in AR applications. [K2]

**CO2:** Apply computer vision techniques, interaction methods, and software architectures to develop basic AR systems. [K3]

**CO3:** Explain the principles of Virtual Reality, including geometric modeling, light, optics, and viewing transformations. [K2]
BT Level: BT2 – Understand

**CO4:** Analyze human vision and visual perception concepts to improve rendering quality and user experience in VR systems. [K4]

**CO5:** Analyze motion, interaction, and audio principles in real and virtual environments for immersive VR applications. [K4]

**SYLLABUS:**

**UNIT – I:**

**Introduction to Augmented Reality:** Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Related fields.

**Displays:** Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays.

**Tracking**: Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors

**UNIT – II:**

**Computer Vision for Augmented Reality:** Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking.

**Interaction:** Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction

**Software Architectures:** AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs

**UNIT – III:**

**Introduction to Virtual Reality:** Defining Virtual Reality, History of VR, Human Physiology and Perception.
**The Geometry of Virtual Worlds:** Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations
**Light and Optics:** Basic Behavior of Light, Lenses, Optical Aberrations, the Human Eye, Cameras, Displays

**UNIT – IV:**

**The Physiology of Human Vision:** From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR.
**Visual Perception:** Visual Perception - Perception of Depth, Perception of Motion, Perception of Color Visual Rendering: Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos.

**UNIT – V:**

**Motion in Real and Virtual Worlds**: Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Interaction: Motor Programs and Remapping, Locomotion, Social Interaction.
**Audio:** The Physics of Sound, the Physiology of Human Hearing, Auditory Perception, AuditoryRendering

**Text Books:**

1. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India;First edition (12 October 2016),ISBN-10: 9332578494
2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016

**Reference Books:**

1. Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 9781484236178
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009
4. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN:9781491962381
5. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
6. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005

| IV B.Tech. I Semester P.E. V | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23CC4102 | AGILE METHODOLOGIES | | | | | | |

**Course Objectives:**
To provide students with a comprehensive understanding of agile methodologies, processes, and practices for effective software development, knowledge management, risk handling, quality assurance, and teamwork in dynamic project environments.

**Course Outcomes: At the end of the course the student will be able to:**
**CO1:** Apply agile methodology and agile process to create high quality software. [K3];
**CO2:** Use Agile methodology for knowledge management. [K3]
**CO3:** Apply Agile development and testing techniques to manage risks. [K3]
**CO4:** Analyze the pros and cons of working in Agile Team. [K4]
**CO5:** Apply Feature Driven Development on large size projects. [K3]

**SYLLABUS:**

**UNIT –I: Agile Methodology:** Theories for Agile Management, Agile Software Development – Traditional Model vs. Agile Model, Classification of Agile Methods, Agile Manifesto and Principles, Agile Project Management, Agile Team Interactions, Ethics in Agile Teams, Agility in Design, Testing, Agile Documentations, Agile Drivers, Capabilities and Values.

**UNIT-II: Agile Process:** Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

**UNIT-III:** Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

**UNIT-IV: Agility and Requirements Engineering:** Impact of Agile Processes in RE, Current Agile Practices, Variance, Overview of RE Using Agile, Managing Unstable Requirements, Requirements Elicitation, Agile Requirements Abstraction Model, Requirements Management in Agile Environment, Agile Requirements Prioritization, Agile Requirements Modelling, Generation – Concurrency in Agile Requirements Generation.

**UNIT-V: Agility and Quality Assurance:** Agile Product Development, Agile Metrics, Feature Driven Development (FDD), Financial and Production Metrics in FDD, Agile Approach to Quality Assurance, Test Driven Development, Agile Approach in Global Software Development.

**TEXT BOOKS:**

1. David J. Anderson and Eli Schragenheim, Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Pearson, 2003.
2. Hazza and Dubinsky, Agile Software Engineering, Springer, 2009th edition, 2008.

**REFERENCE BOOKS:**

1. Craig Larman, ―Agile and Iterative Development, Addison-Wesley, First Edition, 2003.

| IV B.Tech. I Semester | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| P.E. V | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23AI4172 | ARCHITECTURE FOR MANAGEMENT OF LARGE DATASETS | | | | | | |

**Course Objective:**
The objective of this course is to introduce students to the foundational and advanced concepts of big data processing frameworks such as Hadoop, Hive, Spark, Storm, and Giraph, and to equip them with the skills required to set up and administer big data environments.

**Course Outcomes:** Upon successful completion of the course, students will be able to:
**CO1:** Explain the need for Hadoop, the architecture of HDFS, and the process of setting up and securing a Hadoop cluster. [K2]
**CO2:** Explain key Big Data terminologies and apply basic Hadoop administration, monitoring, and maintenance practices. [K2]
**CO3:** Apply Hive concepts and HiveQL to store, query, and analyze data, and explain the architecture of Giraph. [K3]
**CO4:** Apply Apache Spark concepts for distributed data processing and explain the architecture of Storm for real-time analytics. [K3]
**CO5:** Classify different types of digital data and explain the fundamentals, architecture, and applications of large language models for graph-based data. [K4]

**SYLLABUS:**

**UNIT 1.**
**Hadoop, HDFS and Setting up a Hadoop Cluster:** Why Hadoop, Why not RDBMS, RDMBS vs Hadoop, HDFS Daemons, Anatomy of File Read, Anatomy of File Write, Replica Placement Strategy, Working with HDFS commands , Setting up a Hadoop Cluster-Cluster Specification, Cluster Setup and Installation, Hadoop Configuration, Security.

**UNIT 2.**
**Terminologies and Administering Hadoop:** Terminologies used in Big Data Environments - In-memory analytics, In-database processing, Symmetric Multiprocessor System(SMP), Massively Parallel Processing, Difference between Parallel and Distributed Systems, Shared Nothing Architecture, Administering Hadoop-Administering HDFS, Monitoring and Maintenance.

**UNIT 3.**
**Hive and Architecture of Giraph:** What is Hive, Hive Architecture, Hive Data Types, Hive File Format, HiveQL, Tables, Querying Data, User Defined Functions (UDF), Architecture of Giraph.

**UNIT 4.**

**Spark and Architecture of Storm:** Installing Spark, Spark Applications, Jobs, Stages, Tasks, Resilient Distributed Datasets, Shared Variables, Anatomy of a Spark Job Run, Executors and Cluster managers, Architecture of Storm.

**UNIT 5.**

**Classification of Digital Data and Large Language Models for Graphs:** Classification of Digital Data - Structured Data, Semi-structured Data and Unstructured Data, Understanding large language models-What is an LLM, Applications of LLMs, Stages of building and using LLMs, Introducing the transformer architecture, Utilizing large datasets, A closer look at the GPT architecture, Building a large language model.

**Text Books:**

1. Seema Acharya and Suhashini Chellappan, "Big Data Analytics", 2nd Ed, Wiley, 2015
2. Tom White, "Hadoop: The Definitive Guide", 4th Ed, O'reilly, 2015
3. V. K. Jain, Big Data and Hadoop, Khanna Book Publishing, 2020
4. Build a Large Language Model (From Scratch), Sebastian Raschka, September 2024 ISBN 9781633437166

**Reference Books:**

1. Michael Minelli, Michelle Chambers and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013
2. P. J. Sadalage, M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012
3. Storm https://cds.iisc.ac.in/wp-content/uploads/DS256.2017.Storm_.Tutorial.pdf
4. Giraph https://cds.iisc.ac.in/wp-content/uploads/DS256.2017.L12.Pregel.pdf

| IV B.Tech. I Semester P.E. V | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23AI4173 | REINFORCEMENT LEARNING | | | | | | |

**Course Objectives:** To provide the fundamentals of Reinforcement learning.

**Course Outcomes:**
**CO1:** Illustrate elements of Reinforcement Learning. [K2]
**CO2:** Solve then-armed Bandit problem. [K3]
**CO3:** Compare different Finite Mark ov Decision Process. [K2]
**CO4:** Illustrate Monte Carlo Methods in solving real world problems. [K2]
**CO5:** Outline the Applications and Case Studies of Reinforcement Learning. [K2]

**SYLLABUS:**
**UNIT-I: The Reinforcement Learning Problem:** Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, an Extended Example: Tic-Tac Toe, Summary, History of Reinforcement Learning.

**UNIT-II: Multi-arm Bandits**: An n-Armed Bandit Problem, Action-Value Methods, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandits, Associative Search (Contextual Bandits)

**UNIT-III: Finite Markov Decision Processes:** The Agent–Environment Interface, Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks, The Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation.

**UNIT-IV: Monte Carlo Methods:** Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off- policy Prediction via Importance Sampling, Incremental Implementation, Off-Policy Monte Carlo Control, Importance Sampling on Truncated Returns

**UNIT-V: Applications and Case Studies**:TD-Gammon, Samuel's Checkers Player, The Acrobot, Elevator Dispatching, Dynamic Channel Allocation, Job-Shop Scheduling.

**TEXT BOOKS:**
1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning-An Introduction",2ndEdition, The MIT Press,2018
2. Marco Wiering, Martijn van Otterlo Reinforcement Learning State-of-the Art (Adaptation, Learning, and Optimization (12)) 2012th Edition

**REFERENCE BOOKS:**
1. Vincent François-Lavet, Peter Henderson, Riashat Islam, An Introduction to Deep Reinforcement Learning (Foundations and Trends(r) in Machine Learning) , 2019

| IV B.Tech. I Semester | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| P.E. V | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23AI4174 | HIGH PERFORMANCE COMPUTING | | | | | | |

**Course Objectives:**
The main objectives of the course is to study parallel computing hardware and programming models, performance analysis and modeling of parallel programs.

**Course Outcomes:** On completion of the course, student will be able to–
**CO1:** Understand basic concepts of parallel computing and parallel architectures. [K2]
**CO2:** Apply parallel algorithm design techniques and understand GPU computing. [K3]
**CO3:** Apply basic communication operations and shared-memory programming using OpenMP. [K3]
**CO4:** Analyze performance and scalability of parallel systems and apply matrix algorithms. [K4]
**CO5:** Apply parallel algorithms for sorting and graph problems and develop basic CUDA programs. [K3]

**SYLLABUS:**
**UNIT I**
**Introduction:** Motivating Parallelism, Scope of Parallel Computing, Parallel Programming Platforms: Implicit Parallelism, Trends in Microprocessor and Architectures, Limitations of Memory, System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Scalable design principles, Architectures: Nwide superscalar architectures, Multi-core architecture.

**UNIT II**
**Parallel Programming:** Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, The Age of Parallel Processing, the Rise of GPU Computing, A Brief History of GPUs, Early GPU.

**UNIT III**
**Basic Communication:** Operations- One-to-All Broadcast and All-to-One Reduction, Allto-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-toAll Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations. Programming shared address space platforms: threads- basics, synchronization, OpenMP programming

**UNIT IV:**
**Analytical Models:** Sources of overhead in Parallel Programs, Performance Metrics for Parallel Systems, and The effect of Granularity on Performance, Scalability of Parallel Systems, Minimum execution time and minimum cost, optimal execution time. Dense Matrix Algorithms: MatrixVector Multiplication, Matrix-

Matrix Multiplication.

**UNIT V:**

**Parallel Algorithms- Sorting and Graph:** Issues in Sorting on Parallel Computers, Bubble Sort and its Variants, Parallelizing Quick sort, All-Pairs Shortest Paths, Algorithm for sparse graph, Parallel Depth-First Search, Parallel Best First Search. CUDA Architecture : CUDA Architecture, Using the CUDA Architecture, Applications of CUDA Introduction to CUDA C-Write and launch CUDA C kernels, Manage GPU memory, Manage communication and synchronization, Parallel programming in CUDA- C.

**Text Books:**

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2
2. Jason sanders, Edward Kandrot, “CUDA by Example”, Addison-Wesley, ISBN-13: 978-0-13-138768-3

**Reference Books:**

1. Kai Hwang, ”Scalable Parallel Computing”, McGraw Hill 1998, ISBN:0070317984
2. Shane Cook, “CUDA Programming: A Developer's Guide to Parallel Computing with GPUs”, Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884
3. David Culler Jaswinder Pal Singh, ”Parallel Computer Architecture: A Hardware/ Software Approach”, Morgan Kaufmann,1999, ISBN 978-1-55860-343-1
4. Rod Stephens, “Essential Algorithms”, Wiley, ISBN: ISBN: 978-1-118-61210-1

| IV B.Tech. I Semester | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 30 | 70 | 100 | 2 |
| SUBCODE: R23CC41L1 | PROMPT ENGINEERING (SKILL ENHANCEMENT COURSE) | | | | | | |

**COURSE OBJECTIVES:** The main objectives of the course are to

- Apply iterative prompting for clarity and context.
- Create varied prompts to steer model outputs.
- Construct chain-of-thought and structured prompts.
- Develop retrieval-augmented pipelines to ground outputs.
- Evaluate LLM agents and multimodal apps for ethics and robustness.

**COURSE OUTCOMES:**

**CO1:** Understand basic concepts of prompt engineering and use simple prompts with LLMs. [K2]
**CO2:** Use advanced prompting techniques to improve model responses. [K3]
**CO3:** Use structured prompts to get formatted outputs and solve step-by-step problems. [K3]
**CO4:** Build basic retrieval-based LLM applications using LangChain. [K6]
**CO5:** Understand agents, multimodal AI, evaluation methods, and ethical issues in prompt-based systems. [K2]

**SYLLABUS:**

**UNIT I:**

**Foundations of Prompt Engineering:** Definition of prompt engineering, Distinction between prompt engineering and model fine-tuning, Motivation and benefits of prompt engineering, Core principles of effective prompt design, Anatomy of a prompt, Setting up the Python environment for LLM interaction, Iterative prompting lifecycle, Common prompt pitfalls and remediation

**Lab Experiments:**

1. Environment & Connectivity: Install required packages (e.g., transformers, openai); securely configure the API key; run a simple "Hello, world" prompt to verify model access.
2. Baseline vs. Enhanced Prompts: Execute a naïve prompt ("Write a one-paragraph bio of Ada Lovelace.") and an enhanced prompt that adds role framing, specificity, and explicit format instructions; compare both outputs for relevance, completeness, and style.
3. Iterative Refinement on a Simple Task: Summarize the plot of the Shakespearean play Romeo and Juliet in two sentences through three rounds of prompt tweaking:

a. Minimal instruction.
b. Addition of length and style constraints
c. Specification of key content elements (setting and theme) Document how each iteration changes and improves the result.

4. Diagnosing Prompt Failures & Edge Cases: Craft a vague or contradictory prompt; analyze the failure mode (ambiguity, missing context, or format errors); refine the prompt by adding examples or clarifying instructions.

**UNIT II:**

**Advanced Prompt Patterns & Techniques**: Enhanced prompt anatomy: contextual detail and explicit output specifications, Few-shot in-context prompting, Prompt structuring and template design, Role-based prompting to establish personas or system behavior, Negative prompting to filter or suppress undesired content, Constraint specification and instruction enforcement (e.g., length, format), Iterative prompt refinement and optimization

**Lab Experiments:**

1. Few-Shot vs. Zero-Shot Comparison: Design and execute a zero-shot prompt and a few-shot prompt (with 2–3 exemplar input-output pairs) for a chosen text task (e.g., sentiment classification or translation); compare outputs for accuracy, consistency, and adherence to examples.
2. Role-Based & Negative Prompting: Craft a role-based prompt to establish a specific persona (e.g., "You are a financial advisor…"); then create a negative prompt to suppress undesired content (e.g., "Do not mention any brand names"); evaluate how each influences the model's response.
3. Constraint Specification & Iterative Refinement: Select an open-ended task (e.g., summarizing a technical article); issue a basic prompt; identify failures in length or format; refine the prompt by adding explicit constraints (word count, bullet format, etc.); document improvements over two refinement cycles.

**UNIT III:**

**Structured Output & Reasoning Techniques**: Importance of structured outputs for real-world applications, Prompting for specific formats (lists, tables, Markdown), Generating valid JSON and YAML via explicit instructions, Eliciting chain-of-thought reasoning in zero-shot prompts, Decomposing complex tasks into manageable sub-tasks

**Lab Experiments:**

1. Structured Format Prompting: Instruct the model to output information as bullet lists and Markdown tables (e.g., "List three benefits of daily exercise in a Markdown table with columns 'Benefit' and 'Description.'"); verify the output matches the requested structure.
2. JSON/YAML Generation: Provide a brief dataset description (e.g., three books with title, author, publication year) and prompt the model to produce valid JSON or YAML; use a parser to validate syntax and refine the prompt if errors occur.
3. Chain-of-Thought & Task Decomposition: Present a multi-step problem (e.g., a logic puzzle) and apply zero-shot CoT prompting (e.g., "Let's think step by step. Explain your reasoning before the final answer."); separately, decompose the problem into sequential sub-questions, collect partial answers, combine them, and compare accuracy against a direct-answer baseline.

**UNIT IV:**

**Retrieval-Augmented Generation & LangChain Workflows:** Limitations of LLM internal knowledge, Need for external data sources, Introduction to Retrieval-Augmented Generation (RAG), Overview of RAG architecture (indexing vs. retrieval + generation), Getting started with LangChain for LLM applications, Basics of LangChain Expression Language (LCEL), Simplified indexing pipeline: document loading & text splitting, Fundamentals of embeddings and vector stores, Building a basic retrieval-generation pipeline with an LCEL chain

**Lab Experiments:**

1. Building a Simple LCEL Chain: Create a minimal LCEL script that accepts a fixed instruction (e.g., "Summarize this text: …"), passes it to an LLM, and prints the result; verify end-to-end execution.
2. Basic Data Indexing for RAG: Load a small collection of documents; split into uniform chunks (e.g., 200 tokens); generate embeddings for each chunk; store them in an in-memory vector store; inspect for consistency.
3. Constructing & Running a Basic RAG Chain: Build a pipeline that:
    a. Receives a user query
    b. Retrieves the top-k relevant chunks
    c. Constructs a combined prompt with context + query
    d. Send it to the LLM
    e. Returns the answer

Test with sample queries and compare factual accuracy against a prompt without retrieval.

**UNIT V:** Agents, Multimodal AI & Ethical Evaluation: Introduction to LLM agents and their basic architecture, Overview of multimodal AI models (VLMs), Prompting for text-to-image generation and image understanding, Importance of prompt evaluation beyond subjective judgment, Manual evaluation techniques (heuristic checks for accuracy, relevance, format), Introduction to "LLM-as-Judge" for automated evaluation, Security considerations (prompt injection, sensitive information risks), Prompt-based mitigation strategies for safety and robustness, Ethical concerns (bias, misinformation, data privacy), Brief exploration of UI frameworks (Streamlit / Gradio) for deploying prompt-driven apps, Adapting to the evolving nature of prompt engineering through continuous learning

**Lab Experiments:**

1. Building a Simple LLM Agent: Register a tool (e.g., a calculator function) and craft prompts that instruct the agent to invoke it when required; implement using LangChain or a function calling API; test on queries requiring tool execution.
2. Multimodal Prompting Exploration: Generate images from detailed text prompts; feed one generated image into an image-understanding model or API with an appropriate prompt; compare the returned caption to the original prompt to evaluate alignment.
3. Prompt Evaluation & Ethics Workshop:
    a. Select two existing prompts and generate multiple outputs; apply manual heuristic checks for accuracy, relevance, and format compliance.
    b. Use an "LLM-as-Judge" prompt (e.g., "Rate these outputs on a scale of 1–5 for clarity and correctness.") to automate evaluation.
    c. Design a prompt- injection test (e.g., "Ignore previous instructions…"), observe the response, then refine system prompts to mitigate the vulnerability.

| IV B.Tech. I Semester | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | 2 | 0 | 0 | 30 | 70 | 100 | 0 |
| SUBCODE: R23CC41MC | CONSTITUION OF INDIA | | | | | | |

**Course Objectives:**

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

**Course Outcomes:**

**CO1:** Understand Indian Constitution's history, drafting, philosophy, preamble, and features.
**CO2:** Know fundamental rights, duties, and directive principles in Constitution.
**CO3:** Appreciate structure, powers, and functions of legislative, executive, judiciary.
**CO4:** Comprehend local administration structure, roles, and grassroots democratic governance.
**CO5:** Grasp Election Commissions' roles and welfare institutions for marginalized groups.

**SYLLABUS:**

**UNIT–I:** History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution- Preamble, Salient, Features.

**UNIT–II:** Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

**UNIT–III:** Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive- President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

**UNIT–IV:** Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

**UNIT–V:** Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

**Text Books:**

1. The Constitution of India, 1st Edition, (Bare Act), Government Publication, 1950
2. Framing of Indian Constitution, 1st Edition, Dr. S. N. Busi, Dr. B. R. Ambedkar 2015

**Reference Books:**

1. Indian Constitution Law, 7th Edition, M. P. Jain, Lexis Nexis, 2014.

| III B.Tech. II Semester | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| O.E. I | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23OE4150 | Entrepreneurship Development & Venture Creation | | | | | | |

**COURSE OBJECTIVES:** By the end of the program, students will be / able to:

- Inspired; develop entrepreneurial mind-set and attributes; entrepreneurial skill sets for venture creation and intrapreneurial leadership
- Apply process of problem-opportunity identification and feasibility assessment through developing a macro perspective of the real market, industries, domains and customers while using design thinking principles to refine and pivot their venture idea.
- Analyse Customer and Market segmentation, estimate Market size, develop and validate Customer Persona.
- Initiate Solution design, Prototype for Proof of Concept. Understand MVP development and validation techniques to determine Product-Market fit
- Craft initial Business and Revenue models, financial planning and pricing strategy for profitability and financial feasibility of a venture. Understand relevance and viability of informal and formal funding with respect to different business models.
- Understand and develop Go-to-Market strategies with a focus on digital marketing channels.
- Understand and apply story telling skills in presenting a persuasive and defensible Venture Pitch.

**COURSE OUTCOMES:** At the end of the course, students will be able to

**CO1:** Develop an entrepreneurial mindset and appreciate the concepts of entrepreneurship, cultivate essential attributes to become an entrepreneur or Intrapreneur and demonstrate skills such as problem solving, team building, creativity and leadership. [K3]
**CO2:** Comprehend the process of problem-opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution.
**CO3:** Analyze and refine business models to ensure sustainability and profitability. [K4]
**CO4:** Build Prototype for Proof of Concept and validate MVP of their practice venture idea [K6]
**CO5:** Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture. [K6]
**CO6:** Prepare and deliver an investible pitch deck of their practice venture to attract.

**SYLLABUS:**

**UNIT I:**
**Entrepreneurship Fundamentals & Context:** Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skillsets, attributes and networks while on campus.
**Core Teaching Tool:** Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity
**UNIT II:**
**Problem & Customer Identification:** Understanding and analysing the macro-Problem and Industry perspective, technological, socio economic and urbanization trends and their implication on new opportunities. Identifying passion, identifying and defining problem using Design thinking principles. Analysing problem and validating with the potential

customer. Iterating problem-customer fit. Understanding customer segmentation, creating and validating customer personas. Competition and Industry trends mapping and assessing initial opportunity.
**Core Teaching Tool:** Several types of activities including Class, game, Gen AI, 'Get out of the Building' and Venture Activity.

**UNIT III:**
**Solution design, Prototyping & Opportunity Assessment and Sizing -** Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition. Developing Problem-solution fit in an iterative manner. Understanding prototyping and MVP. Developing a feasibility prototype with differentiating value, features and benefits. Initial testing for proof-of-concept and iterate on the prototype. Assess relative market position via competition analysis, sizing the market and assess scope and potential scale of the opportunity.
**Core Teaching Tool:** Venture Activity, no-code Innovation tools, Class activity

**UNIT IV:**
**Business & Financial Model, Go-to-Market Plan -** Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach.
**Business planning:** components of Business plan- Sales plan, People plan and financial plan.
**Financial Planning:** Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analysing financial performance. Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt & Equity, Map the Start-up Lifecycle to Funding Options.
**Core Teaching Tool:** Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

**UNIT V:**
**Scale Outlook and Venture Pitch readiness -** Understand and identify potential and aspiration for scale vis a vis your venture idea. Persuasive Storytelling and its key components. Build an Investor ready pitch deck.
**Core Teaching Tool:** Expert talks; Cases; Class activity and discussions; Venture Activities.

**Suggested Reading:**

- Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition.
- Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business
- Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons.
- Simon Sinek (2011) Start with Why, Penguin Books limited
- Brown Tim (2019) Change by Design Revised & Updated: How Design Thinking Transforms Organizations and Inspires Innovation, Harper Business
- Namita Thapar (2022) The Dolphin and the Shark: Stories on Entrepreneurship, Penguin Books Limited
- Saras D. Sarasvathy, (2008) Effectuation: Elements of Entrepreneurial Expertise, Elgar Publishing Ltd


**Web Resources**
- Learning resource- Ignite 5.0 Course Wadhwani platform (Includes 200+ components of custom created modular content + 500+ components of the most relevant curated content)

| III B.Tech. II Semester | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| O.E. I | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23OE4109 | OPERATING SYSTEMS | | | | | | |

**COURSE OBJECTIVES:**

- Understand the basic concepts and principles of operating systems, including process
- management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve
- Better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

**COURSE OUTCOMES: After completion of this course, the students would be able to**

**CO1:** Classify various operating system generations, functions and services. [K2]
**CO2:** Analyze process scheduling, management and synchronization. [K4]
**CO3:** Analyze deadlock prevention, detection, avoidance and recovery techniques [K4]
**CO4:** Analyze various memory management and storage management techniques [K4].
**CO5:** Analyze the concepts of file system [K4]

**SYLLABUS:**

**UNIT-I:**

**Operating Systems Overview:** Introduction, operating system functions, operating system operations, Computing environments, Free and Open-Source Operating Systems.
**System Structures:** Operating System Services, User and Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, Operating System Structure, Building and Booting an Operating System, Operating System Debugging.

**UNIT-II:**

**Processes:** Process Concept, Process Scheduling, Operations on Processes, Inter-Process Communication.
**Threads and Concurrency:** Multithreading Models, Thread Libraries, Threading Issues.
**CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling.

**UNIT-III:**

**Synchronization Tools:** The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic Problems of Synchronization.
**Deadlocks:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

**UNIT-IV:**

**Memory-Management Strategies:** Introduction, Contiguous Memory Allocation, Paging, Structure of the Page

Table, Swapping.
**Virtual Memory Management:** Introduction, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing.
**Storage Management:** Overview of Mass Storage Structure, HDD Scheduling**.**

**UNIT-V: File System:** File System Interface, File Concept, Access Methods, Directory Structure. File System Implementation: File-System Structure, File-System Operations, Directory Implementation, Allocation Methods, Free Space Management.
**File-System Internals:** File-System Mounting, Partitions and Mounting, File Sharing.
**Protection:** Goals of Protection, Principles of Protection, Protection Rings, Domain of Protection, Access Matrix.

**Text Books:**
**1.** Operating System Concepts, Silberschatz A, Galvin PB, Gagne G, 10th Edition, Wiley, 2018. Modern Operating Systems, Tanenbaum AS, 4th Edition, Pearson, 2016**.**

**Reference Books:**
1. Operating Systems - Internals and Design Principles, Stallings W, 9th Edition, Pearson, 2018.
2. Operating Systems: A Concept-Based Approach, D. M. Dhamdhere, 3rd Edition, McGraw-Hill, 2013.

**Online Learning Resources:**
1. https://nptel.ac.in/courses/106/106/106106144/
2. http://peterindia.net/OperatingSystems.html

| III B.Tech. II Semester | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| O.E. I | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23OE4115 | COMPUTER ORGANIZATION AND ARCHITECTURE | | | | | | |

**COURSE OBJECTIVES:** The purpose of the course is

- Discuss about principles of computer organization and the basic architectural concepts.
- Explain in depth understanding of basic organization, design, programming of a simple digital computer, computer arithmetic, instruction set design, micro programmed control unit, pipelining and vector processing, memory organization and I/O systems.

**COURSE OUTCOMES:** After Completion of the course, Students are able to:

**CO1:** Demonstrate an understanding of the different number systems, codes and relate postulates of Boolean algebra and minimize combinational functions. [K2]

**CO2:** Evaluate and learn different combinational circuits, sequential circuits and able to design them. [K5]

**CO3:** Organize, determine and learns basic structure of components register through language, micro operations and able to write micro programs. [K3]

**CO4:** Determine and able to learn micro programme control and central processing unit. [K3]

**CO5:** Able to learns the internal organization of computers and able to analyze performance of them. [K4]

**UNIT I:**

**Digital Computers and Data Representation**: Introduction, Numbering Systems, Decimal to Binary Conversion, Binary Coded Decimal Numbers, Weighted Codes, Self-Complementing Codes, Cyclic Codes, Error Detecting Codes, Error Correcting Codes, Hamming Code for Error Correction, Alphanumeric Codes, ASCI Code Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation.

**Boolean Algebra and Logical gates**: Boolean Algebra :Theorems and properties, Boolean functions, canonical and standard forms , minimization of Boolean functions using algebraic identities; Karnaugh map representation and minimization using two and three variable Maps; Logical gates ,universal gates and Two-level realizations using gates : AND-OR, OR-AND, NAND-NAND and NOR-NOR structures.

**UNIT II:**

**Digital logic circuits**: Combinatorial Circuits: Introduction, Combinatorial Circuit Design Procedure, Implementation using universal gates, Multi-bit adder, Multiplexers, De-multiplexers, Decoders Sequential Switching Circuits: Latches and Flip-Flops, Ripple counters using T flip-flops;

**Synchronous counters:** Shift Registers; Ring counters

**UNIT III:**

**Computer Arithmetic:** Addition and subtraction, multiplication Algorithms, Booth multiplication algorithm, Division Algorithms, Floating – point Arithmetic Operations. Register Transfer language and

microinstructions: Bus memory transfer, arithmetic and logical micro-operations, shift and rotate micro-operations.

**Basic Computer Organization and Design:** Stored program concept, computer Registers, common bus system, Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input–Output configuration and program Interrupt.

**UNIT IV:**

**Microprogrammed Control:** Control memory, Address sequencing, microprogram example, design of control unit.

**Central Processing Unit**: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation.

**Program Control:** conditional Flags and Branching.

**UNIT V:**

**Memory Organization**: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

**Input-Output Organization:** Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.

**TEXT BOOKS:**

**1.** Digital Logic and Computer Design, Moriss Mano, 11th Edition, Pearson.
**2.** Computer System Architecture, 3rd Edition, M.Morris Mano, PHI

**REFERENCE BOOKS:**

**1.** Digital Logic and Computer Organization, Rajaraman, Radha krishnan, PHI, 2006
**2.** Computer Organization, 5Th Edition, Hamacher, Vranesic, Zaky, TMH, 2002
**3.** Computer Organization & Architecture: Designing for Performance, 7th Edition, William Stallings, PHI, 2006

| III B.Tech. II Semester O.E. II | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23OE4111 | 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

**COURSE OUTCOMES:** After Completion of the course, Students are able to:
**CO1:** Interpret the fundamentals of DBMS. [K2]
**CO2:** Analyzing relational database designing. [K4]
**CO3:** Developing queries in RDBMS [K3]
**CO4:** Analyzing database design methodology and normalization process [K4].
**CO5:** Analyze transaction concepts and File indexing. [K2]

**SYLLABUS:**
**UNIT I:**
**Introduction:** Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.
**Entity Relationship Model:** Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

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

**UNIT III:**
**SQL:** Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL

functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

**UNIT IV:**

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

**UNIT V:**

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

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

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

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

**WEB-RESOURCES:**

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

| IV B.Tech. I Semester O.E. III | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23OE4110 | 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

**COURSE OUTCOMES:** After completion of this course, the students would be able to:

**CO1:** Interpret the syntax and semantics of java programs language and OOPs concepts. [K2]
**CO2:** Make use of different predefined classes and packages and interfaces to develop programs using OOPs concepts. [K3]
**CO3:** Apply exception handling and FILE I/O operations on java programs. [K3]
**CO4:** Make use of Multithreading and String handling Functions on java. [K3]
**CO5:** Make use of Java FX and Event-Handling to in the design of GUI Applications. [K3]

**SYLLABUS:**

**UNIT I**:

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

**Data Types, Variables, and Operators** :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator ( = ), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

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

**UNIT II**:

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

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

**UNIT III**:
**Arrays**: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three dimensional Arrays, Arrays as Vectors.
**Inheritance:** Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class- Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.
**Interfaces**: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

**UNIT IV:**
**Packages and Java Library**: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.
**Exception Handling:** Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.
**Java I/O and File:** Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java (Text Book 2)

**UNIT V:**
**String Handling in Java**: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.
**Multithreaded Programming**: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.
**Java 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

| IV B.Tech. I Semester | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| O.E. IV | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23OE4106 | COMPUTER NETWORKS | | | | | | |

**COURSE OBJECTIVES:**

- To provide insight about networks, topologies, and the key concepts.
- To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
- To understand the principles, key protocols, design issues, and significance of each layers in ISO and TCP/IP.
- To know the basic concepts of network services and various network applications.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1:** Explain the structure, functions, and types of computer networks, and compare the OSI and TCP/IP models. [K2]

**CO2:** Analyze the data link layer design issues, functionalities and protocols. [K4].

**CO3:** Analyse various media access methods such as Random Access, Controlled Access protocols and compare various Ethernet Standards. [K4]

**CO4:** Apply routing algorithms and congestion control techniques in the network layer and understand internetworking concepts [K3].

**CO5:** Describe the functionalities of transport and application layer protocols. [K2]

**SYLLABUS**

**UNIT I:**

**Introduction:** Types of Computer Networks, Reference Models- The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model. History of Internet.

**UNIT II:**

**The Data Link Layer:** Transmission Media, Guided and Un-guided media, Data Link Layer Design Issues, Services Provided to the Network Layer, Error detecting and Error Correcting codes, Elementary Data Link Protocols, Sliding Window Protocols, HDLC, PPP. Multiple Access Protocols Wired Lans: Ethernet, Fast Ethernet, Gigabit Ethernet

**UNIT III:**

**The Network Layer:** Network Layer Design Issues, Routing Algorithms, Congestion, Congestion control algorithms. The Network Layer in the Internet, the IP Version 4 Protocol, IP Addresses- Classful, CIDR, NAT, IP Version 6 Protocol, Transition from IPV4 to IPV6

**UNIT IV:**

**The Transport Layer:** The Transport Layer Services, Transport Layer Protocols: UDP, TCP and SCTP

**UNIT V:**

**The Application Layer:** The World Wide Web, HTTP, Domain Name Space, Remote Loging, Electronic Mail and File Transfer

**Text Books:**

1. "Computer Networks", Andrew S Tanenbaum, David J Wetherall, 5th Edition, Pearson
2. "Data Communications and Networking", Behrouz A Forouzan, 4th Edition, Tata McGraw Hill Education

**Reference Books**:

1. "Data and Computer Communication", William Stallings, Pearson
2. "TCP/IP Protocol Suite", Behrouz Forouzan, McGraw Hill.

| IV B.Tech. I Semester | L | T | P | Internal Marks | External Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|
| O.E. IV | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUBCODE: R23OE4112 | SOFTWARE ENGINEERING | | | | | | |

**COURSE OBJECTIVES:** The objectives of this course are to introduce

- Software life cycle models, Software requirements and SRS document.
- Project Planning, quality control and ensuring good quality software.
- Software Testing strategies, use of CASE tools, Implementation issues, validation &verification procedures.

**OURSE OUTCOMES:** After completion of this course, the students would be able to:
**CO 1:** Make use of Software Life Cycle models to. **[K4]**
**CO 2:** Emphasize the importance of software requirement and project management **[K4]**
**CO 3:** Analyze various types of software design techniques **[K4]**
**CO 4:** practice various Software testing methodologies **[K4].**
**CO 5:** Analyze various CASE tools and software maintenance process models. **[K4]**

**SYLLABUS**

**UNIT-I:**
**Introduction:** Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.
**Software Life Cycle Models:** Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

**UNIT-II:**
**Software Project Management:** Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.
**Requirements Analysis and Specification:** Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

**UNIT-III:**
**Software Design:** Overview of the design process, how to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design.
**Agility:** Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)
**Function-Oriented Software Design:** Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.

**User Interface Design:** Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

**UNIT-IV:**

**Coding And Testing:** Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing**,** testing object-oriented programs, Smoke testing, and some general issues associated with testing.

**Software Reliability and Quality Management:** Software reliability. Statistical testing, Software quality, Software quality management system, ISO9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma**.**

**UNITV:**

**Computer-Aided Software Engineering (Case):** CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, towards second generation CASE Tool, and Architecture of a CASE Environment.

**Software Maintenance:** Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

**Software Reuse:** Reuse-definition, introduction, reason behind noreusesofar, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

**Text Books:**

1. Fundamentals of Software Engineering, Rajib Mall, 5th Edition, PHI.
2. Software Engineering: A Practitioner's Approach, Roger S. Pressman, 9th Edition, McGraw Hill International Edition.

**Reference Books:**

1. Software Engineering, IanSommerville, 10th Edition, Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

**e- Resources:**

1) https://nptel.ac.in/courses/106/105/106105182/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview
3) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview