DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

ACADEMIC REGULATIONS (R23)

FOR

B. Tech Four Year Degree Programme

(Applicable for the batches admitted from the A.Y. 2023-24)

PACE INSTITUTE OF TECHNOLOGY AND SCIENCES (Autonomous)

Approved by AICTE and Govt. of Andhra Pradesh, Accredited by NAAC (A Grade)
Recognized under 2(f) & 12(B) of UGC, Permanently Affiliated to JNTUK, Kakinada
NH-16, Near Valluramma Temple, Ongole-523272
Andhra Pradesh, India.

Academic Regulations (R23) for B. Tech (Regular-Full time)
(Effective for the students admitted into I year from the Academic Year 2023-24 onwards)

1. **Award of the Degree**

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

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

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

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

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

      ii. Registering for Honors is optional.

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

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

3. **Courses of study:**
   The following courses of study are offered at Pace Institute of Technology and Sciences,Ongole

Sl No	Branch	Short name	Code
1	Civil Engineering	CE	01
2	Electrical and Electronics Engineering	EEE	02
3	Mechanical Engineering	ME	03
4	Electronics & Communication Engineering	ECE	04
5	Computer Science and Engineering	CSE	05
6	Computer Science and Information Technology	CSIT	07
7	Information Technology	IT	12
8	Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)	CSE(IoT&CSBT)	47
9	Artificial Intelligence and Data Science	AIDS	54
10	Artificial Intelligence and Machine Learning	AIML	61
11	Computer Science and Engineering (Indian Language)	CSE-R	63
12	Electronics Engineering (VLSI Design & Technology)	EE(VLSID&T)	66

4. **Admissions**
   Admission to the B. Tech Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either based

on the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

5. **Program related terms**

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

   (b) **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

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

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

6. **Semester/Credits:**

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

   (b) 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.

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

7. **Structure of the Undergraduate Programme**

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

S.No.	Category	Breakup of Credits (Total 160)	Percentage of total credits	AICTE Recommendation (%)
1	Humanities and Social Science including Management (HM)	13	8%	8-9%
2	Basic Sciences (BS)	20	13%	12-16%
3	Engineering Sciences (ES)	23.5	14%	10-18%
4	Professional Core (PC)	54.5	34%	30-36%
5	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21%	19-23%
6	Internships & Project work (PR)	16	10%	8-11%
7	Mandatory Courses (MC)	Non-credit	Non-credit	-

8. **Course Classification:** All subjects/ courses offered for the undergraduate programme in Engineering & Technology (B.Tech. degree programmes) are broadly classified as follows:

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

9. **Programme Pattern**

(a) Total duration of the of B. Tech (Regular) Programme is four academic years.

(b) Each academic year of study is divided into two semesters.

(c) Minimum number of instruction days in each semester is 90 days.

(d) 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.

(e) Health/wellness/yoga/sports and NSS /NCC /Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduate students.

(f) Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.

(g) Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.

(h) Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.

(i) Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.

(j) 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.

(k) While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.

(l) A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.

(m) Students shall undergo mandatory summer internships, for a minimum of eight weeks duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year.

(n) There shall also be mandatory full internship in the final semester of the programme along with the project work.

(o) Undergraduate degree with Honors is introduced by the University for the students having good academic record.

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

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

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

10. **Evaluation Process**

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

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

(A) **Theory Courses**

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

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

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

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

iv. If any subject is having both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given same subject code with an extension of 'T' for theory subject and 'P' for practical subject.

(a) **Continuous Internal Evaluation**

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

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

Note:

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

content. It should be continuous assessment throughout the semester and the average marks shall be considered.

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

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

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

   For Example:

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

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

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

(b) **Semester End Examination Evaluation:**

End examination of theory subjects shall have the following pattern:

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

ii. Question I shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks.

iii. There shall be 2 short answer questions from each unit.

   - In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.

iv. The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

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

i. Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.

ii. In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1mark.

iii. In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.

iv. The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

(B) **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 concerned laboratory teacher based on the record/viva and 15 marks for the internal test.

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

i. Procedure: 20 marks

ii. Experimental work & Results: 30 marks

iii. Viva voce: 20 marks.

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

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

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

of day-to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

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

(e) 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.

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

11. **Skill oriented Courses**

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

(b) 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.

(c) 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.

(d) The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The marks/grades shall be assigned to the students by the above committee based on their performance.

(e) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.

(f) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the principal at the beginning of the semester. The Head of the Department shall forward such proposals to the principal for approval.

(g) 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.

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

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

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

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

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

13. **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 institute 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.

(a) The institute shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses.

(b) Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.

(c) Credit transfer policy will be applicable to the Professional & Open Elective courses only.

(d) The concerned department shall identify the courses permitted for credit transfer.

(e) The institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.

(f) The department shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

(g) The institution shall ensure no overlap of MOOC exams with that of the semester end examination schedule. In case of delay in results, the institution will re-issue the marks sheet for such students.

(h) Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.

(i) The department shall submit the following to the examination cell & systems:

  i. List of students who have passed MOOC courses in the current semester along with the certificate of completion.

  ii. Undertaking form filled by the students for credit transfer.

(j) The institution shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

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

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

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

(a) provide option of mobility for learners across the universities of their choice

(b) provide option to gain the credits through MOOCs from approved digital platforms.

(c) facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC

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(d) execute Multiple Entry and Exit system with credit count, credit transfer and credit acceptance from students' account.

15. **Mandatory Internships**

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

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

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

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

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

16. **Guidelines for offering a Minor**

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

(a) The Minor program requires the completion of 12 credits in Minor stream chosen.

(b) Two courses for 06 credits related to a Minor are to be pursued compulsorily for the minor degree, but maybe waived for students who have done similar/equivalent courses. If waived for a student, then the student must take an extra elective course in its place. It is recommended that students should complete the compulsory courses (or equivalents) before registering for the electives.

(c) Electives (minimum of 2 courses) to complete a total of 12 credits.

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

17. **Guidelines for offering Honors**

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

(a) 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.

(b) A student shall earn additional 15 credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).

(c) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.

(d) The concerned Head of The Department shall arrange separate class work and timetable of the courses offered under Honors program.

(e) 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.

(f) Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.

(g) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.

(h) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.

(i) **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.

(j) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

(k) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

Enrolment into Honors:

(a) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline

(b) The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for Honors.

(c) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.

(d) Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.

(e) Honors is to be completed simultaneously with a Major degree program.

Registration for Honors:

(a) The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.

(b) 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.

(c) The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

(d) There is no fee for registration of subjects for Honors program offered in offline at the respective institutions.

18. **Attendance Requirements:**

(a) A student shall be eligible to appear for the semester end examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. 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.

(b) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.

(c) A stipulated fee shall be payable towards condonation of shortage of attendance to the University.

(d) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

(e) 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.

(f) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

(g) 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.

(h) For induction programme attendance shall be maintained as per AICTE norms.

19. **Promotion Rules:**

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

(a) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per university norms.

(b) 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.

(c) 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.

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

20. **Grading:**

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

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

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	Grade	Grade points
		Assigned
90 & above	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

(a) A student obtaining Grade 'F' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

(b) For non-credit audit courses, “Satisfactory” or “Unsatisfactory” shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

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

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

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

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

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

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

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

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

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

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

Award of Class:

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

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

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

21. **With–holding of Results**

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

22. **Multiple Entry / Exit Option**

(a) **Exit Policy:** The students can choose to exit the four-year programme at the end of first/second/third year.

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

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

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

(b) **Entry Policy:**

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

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

23. **Gap Year Concept:**

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/to establish startups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The Head of The 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

24. **Transitory Regulations**

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

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

25. **Minimum Instruction Days for a Semester:**

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

26. **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. Similarly, the medium of instruction and examinations in AICTE approved Indian language B.Tech programme are in Telugu and English.

27. **Student Transfers:**

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

28. **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 competent authorities of institution is final.

(e) The institution may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the institute.

(f) In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Head of the institution is final.

PACE INSTITUTE OF TECHNOLOGY & SCIENCES
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Academic Regulations (R23)
for B. Tech (Lateral Entry Scheme)

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

1. **Award of the Degree**

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

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

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

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

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

      ii. Registering for Honors is optional.

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

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

3. **Minimum Academic Requirements** The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.2

   (a) 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.

   (b) 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**

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

(b) 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.

(c) 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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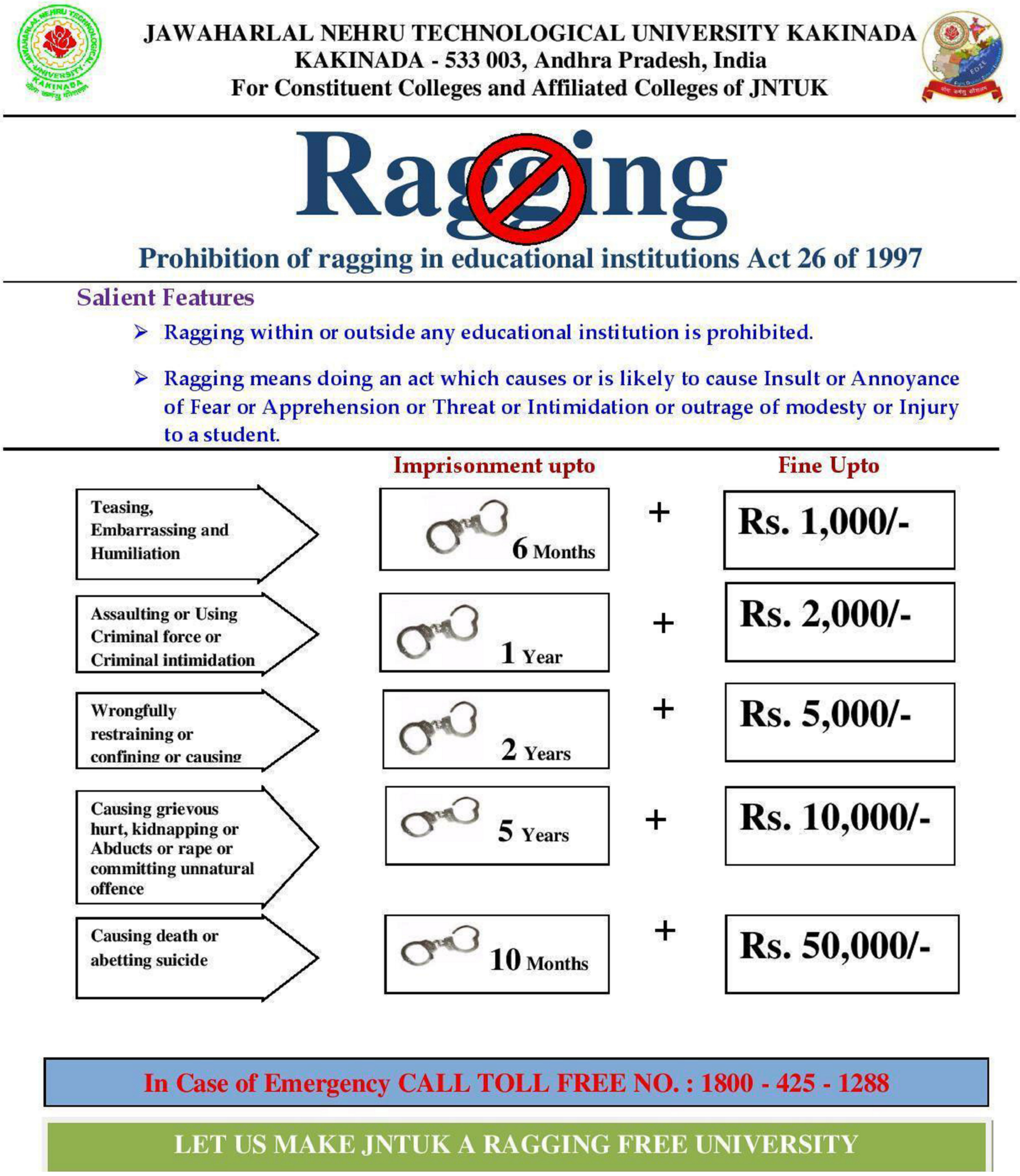
Annexure-I



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India
For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student.

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing	2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India
For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

ABSOLUTELY
NO TO RAGGING

1. **Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.**

2. **Ragging entails heavy fines and/or imprisonment.**

3. **Ragging invokes suspension and dismissal from the College.**

4. **Outsiders are prohibited from entering the College and Hostel without permission.**

5. **Girl students must be in their hostel rooms by 7.00 p.m.**

6. **All the students must carry their Identity Cards and show them when demanded**

7. **The Principal and the Wardens may visit the Hostels and inspect the rooms any time.**

Jawaharlal Nehru Technological University Kakinada
For Constituent Colleges and Affiliated Colleges of JNTUK

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

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

PACE INSTITUTE OF TECHNOLOGY & SCIENCES
PACE

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

I Year - I Semester						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	P23BST01	Communicative English	3	0	0	3
2	P23BST06	Chemistry	3	0	0	3
3	P23BST02	Linear Algebra & Calculus	3	0	0	3
4	P23EST01	Basic Civil And Mechanical Engineering	1	0	4	3
5	P23EST02	Introduction to Programming	3	0	0	3
6	P23BSL01	Communicative English Lab	0	0	2	1
7	P23BSL04	Chemistry Lab	0	0	2	1
8	P23ESL01	Engineering Workshop	0	0	3	1.5
9	P23ESL02	Computer Programming Lab	0	0	3	1.5
10	P23BST07	Health and wellness, Yoga and sports	-	-	1	0.5
Total Credits						19.5

I Year - II Semester						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	P23BST04	Engineering Physics	3	0	0	3
2	P23BST03	Differential Equations & Vector Calculus	3	0	0	3
3	P23EST03	Basic Electrical and Electronics Engineering	3	0	0	3
4	P23EST04	Engineering Graphics	1	0	4	3
5	P23ESL04	IT Workshop	0	0	2	1
6	P23CST01	Data Structures	3	0	0	3
7	P23BSL02	Engineering Physics Lab	0	0	2	1
8	P23ESL03	Electrical and Electronics Engineering Workshop	0	0	3	1.5
9	P23CSL01	Data Structures Lab	0	0	3	1.5
10	P23BST08	NSS/NCC/Scouts & Guides/Community Service	-	-	1	0.5
Total Credits						20.5

PACE INSTITUTE OF TECHNOLOGY & SCIENCES

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
PACE R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

II Year - I Semester						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	P23CST05	Database Management Systems	3	0	0	3.0
2	P23CSL05	Database Management Systems Lab	0	0	3	1.5
3	P23EST09	Digital Logic & Computer Organization	3	0	0	3.0
4	P23BST10	Discrete Mathematics & Graph Theory	3	0	0	3.0
5	P23ACT01	Environmental Science	2	0	0	0.0
6	P23CST03	Object Oriented Programming Through Java	3	0	0	3.0
7	P23CSL03	Object Oriented Programming Through Java Lab	0	0	3	1.5
8	P23AMS01	Python Programming	2	0	0	2.0
9	P23BST12	Universal Human Values - Understanding Harmony	3	0	0	3.0
					TOTAL	20.0

II Year - II Semester						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	P23BST14	Probability & Statistics	3	0	0	3.0
2	P23ADT01	Artificial Intelligence	3	0	0	3.0
3	P23CST04	Operating Systems	3	0	0	3.0
4	P23AMT01	Machine Learning	3	0	0	3.0
5	P23MBT01	Managerial Economics and Financial Analysis	2	0	0	2.0
6	P23BST17	Design Thinking & Innovation	2	0	0	2.0
7	P23CSL04	Operating Systems Lab	0	0	3	1.5
8	P23AML01	Artificial Intelligence & Machine Learning Lab	0	0	3	1.5
9	P23AMS02	Full Stack Development-I	2	0	0	2.0
					TOTAL	21.0

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
PACE R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

III Year - I Semester						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	P23CST08	Computer Networks	3	0	0	3.0
2	P23AMT02	Deep Learning	3	0	0	3.0
3	P23MBT05	Entrepreneurship Development and Venture Creation	3	0	0	3.0
4	P23CBS03	Full Stack Development - II	2	0	0	2.0
5	Professional Elective-I	1. Automota Theory And Compiler Design 2. Web Technologies 3. Object Oriented Analysis And Design 4. Exploratory Data Analysis With Python 5.Internet of Things	3	0	0	3.0
6	P23AMT03	Natural Language Processing	3	0	0	3.0
7	P23AML03	Natural Language Processing Lab	0	0	3	1.5
	P23AML02	Deep Learning Lab	0	0	3	1.5
8	P23XXXX	Tinkering Lab (UI Design - Flutter)	0	0	2	1.0
					TOTAL	21.0

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ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
PACE R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

III Year – II Semester						
S.No	**Category**	**Title**	**L**	**T**	**P**	**C**
1	Professional Core	Reinforcement Learning	3	0	0	3
2	Professional Core	Big Data Analytics	3	0	0	3
3	Professional Core	Data Visualization	3	0	0	3
4	Professional Elective-II	1. Cryptography & Network Security 2. Recommender Systems 3. Software Engineering 4. Social Network Analysis 5. 12-Week SWAYAM / NPTEL Course suggested by the BoS	3	0	0	3
5	Professional Elective-III	1. Computer Vision 2. Cloud Computing 3. DevOps 4. Soft Computing 5. 12-Week SWAYAM / NPTEL Course suggested by the BoS	3	0	0	3
6	Open Elective-II		3	0	0	3
7	Professional Core	Big Data Analytics Lab	0	0	3	1.5
8	Professional Core	Data Visualization Lab	0	0	3	1.5
9	Skill Enhancement Course	Soft skills / SWAYAM Plus - 21st Century Employability Skills	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	-
					Total	23

**Mandatory Industry Internship of 08 weeks duration during summer vacation*

MC	Minor Course	(Student may select from the same specialized minors pool)	3	0	3	4.5
MC	Minor Course	(Student may select from the same specialized minors pool)	3	0	0	3
HC	Honors Course	(Student may select from the same honors pool)	3	0	0	3
HC	Honors Course	(Student may select from the same honors pool)	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*

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).

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST01	Communicative English (Common to All Branches of Engineering)	2	0	0	2

Internal Marks: 30 External Marks: 70

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

Text Books:

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:

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
7. https://www.youtube.com/c/DailyVideoVocabulary/videos

VOCABULARY

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

PACE INSTITUTE OF TECHNOLOGY & SCIENCES
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Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST06	Chemistry (Common to EEE, ECE, CSE, IT & allied branches)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives: At the end of the course the student can be able

1. To predict the Fundamentals of Quantum mechanics, energy level diagrams in homo, hetero nuclear molecules.
2. To Illustrate the commonly used industrial materials.
3. To train the students on the principles and applications of electrochemistry.
4. To train the students on the principles and applications of polymers.
5. To introduce instrumental methods, molecular machines and switches.

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

CO1: Explain the Fundamentals of Quantum mechanics, energy level diagrams in homo, hetero nuclear molecules.

CO2: Explain the. commonly used industrial materials.

CO3: Explain the principles and applications of electrochemistry.

CO4: Explain the principles and applications of polymers.

CO5: Explain the instrumental methods and applications.

UNIT–I: Structure and Bonding Models

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of ψ and ψ2, particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2, N_2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT–II: Modern Engineering materials

Semiconductors – Introduction, basic concept, application

Super conductors-Introduction basic concept, applications.

Supercapacitors: Introduction, Basic Concept-Classification – Applications.

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

UNIT–III: Electrochemistry and Applications

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

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

Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-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.

Text Books:

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, 5^{th} Edition, Wiley Publications, Feb.2008
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3^{rd} Edition

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST02	Linear Algebra & Calculus (Common to All Branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

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: Demonstrate the understanding of rank of a matrix. Analyze the solutions of the system of linear equations.

CO2: Find the Eigen values and Eigen vectors of a matrix, apply Cayley-Hamilton theorem to determine inverse and power of a matrix and identify the nature of quadratic form.

CO3: Utilize mean value theorems to real life problems.

CO4: Familiarize with functions of several variables which are useful in optimization.

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, 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.

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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.

Text Books:

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

Reference Books:

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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST01	Basic Civil and Mechanical Engineering (Common to All branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

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

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

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

CO2: Identity 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.

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: Polymers and Fuel Chemistry

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).

Text Books:

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. 38^{th} Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10^{th} 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

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

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

CO1: Understand the role of mechnical engineering and different engineering materials.

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

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

Text Books:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt.
2. A text 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.

Reference Books:

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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST02	Introduction To Programming (Common to All branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

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

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

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

CO2: Analyse a problem and develop programs involving decision structures and loops.

CO3: Implement different operations on arrays and solve problems using Strings.

CO4: Design the programs by applying the features of pointers, structures and unions.

CO5: Develop problem-solving skills and the ability to debug and optimize the code by using functions and files.

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 (Pointer to Pointer) 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.

Text Books:

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, 2^{nd} edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BSL01	Communicative English Lab (Common to All Branches of Engineering)	0	0	2	1

Internal Marks: 30 External Marks: 70

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:

1. Walden Infotech
2. 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

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23BSL04	Chemistry Lab (Common to EEE, ECE, CSE, IT & allied branches)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

- To verify the fundamental concepts with experiments

Course Outcomes: At the end of the course, the student 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

References:

1. ”Vogel's Quantitative Chemical Analysis 6th Edition” Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESL01	Engineering Workshop (Common to All branches of Engineering)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting, electrical house wiring skills, and basic repairs of two-wheeler vehicle.

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

CO1: Identify workshop tools and their operational capabilities.

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

CO3: Apply sheet metal working operations in various applications and basic repairs of two weeler vehicle.

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.

9. **Basic repairs of Two-wheeler vehicle** – Demonstration of working of two-wheeler vehicle and its repairs.

Text Books:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019.

2. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5^{th} Edn. 2015.

3. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.

3. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14^{th} edition

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESL02	Computer Programming Lab (Common to All branches of Engineering)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

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

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

CO1: Understand and trace the execution of programs written in C language.

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

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

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

1. Basic Linux environment and its editors like Vi, Vim & Emacs etc.
2. Exposure to Turbo C, gcc
3. 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.
Lab2: Converting algorithms/flow charts into C Source code.
Developing the algorithms/flowcharts for the following sample programs

1. Sum and average of 3 numbers
2. Conversion of Fahrenheit to Celsius and vice versa
3. 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:
Lab3: Simple computational problems using arithmetic expressions.

1. Finding the square root of a given number
2. Finding compound interest
3. Area of a triangle using heron's formulae
4. 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

1. 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)
2. Find the maximum of three numbers using conditional operator
3. 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:
Lab5: Problems involving if-then-else structures.

1. Write a C program to find the max and min of four numbers using if-else.

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2. Write a C program to generate electricity bill.
3. TFind the roots of the quadratic equation.
4. Write a C program to simulate a calculator using switch case.
5. 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
Lab6: Iterative problems e.g., the sum of series

1. Find the factorial of given number using any loop.
2. Find the given number is a prime or not.
3. Compute sine and cos series
4. Checking a number palindrome
5. 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.
Lab7: 1D Array manipulation, linear search

1. Find the min and max of a 1-D integer array.
2. Perform linear search on1D array.
3. The reverse of a 1D integer array
4. Find 2's complement of the given binary number.
5. 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

1. Addition of two matrices
2. Multiplication two matrices
3. Sort array elements using bubble sort
4. Concatenate two strings without built-in functions
5. 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 &amp; 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.

1. Write a C program to find the sum of a 1D array using malloc()
2. Write a C program to find the total, average of n students using structures
3. Enter n students data using calloc() and display failed students list
4. Read student name and marks from the command line and display the student details along with the total.
5. 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

1. Create and display a singly linked list using self-referential structure.
2. Demonstrate the differences between structures and unions using a C program.
3. Write a C program to shift/rotate using bitfields.
4. 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.

1. Write a C function to calculate NCR value.
2. Write a C function to find the length of a string.
3. Write a C function to transpose of a matrix.
4. 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

1. Write a recursive function to generate Fibonacci series.
2. Write a recursive function to find the lcm of two numbers.
3. Write a recursive function to find the factorial of a number.
4. Write a C Program to implement Ackermann function using recursion.
5. 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.

1. Write a C program to swap two numbers using call by reference.
2. Demonstrate Dangling pointer problem using a C program.
3. Write a C program to copy one string into another using pointer.
4. 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 12: Recursion, the structure of recursive calls
Lab 14: File operations

1. Write a C program to write and read text into a file.
2. Write a C program to write and read text into a binary file using fread() and fwrite()
3. Copy the contents of one file to another file.
4. Write a C program to merge two files into the third file using command-line arguments.
5. Find no. of lines, words and characters in a file
6. Write a C program to print last n characters of a given file.

Text Books:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.

2. Byron Gottfried, Schaum & 39; 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

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST07	Health and Wellness, Yoga and Sports (Common to All branches of Engineering)	0	0	1	0.5

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: At the end 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:

1. Organizing health awareness programmes in community
2. Preparation of health profile
3. 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:

1. 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
2. Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14^{th} 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. – 3^{rd} 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:

1. Evaluated for a total of 100 marks.
2. 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.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST04	Engineering Physics (Common to All Branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

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

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

CO1: Analyze the intensity variation of light due to interference, diffraction and polarization.

CO2: Familiarize with the basics of crystals and their structures.

CO3: Summarize various types of polarization of dielectrics and classify the magnetic materials.

CO4: Explain the basic concepts of Quantum Mechanics, free electron theory.

CO5: Apply the band theory of solids and Hall Effect to study the semiconductors.

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.

Text Books:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11^{th} 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:

1. `https://www.loc.gov/rr/scitech/selected-internet/physics.html`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST03	Differential Equations and Vector Calculus (Common to All Branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. To enlighten the learners in the concept of differential equations and multivariable calculus.
2. 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: Find the complete solution to the higher order linear differential equations and apply these methods to find the current in complex electrical circuits.

CO3: 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, particular integral, general solution, Wronskian, Method of variation of parameters, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT–III: Partial Differential Equations
Introduction, Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method and non-linear(standard types) equations, Second order PDE: solution of linear PDE with constant coefficients- RHS term of the type $e^{ax+by}, sin(ax+by), cos(ax+by), x^m y^n$

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, Scalar potential functions, 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.

Text Books:

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

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14^{th} Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha ScienceInternational Ltd., 2021 5^{th} Edition(9^{th} reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5^{th} Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9^{th} edition
5. Higher Engineering Mathematics, B. V. Ramana, McGraw Hill Education, 2017

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST03	Basic Electrical & Electronics Engineering (Common to All branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

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

CO1: Describe fundamental laws, operating principles of motors/generators, MC/MI instruments (L2)

CO2: Demonstrate the working of electrical machines, measuring instruments and power generation stations. (L2)

CO3: Apply mathematical tools and fundamental concepts to derive various equations related to electrical circuits and machines. (L3)

CO4: Calculate electrical load and electricity bill of residential and commercial buildings. (L4)

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, Applications.

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, 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.

Text 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

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.

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

CO1: Compare the operation and characteristics of various semiconductor devices and their utilization.

CO2: Implement various power supply circuits using diodes and amplifier circuits using BJT.

CO3: Categorize various types of Logic gates and implement simple combinational logic circuits.

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.

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.

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.

Text Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4^{th} 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.

Semester end examination pattern:

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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST04	Engineering Graphics (Common to All branches of Engineering)	1	0	4	3

Internal Marks: 30 External Marks: 70

Course Objectives:

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

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

CO1: Understand the principles of engineering drawing, including polygons, engineering curves, scales.

CO2: Draw and interpret orthographic projections of points, lines, planes.

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

CO4: Explain principles behind sections of solids and development of surfaces.

CO5: Convert the isometric view into orthographic view and vice versa.

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: Semiconductors

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).

Text Books:

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.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESL04	IT Workshop (Common to All branches of Engineering)	0	0	2	1

Internal Marks: 30 External Marks: 70

Course Objectives:

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

Course Outcomes:

CO1: Understand the fundamental principles of computer hardware components and their interconnections.

CO2: Analyze the historical development of the Internet and its impact on global communication.

CO3: Analyze the underlying principles and structure of LaTeX and Word documents.

CO4: Implement essential toolbars and ribbons for common spreadsheet tasks.

CO5: Understand the principles of effective content organization in presentations.

CO6: Implement AI tools like ChatGPT into their professional workflows for content creation and translation.

PC Hardware & Software Installation

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

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

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

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot

(VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

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

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

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

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

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

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX 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 LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using LaTeX 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 LaTeX 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 – ChatGPT

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, 3^{rd} edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2^{nd} 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, 3^{rd} edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3^{rd} edition

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CST01	Data Structures (Common to CSE, IT & allied branches)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

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

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

CO1: Understand 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: Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees and Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

UNIT–I:

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

UNIT–II:

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

UNIT–III:

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

UNIT–IV:

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

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

UNIT–V:

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

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

Text Books:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2^{nd} 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

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23BSL02	Engineering Physics Lab (Common to All Branches of Engineering)	0	0	2	1

Internal Marks: 30 External Marks: 70

Course Objectives:

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

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

CO1: Apply the concepts of wave optics to get wavelength of light.

CO2: Apply the concept of resonance in sonometer and melde's experiments for getting frequency.

CO3: Study the earth's gravity and rigidity modulus of material.

CO4: Study electrostatics and magnetism to determine its dependent properties.

CO5: Determine the properties of semiconductors and Planks constant.

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.

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12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non- uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

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

References:

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

Web Resources:

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

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESL03	Electrical & Electronics Engineering Workshop (Common to All branches of Engineering)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Objectives:

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

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

CO1: Measure voltage, current and power in an electrical circuit. (L3)

CO2: **CO2:** Measure of Resistance using Wheat stone bridge (L4)

CO3: Discover critical field resistance and critical speed of DC shunt generators. (L4)

CO4: Investigate the effect of reactive power and power factor in electrical loads. (L5)

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 Device & Circuit Theory, Pearson Education, 2021.

2. R. P. Jain, Modern Digital Electronics, 4^{th} Edition, Tata Mc Graw Hill, 2009

3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

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

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CSL01	Data Structures Lab (Common to CSE, IT & allied branches)	0	0	3	1.5

Internal Marks: 15 External Marks: 35

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

CO1: Understand 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 Trees, hashing is advantageous, and design hash-based solutions for specific problems.

List of Experiments:

Exercise 1: Array Manipulation

1. Write a program to reverse an array.
2. C Programs to implement the Searching Techniques – Linear & Binary Search
3. C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

Exercise 2: Linked List Implementation

1. Implement a singly linked list and perform insertion and deletion operations.
2. Develop a program to reverse a linked list iteratively and recursively.
3. Solve problems involving linked list traversal and manipulation.

Exercise 3: Linked List Applications

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

Exercise 4: Double Linked List Implementation

1. Implement a doubly linked list and perform various operations to understand its properties and applications.
2. Implement a circular linked list and perform insertion, deletion, and traversal.

Exercise 5: Stack Operations

1. Implement a stack using arrays and linked lists.
2. Write a program to evaluate a postfix expression using a stack.
3. Implement a program to check for balanced parentheses using a stack.

Exercise 6: Queue Operations

1. Implement a queue using arrays and linked lists.
2. Develop a program to simulate a simple printer queue system.
3. Solve problems involving circular queues.

Exercise 7: Stack and Queue Applications

1. Use a stack to evaluate an infix expression and convert it to postfix.
2. Create a program to determine whether a given string is a palindrome or not.
3. Implement a stack or queue to perform comparison and check for symmetry.

Exercise 8: Binary Search Tree

1. Implementing a BST using Linked List.
2. Traversing of BST.

Exercise 9: Hashing

1. Implement a hash table with collision resolution techniques.
2. Write a program to implement a simple cache using hashing.

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2^{nd} 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.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST08	NSS/NCC/SCOUTS & Guides/Community Service (Common to All branches of Engineering)	0	0	1	0.5

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: At the end of the course, the student 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:

1. Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
2. Conducting orientations programs for the students –future plans-activities-releasing road map etc.
3. Displaying success stories-motivational biopics- award winning movies on societal issues etc.
4. Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT–II: Nature & Care :

Activities:

1. Best out of waste competition.
2. Poster and signs making competition to spread environmental awareness.
3. Recycling and environmental pollution article writing competition.
4. Organising Zero-waste day.
5. Digital Environmental awareness activity via various social media platforms.
6. Virtual demonstration of different eco-friendly approaches for sustainable living.

7. Write a summary on any book related to environmental issues.

UNIT–III: Community Service
Activities:

1. 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.

2. Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,

3. Conducting consumer Awareness. Explaining various legal provisions etc.

4. Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.

5. 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:

1. Evaluated for a total of 100 marks.

2. 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.

3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST02	Discrete Mathematics and Graph Theory (Common to CSE, IT, CSE-AIML, CSE-DS)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. To introduce the concepts of mathematical logic and predicate calculus.
2. To study set theory and algebraic structures.
3. To introduce the concepts of Graph Theory and Trees.
4. To apply discrete mathematics techniques to computer science problems.

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

CO1: Understand and apply propositional and predicate logic.

CO2: Analyze and apply set theory, relations and functions.

CO3: Understand algebraic structures and solve problems using groups and lattices.

CO4: Solve problems using graph theory including paths, circuits, trees and planar graphs.

CO5: Apply discrete mathematics techniques to real-world and computer science problems.

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UNIT–I: Mathematical Logic

Statements and notations – Connectives – Truth tables – Tautologies – Equivalence – Implications – Normal forms – Predicates – Quantifiers – Nested quantifiers – Rules of inference.

UNIT–II: Set Theory and Relations

Basic concepts of set theory – Venn diagrams – Laws of set theory – Power set – Principle of inclusion and exclusion – Properties of binary relations – Closure – Warshall's algorithm – Equivalence and partial ordering relations – Hasse diagram.

UNIT–III: Algebraic Structures and Lattices

Algebraic structures – Semigroups – Monoids – Groups – Subgroups – Homomorphism – Properties – Lattices – Posets – Hasse diagrams – Properties of lattices – Boolean algebra.

UNIT–IV: Graph Theory

Basic concepts – Types of graphs – Subgraphs – Isomorphism – Paths and circuits – Eulerian and Hamiltonian graphs – Planar graphs – Graph coloring – Chromatic number – Applications.

UNIT–V: Trees and Applications

Tree definitions and properties – Spanning trees – Minimum spanning trees (Prim's and Kruskal's algorithms) – Binary trees – Tree traversals – Expression trees – Applications in computer science.

Text Books:

1. Tremblay J.P. and Manohar R., *Discrete Mathematical Structures with Applications to Computer Science*, McGraw-Hill, 2017.
2. Kenneth H. Rosen, *Discrete Mathematics and its Applications*, Tata McGraw-Hill, 7th Edition.

Reference Books:

1. Seymour Lipschutz and Marc Lars Lipson, *Discrete Mathematics*, Schaum's Outlines, Tata McGraw-Hill.
2. C.L. Liu, D.P. Mohapatra, *Elements of Discrete Mathematics*, McGraw-Hill, 3rd Edition.
3. N. Chandrasekaran and M. Umaparvathi, *Discrete Mathematics*, PHI, 2010.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23HST01	Universal Human Values (Common to All Branches of Engineering)	2	0	0	2

Internal Marks: 30 External Marks: 70

Course Objectives:

1. Facilitate the students in understanding the harmony in nature and existence and their interconnectedness.
2. Strengthen self-reflection and development practices for better awareness, understanding and expression.
3. Enable students to handle problems, relationships, work and life with clarity and confidence.
4. Inspire students to act with responsibility (participation) in society and nature for the well-being of all.

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

CO1: Understand the need, basic guidelines, content and process of value education.

CO2: Understand harmony in the human being and in the family.

CO3: Understand harmony in the society and nature.

CO4: Distinguish between the needs of the Self and the Body, Sukh and Suvidha.

CO5: Understand the comprehensive human goal and universal human order.

UNIT–I: Introduction – Value Education

Need, basic guidelines, content and process for value education, understanding harmony in the human being – Harmony in myself! Understanding human being as co-existence of the sentient "I" and the material "Body".

UNIT–II: Harmony in the Human Being

Understanding the needs of Self ('I') and 'Body' – Sukh and Suvidha. Understanding the activities in Self ('I') and in Body – Sanyam and Swasthya; correct appraisal of physical needs, meaning of prosperity in detail, programs to ensure Sanyam and Swasthya.

UNIT–III: Harmony in the Family and Society

Harmony in the family – the basic unit of human interaction, values in human relationship; Trust (Vishwas) and Respect (Samman) as the foundational values of relationships. Understanding the harmony in the society (society being an extension of family).

UNIT–IV: Harmony in the Nature and Existence

Understanding harmony in nature; interconnectedness and mutual fulfilment in nature, the Four Orders of Nature – recycling in nature. Understanding existence as co-existence (Sah-Astitva) of mutually interacting units in all-pervasive space.

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UNIT–V: Holistic Human Vision

Natural acceptance of human values; Definitiveness of Ethical Human Conduct, Universal Human Order, Human society and the global order. Holistic understanding of harmony at all levels of existence.

Text Books:

1. R.R. Gaur, R. Sangal, G.P. Bagaria, *A Foundation Course in Human Values and Professional Ethics*, Excel Books, New Delhi, 2nd Revised Edition, 2019.
2. Jeevan Vidya – A Means to Sustainable Happiness and Prosperity, Jeevan Vidya Trust, Amar Kantak.

Reference Books:

1. R.R. Gaur, R. Sangal, G.P. Bagaria, *Teacher's Manual*, Excel Books, New Delhi, 2019.
2. M.K. Gandhi, *My Experiments with Truth*, Penguin Books.
3. E.F. Schumacher, *Small is Beautiful*, Harper Perennial.
4. J.C. Kumarappa, *Economy of Permanence*, Sarva Seva Sangh Prakashan, Varanasi.
5. Pandit Sunderlal, *Bharat Mein Angreji Raj*, Hindi, Publication Division, Government of India.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CST02	Digital Logic and Computer Organization (Common to CSE, IT, CSE-AIML, CSE-DS)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. Introduce the basic concepts of digital logic design.
2. Understand data representation and arithmetic operations in digital systems.
3. Understand basic components and functions of a computer system.
4. Learn the organization and architecture of CPUs, memory, and input/output.

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

CO1: Understand number systems, binary codes, and Boolean algebra.

CO2: Design and simplify logic circuits using K-maps and logic gates.

CO3: Analyze and design combinational and sequential circuits.

CO4: Explain basic structure, operations and control of the central processing unit.

CO5: Understand memory organization, I/O organization and interfacing.

UNIT–I: Number Systems and Codes

Introduction to number systems: binary, octal, decimal, hexadecimal, conversions. Signed binary numbers – binary arithmetic – 1's and 2's complement arithmetic. Binary codes: BCD, excess-3, gray code. Error detecting and correcting codes – parity, Hamming code.

UNIT–II: Boolean Algebra and Logic Gates

Basic theorems and properties of Boolean algebra, canonical and standard forms. Logic gates, universal gates, realization of Boolean expressions using logic gates. Simplification using Karnaugh maps (up to 5 variables), NAND–NOR implementations.

UNIT–III: Combinational and Sequential Logic

Combinational logic: adders, subtractors, multiplexers, demultiplexers, encoders, decoders. Sequential logic: flip-flops – types, triggering and conversions. Shift registers – types, counters – asynchronous and synchronous.

UNIT–IV: Basic Computer Organization and Design

Instruction codes, computer registers, register transfer language, bus system, memory reference, register reference, input-output and interrupt. Design of a basic computer.

UNIT–V: CPU, Memory and I/O Organization

General register and stack organization. Instruction formats, addressing modes. Memory hierarchy, RAM, ROM, Cache, Associative and Virtual Memory. I/O interface – Programmed I/O, Interrupt-driven I/O and DMA.

Text Books:

1. M. Morris Mano, Michael D. Ciletti, *Digital Design*, Pearson Education, 5th Edition.
2. M. Morris Mano, *Computer System Architecture*, Pearson Education, 3rd Edition.

Reference Books:

1. John P. Hayes, *Computer Architecture and Organization*, McGraw Hill, 3rd Edition.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, *Computer Organization*, 5th Edition, McGraw Hill.
3. William Stallings, *Computer Organization and Architecture*, Pearson Education, 10th Edition.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CST03	Database Management Systems (Common to CSE, IT, CSE-AIML, CSE-DS)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. Learn the fundamentals of database systems and database management.
2. Design ER models and relational models for database applications.
3. Understand relational algebra and SQL for querying databases.
4. Learn normalization techniques to design efficient schemas.
5. Understand transaction management and database recovery.

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

CO1: Understand database concepts and architectures.

CO2: Design and model relational databases using ER diagrams.

CO3: Formulate queries using SQL and relational algebra.

CO4: Apply normalization techniques for schema refinement.

CO5: Understand transaction management, concurrency control and recovery techniques.

UNIT–I: Introduction to Databases

Characteristics of Database approach – Advantages of using DBMS – Database users – Three schema architecture – Data models – Database languages – Database system environment – Centralized and Client/Server architectures – Classification of DBMSs.

UNIT–II: Data Modeling using the Entity–Relationship (ER) Model

Entity types – Entity sets – Attributes and keys – Relationships – Constraints – Weak entity types – ER diagrams – Enhanced ER Model – Specialization – Generalization – Constraints on generalization and specialization – Reduction to relational schema.

UNIT–III: Relational Model and Relational Algebra

Relational model concepts – Relational constraints – Keys – Schema – Relational algebra operations – Selection – Projection – Set operations – Join operations – Aggregate functions – Outer join and division.

UNIT–IV: SQL and Normalization

Overview of SQL – DDL – DML – Integrity constraints – Null values – Nested queries – Joins – Views – Triggers – PL/SQL basics – Functional dependencies – Normal forms (1NF, 2NF, 3NF and BCNF) – Dependency preservation – Lossless decomposition.

UNIT–V: Transaction Management and Recovery

Transaction concepts – Properties of transactions – Serializability of schedules – Concurrency control – Locking techniques – Time-stamp ordering – Recovery concepts – Log-based recovery – Shadow paging – Buffer management.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, *Database System Concepts*, 6th Edition, McGraw-Hill.
2. Ramez Elmasri and Shamkant B. Navathe, *Fundamentals of Database Systems*, 7th Edition, Pearson Education.

Reference Books:

1. C.J. Date, A. Kannan, S. Swamynathan, *An Introduction to Database Systems*, 8th Edition, Pearson Education.
2. Raghu Ramakrishnan, Johannes Gehrke, *Database Management Systems*, 3rd Edition, McGraw-Hill.
3. Peter Rob and Carlos Coronel, *Database Systems: Design, Implementation and Management*, 9th Edition, Cengage Learning.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CST05	Object Oriented Programming through Java (Common to CSE, IT, CSE-AIML, CSE-DS)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. Understand object-oriented programming concepts and their applications.
2. Learn to design and implement object-oriented software using Java.
3. Develop skills to write reusable and efficient object-oriented code.
4. Learn exception handling, file handling, multithreading, and GUI development using Java.

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

CO1: Understand and apply object-oriented programming features in Java.

CO2: Design classes and objects using encapsulation and constructors.

CO3: Apply inheritance, polymorphism, and interfaces in program design.

CO4: Develop programs using exception handling, multithreading and file operations.

CO5: Create graphical user interfaces using AWT and Swing libraries.

UNIT–I: Introduction to Java

Basics of Java – Java Virtual Machine – Java program structure – Data types – Variables – Operators – Control statements – Arrays – Type casting – Classes – Objects – Constructors – Method overloading – Static members – Command-line arguments – Garbage collection.

UNIT–II: Inheritance and Interfaces

Inheritance – Types – super and this keywords – Method overriding – final keyword – Abstract classes – Interfaces – Multiple inheritance using interfaces – Packages – Access modifiers.

UNIT–III: Exception Handling and Multithreading

Exception handling – Try-catch block – Multiple catch – Nested try – Throw – Throws – Finally – Custom exceptions – Multithreading – Creating threads – Thread class and Runnable interface – Thread life cycle – Thread synchronization – Inter-thread communication.

UNIT–IV: File Handling and Collections

File handling – File class – Byte and character streams – Reading and writing from/to files – Scanner and Formatter classes – Serialization and Deserialization – Java Collection Framework – ArrayList, LinkedList, HashSet, TreeSet, HashMap, TreeMap – Iterators.

UNIT–V: GUI and Event Handling

AWT – Components – Containers – Layout managers – Event handling – Delegation event model – Adapter classes – Introduction to Swing – JFrame, JButton, JLabel, JTextField, JCheckBox, JRadioButton, JComboBox – Building GUI applications.

Text Books:

1. Herbert Schildt, *Java: The Complete Reference*, 11th Edition, McGraw Hill Education.
2. E. Balagurusamy, *Programming with Java*, 6th Edition, McGraw Hill Education.

Reference Books:

1. Kathy Sierra, Bert Bates, *Head First Java*, 2nd Edition, O'Reilly Media.
2. Steven Holzner, *Java 2 Black Book*, Dreamtech Press.
3. Cay S. Horstmann, *Core Java Volume I–Fundamentals*, 11th Edition, Pearson.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CSL07	Database Management Systems Lab (Common to CSE, IT, CSE-AIML, CSE-DS)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Objectives:

1. Practice data definition and data manipulation using SQL.
2. Understand schema design using E-R modeling and relational normalization.
3. Explore transaction management and concurrency in practical environments.
4. Apply PL/SQL programming for real-time database applications.

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

CO1: Design ER models and map them to relational schemas.
CO2: Implement DDL and DML operations using SQL.
CO3: Write queries involving joins, subqueries, and aggregate functions.
CO4: Implement views, triggers, cursors and stored procedures using PL/SQL.
CO5: Apply concepts of transaction control and normalization to maintain data integrity.

List of Experiments:

1. Draw ER diagrams for various scenarios and convert them to relational schemas.
2. Create database schema using DDL commands.
3. Insert and manipulate data using DML commands.
4. Practice queries using selection, projection, and various conditional clauses.
5. Write queries using aggregate functions and GROUP BY clause.
6. Implement inner joins, outer joins and nested subqueries.
7. Create views, indexes and sequences.
8. Write PL/SQL blocks using IF, CASE and LOOP constructs.
9. Develop procedures and functions using PL/SQL.
10. Implement triggers and exception handling.
11. Demonstrate cursor operations (explicit and implicit cursors).
12. Simulate transactions and test concurrency control using COMMIT, ROLLBACK and SAVEPOINT.

Reference Books:

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1. Ramez Elmasri and Shamkant B. Navathe, *Fundamentals of Database Systems*, Pearson Education.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, *Database System Concepts*, McGraw Hill.
3. C.J. Date, *An Introduction to Database Systems*, Pearson Education.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CSL06	Object-Oriented Programming Through Java Lab (Common to CSE, IT, CSE-AIML, CSE-DS)	0	0	3	1.5

This lab course enables students to implement object-oriented programming concepts through Java by developing applications using classes, inheritance, interfaces, exception handling, file I/O, multithreading, and graphical user interfaces.

Internal Marks: 30 External Marks: 70

Course Objectives:

1. Understand the principles of object-oriented programming through hands-on Java programming.
2. Implement Java programs using classes, inheritance, interfaces, exception handling, file handling and multithreading.
3. Apply object-oriented features to solve real-world problems.

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

CO1: Write Java programs using classes, objects and constructors.

CO2: Apply inheritance and polymorphism to develop reusable and maintainable code.

CO3: Develop Java applications using interfaces and packages.

CO4: Implement exception handling, multithreading and file I/O operations.

CO5: Create graphical user interfaces using AWT and Swing components.

List of Experiments:

1. Write a Java program to define a class, constructor, and method.
2. Implement method overloading and constructor overloading.
3. Write programs demonstrating single, multilevel and hierarchical inheritance.
4. Implement polymorphism using method overriding.
5. Create and use interfaces and demonstrate multiple inheritance.
6. Develop packages and demonstrate access protection.
7. Write programs to handle predefined and user-defined exceptions.
8. Create threads using `Thread` class and `Runnable` interface, and implement synchronization.
9. Perform file handling operations (read, write, copy) using character and byte streams.

10. Develop Java GUI applications using AWT components.
11. Handle events using delegation event model and adapter classes.
12. Create GUI applications using Swing components like `JButton`, `JLabel`, `JTextField`, etc.

Reference Books:

1. Herbert Schildt, *Java: The Complete Reference*, 11th Edition, McGraw Hill.
2. E. Balagurusamy, *Programming with Java*, 6th Edition, McGraw Hill.
3. Kathy Sierra, Bert Bates, *Head First Java*, O’Reilly Media.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CSL08	Python Programming (SKILL ENHANCEMENT COURSE) (Common to CSE, IT, CSE-AIML, CSE-DS)	0	0	3	1.5

This lab course provides students hands-on experience with Python to develop programs for solving problems in mathematics, science, and engineering.

Internal Marks: 30 External Marks: 70

Course Objectives:

1. Introduce the fundamentals of Python programming.
2. Enable students to apply Python constructs to solve computational problems.
3. Provide exposure to Python libraries for scientific computing and data processing.

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

CO1: Write Python programs using basic constructs like variables, control flow, and functions.

CO2: Work with strings, lists, tuples, dictionaries, and sets.

CO3: Use Python modules and built-in functions for solving mathematical and scientific problems.

CO4: Develop scripts for file handling and exception management.

CO5: Implement programs using libraries such as NumPy, Pandas and Matplotlib.

List of Experiments:

1. Write Python programs demonstrating usage of variables, expressions, and data types.
2. Programs on conditional statements and looping constructs.
3. Functions: user-defined functions, recursion, lambda expressions.
4. Programs using strings and string functions.
5. Programs on lists, tuples, dictionaries, and sets.
6. File operations: reading and writing to files.
7. Exception handling with try-except-else-finally blocks.
8. Usage of built-in modules and importing user-defined modules.
9. Programs using NumPy for mathematical operations.
10. Data analysis using Pandas: Series, DataFrames, file I/O with CSV.

11. Data visualization using Matplotlib: plotting graphs and charts.
12. Mini-project: A real-world problem implemented using multiple concepts.

Reference Books:

1. Allen B. Downey, *Think Python: How to Think Like a Computer Scientist*, 2nd Edition, O'Reilly.
2. Wesley J. Chun, *Core Python Programming*, 2nd Edition, Pearson Education.
3. Mark Lutz, *Learning Python*, 5th Edition, O'Reilly Media.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23MCT01	Environmental Science (Common to All Branches of Engineering)	2	0	0	0

This course enables students to understand and appreciate the importance of natural resources, ecosystems, biodiversity, pollution control, social issues and sustainable development.

Internal Marks: 100 External Marks: 0

Course Objectives:

1. To learn the multidisciplinary nature, scope and importance of Environmental Science.
2. To understand the concept of ecosystem and biodiversity.
3. To analyze different types of natural resources and the problems associated with them.
4. To study environmental pollution and control technologies.
5. To understand social issues and the environment for achieving sustainable development.

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

CO1: Understand the importance and multidisciplinary nature of environmental studies.

CO2: Describe the structure and function of ecosystems and explain biodiversity.

CO3: Identify the use and misuse of natural resources and suggest conservation strategies.

CO4: Explain different types of pollution, their causes, effects and control measures.

CO5: Apply environmental knowledge for sustainable development and decision-making.

UNIT–I: Multidisciplinary Nature of Environmental Studies and Natural Resources

Definition, scope and importance – Need for public awareness. Forest resources, water resources, mineral resources, food resources, energy resources, land resources: use and over-exploitation, case studies. Role of an individual in conservation of natural resources.

UNIT–II: Ecosystems

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT–III: Biodiversity and Its Conservation

Introduction – Definition: genetic, species and ecosystem diversity – Biogeographical classification of India – Value of biodiversity – Hot-spots of biodiversity – Threats to biodiversity – Endangered and endemic species – Conservation of biodiversity: In-situ and Ex-situ conservation.

UNIT–IV: Environmental Pollution

Definition, causes, effects and control measures of: Air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards – Solid waste management – Disaster management: floods, earthquake, cyclone and landslides.

UNIT–V: Social Issues and the Environment

From unsustainable to sustainable development – Urban problems related to energy – Water conservation, rainwater harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust – 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.

Text Book:

1. Erach Bharucha, *Textbook of Environmental Studies for Undergraduate Courses*, Universities Press (India) Pvt. Ltd., 2nd Edition.

Reference Books:

1. Anubha Kaushik and C.P. Kaushik, *Perspectives in Environmental Studies*, New Age International (P) Ltd. Publishers.
2. R. Rajagopalan, *Environmental Studies: From Crisis to Cure*, Oxford University Press.

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Course Code	Course Name	Course Structure			
		L	**T**	**P**	**C**
P23MBT01	Managerial Economics and Financial Analysis	3	0	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

- To understand the fundamentals of Managerial Economics concepts and tools.
- To be able to analyze the demand and supply, production and cost.
- To understand the nature of markets, pricing methods and pricing in different market structures.
- To know the basic concepts of Financial Accounting and Analysis.
- To analyze and interpret the financial statements using ratio analysis.

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

CO1: Understand the fundamentals of economics for managers.

CO2: Apply the concepts of demand and production in real-time business decisions.

CO3: Determine price output in different market conditions.

CO4: Analyze the financial statements of a firm.

CO5: Evaluate various investment project proposals using capital budgeting techniques.

UNIT–I: Introduction to Managerial Economics and Demand

Definition, Nature and Scope of Managerial Economics – Relation with other disciplines – Its significance in managerial decision making – Types of demand – Determinants – Law of demand and its exceptions – Elasticity of demand: Price, Income and Cross elasticity – Measurement and Significance – Concept of Demand Forecasting and Methods.

UNIT–II: Production and Cost Analysis

Production function – Law of Variable Proportions – Isoquants and Isocosts – MRTS – Least Cost Combination of Inputs – Laws of Returns to Scale and Economies of Scale – Cost concepts – Opportunity cost – Fixed vs. Variable costs – Explicit vs. Implicit costs – Out of pocket vs. Imputed costs – Break-Even Analysis (BEA) – Determination of Break-Even Point (Simple numerical problems) – Managerial significance.

UNIT–III: Market Structures and Pricing Practices

Types of Markets – Features – Price-Output Determination – Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly – Pricing Methods and Strategies.

UNIT–IV: Introduction to Financial Accounting
Accounting concepts and conventions – Double-entry system – Journal – Ledger – Trial Balance – Final Accounts with simple adjustments.

UNIT–V: Financial Analysis through Ratios and Capital Budgeting
Concepts of capital and capital budgeting – Time value of money – Methods of capital budgeting: Traditional and Discounted cash flow methods – Ratio analysis: Liquidity, profitability and solvency ratios.

Text Book:

- Aryasri, *Managerial Economics and Financial Analysis*, McGraw Hill Education.

Reference Books:

- Varshney & Maheswari, *Managerial Economics*, Sultan Chand.
- S.N. Maheswari & S.K. Maheswari, *Financial Accounting*, Vikas Publications.
- H. Craig Peterson & W. Cris Lewis, *Managerial Economics*, PHI.
- Van Horne, *Financial Management and Policy*, Pearson.

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Course Code	Course Name	Course Structure			
		L	**T**	**P**	**C**
P23BST01	Probability and Statistics	3	0	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

- To familiarize students with the foundations of probability and statistical techniques.
- To equip students with tools to model uncertainty in real-world scenarios.
- To enable students to interpret statistical data using various distribution models.
- To provide understanding of sampling techniques and estimation theory.
- To introduce students to hypothesis testing and regression analysis.

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

CO1: Understand basic probability and apply Bayes' theorem to real-time problems.

CO2: Distinguish and apply discrete and continuous probability distributions.

CO3: Analyze data using sampling distributions and estimate population parameters.

CO4: Perform hypothesis testing using various statistical tests.

CO5: Apply correlation and regression analysis to interpret statistical data.

UNIT–I: Probability

Probability spaces, conditional probability, independence; Discrete and continuous random variables and their properties – Expectation, variance, moment generating function – Discrete distributions: Binomial, Poisson; Continuous distributions: Uniform, Exponential.

UNIT–II: Normal Distribution and Sampling Theory

Normal distribution and its properties – Central Limit Theorem (without proof) – Sampling distributions – Sampling distribution of means – t-distribution – F-distribution – Chi-square distribution and applications.

UNIT–III: Estimation

Point estimation and interval estimation – Properties of estimators – Confidence intervals for mean and proportions (large and small samples).

UNIT–IV: Tests of Hypothesis

Hypothesis testing – Null and alternative hypothesis – Type I and Type II errors – Level of significance – One tail and two tail tests – Z-test, t-test, F-test and Chi-square test for goodness of fit and independence of attributes.

UNIT–V: Correlation and Regression

Correlation – Karl Pearson's coefficient of correlation – Spearman's rank correlation – Regression equations and estimation – Properties of regression coefficients.

Text Book:

- S.C. Guptha and V.K. Kapoor, *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons.

Reference Books:

- Richard A. Johnson, *Probability and Statistics for Engineers*, Pearson Education.
- Jay L. Devore, *Probability and Statistics for Engineering and the Sciences*, Cengage Learning.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CST03	Artificial Intelligence	3	0	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

- To learn the fundamental concepts of Artificial Intelligence (AI).
- To understand problem solving, searching, and reasoning techniques.
- To explore the use of knowledge representation in AI.
- To study learning methods and expert systems.
- To understand Natural Language Processing and applications of AI.

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

CO1: Understand basic concepts and applications of Artificial Intelligence.

CO2: Apply problem solving and search techniques.

CO3: Represent knowledge using logic and semantic networks.

CO4: Analyze machine learning techniques and expert systems.

CO5: Demonstrate AI applications in NLP, robotics, and other domains.

UNIT–I: Introduction to Artificial Intelligence

Introduction, History, Intelligent Systems, Foundations of AI, Applications, Turing Test, Rational Agent, Task Environment.
Problem Solving: Solving Problems by Searching – Problem Formulation, Example Problems, Search Algorithms, Uninformed Search Strategies – Breadth First Search, Depth First Search, Uniform Cost Search, Iterative Deepening Search.

UNIT–II: Informed Search and Game Playing

Heuristic Functions, Informed Search Strategies – Greedy Best First Search, A* Search, Memory Bounded Heuristic Search, Local Search Algorithms – Hill Climbing, Simulated Annealing.
Game Playing: Minimax Algorithm, Alpha Beta Pruning.

UNIT–III: Knowledge Representation and Reasoning

Propositional Logic, First Order Logic, Forward and Backward Chaining, Resolution.
Knowledge Representation – Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories.

UNIT–IV: Machine Learning and Expert Systems

Basic Concepts of Machine Learning – Supervised Learning, Decision Tree Learning, Neural Networks.

Expert Systems – Architecture of Expert Systems, Knowledge Acquisition, Case Studies.

UNIT–V: Natural Language Processing and Applications

Natural Language Processing: Text Analysis, Syntax, Semantics, Discourse and Pragmatics, Machine Translation.

AI Applications: Language Models, Speech Recognition, Robotics, Computer Vision, AI Tools and Platforms.

Text Book:

- Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 3rd Edition, Pearson Education.

Reference Books:

- Elaine Rich, Kevin Knight, Shivashankar B. Nair, *Artificial Intelligence*, 3rd Edition, McGraw Hill.
- Dan W. Patterson, *Introduction to AI and Expert Systems*, Pearson Education.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CST01	Operating Systems	3	0	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

- Understand the role and functions of operating systems.
- Learn concepts of process, thread, and CPU scheduling.
- Understand deadlocks, memory management and virtual memory.
- Explore file systems and I/O system concepts.
- Study examples of modern operating systems.

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

CO1: Explain fundamental operating system concepts and services.

CO2: Describe process management and CPU scheduling.

CO3: Demonstrate concurrency, synchronization, and deadlock handling.

CO4: Apply memory and file management techniques.

CO5: Understand I/O systems and evaluate modern OS case studies.

UNIT–I: Introduction and System Structures

Introduction to OS – Computer System Organization – OS Structure – System Calls – Types of Operating Systems – OS Design and Implementation – OS Services – Virtual Machines – System Boot.

UNIT–II: Process and CPU Scheduling

Process Concept – Process Scheduling – Operations on Processes – Interprocess Communication – Threads – Multithreading Models – Thread Libraries – CPU Scheduling Criteria and Algorithms – FCFS, SJF, RR, Priority Scheduling.

UNIT–III: Concurrency and Deadlocks

Process Synchronization – Critical Section Problem – Peterson's Solution – Semaphores – Monitors – Deadlocks: System Model – Characterization – Deadlock Prevention, Avoidance, Detection and Recovery.

UNIT–IV: Memory and File Management

Memory Management – Swapping – Contiguous Allocation – Paging – Segmentation – Virtual Memory – Demand Paging – Page Replacement – Thrashing.

File System – File Concept – Access Methods – Directory Structure – File-System Mounting – File Sharing – Protection.

UNIT–V: I/O Systems and OS Case Studies

I/O Hardware – Application I/O Interface – Kernel I/O Subsystem – Streams – Performance – Disk Scheduling – RAID – Swap-Space Management – Case Studies: Linux and Windows.

Text Book:

- Abraham Silberschatz, Peter B. Galvin, Greg Gagne, *Operating System Concepts*, 10th Edition, Wiley.

Reference Books:

- William Stallings, *Operating Systems: Internals and Design Principles*, 9th Edition, Pearson.
- Andrew S. Tanenbaum, Herbert Bos, *Modern Operating Systems*, 4th Edition, Pearson.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CST05	Machine Learning	3	0	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

- Understand the fundamental concepts of machine learning.
- Explore supervised, unsupervised and reinforcement learning methods.
- Apply linear models and decision trees in classification and regression.
- Learn clustering, dimensionality reduction and ensemble methods.
- Implement machine learning algorithms using Python.

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

CO1: Understand types of machine learning and model evaluation techniques.

CO2: Apply supervised learning algorithms for classification and regression.

CO3: Use unsupervised learning algorithms such as clustering and PCA.

CO4: Analyze ensemble learning and dimensionality reduction methods.

CO5: Implement and evaluate ML algorithms using tools like scikit-learn.

UNIT–I: Introduction to Machine Learning

Definition – Types of Machine Learning: Supervised, Unsupervised, Reinforcement Learning – Applications – Steps in Machine Learning – Hypothesis Space and Inductive Bias – Evaluation, Cross-Validation – The Curse of Dimensionality – Overfitting and Underfitting – Bias-Variance Tradeoff.

UNIT–II: Supervised Learning – I

Linear Models for Regression – Linear Regression – Gradient Descent – Regularization – Ridge and Lasso Regression – Model Selection – Performance Metrics for Regression – Logistic Regression – Naive Bayes Classifier.

UNIT–III: Supervised Learning – II

Decision Trees – ID3, C4.5, CART – Random Forests – Support Vector Machines – K-Nearest Neighbors – Model Evaluation: Confusion Matrix, Precision, Recall, F1-Score, ROC Curve – Cross-Validation.

UNIT–IV: Unsupervised Learning

Clustering – K-Means – Hierarchical Clustering – DBSCAN – Clustering Evaluation – Dimensionality Reduction: PCA, t-SNE – Feature Selection and Extraction.

UNIT–V: Advanced Topics and Tools

Ensemble Learning – Bagging – Boosting – Introduction to Neural Networks – Reinforcement Learning Basics – Machine Learning with Python – Scikit-learn Library – Case Studies and Applications.

Text Book:

- Aurélien Géron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, 2nd Edition, O'Reilly.

Reference Books:

- Tom M. Mitchell, *Machine Learning*, McGraw Hill.
- Ethem Alpaydin, *Introduction to Machine Learning*, MIT Press.
- Kevin P. Murphy, *Machine Learning: A Probabilistic Perspective*, MIT Press.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CST07	Artificial Intelligence and Machine Learning	3	0	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

- Understand foundational concepts of Artificial Intelligence and Machine Learning.
- Explore search strategies and knowledge representation methods.
- Apply supervised and unsupervised learning algorithms.
- Understand ensemble methods, neural networks, and reinforcement learning basics.
- Implement ML algorithms using Python libraries.

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

CO1: Understand core AI concepts and types of machine learning.

CO2: Implement search strategies and knowledge representation in AI systems.

CO3: Build predictive models using supervised learning algorithms.

CO4: Analyze data using unsupervised learning and dimensionality reduction techniques.

CO5: Apply ensemble techniques and use ML tools like Scikit-learn and TensorFlow.

UNIT–I: Introduction to AI and Search Techniques

Introduction to AI – Definitions – History – Applications – Types of AI – Intelligent Agents – Problem Solving – Search Strategies: Uninformed (BFS, DFS, UCS), Informed (Greedy, A*) – Game Playing: Minimax, Alpha-Beta Pruning.

UNIT–II: Knowledge Representation and Reasoning

Propositional Logic – First Order Logic – Inference Techniques – Forward and Backward Chaining – Resolution – Ontologies – Semantic Networks – Frames – Production Systems – Expert Systems – Case Studies.

UNIT–III: Supervised Learning

Linear Regression – Logistic Regression – K-Nearest Neighbors – Decision Trees – Support Vector Machines – Naive Bayes – Performance Metrics: Accuracy, Precision, Recall, F1-score, ROC Curve – Cross-Validation.

UNIT–IV: Unsupervised Learning and Dimensionality Reduction
Clustering: K-Means – Hierarchical – DBSCAN – Gaussian Mixture Models – Dimensionality Reduction: PCA, t-SNE – Feature Engineering and Scaling – Data Preprocessing Techniques.

UNIT–V: Ensemble Learning, Neural Networks and Tools
Bagging and Boosting – Random Forest – Introduction to Neural Networks – Perceptron – Feedforward Networks – Backpropagation – Reinforcement Learning Basics – Python Libraries: Scikit-learn, TensorFlow, Keras – Applications and Case Studies.

Text Books:

- E. Charniak and D. McDermott, *Introduction to Artificial Intelligence*, Pearson.
- Aurélien Géron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, 2nd Edition, O'Reilly.

Reference Books:

- Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, Pearson.
- Tom M. Mitchell, *Machine Learning*, McGraw Hill.
- Kevin P. Murphy, *Machine Learning: A Probabilistic Perspective*, MIT Press.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CSP01	Operating Systems Lab	0	0	3	1.5

Internal Marks: 50 **External Marks: 50**

Course Objectives:

- To understand and implement core operating system functionalities.
- To simulate process scheduling, synchronization, and memory management.
- To provide hands-on experience through shell scripting and OS simulations.

Course Outcomes:

CO1: Write shell scripts and simulate shell functionalities.

CO2: Implement CPU scheduling algorithms and analyze their performance.

CO3: Solve synchronization problems using semaphores.

CO4: Simulate memory allocation and page replacement policies.

CO5: Implement file allocation strategies.

List of Experiments:

1. Write shell scripts to demonstrate basic Linux commands and environment variables.
2. Simulate FCFS, SJF, Priority, and Round Robin scheduling algorithms.
3. Solve the Producer-Consumer problem using semaphores.
4. Simulate Reader-Writer and Dining Philosophers problems.
5. Implement Banker's Algorithm for deadlock avoidance.
6. Simulate memory management techniques: Paging and Segmentation.
7. Implement page replacement algorithms: FIFO, LRU, Optimal.
8. Demonstrate inter-process communication using pipes/shared memory.
9. Implement file allocation methods: Contiguous, Linked, and Indexed.
10. Build a mini file system with access control features.

Text Book:

- Abraham Silberschatz, Peter B. Galvin, Greg Gagne, *Operating System Concepts*, 10th Edition, Wiley.

Reference Books:

- William Stallings, *Operating Systems: Internals and Design Principles*, 9th Edition, Pearson.
- Andrew S. Tanenbaum, *Modern Operating Systems*, 4th Edition, Pearson.

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Course Code	Course Name	L	T	P	C
P23MCT02	Design Thinking and Innovation	2	0	0	2

Internal Marks: 100 **External Marks: 0**

Course Objectives:

- Understand the need for design thinking in solving problems.
- Learn the structured process of design thinking.
- Apply creativity and innovation techniques.
- Prototype and test user-centered solutions.

Course Outcomes:

CO1: Describe the design thinking process and its importance.

CO2: Use empathy to understand real user needs.

CO3: Generate and refine creative ideas.

CO4: Build and test prototypes based on feedback.

CO5: Apply design thinking in real-world projects.

Unit I: Introduction to Design Thinking and Innovation
Definition and importance of design thinking. Difference between innovation and invention. Design mindset, creativity, lateral thinking. Phases of design thinking: Empathize, Define, Ideate, Prototype, Test.

Unit II: Empathy and Problem Definition
Understanding user needs, interviews, observation techniques, empathy maps. Define stage: point of view statements and problem framing.

Unit III: Ideation Techniques
Brainstorming rules and methods. SCAMPER, mind mapping, idea filtering, and selection. Convergent and divergent thinking.

Unit IV: Prototyping and Testing
Different types of prototypes. Rapid prototyping tools. User feedback collection. Iterative testing and refinement.

Unit V: Innovation in Practice
Case studies on innovation. Innovation in business models. Role of teamwork and collaboration in innovation. Social and technological innovation examples.

Text Book:

- Tim Brown, *Change by Design*, Harvard Business Review Press.

Reference Books:

- Jeanne Liedtka and Tim Ogilvie, *Designing for Growth*, Columbia Business School Publishing.
- David Kelley and Tom Kelley, *Creative Confidence*, Crown Publishing.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CBS02	Full Stack Development	1	0	2	2

FULL STACK DEVELOPMENT

II B. Tech II Semester – CSE (IoT & CSBT) – R23

Internal Marks: 30 **External Marks:** 70

Course Objectives:

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

Topics and Sample Experiments:

1. **Lists, Links and Images**
    - Ordered, unordered, nested lists and definition lists.
    - Hyperlinks using `<a>` tag and attributes.
    - Embedding personal images linking to profiles.
    - Creating an image gallery using thumbnails.
2. **HTML Tables, Forms and Frames**
    - Tables with `<table>`, `<tr>`, `<td>`, etc.
    - Registration form using various input types.
    - Frames with images, text, and hyperlinks.
3. **HTML5 and CSS**
    - HTML5 semantic tags: `<article>`, `<nav>`, etc.
    - Embedding audio and video.
    - Inline, internal, and external styles.
4. **CSS Selectors**
    - Simple, combinator, pseudo-class, pseudo-element, and attribute selectors.
5. **CSS Features**
    - Colors, background, font, text, and box model.

6. **JavaScript I/O and Type Conversion**
   - Embedding JS internally and externally.
   - Using alert, prompt, and console output.
   - Type conversion and basic interactions.
7. **JavaScript Objects**
   - Document, window, array, math, string, regex, date objects.
   - User-defined objects with properties, methods, accessors.
8. **JS Conditionals and Loops**
   - If, switch, for, while, do-while, for-in, for-of.
   - Armstrong number, denomination calculator.
9. **JavaScript Functions and Events**
   - Functions for factorial, Fibonacci, primes, palindrome.
   - Event-driven UI with buttons triggering functions.
   - Form validation for name, mobile, and email.
10. **Node.js**
    - Create server, use HTTP module.
    - File operations: read, write, parse URLs.
    - Modularizing applications.

Textbooks:

1. Robert W. Sebesta, *Programming the World Wide Web*, 7th Edition, Pearson, 2013.
2. Vasan Subramanian, *Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React and Node*, 2nd Edition, APress.

Web Links:

- `https://www.w3schools.com/html`
- `https://www.w3schools.com/css`
- `https://www.w3schools.com/js/`
- `https://www.w3schools.com/nodejs`
- `https://www.w3schools.com/typescript`

Course Code	Course Name	L	T	P	C
P23CST09	Deep Learning	3	0	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

- Understand the fundamentals of neural networks and deep learning.
- Study various architectures like CNNs, RNNs, and autoencoders.
- Learn to use frameworks like TensorFlow and Keras.
- Apply deep learning techniques to real-world problems.

Course Outcomes:

CO1: Describe the basics of deep learning and artificial neural networks.

CO2: Apply forward and backward propagation techniques.

CO3: Design and train convolutional and recurrent neural networks.

CO4: Use deep learning tools and frameworks effectively.

CO5: Solve problems in vision, language, and prediction using deep learning.

Unit I: Introduction to Deep Learning
Overview of Machine Learning and Artificial Neural Networks – History of Deep Learning – Activation Functions – Cost Functions – Forward and Backward Propagation – Gradient Descent – Loss Minimization.

Unit II: Deep Neural Networks
Architecture of Deep Neural Networks – Hyperparameter Tuning – Batch Normalization – Dropout – Optimization Techniques: SGD, Adam, RMSProp – Vanishing and Exploding Gradients.

Unit III: Convolutional Neural Networks (CNN)
Convolution Operation – Pooling Layers – Padding – Stride – CNN Architectures – Applications of CNNs in Image Recognition and Classification – Transfer Learning and Fine-tuning.

Unit IV: Recurrent Neural Networks (RNN)
Introduction to RNNs – Backpropagation Through Time – LSTM – GRU – Applications in NLP – Sequence to Sequence Models – Attention Mechanisms.

Unit V: Autoencoders and Generative Models
Autoencoders – Undercomplete and Sparse Autoencoders – Variational Autoencoders (VAE) – Generative Adversarial Networks (GAN) – Applications in Generation and Anomaly Detection.

Text Book:

- Ian Goodfellow, Yoshua Bengio, and Aaron Courville, *Deep Learning*, MIT Press.

Reference Books:

- François Chollet, *Deep Learning with Python*, Manning.
- Nikhil Buduma, *Fundamentals of Deep Learning*, O'Reilly.

Course Code	Course Name	L	T	P	C
P23CST08	Computer Networks	3	0	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

- Understand the basics of networking and network architectures.
- Learn protocols at different layers of the OSI and TCP/IP models.
- Study data transmission, routing, addressing, and transport concepts.
- Explore real-world application protocols and services.

Course Outcomes:

CO1: Describe OSI and TCP/IP models and their protocol layers.

CO2: Apply subnetting, addressing, and routing concepts.

CO3: Analyze data link protocols and error control mechanisms.

CO4: Evaluate transport layer services and congestion control.

CO5: Discuss application protocols like HTTP, DNS, FTP, and SMTP.

Unit I: Introduction to Computer Networks
Overview of computer networks – Types of networks – Network topology – OSI and TCP/IP reference models – Network devices – Transmission media – Packet switching vs. circuit switching.

Unit II: Data Link Layer
Framing – Error detection and correction – CRC – Stop and wait – Sliding window – Medium Access Control: ALOHA, CSMA/CD – IEEE 802.3 – Ethernet.

Unit III: Network Layer
IP addressing – Subnetting – Supernetting – Routing algorithms: distance vector, link state – RIP, OSPF – IPv4, IPv6 – NAT – ICMP – ARP.

Unit IV: Transport Layer
Process-to-process communication – UDP – TCP – Segment structure – Flow and error control – Congestion control – Connection management – Sliding window protocol.

Unit V: Application Layer
Client-server model – DNS – HTTP – FTP – SMTP – SNMP – Firewalls and proxies – Multimedia communication – Network security basics.

Text Book:

- Behrouz A. Forouzan, *Data Communications and Networking*, 5th Edition, McGraw-Hill.

Reference Books:

- Andrew S. Tanenbaum, *Computer Networks*, 5th Edition, Pearson.
- Larry L. Peterson and Bruce S. Davie, *Computer Networks: A Systems Approach*, 5th Edition.

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Course Code	Course Name	L	T	P	C
P23CST10	Natural Language Processing	3	0	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

- Understand the basics of language processing.
- Learn syntactic and semantic processing techniques.
- Explore machine learning approaches for NLP.
- Apply NLP to real-world applications.

Course Outcomes:

CO1: Describe foundational concepts of NLP.

CO2: Perform preprocessing tasks like tokenization and stemming.

CO3: Implement part-of-speech tagging and parsing algorithms.

CO4: Use neural methods for word representation and classification.

CO5: Build applications like sentiment analysis and machine translation.

Unit I: Introduction to NLP and Language Models
What is NLP – NLP applications – Challenges in NLP – Text normalization – Tokenization – Language modeling – N-gram models – Smoothing – Perplexity.

Unit II: Morphology and POS Tagging
Morphology basics – Stemming and lemmatization – POS tagging – Rule-based and stochastic tagging – Hidden Markov Models – Viterbi algorithm.

Unit III: Syntax and Parsing
Syntax trees – Constituency and dependency parsing – Context-Free Grammar – Top-down and bottom-up parsing – CYK algorithm.

Unit IV: Semantics and Embeddings
Lexical semantics – WordNet – TF-IDF – Word2Vec – GloVe – Cosine similarity – Semantic similarity – Sentence and document representations.

Unit V: NLP Applications
Sentiment analysis – Named entity recognition – Question answering – Machine translation – Chatbots – Text classification – Ethics in NLP.

Text Book:

- Daniel Jurafsky and James H. Martin, *Speech and Language Processing*, 3rd Ed. Draft, Prentice Hall.

Reference Books:

- Steven Bird et al., *Natural Language Processing with Python*, O'Reilly.
- Yoav Goldberg, *Neural Network Methods for NLP*, Morgan and Claypool.

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Course Code	Course Name	Course Structure			
		L	T	P	C
MOOC - I	NPTEL	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. Understand the fundamentals and applications of the Internet of Things (IoT).
2. Familiarize with architecture, protocols, and enabling technologies of IoT.
3. Learn the programming aspects of IoT and work with basic sensors and microcontrollers.
4. Understand cloud and data analytics integration in IoT.
5. Explore IoT security challenges and real-world use cases.

Course Outcomes:

CO1: Define IoT, its applications, and architecture.
CO2: Explain the key technologies and protocols enabling IoT.
CO3: Develop basic IoT applications using sensors and microcontrollers.
CO4: Analyze the role of cloud and data analytics in IoT.
CO5: Identify and address IoT security challenges and real-life applications.

UNIT–I: Introduction to IoT
Definition and Characteristics of IoT – Physical Design – Logical Design – IoT Enabling Technologies – IoT Levels – Domain Specific IoTs – IoT vs M2M – IoT System Management.

UNIT–II: IoT Architecture and Protocols
IoT Reference Architecture – Communication Models – Communication APIs – Protocols for IoT – IEEE 802.15.4 – Zigbee – RPL – 6LoWPAN – MQTT – CoAP – Bluetooth – RFID – NFC.

UNIT–III: IoT Hardware Platforms and Sensors
Raspberry Pi – Features – Interfaces – GPIO – Operating System – Arduino – Sensors and Actuators – Types of Sensors – Interfacing – Applications of Sensors in IoT.

UNIT–IV: Cloud and Data Analytics in IoT
Cloud Computing – Cloud Platforms – Integration of IoT with Cloud – Data Analytics for IoT – Big Data – Hadoop – Spark – Machine Learning Basics for IoT.

UNIT–V: Security and Applications of IoT
Security Issues in IoT – Challenges – Authentication – Privacy – Access Control – Real-World Applications: Smart Cities – Smart Home – Wearables – Industrial IoT – Healthcare – Agriculture.

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things: A Hands-on Approach”, Universities Press, 2015.

Reference Books:

1. Raj Kamal, “Internet of Things: Architecture and Design Principles”, McGraw-Hill, 2017.
2. Ovidiu Vermesan and Peter Friess, “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers, 2013.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23AMT02	Deep Learning Lab	0	0	3	1.5

Internal Marks: 30 External Marks: 70

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

1. Implement deep neural networks to solve real world problems.
2. Choose appropriate pre-trained model to solve real time problem.
3. Interpret the results of two 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 a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.
3. Design a neural network for classifying news wires (Multi-class classification) using Reuters dataset.
4. Design a 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.

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Text Books:

1. Reza Zadeh and Bharath Ramsundar, *Tensorflow for Deep Learning*, O'Reilly Publishers, 2018.

Reference Books:

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

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23AMLO2	Natural Language Processing Lab	0	0	3	1.5

Internal Marks: 30 External Marks: 70

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

1. Use the NLTK and spaCy toolkit for NLP programming. (L3)
2. Analyze various corpora for developing programs. (L4)
3. Develop various pre-processing techniques for a given corpus. (L6)
4. Develop programming logic using NLTK functions. (L6)
5. Build applications using various NLP techniques for a given corpus. (L6)

List of Experiments:

1. Installation and exploring features of NLTK and spaCy tools. Download WordCloud and few corpora.

2. (i) Write a program to implement word tokenizer, sentence and paragraph tokenizers.
   (ii) Check how many words are there in any corpus. Also check how many distinct words are there.

3. (i) Write a program to implement both user-defined and pre-defined functions to generate
   (a) Uni-grams (b) Bi-grams (c) Tri-grams (d) N-grams
   (ii) Write a program to calculate the highest probability of a word (w2) occurring after another word (w1).

4. (i) Write a program to identify the word collocations.
   (ii) Write a program to print all words beginning with a given sequence of letters.
   (iii) Write a program to print all words longer than four characters.

5. (i) Write a program to identify the mathematical expression in a given sentence.
   (ii) Write a program to identify different components of familiarity.

6. (i) Write a program to identify all antonyms and synonyms of a word.
   (ii) Write a program to find hyponymy, homonymy, polysemy for a given word.

7. (i) Write a program to find all the stop words in any given text.
   (ii) Write a function that finds the 50 most frequently occurring words of a text that are not stop words.

8. Write a program to implement various stemming techniques and prepare a chart with the performance of each method.
9. Write a program to implement various lemmatization techniques and prepare a chart with the performance of each method.
10. (i) Write a program to implement Conditional Frequency Distribution (CFD) for any corpus.
    (ii) Find all the four-letter words in any corpus. With the help of frequency distribution (FreqDist), show these words in decreasing order of frequency.
    (iii) Define a conditional frequency distribution over the names corpus that allows you to see which initial letters are more frequent for males versus females.
11. (i) Write a program to implement Part-of-Speech (PoS) tagging for any corpus.
    (ii) Write a program to identify which word has the greatest number of distinct tags? What are they, and what do they represent?
    (iii) Write a program to list tags in order of decreasing frequency and what do the 20 most frequent tags represent?
    (iv) Write a program to identify which tags are nouns most commonly found after? What do these tags represent?
12. Write a program to implement TF-IDF for any corpus.
13. Write a program to implement chunking and chinking for any corpus.
14. (i) Write a program to find all the misspelled words in a paragraph.
    (ii) Write a program to prepare a table with frequency of misspelled tags for any given text.
15. Write a program to implement all the NLP Pre-Processing Techniques required to perform further tasks.

Case Studies: (At least any one Case Study has to be performed)

- Case Study 1: Write a program to implement Named Entity Recognition (NER) for any corpus.
- Case Study 2: Write a program to perform Auto-Correction of spellings for any text.
- Case Study 3: Check for all positive words in a news article / any text.

Reference Books:

1. Steven Bird, Ewan Klein, and Edward Loper, *Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit.*

Web References:

1. http://www.nptelvideos.in/2012/11/natural-languageprocessing.html

Course Code	Course Name	Course Structure			
		L	T	P	C
P23CBS03	Full Stack Development - 2	0	1	2	2

Internal Marks: 30 External Marks: 70

List of Experiments:

1. **Node.js**
   - Create a web server and demonstrate the JavaScript workflow.
   - Transfer data over HTTP using HTTP module.
   - Create a text file `src.txt` with the following content: HTML, CSS, Javascript, Typescript, MongoDB, Express.js, React.js, Node.js
   - Parse a URL using URL module.
   - Create a user-defined module and demonstrate modularization in Node.js.
2. **Typescript**
   - Understand simple and special types.
   - Use function parameters and return types.
   - Demonstrate arrow functions using optional, default, and REST parameters.
   - Work with class, constructor, properties, methods and access specifiers.
   - Understand namespaces and modules.
   - Implement generics with variables, functions and constraints.
3. **Augmented Programs (Any 2)**
   - Apply 2D and 3D transformations using CSS.
   - Design a web page using HTML5 and CSS3.
   - Design a to-do list application using JavaScript.
4. **ExpressJS – Routing, HTTP Methods, Middleware**
   - Define and handle routes, route/query parameters, and build URLs.
   - Perform HTTP methods: accept, retrieve, delete resources.
   - Demonstrate middleware usage.
5. **ExpressJS – Templating, Form Data**
   - Use a templating engine.
   - Work with form data.
6. **ExpressJS – Cookies, Sessions, Authentication**

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- Implement session management using cookies and sessions.
- Implement user authentication.

7. **ExpressJS – Database, RESTful APIs**
    - Connect MongoDB using Mongoose and perform CRUD.
    - Build a single-page application using RESTful APIs.

8. **ReactJS – Render HTML, JSX, Components (Function & Class)**
    - Render HTML to a web page.
    - Use JSX syntax.
    - Create/nest function and class components.

9. **ReactJS – Props and States, Styles, Events**
    - Work with props and states.
    - Apply CSS and SASS styles, and display data.
    - Handle events.

10. **ReactJS – Conditional Rendering, Lists, Forms**
    - Implement conditional rendering.
    - Render lists.
    - Work with various form fields using React forms.

11. **ReactJS – React Router, Updating the Screen**
    - Use React Router to navigate between pages.
    - Demonstrate screen updates.

12. **ReactJS – Hooks, Sharing Data**
    - Demonstrate the use of React hooks.
    - Share data between components.

13. **ReactJS Applications**
    - Design a To-do list application.

14. **MongoDB – Installation, CRUD**
    - Install MongoDB and configure Atlas.
    - Use `insert()`, `find()`, `update()`, `remove()`.

15. **MongoDB – Databases, Collections, Records**
    - Create/drop databases and collections.
    - Use `find()`, `limit()`, `sort()`, `createIndex()`, `aggregate()`.

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16. **Augmented Programs (Any 2)**

    - Design a To-do list app using NodeJS and ExpressJS.
    - Design a Quiz app using ReactJS.
    - Complete MongoDB certification from MongoDB University.

Text Books:

1. Robert W. Sebesta, *Programming the World Wide Web*, 7th Edition, Pearson, 2013.
2. Vasan Subramanian, *Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node*, 2nd Edition, APress, O'Reilly.

Reference Books:

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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23MBT05	Entrepreneurship and New Venture Creation / Entrepreneurship Development	3	0	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

1. Develop entrepreneurial mindset, attributes, and skill sets for venture creation and intrapreneurial leadership.
2. Apply problem-opportunity identification and feasibility assessment using design thinking.
3. Analyse customer and market segmentation, estimate market size, and validate customer personas.
4. Initiate solution design, prototyping, MVP development, and validation to determine product-market fit.
5. Craft business and revenue models, perform financial planning, and assess funding options.
6. Develop Go-to-Market strategies, especially digital marketing.
7. Apply storytelling skills for persuasive and defensible venture pitches.

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

1. Cultivate entrepreneurial and intrapreneurial attributes, and demonstrate problem-solving, team building, creativity, and leadership.
2. Comprehend problem-opportunity identification through design thinking and market analysis.
3. Analyse and refine business models for sustainability and profitability.
4. Build and validate MVPs and prototypes.
5. Prepare business and financial plans to assess venture viability.
6. Deliver an investible pitch deck to attract stakeholders.

UNIT–I: Entrepreneurship Fundamentals & Context

Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models, economic development. Building entrepreneurial mindset, skillsets, attributes, and networks.
Core Teaching Tool: Simulation, games, industry case studies, venture activities.

UNIT–II: Problem & Customer Identification

Macro-problem analysis, technological and socio-economic trends, design thinking for problem definition, customer validation, segmentation, persona creation, competition mapping.
Core Teaching Tool: Class activities, games, Gen AI, venture activities.

UNIT–III: Solution Design, Prototyping & Opportunity Assessment
Jobs-to-be-done framework, innovative solution design, problem-solution fit, MVP, feasibility prototyping, proof-of-concept, competition analysis, market sizing.
Core Teaching Tool: Venture activities, no-code tools, class activities.

UNIT–IV: Business & Financial Model, Go-to-Market Plan
Business models, lean canvas, business planning, financial templates, unit economics, marketing channels, digital presence, customer acquisition, funding options.
Core Teaching Tool: Founder case studies, class activities, venture activities.

UNIT–V: Scale Outlook & Venture Pitch Readiness
Scaling potential, persuasive storytelling, investor pitch deck preparation.
Core Teaching Tool: Expert talks, case discussions, venture activities.

Text Books:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha, *Entrepreneurship*, McGrawHill, 11th Edition, 2020.
2. Eric Ries, *The Lean Startup*, Crown Business, 2011.
3. Alexander Osterwalder, Yves Pigneur, *Business Model Generation*, Wiley, 2010.
4. Simon Sinek, *Start with Why*, Penguin, 2011.
5. Tim Brown, *Change by Design*, Harper Business, 2019.
6. Namita Thapar, *The Dolphin and the Shark*, Penguin, 2022.
7. Saras D. Sarasvathy, *Effectuation: Elements of Entrepreneurial Expertise*, Elgar Publishing, 2008.

Web Resources:

1. Ignite 5.0 Course – Wadhwani Platform (includes curated and custom modular content)

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Course Code	Course Name	Course Structure			
		L	T	P	C
P23CSTXX	Automata Theory and Compiler Design	3	0	0	3

Internal Marks: 30 **External Marks: 70**

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

1. Understand and apply formal language theory.
2. Design and implement parsers.
3. Understand the phases of a compiler.
4. Apply semantic analysis and error handling.
5. Optimize intermediate and target code.

UNIT–I: Introduction to Finite Automata

Structural Representations, Automata and Complexity, 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, Processing Strings, Language of DFA, Conversion of NFA with ϵ-transitions to NFA without ϵ-transitions, Conversion of NFA to DFA.

UNIT–II: Regular Expressions and Context-Free Grammars

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

UNIT–III: Pushdown Automata and Turing Machines

Definition of PDA, Languages of a PDA, Equivalence of PDA's and CFG's. Turing Machines: Introduction, Formal Description, Instantaneous Description, Languages of a Turing Machine. Undecidability: Non-Recursively Enumerable Languages, Undecidable RE Problems, Undecidable Problems of Turing Machines.

UNIT–IV: Compiler Structure and Parsing

Structure of a Compiler. Lexical Analysis: Role, Input Buffering, Token Recognition, Lex Tool. Syntax Analysis: Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, LR Parsing – SLR, LALR.

UNIT–V: Syntax-Directed Translation and Intermediate Code Generation

Syntax-Directed Definitions, Evaluation Orders, Translation Schemes, L-Attributed SDDs. Intermediate-Code Generation: Syntax Trees, Three-Address

Code. Run-Time Environments: Stack Allocation, Access to Nonlocal Data, Heap Management.

Text Books:

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

Reference Books:

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

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Course Code	Course Name	Course Structure			
		L	**T**	**P**	**C**
P23AIMLXX	Exploratory Data Analysis with Python	3	0	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

- Introduce the fundamentals of Exploratory Data Analysis.
- Cover essential exploratory techniques for understanding multivariate data using statistical and graphical methods.
- Evaluate models and select the best performing model.

UNIT–I: Exploratory Data Analysis Fundamentals

Understanding data science, Significance of EDA, Steps in EDA, Making sense of data, Numerical and Categorical data, Measurement scales, Comparison of EDA with classical and Bayesian analysis, Software tools for EDA. Getting started with EDA.

Sample Experiments:

1. Download dataset from Kaggle and install Python libraries (`numpy`, `pandas`, `matplotlib`, `seaborn`).
2. Perform NumPy array operations and explore built-in functions.
3. Load datasets into pandas DataFrame and select rows/columns.

UNIT–II: Visual Aids for EDA

Line chart, Bar chart, Scatter plot, Polar chart, Histogram, Choosing appropriate chart type. Case Study: EDA with personal email data (data transformation, cleansing, descriptive statistics, refactoring, analysis).

Sample Experiments:

1. Apply visualization techniques (line, bar, scatter, bubble plots).
2. Scatter plots using seaborn (Iris dataset).
3. Apply area, stacked, pie, table charts.
4. Generate polar, histogram, lollipop charts.

UNIT–III: Data Transformation

Merging, concatenating, reshaping, handling missing data, filling values, discretization/binning, outlier detection, permutation, sampling, challenges of transformation.

Sample Experiments:

1. Merge DataFrames, reshape with hierarchical indexing, deduplicate, replace values.
2. Apply missing data handling (fill, forward/backward fill, interpolation).
3. Transformation techniques (rename axis, discretize, sampling, dummy variables).

UNIT–IV: Descriptive Statistics

Distribution functions, measures of central tendency and dispersion, kurtosis, percentiles, quartiles, correlation, uni/bivariate/multivariate analysis, time series analysis.

Sample Experiments:

1. Study uniform, normal, gamma, exponential, Poisson, binomial distributions.
2. Data cleaning on sample dataset.
3. Compute mean, median, mode; variance, std. deviation, skewness, kurtosis.
4. Calculate IQR and visualize using box plots.
5. Perform bivariate and multivariate analysis.
6. Time series analysis on Open Power Systems dataset.

UNIT–V: Model Development and Evaluation

Unified ML workflow, preprocessing, training, evaluation, selection, deployment. Case Study: Wine Quality Dataset Analysis.

Sample Experiments:

1. Hypothesis testing (Z-test, T-test).
2. Develop and evaluate model using metrics: prediction score, R^2, MAE, MSE.

Text Book:

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

Reference Books:

1. Ronald K. Pearson, *Exploratory Data Analysis Using R*, CRC Press, 2020.
2. Radhika Datar, Harish Garg, *Hands-On Exploratory Data Analysis with R*, Packt Publishing, 2019.

Web References:

1. `https://github.com/PacktPublishing/Hands-on-Exploratory-Data-Analysis-with-Python`

2. https://www.analyticsvidhya.com/blog/2022/07/step-by-step-exploratory-dataanalysis-eda-using-python/
3. https://github.com/PacktPublishing/Exploratory-Data-Analysis-with-Python-Cookbook

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Course Code	**Course Name**	**Course Structure**			
		L	**T**	**P**	**C**
P23CSTXX	Object Oriented Analysis and Design	3	0	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

- Become familiar with all phases of Object-Oriented Analysis and Design (OOAD).
- Master the main features of UML.
- Understand Object Technologies and their applications, and develop problem-solving skills in various domains.
- Learn Object Design Principles and their implementation.

UNIT–I: Introduction

The Structure of Complex Systems, The Inherent Complexity of Software, Attributes of Complex Systems, 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 modelling, principles of modelling, object-oriented modelling, conceptual model of UML, Architecture, and Software Development Life Cycle. Basic Structural Modelling: Classes, Relationships, Common Mechanisms, and Diagrams.
Case Study: Control System – Traffic Management.

UNIT–III: Class & Object Diagrams

Terms, concepts, and modelling techniques for Class & Object Diagrams. Advanced Structural Modelling: 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 Modelling: Component, Deployment, Component Diagrams, and Deployment Diagrams.
Case Study: Weather Forecasting.

Text Books:

1. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. 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-Dreamtech India Pvt. Ltd.
3. Atul Kahate, *Object-Oriented Analysis & Design*, The McGraw-Hill Companies.
4. Craig Larman, *Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Unified Process*, Pearson Education.

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Course Code	Course Name	Course Structure			
		L	T	P	C
P21CIT02	Web Technologies	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Prerequisites:

- Object Oriented Programming

Course Objectives:

- To develop the static web pages using HTML and CSS.
- To enable the students to identify the fundamental concepts for developing web applications using PHP language for server-side scripting.
- To analyze how data can be transported using XML.
- To develop web applications with server-side programming using Java Servlets.
- To develop web applications with server-side programming using JSP.

Course Outcomes:

- Summarize the basic tags and properties in HTML, XHTML and CSS.
- Create web pages using client-side scripting, validating forms, and XML.
- Identify the role of server-side scripting using PHP programming.
- Design dynamic web applications using server-side programming with Java Servlets.
- Contrast how to connect and retrieve data through web page from database using JDBC.

Course Content:

UNIT I: HTML and CSS (9 Lectures)

- HTML Common tags: List, Tables, Images, Forms, Frames, Links and Navigation
- CSS: Introduction, CSS Properties, Controlling Fonts, Text Formatting, Pseudo classes, Selectors

UNIT II: Client-side Scripting and XML (9 Lectures)

- JavaScript: Declaring variables, scope of variables, functions, event handlers (onclick, onsubmit etc.), Document Object Model, Form validation
- XML: Introduction to XML, defining XML tags, attributes and values, Document Type Definition, XML Schemas, Document Object Model

UNIT III: PHP (9 Lectures)

- Creating and running PHP scripts, Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions
- Reading data from web form controls (text boxes, radio buttons, lists, etc.)
- Handling file uploads, connecting to MySQL database, executing queries, handling results, handling sessions and cookies

UNIT IV: Java Servlets (9 Lectures)

- Introduction: CGI, Lifecycle of a servlet, deploying a servlet
- Servlet API, Reading parameters, Initialization parameters
- Handling HTTP requests and responses, Cookies and Sessions

UNIT V: JSP and JDBC (9 Lectures)

- JSP: Anatomy of a JSP page, JSP Processing, MVC design, Declaring variables and methods, sharing data, passing control and data between pages, session and application data sharing
- JDBC: Database programming, javax.sql.* package, Accessing database via JSP, application-specific DB actions

Text Books:

1. Uttam K Roy, *Web Technologies*, Oxford University Press.
2. Steven Holzner, *The Complete Reference PHP*, Tata McGraw-Hill.

Reference Books:

1. Chris Bates, *Web Programming: Building Internet Applications*, 2nd Edition, Wiley Dreamtech.
2. Hans Bergsten, *Java Server Pages*, SPD O'Reilly.
3. D. Flanagan, *JavaScript*, O'Reilly, SPD.
4. Jon Duckett, *Beginning Web Programming*, WROX.
5. R. W. Sebesta, *Programming the World Wide Web*, 4th Edition, Pearson.
6. Dietel and Nieto, *Internet and World Wide Web – How to Program*, Pearson.

Web References:

- https://www.w3schools.com/html/
- https://www.javatpoint.com/servlet-tutorial
- http://nptel.ac.in/courses/106105084/

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Course Code	Course Name	Course Structure			
		L	T	P	C
—	Reinforcement Learning	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objective:

- To provide the fundamentals of Reinforcement Learning.

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

1. Enumerate the elements of Reinforcement Learning.
2. Solve the n-armed Bandit problem.
3. Compare different Finite Markov Decision Processes.
4. Discuss Monte Carlo Methods for solving real world problems.
5. List the Applications and Case Studies of Reinforcement Learning.

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*, 2nd Edition, The MIT Press, 2018.
2. Marco Wiering and Martijn van Otterlo, *Reinforcement Learning: State-of-the-Art (Adaptation, Learning, and Optimization)*, 2012 Edition.

Reference Books:

1. Vincent François-Lavet, Peter Henderson, Riashat Islam, *An Introduction to Deep Reinforcement Learning (Foundations and Trends in Machine Learning)*, 2019.

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Course Code	Course Name	Course Structure			
		L	T	P	C
—	Big Data Analytics	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

- Optimize business decisions and create competitive advantage with Big Data analytics.
- Introduce Java concepts required for developing MapReduce programs.
- Derive business benefit from unstructured data.
- Impart the architectural concepts of Hadoop and introduce MapReduce paradigm.
- Introduce programming tools Pig & Hive in the Hadoop ecosystem.

UNIT–I: Data Structures in Java

Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and type parameters, implementing generic types, generic methods, wrapper classes, concept of serialization.

UNIT–II: Working with Big Data

Google File System, Hadoop Distributed File System (HDFS), building blocks of Hadoop (NameNode, DataNode, Secondary NameNode, JobTracker, TaskTracker), configuring Hadoop cluster (Local, Pseudo-distributed, Fully Distributed mode), configuring XML files.

UNIT–III: Writing MapReduce Programs

A Weather Dataset, understanding Hadoop API for MapReduce (old and new), basic programs of Hadoop MapReduce: driver code, mapper code, reducer code, record reader, combiner, practitioner.

UNIT–IV: Stream Memory and Spark

Introduction to streams concepts – stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements, introduction to Spark, Spark architecture and components, Spark installation, Spark RDD – operations on RDD.

UNIT–V: Pig and Hive

Pig: Architecture, Pig Latin application flow, syntax and usage, modes of execution, interfaces, scripting.
Hive: Architecture, Hive clients, data types, creating/managing databases and tables, data manipulation language, querying and analyzing data.

Text Books:

1. Cay Horstmann, *Big Java*, 4th Edition, Wiley John Sons, INC.
2. Tom White, *Hadoop: The Definitive Guide*, 3rd Edition, O'Reilly.

Reference Books:

1. Chuck Lam, *Hadoop in Action*, Manning Publications.
2. Dirk deRoos et al., *Hadoop for Dummies*, Wiley.
3. Alex Holmes, *Hadoop in Practice*, Manning Publications.
4. Dr. A. Krishna Mohan and Dr. E. Laxmi Lydia, *Big Data Analytics*.
5. Srinath Perera, Thilina Gunarathne, *Hadoop MapReduce Cookbook*.

Software Links:

- Hadoop: `http://hadoop.apache.org/`
- Hive: `https://cwiki.apache.org/confluence/display/Hive/Home`
- Pig Latin: `http://pig.apache.org/docs/r0.7.0/tutorial.html`

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Course Code	Course Name	Course Structure			
		L	T	P	C
—	Data Visualization	3	0	0	3

Internal Marks: 30 External Marks: 70

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.
- Gain a detailed view of visual perception, the visualized data, and the actual visualization, interaction, and distortion techniques.

UNIT–I: Introduction

What Is Visualization?, History of Visualization, Relationship between Visualization and Other Fields.

The Visualization Process, Introduction to 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 and Techniques

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

UNIT–IV: Advanced Structures

Visualization of groups, trees, graphs, clusters, networks, software, metaphorical visualization.

UNIT–V: Volumetric and Geographic Visualization

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

Evaluating visualizations, recent trends in perception techniques, various visualization techniques, data structures used in data visualization.

Text Books:

1. Ward, Grinstein, Keim. *Interactive Data Visualization: Foundations, Techniques, and Applications*. 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`

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Course Code	Course Name	Course Structure			
		L	T	P	C
—	Cryptography & Network Security	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

- Explain the objectives of information security.
- Explain the importance and application of confidentiality, integrity, authentication, and availability.
- Understand the basic categories of threats to computers and networks.
- Understand the mathematics of cryptography.
- Learn the fundamentals of symmetric and asymmetric cryptographic algorithms.
- Explore enhanced security mechanisms at Network, Transport, and Application layers.

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.

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() fields, Polynomials.

Mathematics of Asymmetric Cryptography: Primes, primality testing, Euler's phi-function, Fermat's Little Theorem, Euler's Theorem, generating primes, factorization, Chinese Remainder Theorem, quadratic congruence, exponentiation and logarithm.

UNIT–III: Cryptographic Algorithms

Symmetric Key Ciphers: Block cipher principles, DES, AES, Blowfish, IDEA, block cipher modes, stream ciphers (RC4, RC5).

Asymmetric Key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman key exchange, Elgamal cryptographic system, elliptic curve arithmetic and elliptic curve cryptography.

UNIT–IV: Hash Functions, MACs and Digital Signatures

Cryptographic Hash Functions: Applications, properties, requirements, SHA algorithms, CBC-based hash functions.

MACs: Authentication requirements, functions, HMAC, DAA, CMAC.

Digital Signatures: Elgamal digital signature, RSA-PSS, elliptic curve digital signature algorithm (ECDSA).

UNIT–V: Network and Internet Security
Transport-Level Security: Web security considerations, TLS/SSL, HTTPS, SSH.
IP Security: Overview, policy, ESP, authentication header protocol.
E-mail Security: Email format, threats, S/MIME, PGP.

Text Books:

1. William Stallings, *Cryptography and Network Security – Principles and Practice*, 7th Edition, Pearson Education, 2017.
2. Behrouz A. Forouzan, Debdeep Mukhopadhyay, *Cryptography and Network Security*, 3rd Edition, McGraw Hill, 2015.

Reference Books:

1. Atul Kahate, *Cryptography and Network Security*, 3rd Edition, McGraw Hill.
2. Wade Trappe, Lawrence C. Washington, *Introduction to Cryptography with Coding Theory*.

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Course Code	Course Name	Course Structure			
		L	T	P	C
—	Recommender Systems	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

- Cover the basic concepts of recommender systems, including personalization algorithms, evaluation tools, and user experiences.

UNIT–I: Introduction

Functions of recommender systems, linear algebra notation: matrix addition, multiplication, transposition, and inverses, covariance matrices, understanding ratings, applications of recommendation systems, issues with recommender systems.

UNIT–II: Collaborative Filtering

User-based nearest neighbour recommendation, item-based nearest neighbour recommendation, model-based and pre-processing based approaches, attacks on collaborative recommender systems.

UNIT–III: Content-based and Knowledge-based Recommendation

Content-based: High-level architecture, advantages and drawbacks, item profiles, feature discovery, tag-based features, representing item profiles, learning user profiles, similarity-based retrieval, classification algorithms.
Knowledge-based: Knowledge representation and reasoning, constraint-based recommenders, case-based recommenders.

UNIT–IV: Hybrid Approaches

Opportunities for hybridization, monolithic design: feature combination, feature augmentation, parallelized hybridization: weighted, switching, mixed, pipelined hybridization: cascade, meta-level, limitations of hybridization strategies.

UNIT–V: Evaluation and Communities

Evaluation: General properties of evaluation research, evaluation designs, historical dataset evaluation, error metrics, decision-support metrics, user-centered metrics.
Communities: Collaboration and recommender systems in personalized web search, social tagging recommender systems, trust and recommendations.

Text Books:

1. Jannach D., Zanker M., Felfering A., *Recommender Systems: An Introduction*, 1st Edition, Cambridge University Press, 2011.

2. Ricci F., Rokach L., Shapira D., Kantor B.P., *Recommender Systems Handbook*, 1st Edition, Springer, 2011.

Reference Books:

1. Manouselis N., Drachsler H., Verbert K., Duval E., *Recommender Systems for Learning*, 1st Edition, Springer, 2013.

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Course Code	Course Name	Course Structure			
		L	T	P	C
—	Software Engineering	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To introduce software life cycle models, software requirements and SRS documentation.
- To explain project planning, quality control, and ensuring good quality software.
- To discuss software testing strategies, use of CASE tools, implementation issues, and validation & verification procedures.

UNIT–I: Introduction & Life Cycle Models

Evolution of software, Software development projects, Exploratory style of development, Emergence of software engineering, Notable changes in practices, Computer system engineering.
Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, Rapid Application Development, Agile model, Spiral model.

UNIT–II: Project Management & Requirements

Software project management complexities, Responsibilities of project manager, Metrics for size estimation, Estimation techniques: Empirical, COCOMO, Halstead's software science, Risk management.
Requirements Analysis and Specification: Requirements gathering and analysis, SRS, Formal specification: Axiomatic, Algebraic, Executable, and 4GL.

UNIT–III: Software Design & Agility

Design process overview, Good software design characteristics, Layered module arrangement, Cohesion and Coupling.
Agility: Cost of Change, Agile Processes, Extreme Programming (XP), Other Agile Models, Agile toolset (Textbook 2).
Function-Oriented Design: SA/SD methodology, Structured analysis, DFD model development, Structured and Detailed Design, Design Review.
User Interface Design: Good UI characteristics, Basic concepts, UI types, Component-based GUI development, UI design methodology.

UNIT–IV: Coding, Testing & Quality

Coding practices, Code review, Documentation.
Testing: Black-box, White-box, Debugging, Program analysis tools, Integration testing, Object-oriented testing, Smoke testing, General testing issues.
Software Reliability & Quality: Reliability, Statistical testing, Quality management, ISO9000, SEI CMM, Other standards, Six Sigma.

UNIT–V: CASE Tools, Maintenance & Reuse

CASE: Scope, Environment, Lifecycle support, Characteristics, Second-generation tools, Architecture.

Maintenance: Characteristics, Reverse engineering, Models, Cost estimation.

Reuse: Definition, Need, Challenges, Reuse approach, Organizational-level reuse.

Textbooks:

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

Reference Books:

1. Ian Sommerville, *Software Engineering*, 10th Edition, Pearson.
2. Deepak Jain, *Software Engineering: Principles and Practices*, Oxford University Press.

e-Resources:

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

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Course Code	Course Name	Course Structure			
		L	**T**	**P**	**C**
—	Social Network Analysis	3	0	0	3

Internal Marks: 30 **External Marks:** 70

UNIT–I: Introduction

Semantic Web overview: Limitations of the current Web, Development of the Semantic Web, Emergence of the Social Web.

Social Network Analysis: Development, Key concepts and measures, Electronic sources (discussion networks, blogs, online communities, web-based networks), Applications.

UNIT–II: Modelling, Aggregating and Knowledge Representation

Ontologies in the Semantic Web: Knowledge representation, Ontology languages (RDF, OWL).

Social Network Data: Network representation, Ontological representation of individuals and relationships, Aggregation and reasoning, Advanced representation methods.

UNIT–III: Extraction and Mining of Communities

Community evolution from Web archives, Community detection: Definitions, Evaluation, Mining methods.

Applications & Tools: Social network infrastructures, Tools for community detection, Decentralized OSNs, Multi-relational characterization of dynamic communities.

UNIT–IV: Predicting Human Behavior and Privacy

Behavior prediction in communities, User data management, Inference and distribution, Reality mining, Context awareness.

Privacy & Trust: Online social network privacy, Trust in online environments, Subjective logic models, Trust analysis and transitivity, Reputation integration, Threats and countermeasures.

UNIT–V: Visualization and Applications

Graph theory concepts: Centrality, Clustering, Node-edge diagrams, Matrix representation.

Visualization Methods: Node-link and matrix-based representations, Hybrid models.

Applications: Cover networks, Community welfare, Collaboration networks, Co-citation networks.

Textbooks:

1. Peter Mika, *Social Networks and the Semantic Web*, 1st Edition, Springer, 2007.
2. Borko Furht, *Handbook of Social Network Technologies and Applications*, 1st

Edition, Springer, 2010.

Reference Books:

1. Guandong Xu, Yanchun Zhang, Lin Li, *Web Mining and Social Networking – Techniques and Applications*, Springer, 2011.
2. Dion Goh and Schubert Foo, *Social Information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively*, IGI Global, 2008.
3. Max Chevalier, Christine Julien, Chantal Soulé-Dupuy, *Collaborative and Social Information Retrieval and Access*, IGI Global, 2009.
4. John G. Breslin, Alexander Passant, Stefan Decker, *The Social Semantic Web*, Springer, 2009.

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Course Code	Course Name	Course Structure			
		L	T	P	C
—	Computer Vision	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To understand the fundamental concepts related to sources, shadows and shading.
- To understand the geometry of multiple views.

UNIT–I: Cameras, Radiometry, Shading and Color

Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases.
Sources, Shadows, and Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Photometric Stereo, Global Shading Models.
Color: Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT–II: Filters, Edge Detection and Texture

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.
Texture: Representing Texture, Analysis and Synthesis Using Oriented Pyramids, Synthesis by Sampling Local Models, Shape from Texture.

UNIT–III: Multiple Views and Segmentation

Geometry of Multiple Views: Two Views, Stereopsis – Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras.
Segmentation by Clustering: Definition, Human Vision – Grouping and Gestalt, Applications – Shot Boundary Detection, Background Subtraction, Clustering Pixels, Graph-Theoretic Clustering.

UNIT–IV: Model Fitting, Probabilistic Methods, Tracking

Model Fitting: Hough Transform, Fitting Lines and Curves, Probabilistic Inference, Robustness.
Probabilistic Methods: Missing Data, EM Algorithm, Fitting and Segmentation.
Tracking with Linear Dynamic Models: Abstract Inference, Linear Models, Kalman Filtering, Data Association, Applications and Examples.

UNIT–V: Geometric Camera Models and Applications

Analytical Euclidean Geometry, Camera Parameters, Perspective Projection, Affine Cameras, Affine Projection Equations.
Geometric Camera Calibration: Least-Squares Estimation, Linear Approach, Radial Distortion, Analytical Photogrammetry.

Case Studies: Mobile Robot Localization, Model-Based Vision (Pose Consistency, Pose Clustering, Invariants, Verification), Medical Imaging Registration, Curved Surfaces, Alignment.

Textbooks:

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.

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Course Code	Course Name	Course Structure			
		L	T	P	C
—	Cloud Computing	3	0	0	3

Internal Marks: 30 **External Marks:** 70

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 advanced concepts such as containers, serverless computing, and cloud-centric Internet of Things.

UNIT–I: Introduction to Cloud Computing Fundamentals

Cloud computing overview, defining a cloud, cloud computing reference model, types of services: IaaS, PaaS, SaaS.
Cloud deployment models: public, private, hybrid.
Utility computing, cloud characteristics and benefits, service providers: AWS, Azure, Google AppEngine.

UNIT–II: Cloud Enabling Technologies

Ubiquitous Internet, parallel and distributed computing: Elements and architectures (SISD, SIMD, MISD, MIMD), inter-process communication.
Technologies: RPC, SOA, Web services, virtualization fundamentals.

UNIT–III: Virtualization and Containers

Virtualized environments: Characteristics and taxonomy, virtualization pros and cons, cloud virtualization (XEN, VMware).
Containers: Building blocks, platforms (LXC, Docker), orchestration (Docker Swarm, Kubernetes).
Public cloud services: VMs (e.g., Amazon EC2), containers (e.g., Amazon ECS).

UNIT–IV: Cloud Computing Challenges

Cloud economics, interoperability, standards, scalability, fault tolerance, energy efficiency, federated clouds.
Security: Fundamentals, cloud security architecture, shared responsibility model, and security for deployment models.

UNIT–V: Advanced Concepts in Cloud Computing

Serverless computing, Function-as-a-Service (FaaS), architectures, platforms: AWS Lambda, OpenFaaS.
Internet of Things (IoT): Applications, cloud-centric IoT architecture, layers.

Edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.

Textbooks:

1. Rajkumar Buyya et al., *Mastering Cloud Computing*, 2nd Edition, McGraw Hill, 2024.
2. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, *Distributed and Cloud Computing*, Elsevier, 2012.

Reference Books:

1. Dan C. Marinescu, *Cloud Computing: Theory and Practice*, 2nd Edition, MK Elsevier, 2018.
2. K. Chandrasekhran, *Essentials of Cloud Computing*, CRC Press, 2014.
3. Online documentation and tutorials from cloud providers (e.g., AWS, Azure, GCP).

Course Code	Course Name	Course Structure			
		L	T	P	C
—	DevOps	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

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

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)

Need for source code control, history of source code management, roles and code, source code management systems and migrations, Version Control and GIT, GIT Installation, features, workflow, working with remote repositories, GIT commands, branching, staging, and collaboration.
Unit Testing – Code Coverage: Junit, nUnit & Code Coverage with SonarQube, Code Quality Analysis.

UNIT–III: Build Automation – Continuous Integration (CI)

Build Automation, What is CI and why it is required, CI tools, Introduction to Jenkins (architecture), Jenkins workflow, master-slave architecture, Jenkins Pipelines, pipeline basics, Jenkins for Continuous Integration, create/manage builds, user management, scheduling builds, launching builds on slave nodes.

UNIT–IV: Continuous Delivery and Containerization

Importance of Continuous Delivery, Continuous Deployment Flow, Containerization with Docker: Introduction, installation, commands, images & containers, Dockerfile, running containers, working with containers, publishing to DockerHub.
Testing Tools: Introduction to Selenium and its features, JavaScript testing.

UNIT–V: Configuration Management – Ansible & Kubernetes

Introduction to Ansible, tasks, roles, Jinja2 templating, vaults, deployments using Ansible.

Containerization using Kubernetes (OpenShift): Introduction to Kubernetes namespace & resources, CI/CD on OCP, BC, DC & ConfigMaps, deploying apps on OpenShift container pods. Introduction to Puppet Master and Chef.

List of Experiments:

1. Code for a simple user registration form for an event.
2. Explore Git and GitHub commands.
3. Practice source code management on GitHub.
4. Jenkins installation and setup.
5. Demonstrate CI/CD using Jenkins.
6. Explore Docker commands for content management.
7. Develop a simple containerized application using Docker.
8. Integrate Kubernetes and Docker.
9. Automate running a containerized application using Kubernetes.
10. Install and explore Selenium for automated testing.
11. Write a JavaScript program and perform testing using Selenium.
12. Develop test cases for the containerized application using Selenium.

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, 2021.

Reference Books:

1. Len Bass, Ingo Weber, Liming Zhu., *DevOps: A Software Architect's Perspective*, Addison Wesley.
2. Gene Kim, Jez Humble, Patrick Debois, John Willis., *The DevOps Handbook*, 1st Edition, IT Revolution Press, 2016.
3. Joakim Verona., *Practical DevOps*, 1st Edition, Packt Publishing, 2016.
4. Joakim Verona., *Practical DevOps*, 2nd Edition, Ingram Short Title, 2018.
5. Deepak Gaikwad, Viral Thakkar., *DevOps Tools from Practitioner's Viewpoint*, Wiley Publications.

Course Code	Course Name	Course Structure			
		L	T	P	C
—	Soft Computing	3	0	0	3

Internal Marks: 30 **External Marks:** 70

Course Objectives:

- To introduce concepts in Soft Computing such as Artificial Neural Networks, Fuzzy Logic-based systems, Genetic Algorithm-based systems, and their hybrids.

UNIT–I: Introduction to Soft Computing and Neural Networks

Definition and overview of Soft Computing. Artificial Neural Networks, biological neurons, basic models of ANN, connections, learning mechanisms, activation functions. McCulloch and Pitts neuron, Hebb network.

UNIT–II: Perceptron and Back Propagation Networks

Perceptron networks, learning rule, training and testing algorithms. Adaptive Linear Neuron (ADALINE), Back Propagation Network: architecture and training algorithm.

UNIT–III: Fuzzy Logic and Fuzzy Sets

Fuzzy logic basics, fuzzy sets and properties, operations on fuzzy sets and fuzzy relations. Membership functions, fuzzification, methods of membership value assignments, intuition and inference, rank ordering, Lambda-Cuts, and defuzzification methods.

UNIT–IV: Fuzzy Systems and Neuro-Fuzzy Hybrids

Truth values and tables in fuzzy logic, fuzzy propositions, rule formation and decomposition, rule aggregation. Fuzzy inference systems: Mamdani and Sugeno types. Neuro-fuzzy hybrid systems – characteristics and classification.

UNIT–V: Genetic Algorithms and Hybrids

Introduction to Genetic Algorithms, operators: coding, selection, crossover, mutation, stopping criteria, flow of GA. Genetic-Neuro hybrid systems. Genetic-Fuzzy rule-based systems.

Textbooks:

1. S.N. Sivanandam and S.N. Deepa, *Principles of Soft Computing*, John Wiley Sons, 2007.
2. Timothy J. Ross, *Fuzzy Logic with Engineering Applications*, John Wiley Sons, 2016.

Reference Books:

1. N.K. Sinha and M.M. Gupta, *Soft Computing Intelligent Systems: Theory and Applications*, Academic Press / Elsevier, 2009.

2. Simon Haykin, *Neural Networks – A Comprehensive Foundation*, Prentice Hall, 1998.

3. R. Eberhart and Y. Shi, *Computational Intelligence: Concepts to Implementation*, Morgan Kaufman / Elsevier, 2007.

4. Driankov D., Hellendoorn H., Reinfrank M., *An Introduction to Fuzzy Control*, Narosa Publishing, 2001.

5. Bart Kosko, *Neural Networks and Fuzzy Systems*, Prentice Hall, 1992.

6. Goldberg D.E., *Genetic Algorithms in Search, Optimization, and Machine Learning*, Addison Wesley, 1989.

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Course Code	Course Name	Course Structure			
		L	T	P	C
—	Big Data Analytics Lab	0	0	3	1.5

Software Requirements:

- Hadoop: `https://hadoop.apache.org/release/2.7.6.html`
- Java: `https://www.oracle.com/java/technologies/javase/javase8u211-later-archive-downloads.html`
- Eclipse: `https://www.eclipse.org/downloads/`

List of Experiments:

1. **(Week 1-2)** Implement the following data structures in Java:
   - Linked List
   - Stack
   - Queue
   - Set
   - Map
2. **(Week 3)**
   (i) Set up and install Hadoop in its three operating modes: Standalone, Pseudo-distributed, Fully-distributed.
   (ii) Use web-based tools to monitor your Hadoop setup.
3. **(Week 4)** Perform file management tasks in Hadoop:
   - Adding files and directories
   - Retrieving files
   - Deleting files
4. **(Week 5)** Run a basic Word Count MapReduce program to understand the MapReduce paradigm.
5. **(Week 6)** Write a MapReduce program that mines weather data collected from sensors worldwide.
6. **(Week 7)** Use MapReduce to find the shortest path between two people in a social graph.
7. **(Week 8)** Implement the Friends-of-Friends (FoF) algorithm using two MapReduce jobs.
8. **(Week 9)** Implement an iterative PageRank algorithm using MapReduce.
9. **(Week 10)** Perform an efficient semi-join in MapReduce using Bloom filters.

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10. **(Week 11)** Install and run Pig. Write Pig Latin scripts to:
    - Sort
    - Group
    - Join
    - Project
    - Filter data
11. **(Week 12)** Install and run Hive. Use Hive to:
    - Create, alter, and drop databases
    - Create and manage tables, views, functions, and indexes

Course Code	Course Name	Course Structure			
		L	**T**	**P**	**C**
—	Soft Skills	0	1	2	2

Course Objectives:

- To equip the students with effective communication skills in English.
- To train students in interview, group discussion, and presentation skills.
- To develop students' confidence and interpersonal skills.
- To improve students' writing and organizational abilities.

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 and 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, Business, Telephone, Dining.

UNIT–III: Standard Operational Methods

Basics of Grammar – Tenses, Prepositions, Pronunciation.
Letter Writing, Note Making, Note Taking, Minutes Preparation, Emails.

UNIT–IV: Job-Oriented Skills

Group Discussion, Mock Group Discussions, Resume Writing, Interview Skills, Mock Interviews.

UNIT–V: Interpersonal Relationships

Definition, Importance, Types, Uses, Influencing Factors, Accommodating Styles, Consequences.

Textbooks:

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. Meenakshi Raman and Sangeeta Sharma, *Technical Communication: Principles and Practice*, Oxford University Press, 2011.

E-resources:

- https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01

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Course Code	Course Name	Course Structure			
		L	T	P	C
—	Technical Paper Writing & IPR	2	0	0	-

Course Objective:

- To explain the basics of writing technical reports, understanding formatting and structure, and mastering proofreading, proposals, and writing practice.

UNIT–I: Introduction and Planning

Basics of technical report writing, sentence construction, using transitions, tenses in writing.

Planning and structuring reports: identifying readers, using voice, formatting, report sections, writing minutes of meetings.

UNIT–II: Drafting and Editing

Drafting reports, use of illustrations and graphics.

Final edits: grammar, spelling, readability, writing in plain English, avoiding jargon, paragraphing, ambiguity.

UNIT–III: Proofreading and Presentation

Proofreading methods, writing summaries, summary activities.

Presenting reports: printed and verbal presentations, introduction to proposals and writing practice.

UNIT–IV: Using Word Processor Tools

Working with table of contents, index, outline, comments, tracking changes, footnotes, endnotes, citations, bibliography, document comparison, password protection, macros.

UNIT–V: Intellectual Property Rights (IPR)

Nature and types: patents, designs, trademarks, copyrights.

Process: research, innovation, patenting, development.

International IPR scenario: cooperation and global frameworks.

Textbooks:

1. Kompal Bansal & Parshit Bansal, *Fundamentals of IPR for Beginners*, 1st Ed., BS Publications, 2016.
2. William S. Pfeiffer and Kaye A. Adkins, *Technical Communication: A Practical Approach*, Pearson.
3. T. Ramappa, *Intellectual Property Rights Under WTO*, 2nd Ed., S. Chand, 2015.

Reference Books:

1. Adrian Wallwork, *English for Writing Research Papers*, Springer, 2011.

2. Day R., *How to Write and Publish a Scientific Paper*, Cambridge University Press, 2006.

E-resources:

- `https://www.udemy.com/course/reportwriting/`
- `https://www.udemy.com/course/professional-business-english-and-technical-report-writing/`
- `https://www.udemy.com/course/betterbusinesswriting/`

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Course Code	Course Name	Course Structure			
		L	T	P	C
—	Data Visualization Lab	0	0	3	1.5

Course Objectives:

- To visualize different datasets using histograms and line charts.
- To understand the use of bar charts and box plots.
- To explore scatter plots and mosaic plots.
- To understand various map visualizations.
- To learn advanced graphs such as correlograms, heatmaps, and 3D graphs.

Course Outcomes:

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

- Visualize datasets using histograms and line charts.
- Apply bar charts and box plots on different datasets.
- Create scatter plots and mosaic plots in R.
- Use map visualizations in R.
- Develop advanced graphs such as correlograms, heatmaps, and 3D graphs.

List of Experiments:

1. a) Load VADeaths dataset and visualize using histograms.

   b) Load airquality dataset and plot La Guardia Airport's daily max temperature using histogram.

2. Load AirPassengers dataset and create a line chart showing growth in air traffic.

3. a) Load iris dataset, use bar charts and demonstrate stacked plots.

   b) Visualize ozone concentration using airquality dataset.

4. a) Use box plots on iris dataset with groupings and color palettes.

   b) Use box plots for airquality parameters.

5. Visualize iris dataset using scatter plot, multivariate scatter plot, and scatter matrix.

6. Load diamonds dataset, visualize large dataset structure with hexbin plots and apply color palette.

7. Load HairEyeColor dataset and plot categorical data using mosaic plots.

8. Load mtcars dataset and visualize with heatmap.
9. Install `leaflet` library in R and perform map visualizations.
10. Visualize iris dataset using 3D graphs like `scatter3d`, `cloud`, and `xyplot`.
11. Use correlogram to visualize correlation matrix of iris dataset.
12. Install `maps` library in R and draw map visualizations.

Web References:

- `https://www.analyticsvidhya.com/blog/2015/07/guide-data-visualization-r/`
- `https://www.geeksforgeeks.org/data-visualization-in-r/`

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