



SANTHIRAM ENGINEERING COLLEGE (AUTONOMOUS)

Approved by A.I.C.T.E., New Delhi, Permanently Affiliated to JNT University, Ananthapuramu
Accredited by NAAC with Grade-A, Accredited by NBA (ECE & CSE)
An ISO 9001:2015 Certified Institution, 2(f) & 12(B) recognition by UGC Act, 1956
NH-40, NANDYAL-518501 (Dist), A.P.

Learn - Grow - Empower

R-23

ACADEMIC REGULATIONS COURSE STRUCTURE AND DETAILED SYLLABI B.TECH-CSD(32)

Regular Four Year UG Degree Course

(Applicable for the batches admitted from 2023-2024)

&

Lateral Entry Three Year UG Degree Course

(Applicable for the batches admitted from 2024-2025)



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 163 credits and secures all 163 credits.
- (iii) A Student who secures highest percentage of marks in the batch of every department will be honoured with gold medal.
- (iv) A Student who secures second highest percentage of marks in the batch of every department will be honoured with silver medal.

(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., 163 credits.
- (ii) Registering for Honors is optional.
- (iii) Honors is to be completed simultaneously with B.Tech. programme.

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

3. Admissions

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

4. Program related terms

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

Credit Definition:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit
4 weeks MOOCs course	1 credit

- a) **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.
- b) **Choice Based Credit System (CBCS):** The CBCS provides a choice for students to select from the prescribed courses.

5. Semester/Credits:

- A semester comprises 90 working days and an academic year is divided into two semesters.
- 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.
- Regular courses may also be completed well in advance through MOOCs satisfying prerequisites.

6. Structure of the Undergraduate Programme

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

S.No.	Category	Breakup of Credits (Total 163)	Percentage of total credits	AICTE Recommendation (%)
1.	Humanities and Social Science including Management (HM)	13	8 %	8 – 9%
2.	Basic Sciences (BS)	20	13 %	12 - 16%
3.	Engineering Sciences (ES)	23.5	14%	10 – 18%
4.	Professional Core (PC)	54.5	34 %	30 – 36%
5.	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21 %	19 - 23%
6.	Internships & Project work (PR)	16	10 %	8 – 11%
7.	Mandatory Courses (MC)	Non-credit	Non-credit	---

7. Course Classification:

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

S.No.	Broad Course Classification	Course Category	Description
1.	Foundation Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses

2.	Core Courses	Professional Core Courses (PC)	Includes subjects related to the parent discipline/department/branch of Engineering
3.	Elective Courses	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/department/ branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering
		Domain specific skill enhancement courses (SEC)	interdisciplinary/job-oriented/domain courses which are relevant to the industry
4.	Project & Internships	Project	B.Tech. Project or Major Project
		Internships	Summer Internships – Community based and Industry Internships; Industry oriented Full Semester Internship
5.	Audit Courses	Mandatory non-credit courses	Covering subjects of developing desired attitude among the learners

8. Programme Pattern

- Total duration of the of B. Tech (Regular) Programme is four academic years.
- Each academic year of study is divided into two semesters.
- Minimum number of instruction days in each semester is 90 days.
- There shall be mandatory student induction program for fresher's, 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.
- Health/wellness/yoga/sports and NSS /NSS /Scouts & Guides / Community service activities are made mandatory as credit courses for all the under graduate students.
- Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.
- Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.
- Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.
- 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.
- 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 163 credits by opting for the courses offered through various verticals/tracks under Open Electives.
- While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.
- A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall

- focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.
- xiii. Students shall undergo mandatory summer internships, for a minimum of eight weeks duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year.
 - xiv. There shall also be mandatory full internship in the final semester of the programme along with the project work.
 - xv. Undergraduate degree with Honors is introduced by the Institution for the students having good academic record.
 - xvi. The Institution shall take measures to implement Virtual Labs (<https://www.vlab.co.in>) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.
 - xvii. The college shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.
 - xviii. Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

9. Evaluation Process

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

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

Theory Courses

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

- i) For theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.
- ii) For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.
- iii) If any course contains two different branch subjects, the syllabus shall be written in two parts with 3 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.

- iv) If any subject is having both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given a separate subject code for theory subject and 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/short answer paper, 15 marks for subjective paper and 5 marks for assignment.
- ii) Objective paper shall contain maximum of 20 bits for 10 marks /Short answer paper shall contain for 05 short answer questions with 2 marks each and Subjective paper shall contain 3 either or type questions of which student has to answer one from each either-or type of questions. Each question carries 5 marks. Time duration for the midterm examination is 110 min.

Note:

- The Subjective with Short answer paper shall contain one mandatory question with 05 short answer questions with 2 marks each and 3 either or type questions (from 2 to 7) of equal weight age of 5 marks. Any fraction shall be rounded off to the next higher mark. Total marks for each midterm examination is 25 marks.
 - 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 average marks shall be considered. For Midterm-I average of 2 assignments and for Midterm-II average of 3 assignments are considered from the respective units of syllabus.
- iii) If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.
 - iv) First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.
 - v) Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weight age given to the better mid exam and 20% to the other.

For Example:

Marks obtained in first mid: 25

Marks obtained in second mid: 20

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

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

Marks obtained in first mid: Absent

Marks obtained in second mid: 25

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

b) End Examination Evaluation:

End examination of theory subjects shall have the following pattern:

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

- ii) Question I shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks.
- iii) There shall be 2 short answer questions from each unit.
- iv) In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
- v) The question 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 weight age 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 1 mark.
- 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.
- v) ***There shall be online evaluation for semester theory end examinations. The evaluation is completely online. A minimum of 50% of theory courses shall be sent for online external evaluation. Remaining courses evaluation shall be done by online internal evaluation.***

a) Practical Courses

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

- b) **For practical courses**, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.
- c) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the record/viva and 15 marks for the internal test.
- d) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and an external examiner (expert in the subject from the same department) from the other college nominated by the principal from the panel of **Three** members submitted by the Head of the Department.
 - Procedure: 20 marks
 - Experimental work & Results: 30 marks
 - Viva voce: 20 marks.

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

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

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

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

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

- f) **There shall be no external examination for mandatory courses** with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, an examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.
- g) **The laboratory and mid semester** test papers shall be preserved for a minimum of 3 years in the respective institution as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.
- h) **Semester End Examination answer scripts** will be preserved for one academic year (For example first year papers will be preserved up to second year second semester results declaration). However, the soft copy of all the Semester End Examinations answer scripts will be preserved permanently in the institution.

10. Skill oriented Courses

- i) **There shall be five skill-oriented courses offered during III to VII semesters.**
- ii) Out of the five skill courses two shall be skill-oriented courses from the same domain, of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.
- iii) The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an external subject expert nominated by the principal from the panel of Three members submitted by the Head of the Departments. 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 an external subject expert nominated by the principal shall monitor the evaluation process. The marks/grades shall be assigned to the students by the above committee based on their performance.
- iv) The student shall be given an option to choose either the skill courses being offered by the institution 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.

- v) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the institution. The Head of the Department shall forward such proposals to the principal for approval.
- vi) If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the principal.

11. Massive Open Online Courses (MOOCs):

A Student has to pursue and complete TWO courses compulsorily through MOOCs approved by the institution. A student can pursue courses other than core through MOOCs and it is mandatory to complete two courses 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 Institution.

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

12. Credit Transfer Policy

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

- i) The Institution shall offer credit mobility for MOOCs and give the equivalent credit weight age to the students for the credits earned through online learning courses.
- ii) Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.
- iii) Credit transfer policy will be applicable to the Professional & Open Elective courses only.
- iv) The concerned department shall identify the courses permitted for credit transfer.
- v) The institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.
- vi) The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

- vii) The Institution shall ensure no overlap of MOOC exams with that of the institution examination schedule. In case of delay in results, the Institution will re-issue the marks sheet for such students.
- viii) Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.
- ix) The respective Departments shall submit the following to the examination section of the Institution:
 - a) List of students who have passed MOOC courses in the current semester along with the certificate of completion.
 - b) Undertaking form filled by the students for credit transfer.
 - x) *A MOOC course online assignment, programming assignment (if any) and proctor exam marks together taken as Final Marks (i.e., 100 marks) for that subject for credit transfer.*
- xi) 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 Institution from time to time.

13. Academic Bank of Credits (ABC)

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

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

14. Mandatory Internships

Summer Internships: Two summer internships either onsite or virtual each with a minimum of 08 weeks duration, done at the end of second and third years, respectively are mandatory. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the Undergraduate program. One of the two summer internships at the end of second year (Community Service Project) shall be society oriented and shall be completed in collaboration with government organizations/NGOs & others. The other internship at the end of third year is Industry Internship and shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The guidelines issued by the APSCHE / University/Institution 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% weight age 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 from the panel of Three members submitted by the Head of the Departments and is evaluated for 140 marks.

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

15. Guidelines for offering a Minor

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

- i) The Minor program requires the completion of 18 credits in Minor stream chosen.
- ii) Two courses for 06 credits related to a Minor are to be pursued compulsorily for the minor degree, but maybe waived for students who have done similar/equivalent courses. If waived for a student, then the student must take an extra elective course in its place. It is recommended that students should complete the compulsory courses (or equivalents) before registering for the electives.
- iii) Electives (minimum of 2 courses) to complete a total of 12 credits.

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

16. Guidelines for offering Honors

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

- i) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
- ii) A student shall earn additional 158 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., 163 credits).
- iii) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.
- iv) The concerned HODs of the college shall arrange separate class work and timetable of the courses offered under Honors program.
- v) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.
- vi) Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.
- vii) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.
- viii) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.
- ix) A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree programme.
- x) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- xi) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering.

Enrolment into Honors:

- i) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline
- ii) The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for Honors.
- iii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.
- iv) Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.
- v) Honors is to be completed simultaneously with a Major degree program.

Registration for Honors:

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

17. Attendance Requirements:

- i) A student shall be eligible to appear for the Institution external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects.
- ii) 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.
- iii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.
- iv) A stipulated fee shall be payable towards condonation of shortage of attendance to the University/Institution.
- v) 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.
- vi) 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.
- vii) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
- viii) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.
- viii) For induction programme attendance shall be maintained as per AICTE norms.

18. Promotion Rules:

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in section 16/17.

- i) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per university/institution norms.
- ii) A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any **decimal** fraction should be **rounded off** to **lower** digit) up to in the subjects that have been studied up to III semester.
- iii) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any **decimal** fraction should be **rounded off** to **lower** digit) in the subjects that have been studied up to V semester. And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required

credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

- iv) When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted, and the BoS members of concerned Departments will suggest the substitute subjects.

19. Grading:

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

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

Structure of Grading of Academic Performance

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

- 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.
- 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 point 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 ith semester and

C_i is the total number of credits up to that semester.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts. While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

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

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

Award of Class:

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

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

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

20. With-holding of Results

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

21. Multiple Entry / Exit Option

(a) Exit Policy:

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

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

- iii) **Bachelor of Science (in Field of study/discipline)** i.e., **B.Sc. Engineering in(Field of study/discipline)**- Programme duration: First three years (first six semesters) of the undergraduate programme, 130 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/Institution shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE and State government.

22. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/to establish start-ups. 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 of the respective college shall forward such proposals submitted by the students to the principal. An evaluation committee constituted by the Institution shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not.

23. Transitory Regulations

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

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

24. Minimum Instruction Days for a Semester:

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

25. Medium of Instruction:

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

26. Student Transfers:

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

27. Amendment of Regulations:

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.

28. General Instructions:

- i. The academic regulations should be read as a whole for purpose of any interpretation.
- ii. Malpractices rules-nature and punishments are appended.
- iii. Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.
- iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor / Chairman of Academic Council is final.
- v. The Universities/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 Universities/Institution.
- vi. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Vice-Chancellor / Head of the institution is final.

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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 123 credits and secures all 123 credits.
- (b) Award of B.Tech. degree with Honors if he/she fulfils the following:
 - (i) Student secures additional 18 credits fulfilling all the requisites of a B.Tech. program i.e., 123 credits.
 - (ii) Registering for Honors is optional.
 - (iii) Honors are to be completed simultaneously with B.Tech. Programme.

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

3. Minimum Academic Requirements

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

- i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.
- ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester.
And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. Course Pattern

- i) The entire course of study is three academic years on semester pattern.
 - ii) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.
 - iii) When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.
- 5. All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

**RULES FOR
DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN
EXAMINATIONS**

	Nature of Malpractices/Improper conduct	Punishment
	<i>If the candidate:</i>	
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The Hall Ticket of the candidate is to be cancelled and handed over to the examination of the autonomous college.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all examinations, if his involvement is established. Otherwise, the candidate is debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject only.
6.	Refuses to obey the orders of the Chief Superintendent /Assistant - Superintendent /any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the Controller of Examinations / Assistant Controller of Examinations, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. If the candidate physically assaults the invigilator/ Controller of Examinations / Assistant Controller of Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.

9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person (s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject only or in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations, depending on the recommendation of the committee.
12.	If any malpractice is detected, which is not covered in the above clauses 1 to 11 shall be reported to the College for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
3. A show cause notice shall be issued to the college.
4. Impose a suitable fine on the college.
5. Shifting the examination centre from the college to another college for a specific period of not less than one year.

Note:-

Whenever the performance of a student is cancelled in any subject/subjects due to Malpractice, he has to register for End Examinations in that subject/subjects consequently and has to fulfil all the norms required for the award of Degree.

**SANTHIRAM ENGINEERING COLLEGE****(AUTONOMOUS)****DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE****Course Structure****B.Tech I-Year I Semester :**

S. No	Subject Code	Course Category	Name of the Subject	Hours/Week			
				L	T	P	C
1	23A92101	BS	ENGINEERING PHYSICS	3	0	0	3
2	23A91101	BS	LINEAR ALGEBRA & CALCULUS	3	0	0	3
3	23A04101	ES	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	3	0	0	3
4	23A03101	ES	ENGINEERING GRAPHICS	1	0	4	3
5	23A05101	ES	INTRODUCTION TO PROGRAMMING	3	0	0	3
6	23A05102	ES	IT WORKSHOP	0	0	2	1
7	23A92102	BS	ENGINEERING PHYSICS LAB	0	0	2	1
8	23A04102	ES	ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP	0	0	3	1.5
9	23A05103	ES	COMPUTER PROGRAMMING LAB	0	0	3	1.5
10	23A99101	HM	NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE	0	0	1	0.5

B.Tech I-Year II Semester :

S. No	Subject Code	Course Category	Name of the Subject	Hours/Week			
				L	T	P	C
1	23A94101	HM	COMMUNICATIVE ENGLISH	2	0	0	2
2	23A93101	BS	CHEMISTRY	3	0	0	3
3	23A91202	BS	DIFFERENTIAL EQUATIONS & VECTOR CALCULUS	3	0	0	3
4	23A03102	ES	BASIC CIVIL AND MECHANICAL ENGINEERING	3	0	0	3
5	23A05204	PC	DATA STRUCTURES	3	0	0	3
6	23A94102	HM	COMMUNICATIVE ENGLISH LAB	0	0	2	1
7	23A93102	BS	CHEMISTRY LAB	0	0	2	1
8	23A03103	ES	ENGINEERING WORKSHOP	0	0	3	1.5
9	23A05205	PC	DATA STRUCTURES LAB	0	0	3	1.5
10	23A99102	HM	HEALTH AND WELLNESS YOGA AND SPORTS	0	0	1	0.5

**SANTHIRAM ENGINEERING COLLEGE****(AUTONOMOUS)****DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE****Course Structure****B.Tech II-Year I Semester :**

S. No	Subject Code	Course Category	Name of the Subject	Hours/Week			
				L	T	P	C
1.	23A91305	BS	DISCRETE MATHEMATICS & GRAPH THEORY	3	0	0	3
2.	23A99303	HM	UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT	2	1	0	3
3.	23A32301	PC	INTRODUCTION TO DATA SCIENCE	3	0	0	3
4.	23A05307	PC	ADVANCED DATA STRUCTURES & ALGORITHMS ANALYSIS	3	0	0	3
5.	23A05308	PC	OBJECT ORIENTED PROGRAMMING THROUGH JAVA	3	0	0	3
6.	23A32302	PC	DATA SCIENCE LAB	0	0	3	1.5
7.	23A05310	PC	OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB	0	0	3	1.5
8.	23A05306	SC	PYTHON PROGRAMMING	0	1	2	2
9.	23A93303	MC(NC)	ENVIRONMENTAL SCIENCE	2	0	0	0

B.Tech II-Year II Semester :

S. No	Subject Code	Course Category	Name of the Subject	Hours/Week			
				L	T	P	C
1	23A91408	ES	OPTIMIZATION TECHNIQUES	2	0	0	2
2	23A91409	BS	STATISTICAL METHODS FOR DATA SCIENCE	3	0	0	3
3	23A32403	PC	DATA ENGINEERING	3	0	0	3
4	23A05412	PC	DATABASE MANAGEMENT SYSTEMS	3	0	0	3
5	23A04310	ES	DIGITAL LOGIC & COMPUTER ORGANIZATION	3	0	0	3
6	23A32404	PC	DATA ENGINEERING LAB	0	0	2	1.5
7	23A05415	PC	DATABASE MANAGEMENT SYSTEMS LAB	0	0	2	1.5
8	23A32405	SC	EXPLORATORY DATA ANALYSIS WITH PYTHON	0	1	2	2
9	23A99405	MC(C)	DESIGN THINKING AND INNOVATION	1	0	2	2

**SANTHIRAM ENGINEERING COLLEGE****(AUTONOMOUS)****DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE****Course Structure****B.Tech III-Year I Semester :**

S. No	Subject Code	Course Category	Name of the Subject	Hours/Week			
				L	T	P	C
1	23A33402	PC	MACHINE LEARNING	3	0	0	3
2	23A05411	PC	OPERATING SYSTEMS	3	0	0	3
3	23A05413	PC	SOFTWARE ENGINEERING	3	0	0	3
4	23A05517	PC	INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS	3	0	0	3
5	23A05520	PE	AUTOMATA THEORY AND COMPILER DESIGN PE-I	3	0	0	3
6	23A05521	PE	OBJECT ORIENTED ANALYSIS AND DESIGN PE-I	3	0	0	3
7	23A05522	PE	SOFT COMPUTING PE-I	3	0	0	3
8	23A32506	PE	INTERNET OF THINGS PE-I	3	0	0	3
9	23A01501	OE	GREEN BUILDINGS OE-I	3	0	0	3
10	23A01502	OE	CONSTRUCTION TECHNOLOGY AND MANAGEMENT OE-I	3	0	0	3
11	23A02503	OE	ELECTRICAL SAFETY PRACTICES AND STANDARDS OE-I	3	0	0	3
12	23A03504	OE	SUSTAINABLE ENERGY TECHNOLOGIES OE-I	3	0	0	3
13	23A04527	OE	ELECTRONIC CIRCUITS OE-I	3	0	0	3
14	23A91513	OE	MATHEMATICS FOR MACHINE LEARNING AND AI OE-I	3	0	0	3
15	23A92503	OE	MATERIALS CHARACTERIZATION TECHNIQUES OE-I	3	0	0	3
16	23A93504	OE	CHEMISTRY OF ENERGY SYSTEMS OE-I	3	0	0	3
17	23A94505	OE	ENGLISH FOR COMPETITIVE EXAMINATIONS OE-I	3	0	0	3
18	23A95507	OE	ENTREPRENEURSHIP AND NEW VENTURE CREATION OE-I	3	0	0	3
19	23A33510	PC	MACHINE LEARNING LAB	0	0	3	1.5
20	23A33511	PC	OPERATING SYSTEMS LAB	0	0	3	1.5
21	23A05416	SC	FULL STACK DEVELOPMENT-I (SKILL ENHANCEMENT COURSE)	0	1	2	2
22	23A04526	MC(C)	TINKERING LAB	0	0	2	1
23	23A99507		EVALUATION OF COMMUNITY SERVICE INTERNSHIP	0	0	0	2

**SANTHIRAM ENGINEERING COLLEGE****(AUTONOMOUS)****DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE****Course Structure****B.Tech III-Year II Semester :**

S. No	Subject Code	Course Category	Name of the Subject	Hours/Week			
				L	T	P	C
1	23A33506	PC	NATURAL LANGUAGE PROCESSING	3	0	0	3
2	23A32607	PC	PREDICTIVE ANALYTICS	3	0	0	3
3	23A33509	PC	DATA VISUALIZATION	3	0	0	3
4	23A32609	PE	SOCIAL NETWORK ANALYSIS PE-II	3	0	0	3
4	23A05627	PE	CRYPTOGRAPHY & NETWORK SECURITY PE-II	3	0	0	3
5	23A32608	PE	COMPUTER NETWORKS PE-II	3	0	0	3
6	23A32609	PE	RECOMMENDER SYSTEMS PE-II	3	0	0	3
7	23A32610	PE	DEEP LEARNING PE-II	3	0	0	3
8	23A05633	PE	SOFTWARE PROJECT MANAGEMENT PE-III	3	0	0	3
9	23A32611	PE	INTRODUCTION TO QUANTUM COMPUTING PE-III	3	0	0	3
10	23A32612	PE	COMPUTER VISION PE-III	3	0	0	3
11	23A05626	PE	CLOUD COMPUTING PE-III	3	0	0	3
12	23A32613	PC	PREDICTIVE ANALYTICS LAB	0	0	3	1.5
13	23A33615	PC	NLP AND DATA VISUALIZATION LAB (USING POWER BI / TABLEAU ETC.,)	0	0	3	1.5
14	23A94403	SC	SOFT SKILLS	1	0	2	2
15	23A99608	MC(NC)	TECHNICAL PAPER WRITING & IPR	2	0	0	0
16	23A01603	OE	DISASTER MANAGEMENT OE-II	3	0	0	3
17	23A03605	OE	SUSTAINABILITY IN ENGINEERING PRACTICES OE-II	3	0	0	3
18	23A02604	OE	RENEWABLE ENERGY SOURCES OE-II	3	0	0	3
19	23A03606	OE	AUTOMATION AND ROBOTICS OE-II	3	0	0	3
20	23A04639	OE	DIGITAL ELECTRONICS OE-II	3	0	0	3
21	23A91614	OE	OPTIMIZATION TECHNIQUES FOR ENGINEERS OE-II	3	0	0	3
22	23A91609	OE	MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES OE-II	3	0	0	3
23	23A92604	OE	PHYSICS OF ELECTRONIC MATERIALS AND DEVICES OE-II	3	0	0	3
24	23A93605	OE	CHEMISTRY OF POLYMERS AND APPLICATIONS OE-II	3	0	0	3
25	23A94607	OE	ACADEMIC WRITING AND PUBLIC SPEAKING OE-II	3	0	0	3
26	23A99609	MC	MINI PROJECT	0	0	0	0
27	23A32614	MC	WORKSHOP	0	0	0	0

**SANTHIRAM ENGINEERING COLLEGE****(AUTONOMOUS)****DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE****Course Structure****B.Tech IV-Year I Semester :**

S. No	Subject Code	Course Category	Name of the Subject	Hours/Week			
				L	T	P	C
1	23A32715	PC	BIG DATA ANALYTICS	3	0	0	3
2	23A95708	HM	BUSINESS ETHICS AND CORPORATE GOVERNANCE (MC-II)	2	0	0	2
3	23A95709	HM	E-BUSINESS (MC-II)	2	0	0	2
4	23A95710	HM	MANAGEMENT SCIENCE(MC-II)	2	0	0	2
5	23A05741	PE	SOFTWARE ARCHITECTURE & DESIGN PATTERNS (PE-IV)	3	0	0	3
6	23A05742	PE	BLOCKCHAIN TECHNOLOGY(PE-IV)	3	0	0	3
7	23A05630	PE	DEVOPS (PE-IV)	3	0	0	3
8	23A32716	PE	NOSQL DATABASES (PE-IV)	3	0	0	3
9	23A05629	PE	CYBER SECURITY (PE-IV)	3	0	0	3
10	23A05746	PE	AGILE METHODOLOGIES (PE-V)	3	0	0	3
11	23A32717	PE	EXPERT SYSTEMS (PE-V)	3	0	0	3
12	23A05745	PE	REINFORCEMENT LEARNING (PE-V)	3	0	0	3
13	23A32718	PE	HIGH PERFORMANCE COMPUTING (PE-V)	3	0	0	3
14	23A05749	PE	INTRODUCTION TO LARGE LANGUAGE MODELS (PE-V)	3	0	0	3
15	23A01704	OE	BUILDING MATERIALS AND SERVICES (OE-III)	3	0	0	3
16	23A01705	OE	ENVIRONMENTAL IMPACT ASSESSMENT (OE-III)	3	0	0	3
17	23A02705	OE	SMART GRID TECHNOLOGIES (OE-III)	3	0	0	3
18	23A03707	OE	3D PRINTING TECHNOLOGIES (OE-III)	3	0	0	3
19	23A04519	OE	MICROPROCESSORS AND MICROCONTROLLERS (OE-III)	3	0	0	3
20	23A91716	OE	WAVELET TRANSFORMS AND ITS APPLICATIONS (OE-III)	3	0	0	3
21	23A92705	OE	SMART MATERIALS AND DEVICES (OE-III)	3	0	0	3
22	23A92706	OE	INTRODUCTION TO QUANTUM MECHANICS (OE-III)	3	0	0	3
23	23A93706	OE	GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (OE-III)	3	0	0	3
24	23A95711	OE	EMPLOYABILITY SKILLS (OE-III)	3	0	0	3
25	23A01706	OE	GEO-SPATIAL TECHNOLOGIES (OE-IV)	3	0	0	3
26	23A01707	OE	SOLID WASTE MANAGEMENT (OE-IV)	3	0	0	3
27	23A02706	OE	ELECTRIC VEHICLES (OE-IV)	3	0	0	3
28	23A03708	OE	TOTAL QUALITY MANAGEMENT (OE-IV)	3	0	0	3
29	23A04755	OE	TRANSDUCERS AND SENSORS (OE-IV)	3	0	0	3
30	23A91715	OE	FINANCIAL MATHEMATICS (OE-IV)	3	0	0	3



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31	23A32611	OE	INTRODUCTION TO QUANTUM COMPUTING(OE-IV)	3	0	0	3
32	23A92707	OE	SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS (OE-IV)	3	0	0	3
33	23A93707	OE	CHEMISTRY OF NANOMATERIALS AND APPLICATIONS (OE-IV)	3	0	0	3
34	23A95712	OE	LITERARY VIBES (OE-IV)	3	0	0	3
35	23A05525	SC	FULL STACK DEVELOPMENT-II (SKILL ENHANCEMENT COURSE)	0	1	2	2
36	23A95713	MC (NC)	GENDER SENSITIZATION(AC)	2	0	0	0
37	23A32719		EVALUATION OF INDUSTRY INTERNSHIP	0	0	0	2

B.Tech IV-Year II Semester :

S. No	Subject Code	Course Category	Name of the Subject	Hours/Week			
				L	T	P	C
01	23A32820	--	INTERNSHIP	--	--	--	4
02	23A32821	--	PROJECT	--	--	--	8

I B.Tech I Semester Course Structure

S.No	Subject Code	Course Category	Name of the Subject	Hours/Week			Credits	Marks		
				Lecture	Tutorial	Practical		Internal	External	Total
1	23A92101	BS&H	ENGINEERING PHYSICS	3	0	0	3	30	70	100
2	23A91101	BS&H	LINEAR ALGEBRA & CALCULUS	3	0	0	3	30	70	100
3	23A04101	ES	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	3	0	0	3	30	70	100
4	23A03101	ES	ENGINEERING GRAPHICS	1	0	4	3	30	70	100
5	23A05101	ES	INTRODUCTION TO PROGRAMMING	3	0	0	3	30	70	100
6	23A05102	ES	IT WORKSHOP	0	0	2	1	30	70	100
7	23A92102	BS&H	ENGINEERING PHYSICS LAB	0	0	2	1	30	70	100
8	23A04102	ES	ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP	0	0	3	1.5	30	70	100
9	23A05103	ES	COMPUTER PROGRAMMING LAB	0	0	3	1.5	30	70	100
10	23A99101	BS&H	NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE	0	0	1	0.5	0	100	100

I B.Tech I Semester Syllabus



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I B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A92101) ENGINEERING PHYSICS

Course Category	Basic Science & Humanities (BS & H)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. 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.

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 - Intensity of diffracted beams, X-ray Diffractometer - crystal structure determination by Laue's and powder methods.

UNIT-III DIELECTRIC MATERIALS & 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.



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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 – Determination of Energy Band Gap (E_g) 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, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015).

REFERENCE BOOKS:

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

e- Resources and Digital Material:

1. <http://ndl.iitkgp.ac.in/document/aUUzSzg0NXozaDZheVpnMEtnb3lZclAvRWlIWmN0VUxxeFpzVURYaUxyWT0>
2. <https://books.google.com/books?id=fGo7BgUozoMC&printsec=frontcover>

COURSE OUTCOMES:

1. Analyze the intensity variation of light due to polarization, interference and diffraction.
2. Familiarize with the basics of crystals and their structures.
3. Summarize various types of polarization of dielectrics and classify the magnetic materials.
4. Explain the basic concepts of Quantum Mechanics and the band theory of solids.
5. Identify the type of semiconductor using Hall effect.

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L	T	P	C
3	0	0	3

(23A91101) LINEAR ALGEBRA & CALCULUS

Course Category	Basic Science & Humanities (BS & H)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. 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.

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: Consistency of linear system of 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. Curvature: Radius of curvature, Centre of curvature.

UNIT-IV PARTIAL DIFFERENTIATION AND APPLICATIONS (MULTI VARIABLE CALCULUS)

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



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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, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition

REFERENCE BOOKS:

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

e- Resources and Digital Material:

1. <https://elibrary.in.pearson.com>
2. <https://archive.nptel.ac.in/courses/111/106/111106051/>

COURSE OUTCOMES:

1. Develop and use of matrix algebra techniques that are needed by engineers for practical applications.
2. Utilize mean value theorems to real life problems
3. Familiarize with functions of several variables which is useful in optimization
4. Learn important tools of calculus in higher dimensions.
5. 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.



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L	T	P	C
3	0	0	3

(23A04101) BASIC ELECTRICAL & ELECTRONICS ENGINEERING PART A: BASIC ELECTRICAL ENGINEERING

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. 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.

UNIT-I DC & AC CIRCUITS

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

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

UNIT-II MACHINES AND MEASURING INSTRUMENTS

Machines:

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

Measuring Instruments:

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



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UNIT-III ENERGY RESOURCES, ELECTRICITY BILL & SAFETY MEASURES

Energy Resources:

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

Electricity bill:

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

Equipment Safety Measures:

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

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. Bhattacharya, Person Publications, 2018, Second Edition.

e-Resources and Digital Material:

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

COURSE OUTCOMES:

1. Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.
2. Understand the problem solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations



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3. : Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.
4. Analyze different electrical circuits, performance of machines and measuring instruments.
5. Evaluate different circuit configurations, Machine performance and Power systems operation.



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L	T	P	C
3	0	0	3

(23A04101) BASIC ELECTRICAL & ELECTRONICS ENGINEERING PART B: BASIC ELECTRONICS ENGINEERING

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. This course provides the student with the fundamental skills to understand the principles of digital electronics, basics of semiconductor devices like diodes & transistors, characteristics and its applications.

UNIT-I SEMICONDUCTOR DEVICES

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

UNIT-II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION

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

UNIT-III DIGITAL ELECTRONICS

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.



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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.

COURSE OUTCOMES:

1. Apply the concept of science and mathematics to understand the working of diodes, transistors, and their applications.
2. Explain the characteristics of diodes and transistors.
3. Familiarize with the number systems, codes, Boolean algebra and logic gates.
4. Understand the working mechanism of different combinational, sequential circuits and their role in the digital systems.



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L	T	P	C
1	0	4	3

(23A03101) ENGINEERING GRAPHICS

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. Understand the basic principles and conventions of engineering drawing, use Engineering instruments and draw engineering curves.
2. Use orthographic projections and make the students draw the projections of lines and planes Inclined to both the planes.
3. Draw the projections of the Solids in different positions with respect to the Reference planes.
4. Understand the importance of sectioning and concept of development of surfaces.
5. Represent and convert isometric views to orthographic views and vice versa.

UNIT-I INTRODUCTION TO ENGINEERING GRAPHICS, CURVES AND SCALES

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

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

Scales: Plain scales, diagonal scales and Vernier scales.

UNIT-II ORTHOGRAPHIC PROJECTIONS, PROJECTIONS OF STRAIGHT LINES AND PLANES

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 and its Traces.

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

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 other and axes inclined to both the reference planes.



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UNIT-IV SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES

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

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

UNIT-V CONVERSION OF VIEWS AND COMPUTER GRAPHICS

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

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

TEXT BOOKS:

1. N.D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.
2. Engineering Drawing, K.L. Narayana & P. Kannaiah, Tata McGraw Hill, 2013.

REFERENCE BOOKS:

1. Engineering Drawing, M.B. Shah and B.C. Rana, Pearson Education Inc, 2009.
2. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.
3. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000.
4. K.C. John, Engineering Graphics, 2/e, PHI, 2013.
5. Basant Agarwal and C.M. Agarwal, Engineering Drawing, Tata McGraw Hill, 2008.

e-Resources and Digital Material:

1. <https://nptel.ac.in/courses/112/105/112105294/>
2. <https://nptel.ac.in/courses/112/103/112103019/>

COURSE OUTCOMES:

1. Understand the principles of engineering drawing, including engineering curves, Scales, orthographic and isometric projections.
2. Draw and interpret orthographic projections of Points, lines, Planes and solids in front, top and side views.
3. Understand and apply concepts of sectional views to represent details of solids in simple positions.
4. Gain a clear understanding of the principles behind development of surfaces and to understand how to unfold basic geometric shapes into flat patterns.
5. Develop the ability to draw isometric views and orthographic views and should be able to convert isometric views to orthographic views and vice versa.

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I B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A05101) INTRODUCTION TO PROGRAMMING

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

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.

UNIT-I INTRODUCTION TO PROGRAMMING AND PROBLEM SOLVING

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program - Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting. Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT-II CONTROL STRUCTURES

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

UNIT-III ARRAYS AND STRINGS

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

UNIT-IV POINTERS & USER DEFINED DATA TYPES

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, dynamic memory management. User-defined data types-Structures and Unions, Bit-fields, self-referential structures.



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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, command line arguments, recursion. Scope and Lifetime of Variables, Basics of File Handling, random access to a file. 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. Schaums Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

REFERENCE BOOKS:

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

e- Resources and Digital Material:

1. https://onlinecourses.nptel.ac.in/noc20_cs06/preview

COURSE OUTCOMES:

1. Understand basics of computers, the concept of algorithm and algorithmic thinking.
2. Analyze a problem and develop an algorithm to solve it.
3. Implement various algorithms using the C programming Language
4. Understand more advanced features of C language.
5. Develop problem-solving skills and the ability to debug and optimize the code.



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L	T	P	C
0	0	2	1

(23A05102) IT WORKSHOP

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Skill Development

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.

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



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instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

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

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

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

LaTeX and WORD

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

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

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

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

EXCEL

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



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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:



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

COURSE OUTCOMES:

1. Perform Hardware troubleshooting.
2. Understand Hardware components and inter dependencies.
3. Safeguard computer systems from viruses/worms.
4. Document/ Presentation preparation.
5. Perform calculations using spreadsheets

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I B.Tech. I Sem.

L	T	P	C
0	0	2	1

(23A92102) ENGINEERING PHYSICS LAB

Course Category	Basic Science & Humanities (BS & H)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

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

List of Experiments:

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

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



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REFERENCE BOOKS:

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

e-Resources and Digital Material:

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

COURSE OUTCOMES:

1. Operate optical instruments like travelling microscope and spectrometer.
2. Estimate the wavelengths of different colors using diffraction grating.
3. Plot the intensity of the magnetic field of circular coil carrying current with distance.
4. Calculate the band gap of a given semiconductor.
5. Identify the type of semiconductor using Hall effect.



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I B.Tech. I Sem.

L	T	P	C
0	0	3	1.5

(23A04102) ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP

PART A: ELECTRICAL ENGINEERING LAB

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

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

Activities: (PART A & PART B)

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

List of experiments: (PART A)

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

Note: Minimum Six Experiments to be performed.



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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

COURSE OUTCOMES:

1. Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
2. Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
3. Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
4. Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.
5. Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.



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L	T	P	C
0	0	3	1.5

(23A04102) ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP

PART B: ELECTRONICS ENGINEERING LAB

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

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

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

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

REFERENCE BOOKS:

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

COURSE OUTCOMES:

1. Identify & testing of various electronic components
2. Understand the usage of electronic measuring instruments.
3. Plot and discuss the characteristics of various electron devices.
4. Explain the operation of a digital circuit.



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I B.Tech. I Sem.

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(23A05103) COMPUTER PROGRAMMING LAB

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

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

UNIT I

WEEK

1

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

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

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

WEEK 2

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

Suggested Experiments /Activities:

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

Lab 1: Converting algorithms/flow charts into C Source code. Developing the algorithms/flowcharts for the following sample programs

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

WEEK 3

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

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:



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Lab 3: Simple computational problems using arithmetic expressions.

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

UNIT II

WEEK 4

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

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:

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

i) Evaluate the following expressions.

- a) $A+B*C+(D*E) + F*G$
- b) $A/B*C-B+A*D/3$
- c) $A+++B---A$
- d) $J= (i++) + (++i)$

ii) Find the maximum of three numbers using conditional operator

iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5

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

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

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

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

WEEK 6

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

Suggested Experiments/Activities:



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Tutorial 6: Loops, while and for loops

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

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

UNIT

III

WEEK

7:

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

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7: 1D Array manipulation, linear search

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

WEEK 8:

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

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort

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

UNIT IV

WEEK9:

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



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

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

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

WEEK 10:

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

Suggested Experiments/Activities:

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

Lab10 : Bitfields, linked lists

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

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

UNIT V

WEEK

11:

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

Suggested Experiments/Activities:

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

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

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



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WEEK 12:

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

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

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

WEEK 13:

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

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

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

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

WEEK14:

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

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

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

TEXT BOOKS:

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



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2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

REFERENCE BOOKS:

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

COURSE OUTCOMES:

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



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I B.Tech. I Sem.

L	T	P	C
0	0	1	0.5

(23A99101) NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE

Course Category	Basic Science & Humanities (BS & H)
Course Enrichment Relevance	Environment & Sustainability

COURSE OBJECTIVES:

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

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 & CareActivities:

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.



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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.

COURSE OUTCOMES:

1. Understand the importance of discipline, character and service motto.
2. Solve some societal issues by applying acquired knowledge, facts, and techniques.
3. Explore human relationships by analyzing social problems.
4. Determine to extend their help for the fellow beings and downtrodden people.
5. Develop leadership skills and civic responsibilities.

Remarks:

General Guidelines:

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

Evaluation Guidelines:

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

I B.Tech II Semester Course Structure



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S.No	Subject Code	Course Category	Name of the Subject	Hours/Week			Credits	Marks		
				Lecture	Tutorial	Practical		Internal	External	Total
1	23A94101	BS&H	COMMUNICATIVE ENGLISH	2	0	0	2	30	70	100
2	23A93101	BS	CHEMISTRY	3	0	0	3	30	70	100
3	23A91202	BS&H	DIFFERENTIAL EQUATIONS & VECTOR CALCULUS	3	0	0	3	30	70	100
4	23A03102	ES	BASIC CIVIL AND MECHANICAL ENGINEERING	3	0	0	3	30	70	100
5	23A05204	PC	DATA STRUCTURES	3	0	0	3	30	70	100
6	23A94102	BS&H	COMMUNICATIVE ENGLISH LAB	0	0	2	1	30	70	100
7	23A93102	BS	CHEMISTRY LAB	0	0	2	1	30	70	100
8	23A03103	ES	ENGINEERING WORKSHOP	0	0	3	1.5	30	70	100
9	23A05205	PC	DATA STRUCTURES LAB	0	0	3	1.5	30	70	100
10	23A99102	BS&H	HEALTH AND WELLNESS YOGA AND SPORTS	0	0	1	0.5	0	100	100

I B.Tech II Semester Syllabus



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I B.Tech. II Sem.

L	T	P	C
2	0	0	2

(23A94101) COMMUNICATIVE ENGLISH

Course Category	Basic Science & Humanities (BS & H)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. 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

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, Extensive and Intensive reading.
- **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.



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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:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
- **Writing:** Summarizing, Note-making, paraphrasing
- **Grammar:** Verbs - tenses; subject-verb agreement; Compound words, Collocations
- **Vocabulary:** Compound words, Collocations

UNIT-IV

Lesson: INSPIRATION: The Toys of Peace by Saki

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

UNIT-V

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

- **Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
- **Speaking:** Formal oral presentations on topics from academic contexts
- **Reading:** Reading comprehension.
- **Writing:** Writing structured essays on specific topics, Writing review on the book reading.
- **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, 1 st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)



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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

e-Resources and Digital Material:

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>

COURSE OUTCOMES:

1. Understand the context, topic, and pieces of specific information from social or transactional dialogues.(L1)
2. Apply grammatical structures to formulate sentences and correct word forms.(L3)
3. Analyze discourse markers to speak clearly on a specific topic in informal discussions. (L4)
4. Evaluate reading/listening texts and to write summaries based on global comprehension of these texts. (L5)
5. Create a coherent paragraph, essay, and resume. (L6)

Remarks:

VOCABULARY

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

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I B.Tech. II Sem.

L	T	P	C
3	0	0	3

(23A93101) CHEMISTRY

Course Category	Basic Science (BS)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To familiarize engineering chemistry and its applications
2. To train the students on the principles and applications of electrochemistry and polymers
3. To introduce instrumental methods, and applications

UNIT-I STRUCTURE AND BONDING MODELS

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2 , particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2 and CO , etc. π -molecular orbitals of butadiene and benzene, calculation of bond order. Crystal field theory- splitting in octahedral and tetrahedral geometry. Properties of coordination compounds.

UNIT-II MODERN ENGINEERING MATERIALS

Conductors, Insulators-Basic Concept, Applications, Semiconductors - Introduction, basic concept, application Superconductors-Introduction basic concept, applications. Supercapacitors: Introduction, Basic Concept-Classification - Applications.. Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphines nanoparticles.

UNIT-III ELECTROCHEMISTRY AND APPLICATIONS

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations). Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples. Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries-working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell-working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).



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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, Dhanpat Rai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins Physical Chemistry, 10/e, Oxford University Press, 2010.
3. K N Jayaveera, G V Subba Reddy and C Rama Chandraiah, Engineering Chemistry 1/e Mc Graw Hill Education (India) Pvt Ltd, New Delhi 2016
4. B.K Sharma Engineering Chemistry, Krishna Prakashan, Meerut.

REFERENCE BOOKS:

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

e- Resources and Digital Material:

1. <https://www.digimat.in/nptel/courses/video/122106028/L01.html>
2. <https://www.digimat.in/nptel/courses/video/104101115/L01.html>

COURSE OUTCOMES:

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

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I B.Tech. II Sem.

L	T	P	C
3	0	0	3

(23A91202) DIFFERENTIAL EQUATIONS & VECTOR CALCULUS

Course Category	Basic Science & Humanities (BS & H)
Course Enrichment Relevance	Employability

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.

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: Orthogonal Trajectory, Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

UNIT-II LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER (CONSTANT COEFFICIENTS)

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Euler-Cauchy's Linear Equations. Applications to L-C-R Circuit problems and Simple Harmonic motion

UNIT-III PARTIAL DIFFERENTIAL EQUATIONS

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

UNIT-IV VECTOR DIFFERENTIATION

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

UNIT-V VECTOR INTEGRATION

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



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES:

1. Solve the differential equations related to various engineering fields.
2. Identify solution methods for partial differential equations that model physical processes.
3. Interpret the physical meaning of different operators such as gradient, curl and divergence
4. Estimate the work done against a field, circulation and flux using vector calculus.

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I B.Tech. II Sem.

L	T	P	C
3	0	0	3

**(23A03102) BASIC CIVIL AND MECHANICAL
ENGINEERING PART A: BASIC CIVIL ENGINEERING**

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. Get familiarized with the scope and importance of Civil and Mechanical Engineering in different sectors and industries.
2. Introduce the preliminary concepts of Building Planning, Building Construction, Materials and the related tests.
3. Acquire preliminary knowledge of surveying and understand the importance of the quality of the drinking water.

UNIT-I BASICS OF CIVIL ENGINEERING

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-Tests on these materials.

Factors to be considered in Building Planning- Nature of Buildings- Typical Layouts of a Residential Building- Industrial Building- Commercial Building like a Supermarket / Hotel / Theatre.

UNIT-II SURVEYING

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



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UNIT-III TRANSPORTATION ENGINEERING, WATER RESOURCES AND ENVIRONMENTAL ENGINEERING

Importance of Transportation in Nations economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences - Basic geometric design elements of a highway- Camber- Stopping Sight Distance- Super elevation-Introduction.

Water Resources and Environmental Engineering: Sources of water- Quality of water Specifications and Tests- Introduction to Hydrology- Hydrograph-Ground Water - Irrigation-Rain water Harvesting Rain water runoff- Water Storage Structures (Simple introduction to Dams and Reservoirs).

TEXT BOOKS:

1. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata Mcgraw Hill publications (India) Pvt. Ltd.
2. Basic Civil Engineering, S.S. Bhavikatti, New Age International Publishers.
3. Engineering Materials, Dr. S.C. Rangwala, Charotor Publishing House.

REFERENCE BOOKS:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi.

e-Resources and Digital Material:

1. <https://www.nptelvideos.com/course.php?id=285>
2. <https://nptel.ac.in/courses/105101087>

COURSE OUTCOMES:

1. Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.
2. Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.
3. Realize the importance of Transportation in nations economy and the engineering measures related to highways in terms of geometrics.



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3	0	0	3

(23A03102) BASIC CIVIL AND MECHANICAL ENGINEERING

PART B: BASIC MECHANICAL ENGINEERING

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. Explain different engineering materials and manufacturing processes.
2. Provide an overview of different thermal and mechanical systems, introduce 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 AND THERMAL ENGINEERING

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, MECHANICAL POWER TRANSMISSION & INTRODUCTION TO ROBOTICS

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

Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Cotter and Knuckle joints, 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. Ltd.



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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. Ltd

REFERENCE BOOKS:

1. Appu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.

e- Resources and Digital Material:

1. <https://www.nptelvideos.com/video.php?id=1191&c=7>
2. <https://nptel.ac.in/courses/112105249>

COURSE OUTCOMES:

1. Understand the importance of water resources and storage structures so that the Social responsibilities of water conservation will be appreciated.
2. Understand the different manufacturing processes and explain the basics of thermal engineering and its applications.
3. Describe the working of different mechanical power transmission systems and power plants, learn basics of robotics.



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I B.Tech. II Sem.

L	T	P	C
3	0	0	3

(23A05204) DATA STRUCTURES

Course Category	Professional Core course (PC)
Course Enrichment Relevance	Employability

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.

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

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



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UNIT-V

Trees: Introduction to Trees, binary tree and its properties, binary tree representation. Binary Search Tree – Insertion, Deletion & Traversal.
Height Balanced Search Tree: AVL Tree and operations.

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, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

REFERENCE BOOKS:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures” by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms” by Robert Sedgewick

COURSE OUTCOMES:

1. Understand basics of computers, the concept of algorithm and algorithmic thinking
2. Analyze a problem and develop an algorithm to solve it.
3. Develop programs using stacks to handle recursive algorithms, program and solve related problems.
4. Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs
5. Devise novel solutions to small scale programming and design hash-based solutions for specific problem

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I B.Tech. II Sem.

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0	0	2	1

(23A94102) COMMUNICATIVE ENGLISH LAB

Course Category	Basic Science & Humanities (BS & H)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

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

List of Topics:

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

Suggested Software:

- Walden Infotech
- Young India Films

REFERENCE BOOKS:

1. Meenakshi Raman, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.
2. Grant Taylor: English Conversation Practice, Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. T. Balasubramanyam, A Textbook of English Phonetics for Indian Students,(3rd Ed) Trinity Press.

e-Resources and Digital Material:

1. www.esl-lab.com
2. www.englishmedialab.com



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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

COURSE OUTCOMES:

1. Understand the different aspects of the English language proficiency with emphasis on LSRW skills.(L1)
2. Apply communication skills through various language learning activities.(L3)
3. Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.(L4)
4. Evaluate and exhibit professionalism in participating in debates and group discussions.(L5)
5. Create effective resonate and prepare themselves to face interviews in future.(L6)

Remarks:

Additional E-Resources:

1. <https://www.youtube.com/c/ArnelsEverydayEnglish/featured>
2. <https://www.youtube.com/c/engvidAdam/featured>
3. <https://www.youtube.com/c/EnglishClass101/featured>
4. <https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists>
5. 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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I B.Tech. II Sem.

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0	0	2	1

(23A93102) CHEMISTRY LAB

Course Category	Basic Science (BS)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Verify the fundamental concepts with experiments.

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.

TEXT BOOKS:

1. Skoog and West, Principles of Instrumental Analysis, Thomson, 2007.
2. J.M. Lehn, Supra Molecular Chemistry, VCH Publications

REFERENCE BOOKS:

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

e-Resources and Digital Material:

1. <https://www.labsafety.org/report-a-lab-accident>
2. <https://www.labsafety.org/product/lab-safety-rules>

COURSE OUTCOMES:

1. Determine the cell constant and conductance of solutions.
2. Prepare advanced polymer Bakelite materials.
3. Measure the strength of an acid present in secondary batteries.
4. Analyse the IR spectra of some organic compounds.
5. Calculate strength of acid in Pb-Acid battery.



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I B.Tech. II Sem.

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(23A03103) ENGINEERING WORKSHOP

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

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

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) Go down lighting d) Tube light
e) Three phase motor f) Soldering of wires

6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.

7. **Welding Shop:** Demonstration and practice on Arc Welding and Gas welding.

Preparation of Lap Joint and Butt joint.

8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES:

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



SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

I B.Tech. II Sem.

L	T	P	C
0	0	3	1.5

(23A05205) DATA STRUCTURES LAB

Course Category	Professional Core course (PC)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. 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.

List of Experiments:

Exercise 1: Array Manipulation

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

Exercise 2: Linked List Implementation

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

Exercise 3: Linked List Applications

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

Exercise 4: Double Linked List Implementation

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

Exercise 5: Stack Operations

- i) Implement a stack using arrays and linked lists.



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- ii) Write a program to evaluate a postfix expression using a stack.
- iii) Implement a program to check for balanced parentheses using a stack.

Exercise 6: Queue Operations

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

Exercise 7: Stack and Queue Applications

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

Exercise 8: Binary Search Tree

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

Exercise 9: Hashing

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures” by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms by Robert Sedgewick.

COURSE OUTCOMES:



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1. Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
2. Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
3. Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
4. 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.
5. Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

I B.Tech. II Sem.

L	T	P	C
0	0	1	0.5

(23A99102) HEALTH AND WELLNESS YOGA AND SPORTS

Course Category	Basic Science & Humanities (BS & H)
Course Enrichment Relevance	Environment & Sustainability

COURSE OBJECTIVES:

1. 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.

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 group

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



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COURSE OUTCOMES:

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

Remarks:

General Guidelines:

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

Evaluation Guidelines:

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

II B.Tech I Semester Course Structure

**SANTHIRAM ENGINEERING COLLEGE****(AUTONOMOUS)****DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING & DATA SCIENCE****Course Structure**

S.No	Subject Code	Course Category	Name of the Subject	Hours/Week			Credits	Marks		
				Lecture	Tutorial	Practical		Internal	External	Total
1	23A91305	BS	DISCRETE MATHEMATICS & GRAPH THEORY	3	0	0	3	30	70	100
2	23A99303	HS	UNIVERSAL HUMAN VALUES - UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT	2	1	0	3	30	70	100
3	23A32301	ES	INTRODUCTION TO DATA SCIENCE	3	0	0	3	30	70	100
4	23A05307	PC	ADVANCED DATA STRUCTURES & ALGORITHMS ANALYSIS	3	0	0	3	30	70	100
5	23A05308	PC	OBJECT ORIENTED PROGRAMMING THROUGH JAVA	3	0	0	3	30	70	100
6	23A32302	PC	DATA SCIENCE LAB	0	0	3	1.5	30	70	100
7	23A05310	PC	OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB	0	0	3	1.5	30	70	100
8	23A05306	SC	PYTHON PROGRAMMING	0	1	2	2	30	70	100
9	23A93303	MC(NC)	ENVIRONMENTAL SCIENCE	2	0	0	0	30	0	30
10	23A91304	BS	COMPETITIVE ABILITY COURSE - I	2	nil	nil	0	30	0	30

II B.Tech I Semester Syllabus

**SANTHIRAM ENGINEERING COLLEGE****(AUTONOMOUS)****DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE**

II B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A91305) DISCRETE MATHEMATICS & GRAPH THEORY

Course Category	Basic Science (BS)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Introduce the concepts of mathematical logic and gain knowledge in sets
2. Introduce the concepts of set theory, relations and functions
3. Solve problems using counting techniques and combinatorics
4. Introduce generating functions and recurrence relations
5. Use Graph Theory for solving real world problems

UNIT-I MATHEMATICAL LOGIC

Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus.

UNIT-II SET THEORY

The Principle of Inclusion- Exclusion, Pigeon hole principle and its application, Functions composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties. Algebraic structures: Algebraic systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, homomorphism, Isomorphism

UNIT-III ELEMENTARY COMBINATORICS

Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems.

UNIT-IV RECURRENCE RELATIONS

Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of Inhomogeneous, Recurrence Relations.

UNIT-V GRAPHS

Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four Color Problem

TEXT BOOKS:



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1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.
2. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited.

REFERENCE BOOKS:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited
2. Graph Theory with Applications to Engineering and Computer Science by Narsingh Deo.

e- Resources and Digital Material:

1. <http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf>

COURSE OUTCOMES:

1. Apply mathematical logic to solve problems L2,L3
2. Understand the concepts and perform the operations related to sets, relations and functions. Gain the conceptual background needed and identify structures of algebraic nature L3,L5
3. Apply basic counting techniques to solve combinatorial problems L3
4. Formulate problems and solve recurrence relations. L2,L3
5. Apply Graph Theory in solving computer science problems L3,L5

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II B.Tech. I Sem.

L	T	P	C
2	1	0	3

**(23A99303) UNIVERSAL HUMAN VALUES - UNDERSTANDING
HARMONY AND ETHICAL HUMAN CONDUCT**

Course Category	Humanities & Social Sciences (HS)
Course Enrichment Relevance	Human Values

COURSE OBJECTIVES:

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

UNIT-I INTRODUCTION TO VALUE EDUCATION

Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself Lecture

3: self-exploration as the Process for Value Education

Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 Exploring Human Consciousness

Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations Tutorial

3: Practice Session PS3 Exploring Natural Acceptance

UNIT-II HARMONY IN THE HUMAN BEING

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

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

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

Lecture 9: The body as an Instrument of the self Lecture

10: Understanding Harmony in the self

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

11: Harmony of the self with the body

Lecture 12: Programme to ensure self-regulation and Health

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



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UNIT-III HARMONY IN THE FAMILY AND SOCIETY

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

14: 'Trust' – the Foundational Value in Relationship

Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust

Lecture 15: 'Respect' – as the Right Evaluation

Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect Lecture

16: Other Feelings, Justice in Human-to-Human Relationship Lecture 17:

Understanding Harmony in the Society

Lecture 18: Vision for the Universal Human Order

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

UNIT-IV HARMONY IN THE NATURE/EXISTENCE

Lecture 19: Understanding Harmony in the Nature

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

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

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

22: The Holistic Perception of Harmony in Existence

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

UNIT-V IMPLICATIONS OF THE HOLISTIC UNDERSTANDING

Lecture 23: Natural Acceptance of Human Values

Lecture 24: Definitiveness of (Ethical) Human Conduct

Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct Lecture

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

Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education

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

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

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

TEXT BOOKS:

1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

REFERENCE BOOKS:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan,
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
3. Amarkantak, 1999. 3. The Story of Stuff (Book).



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4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa

e- Resources and Digital Material:

1. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf>
2. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf>
3. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf>
4. <https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf>
5. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf>

COURSE OUTCOMES:

1. Define the terms like Natural Acceptance, Happiness and Prosperity
2. Identify one's self, and one's surroundings (family, society nature)
3. Apply what they have learnt to their own self in different day-to-day settings in real life
4. Relate human values with human relationship and human society
5. Justify the need for universal human values and harmonious existence and develop as socially and ecologically responsible engineers (L5,L6)



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II B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A32301) INTRODUCTION TO DATA SCIENCE

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Professional Ethics

COURSE OBJECTIVES:

1. Knowledge and expertise to become a data scientist.
2. Essential concepts of statistics and machine learning that are vital for data science
3. Significance of exploratory data analysis (EDA) in data science.
4. Critically evaluate data visualizations presented on the dashboards
5. Suitability and limitations of tools and techniques related to data science process

UNIT-I DATA SCIENCE PROCESS

Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science **Data Science process:** Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

UNIT-II HANDLING LARGE DATA

Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning **Handling large data:** problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

UNIT-III NOSQL MOVEMENT FOR HANDLING BIGDATA

Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling

UNIT-IV TOOLS AND APPLICATIONS OF DATA SCIENCE

:

Introducing **Neo4j** for dealing with graph databases, graph query language **Cypher**, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts



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UNIT-V DATA VISUALIZATION AND PROTOTYPE APPLICATION DEVELOPMENT

Data Visualization options, Crossfilter, the JavaScript MapReduce library, Creating an interactive dashboard with dc.js, Dashboard development tools. Applying the Data Science process for real world problem solving scenarios as a detailed case study.

TEXT BOOKS:

1. Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, “Introducing to Data Science using Python tools”, Manning Publications Co, Dreamtech press, 2016
2. Prateek Gupta, “Data Science with Jupyter” BPB publishers, 2019 for basics

REFERENCE BOOKS:

1. Joel Grus, ‘Data Science From Scratch’, OReilly, 2019
2. Doing Data Science: Straight Talk From The Frontline, 1 st Edition, Cathy O’Neil and Rachel Schutt, O’Reilly, 2013

e- Resources and Digital Material:

COURSE OUTCOMES:

1. Understand significance of Data Science.
2. Apply machine learning in Data Science.
3. Analyze large data.
4. Perform the text mining and text analytics.
5. Creating an interactive dashboard.

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II B.Tech. I Sem.

L	T	P	C
3	0	0	3

**(23A05307) ADVANCED DATA STRUCTURES & ALGORITHMS
ANALYSIS**

Course Category	Professional Core course (PC)
Course Enrichment Relevance	Professional Ethics

COURSE OBJECTIVES:

1. Course Objectives: The main objectives of the course is to . provide knowledge on advance data structures frequently used in Computer Science domain
2. Develop skills in algorithm design techniques popularly used
3. Understand the use of various data structures in the algorithm design

UNIT-I INTRODUCTION TO ALGORITHM ANALYSIS, AVL TREES , B-TREES

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

AVL Trees - Creation, Insertion, Deletion operations and Application B-Trees - Creation, Insertion, Deletion operations and Applications

UNIT-II HEAP TREES (PRIORITY QUEUES),GRAPHS ,DIVIDE AND CONQUER

Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications

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

UNIT-III GREEDY METHOD, DYNAMIC PROGRAMMING

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

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

UNIT-IV BACKTRACKING, BRANCH AND BOUND

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

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



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UNIT-V NP HARD AND NP COMPLETE PROBLEMS, NP HARD SCHEDULING PROBLEMS

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

NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision

Problem (CNDP), Traveling Salesperson Decision Problem (TSP)

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

e- Resources and Digital Material:

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

COURSE OUTCOMES:

1. students will be able to. Illustrate the working of the advanced tree data structures and their applications (L2)
2. Understand the Graph data structure, traversals and apply them in various contexts. (L2)
3. Use various data structures in the design of algorithms (L3)
4. Recommend appropriate data structures based on the problem being solved (L5)
5. Analyze algorithms with respect to space and time complexities (L4)



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II B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A05308) OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Course Category	Professional Core course (PC)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

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

UNIT-I OBJECT ORIENTED PROGRAMMING

Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style. **Data Types**, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, **Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators. **Control Statements:** Introduction, if Expression, Nested if Expressions, if-else Expressions, Ternary Operator, Switch Statement, Iteration Statements, while Expression, do-while Loop, for Loop, Nested for Loop, For-Each for Loop, Break Statement, Continue Statement

UNIT-II CLASSES AND OBJECTS

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

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



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

UNIT-III ARRAYS

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

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class □ Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance. Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT-IV PACKAGES AND JAVA LIBRARY

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

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

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

UNIT-V STRING HANDLING IN JAVA

Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

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

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

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

TEXT BOOKS:

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



SANTHIRAM ENGINEERING COLLEGE

(AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

REFERENCE BOOKS:

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

e- Resources and Digital Material:

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. .
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01288046454761881634_7_shared/overview

COURSE OUTCOMES:

1. Analyze problems, design solutions using OOP principles, and implement them efficiently in Java. (L4)
2. Design and implement classes to model real-world entities, with a focus on attributes, behaviors, and relationships between objects (L4)
3. Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch. (L3)
4. Apply Competence in handling exceptions and errors to write robust and fault-tolerant code. (L3)
5. Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX. (L3) and Choose appropriate data structure of Java to solve a problem (L6)



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II B.Tech. I Sem.

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(23A32302) DATA SCIENCE LAB

Course Category	Professional Core course (PC)
Course Enrichment Relevance	Professional Ethics

COURSE OBJECTIVES:

1. The main objective of the course is to inculcate the basic understanding of Data Science and its Practical implementation using Python.

1. Creating a NumPy Array

- a. Basic ndarray
- b. Array of zeros
- c. Array of ones
- d. Random numbers in ndarray
- e. An array of your choice
- f. Imatrix in NumPy
- g. Evenly spaced ndarray

2. The Shape and Reshaping of NumPy Array

- a. Dimensions of NumPy array
- b. Shape of NumPy array
- c. Size of NumPy array
- d. Reshaping a NumPy array
- e. Flattening a NumPy array
- f. Transpose of a NumPy array

3. Expanding and Squeezing a NumPy Array

- a. Expanding a NumPy array



- b. Squeezing a NumPy array
- c. Sorting in NumPy Arrays
- 4. Indexing and Slicing of NumPy Array
 - a. Slicing 1-D NumPy arrays
 - b. Slicing 2-D NumPy arrays
 - c. Slicing 3-D NumPy arrays
 - d. Negative slicing of NumPy arrays
- 5. Stacking and Concatenating Numpy Arrays
 - a. Stacking ndarrays
 - b. Concatenating ndarrays
 - c. Broadcasting in Numpy Arrays
- 6. Perform following operations using pandas
 - a. Creating dataframe
 - b. concat()
 - c. Setting conditions
 - d. Adding a new column
- 7. Perform following operations using pandas
 - a. Filling NaN with string
 - b. Sorting based on column values
 - c. groupby()
- 8. Read the following file formats using pandas
 - a. Text files
 - b. CSV files
 - c. Excel files



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d. JSON files

9. Read the following file formats

a. Pickle files

b. Image files using PIL

c. Multiple files using Glob

d. Importing data from database

10. Demonstrate web scraping using python

11. Perform following preprocessing techniques on loan prediction dataset

a. Feature Scaling

b. Feature Standardization

c. Label Encoding

d. One Hot Encoding

12. Perform following visualizations using matplotlib

a. Bar Graph

b. Pie Chart

c. Box Plot

d. Histogram

e. Line Chart and Subplots

f. Scatter Plot

13. Getting started with NLTK, install NLTK using PIP

14. Python program to implement with Python Sci Kit-Learn & NLTK

15. Python program to implement with Python NLTK/Spicy/Py NLPI.

REFERENCE BOOKS:



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1. <https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-datascience-beginners/>
2. <https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutesguide-to-key-concepts/>
<https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formatspython/>
3. <https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessingpython-scikit-learn/>
4. <https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-datavisualization-exploration-python/6>.
5. <https://www.nltk.org/book/ch01.html>

e- Resources and Digital Material:

1. <https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-datascience-beginners>.
<https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-datavisualization-exploration-python/>
2. <https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutesguide-to-key-concepts/>
3. <https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formatspython/>
4. <https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessingpython-scikit-learn/>
5. <https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-datavisualization-exploration-python/>
6. <https://www.nltk.org/book/ch01.html>

COURSE OUTCOMES:

- a) Apply principles and techniques for optimizing the performance of Python applications (L3)
- b) Implement parallel computing applications using Python (L5)
- c) Develop GP Unaccelerated Python applications (L6)



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II B.Tech. I Sem.

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(23A05310) OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

Course Category	Professional Core course (PC)
Course Enrichment Relevance	Professional Ethics

COURSE OBJECTIVES:

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

Exercise 1:

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

Exercise - 2

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

Exercise - 3

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



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- c) Write a JAVA program to implement constructor.
- d) Write a JAVA program to implement constructor overloading.

Exercise - 4

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

Exercise - 5

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

Exercise - 6

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

Exercise - 7

- a) Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds, (Repeat the same by implementing Runnable)
- b) Write a program illustrating **is Alive** and **join ()**



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c) Write a Program illustrating Daemon Threads.

d) Write a JAVA program Producer Consumer Problem

Exercise - 8

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

Exercise - 9

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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e- Resources and Digital Material:

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

COURSE OUTCOMES:



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1. Course Outcomes: After completion of the course, students will be able to Demonstrate a solid understanding of Java syntax, including data types, control structures, methods, classes, objects, inheritance, polymorphism, and exception handling. (L2)
2. Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively. (L3)
3. Familiar with commonly used Java libraries and APIs, including the Collections Framework, Java I/O, JDBC, and other utility classes. (L2)
4. Develop problem-solving skills and algorithmic thinking, applying OOP concepts to design efficient solutions to various programming challenges. (L3)
5. Proficiently construct graphical user interface (GUI) applications using JavaFX (L4)
6. Develop new programs for solving typical computer science problems (L6)



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II B.Tech. I Sem.

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(23A05306) PYTHON PROGRAMMING

Course Category	Skill Oriented Course (SC)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

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

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

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

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

Sample Experiments:

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

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



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Arguments.

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

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

Sample Experiments:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to perform the given operations on a list: i. Addition ii. Insertion iii. slicing
12. Write a program to perform any 5 built-in functions by taking any list

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

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

Sample Experiments:

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

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



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

18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.

19. Python program to print each line of a file in reverse order.

20. Python program to compute the number of characters, words and lines in a file.

21. Write a program to create, display, append, insert and reverse the order of the items in the array.

22. Write a program to add, transpose and multiply two matrices.

23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V: Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not.

25. Python Program to demonstrate NumPy arrays creation using array () function.

26. Python program to demonstrate use of ndim, shape, size, dtype.

27. Python program to demonstrate basic slicing, integer and Boolean indexing.

28. Python program to find min, max, sum, cumulative sum of array

29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:

a) Apply head () function to the pandas data frame

b) Perform various data selection operations on Data Frame

30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

REFERENCE BOOKS:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2ndEdition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson

e- Resources and Digital Material:

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

COURSE OUTCOMES:

1. Classify data structures of Python (L4)
2. Apply Python programming concepts to solve a variety of computational problems (L3)
3. Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs (L3)
4. Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas (L2)
5. Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries (L3)
6. Propose new solutions to computational problems (L6)



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II B.Tech. I Sem.

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(23A93303) ENVIRONMENTAL SCIENCE

Course Category	Mandatory Course (Non-credit)
Course Enrichment Relevance	Environment & Sustainability

COURSE OBJECTIVES:

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

UNIT-I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Multidisciplinary Nature Of Environmental Studies: - Definition, Scope and Importance - Need for Public Awareness.

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

UNIT-II ECOSYSTEMS, BIODIVERSITY AND ITS CONSERVATION

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

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

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



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UNIT-III ENVIRONMENTAL POLLUTION, SOLID WASTE MANAGEMENT

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

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

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

floods, earthquake, cyclone and landslides.

UNIT-IV SOCIAL ISSUES AND THE ENVIRONMENT

Social Issues and the Environment: From Unsustainable to Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, watershed management -Resettlement and rehabilitation of people; its problems and concerns. Case studies - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies - Wasteland reclamation. - Consumerism and waste products. - Environment Protection Act. - Air (Prevention and Control of Pollution) Act. - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act-Issues involved in enforcement of environmental legislation - Public awareness.

UNIT-V HUMAN POPULATION AND THE ENVIRONMENT, FIELD WORK

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Deeksha Dave and E.Sai Baba Reddy, 'Textbook of Environmental Science', Cengage Publications.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

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

e- Resources and Digital Material:

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

COURSE OUTCOMES:

1. Grasp the multidisciplinary nature of environment studies and various renewable resources.
2. Understand the bio geo chemical cycles and ecological pyramids.
3. Can able to know the resources and their pollution methods
4. Can understand the social issues.
5. Can understand the women and child development and environmental technology.

II B.Tech II Semester Course Structure



II B.Tech. II Sem. - Course Structure

S.No	Subject Code	Course Category	Name of the Subject	Hours/Week			Credits	Marks		
				Lecture	Tutorial	Practical		Internal	External	Total
1	23A91408	ES	OPTIMIZATION TECHNIQUES	2	0	0	2	30	70	100
2	23A91409	BS	STATISTICAL METHODS FOR DATA SCIENCE	3	0	0	3	30	70	100
3	23A32403	PC	DATA ENGINEERING	3	0	0	3	30	70	100
4	23A05412	CC	DATABASE MANAGEMENT SYSTEMS	3	0	0	3	30	70	100
5	23A04310	ES	DIGITAL LOGIC & COMPUTER ORGANIZATION	3	0	0	3	30	70	100
6	23A32404	PC	DATA ENGINEERING LAB	0	0	2	1.5	30	70	100
7	23A05415	CC	DATABASE MANAGEMENT SYSTEMS LAB	0	0	2	1.5	30	70	100
8	23A32405	SC	EXPLORATORY DATA ANALYSIS WITH PYTHON	0	1	2	2	30	70	100
9	23A99405	MC(C)	DESIGN THINKING AND INNOVATION	1	0	2	2	30	70	100
10	23A99406	MC(NC)	MINOR PROJECT	0	0	3	0	50	0	50

II B.Tech II Semester Syllabus

**SANTHIRAM ENGINEERING COLLEGE****(AUTONOMOUS)****DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE**

II B.Tech. II Sem.

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2	0	0	2

(23A91408) OPTIMIZATION TECHNIQUES

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To provide the basic knowledge about Optimization, importance, application areas of in the industry, Linear Programming
2. To impart different optimization models under typical situations in the business organization like transportation, assignment.
3. To understand the process of sequencing in a typical industry.
4. To describe different game strategies under cut-throat competitive business environment
5. To develop networks of activities of projects and to find out optimal modes of completing projects using network modelling evaluation techniques.

UNIT-I INTRODUCTION

Meaning, Nature, Scope & Significance of Optimization - Typical applications. The Linear Programming Problem - Introduction, Formulation of Linear Programming problem, Limitations of L.P.P, Graphical method, Simplex method: Maximization and Minimization model(exclude Duality problems), Big-M method and Two Phase method.

UNIT-II TRANSPORTATION PROBLEM

Introduction, Transportation Model, Finding initial basic feasible solutions, Moving towards optimality, Unbalanced Transportation problems, Transportation problems with maximization, Degeneracy.

Assignment Problem Introduction, Mathematical formulation of the problem, Solution of an Assignment problem, Hungarian Algorithm, Multiple Solution, Unbalanced Assignment problems, Maximization in Assignment Model.

UNIT-III SEQUENCING

Job sequencing, Johnsons Algorithm for n Jobs and Two machines, n Jobs and Three Machines, n jobs through m machines, Two jobs and m Machines Problems.

UNIT-IV GAME THEORY

Concepts, Definitions and Terminology, Two Person Zero Sum Games, Pure Strategy Games (with Saddle Point), Principle of Dominance, Mixed Strategy Games (Game without Saddle Point), Significance of Game Theory in Managerial Application.



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UNIT-V PROJECT MANAGEMENT

Network Analysis -Definition - objectives - Rules for constructing network diagram - Determining Critical Path-Earliest & Latest Times -Floats - Application of CPM and PERT techniques in Project Planning and Control - PERT Vs CPM. (exclude Project Crashing).

TEXT BOOKS:

1. Operations Research / R.Pannarselvam, PHI Publications.
2. Operations Research / S.D.Sharma-Kedarnath
3. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/Pearson Education
4. Engineering Optimization: Theory and practice / S.S.Rao, New Age International (P) Limited

REFERENCE BOOKS:

1. Quantitative Techniques in Management / ND Vohra, Tata McGraw Hill, 4th Edition, 2011
2. Introduction to O.R/Hiller & Libermann (TMH).
3. Operations Research: Methods & Problems / Maurice Saseini, Arthur Yassan & Lawrence Friedman. Pearson
4. Quantitative Analysis For Management/ Barry Render, Ralph M. Stair, Jr and Michael E. Hanna/
5. Operations Research / Wagner/ PHI Publications.

e-Resources and Digital Material:

1. https://onlinecourses.swayam2.ac.in/cec20_ma10/preview
2. https://onlinecourses.nptel.ac.in/noc20_ma23/preview
3. https://onlinecourses.nptel.ac.in/noc19_ma29/preview

COURSE OUTCOMES:

1. Understanding Optimization and Formulation of Linear Programming Models (L1)
2. Formulate and Solve Transportation & Assignment Models (L3)
3. Sequencing of operations and optimizing (L2)
4. Discuss the game theory and strategies (L2)
5. Developing networks of activities and finding optimal mode of projects evaluation.(L3)

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II B.Tech. II Sem.

L	T	P	C
3	0	0	3

(23A91409) STATISTICAL METHODS FOR DATA SCIENCE

Course Category	Basic Science (BS)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand random variables, probability distributions, mathematical expectation, population and sample concepts, and the properties of good estimators such as consistency, unbiasedness, and sufficiency.
2. To understand and apply various methods of point estimation, including Maximum Likelihood, Method of Moments, Least Squares, Minimum Chi-Square, Modified Minimum Chi-Square, and Asymptotic Maximum Likelihood Estimation.
3. To construct and interpret confidence intervals for population proportions, means, variances, differences between means, and ratios of two normal populations.
4. To understand and apply hypothesis testing concepts, types of errors, power of tests, Neyman–Pearson lemma, uniformly most powerful tests, and likelihood ratio tests.
5. To apply t-tests, F-tests, and Chi-square tests for analyzing population means, equality of means and variances, goodness of fit, independence of attributes, and variance of a normal population.

UNIT-I BASIC CONCEPTS

Random variables (discrete and continuous), probability density functions, properties, mathematical expectation. Probability distributions: Binomial, Poisson and Normal-their properties. Population, sample, parameter and statistic; characteristics of a good estimator; Consistency - Invariance property of Consistent estimator, Sufficient condition for consistency; Unbiasedness; Sufficiency.

UNIT-II POINT ESTIMATION

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

UNIT-III INTERVAL ESTIMATION

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

UNIT-IV TESTING OF HYPOTHESES

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

UNIT-V SMALL SAMPLE TESTS

Student's t-test, test for a population mean, equality of two population means, paired t-test, F-test for equality of two population variances, Chi-square test for goodness of fit and test for independence of attributes, -X² test for testing variance of a normal distribution.



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TEXT BOOKS:

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

REFERENCE BOOKS:

1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
2. S. Ross, a First Course in Probability, Pearson Education India, 2002.
3. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.
4. Robert V Hogg, Elliot A Tannis and Dale L. Zimmerman, Probability and Statistical Inference, 9th edition, Pearson publishers, 2013.

e- Resources and Digital Material:

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

COURSE OUTCOMES:

1. Understand the basic concepts of Statistics. (L2, L3)
2. Analyze the data and draw conclusion about collection of data under study using Point estimation (L3, L5)
3. Analyze data and draw conclusion about collection of data under study using Interval estimation. (L3)
4. Analyze to test various hypotheses included in theory and types of errors for large samples. (L2, L3)
5. Apply the different testing tools like t-test, F-test, chi-square test to analyze the relevant real life problems. (L3, L5)



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(23A32403) DATA ENGINEERING

Course Category	Professional Core course (PC)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Explain basic concepts of Data Engineering
2. Discuss about Data Engineering Life Cycle
3. How to design Good Data Architecture

UNIT-I INTRODUCTION TO DATA ENGINEERING

Definition, Data Engineering Life Cycle, Evolution of Data Engineer, Data Engineering Versus Data Science, Data Engineering Skills and Activities, Data Maturity, Data Maturity Model, Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities, Data Engineers and Other Technical Roles.

UNIT-II DATA ENGINEERING LIFE CYCLE

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

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

UNIT-III DESIGNING GOOD DATA ARCHITECTURE

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

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

UNIT-IV STORAGE

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

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



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UNIT-V QUERIES, MODELING AND TRANSFORMATION

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES:

1. Understand the basics of Data Engineering
2. Understand Data Engineering Life cycle
3. Evaluate and select appropriate technologies and frameworks for specific data engineering tasks. (L5)
4. Implement data quality checks and governance processes to ensure data reliability and compliance. (L5)
5. Apply appropriate data modeling techniques for different types of data. (L3)



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3	0	0	3

(23A05412) DATABASE MANAGEMENT SYSTEMS

Course Category	Core Course (CC)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

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

UNIT-I INTRODUCTION

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

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

UNIT-II RELATIONAL MODEL

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

UNIT-III SQL

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



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UNIT-IV SCHEMA REFINEMENT (NORMALIZATION)

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

UNIT-V TRANSACTION CONCEPT

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

e-Resources and Digital Material:

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

COURSE OUTCOMES:

1. Understand the basic concepts of database management systems (L2)
2. Analyze a given database application scenario to use ER model for conceptual design of the database (L4)
3. Utilize SQL proficiently to address diverse query challenges (L3).
4. Employ normalization methods to enhance database structure (L3)
5. Assess and implement transaction processing, concurrency control and database recovery protocols in databases. (L4)



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3	0	0	3

(23A04310) DIGITAL LOGIC & COMPUTER ORGANIZATION

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

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

UNIT-I DATA REPRESENTATION

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

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

UNIT-II DIGITAL LOGIC CIRCUITS-II

Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters

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

UNIT-III COMPUTER ARITHMETIC

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

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

UNIT-IV THE MEMORY ORGANIZATION

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

UNIT-V INPUT /OUTPUT ORGANIZATION

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



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TEXT BOOKS:

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

REFERENCE BOOKS:

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

e-Resources and Digital Material:

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

COURSE OUTCOMES:

1. Design Combinational Circuits with the help of logic gates (L2).
2. Design sequential Circuits and demonstrate an understanding of computer functional units. (L2, L6)
3. Analyze the design and operation of processors, including instruction execution, pipelining, and control unit mechanisms, to comprehend their role in computer systems. (L3)
4. Describe memory hierarchy concepts, including cache memory, virtual memory, and secondary storage, and evaluate their impact on system performance and scalability. (L3)
5. Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices, including interrupts, DMA, and I/O mapping techniques. (L3)



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0	0	2	1.5

(23A32404) DATA ENGINEERING LAB

Course Category	Professional Core course (PC)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. The main objective of this course is to teach how build data engineering infrastructure and data pipelines.
1. Installing and configuring Apache NiFi, Apache Airflow
2. Installing and configuring Elasticsearch, Kibana, PostgreSQL, pgAdmin 4
3. Reading and Writing files
 - a. Reading and writing files in Python
 - b. Processing files in Airflow
 - c. NiFi processors for handling files
 - d. Reading and writing data to databases in Python
 - e. Databases in Airflow
 - f. Database processors in NiFi
4. Working with Databases
 - a. Inserting and extracting relational data in Python
 - b. Inserting and extracting NoSQL database data in Python
 - c. Building database pipelines in Airflow
 - d. Building database pipelines in NiFi
5. Cleaning, Transforming and Enriching Data
 - a. Performing exploratory data analysis in Python



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- b. Handling common data issues using pandas
- c. Cleaning data using Airflow
- 6. Building the Data Pipeline
- 7. Building a Kibana Dash Board
- 8. Perform the following operations
 - a. Staging and validating data
 - b. Building idempotent data pipelines
 - c. Building atomic data pipelines
- 9. Version Control with the NiFi Registry
 - a. Installing and configuring the NiFi Registry
 - b. Using the Registry in NiFi
 - c. Versioning your data pipelines
 - d. Using git-persistence with the NiFi Registry
- 10. Monitoring Data Pipelines
 - a. Monitoring NiFi in the GUI
 - b. Monitoring NiFi using processors
 - c. Monitoring NiFi with Python and the REST API
- 11. Deploying Data Pipelines
 - a. Finalizing your data pipelines for production
 - b. Using the NiFi variable registry
 - c. Deploying your data pipelines
- 12. Building a Production Data Pipeline



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- a. Creating a test and production environment
- b. Building a production data pipeline
- c. Deploying a data pipeline in production

REFERENCE BOOKS:

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

COURSE OUTCOMES:

1. Analyze and troubleshoot data engineering problems using systematic approaches. (L5)
2. Work effectively in teams to solve data engineering challenges and deliver projects on time. (L6)

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II B.Tech. II Sem.

L	T	P	C
0	0	2	1.5

(23A05415) DATABASE MANAGEMENT SYSTEMS LAB

Course Category	Core Course (CC)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

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

Experiments covering the topics:

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

Sample Experiments:

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5. i. Create a simple PL/SQL program which includes declaration



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section, executable section and exception -Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)

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

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

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

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

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

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

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

12. Create a table and perform the search operation on table using indexing and non-indexing techniques.

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

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

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

TEXT BOOKS:

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



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COURSE OUTCOMES:

1. Utilizing Data Definition Language (DDL), Data Manipulation Language (DML), and Data Control Language (DCL) commands effectively within a database environment (L3)
2. Constructing and execute queries to manipulate and retrieve data from databases. (L3)
3. Develop application programs using PL/SQL. (L3)
4. Analyze requirements and design custom Procedures, Functions, Cursors, and Triggers, leveraging their capabilities to automate tasks and optimize database functionality (L4)
5. Establish database connectivity through JDBC (Java Database Connectivity) (L3)



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L	T	P	C
0	1	2	2

(23A32405) EXPLORATORY DATA ANALYSIS WITH PYTHON

Course Category	Skill Oriented Course (SC)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

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

UNIT-I

Exploratory Data Analysis Fundamentals: Understanding data science, The significance of EDA, Steps in EDA, Making sense of data, Numerical data, Categorical data, Measurement scales, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA, Getting started with EDA.

Sample Experiments:

- 1.a) Download Dataset from Kaggle using the following link:
<https://www.kaggle.com/datasets/sukhmanibedi/cars4u>
- b) Install python libraries required for Exploratory Data Analysis (numpy, pandas, matplotlib, seaborn)
2. Perform Numpy Array basic operations and Explore Numpy Built-in functions.
3. Loading Dataset into pandas dataframe
4. Selecting rows and columns in the dataframe

UNIT-II

Visual Aids for EDA: Technical requirements, Line chart, Bar charts, Scatter plot using seaborn, Polar chart, Histogram, Choosing the best chart

Case Study: EDA with Personal Email, Technical requirements, Loading the dataset, Data transformation, Data cleansing, Applying descriptive statistics, Data refactoring, Data analysis.

Sample Experiments:

5. Apply different visualization techniques using sample dataset



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- a) Line Chart b) Bar Chart c) Scatter Plots d) Bubble Plot
- 6. Generate Scatter Plot using seaborn library for iris dataset
- 7. Apply following visualization Techniques for a sample dataset
 - a) Area Plot b) Stacked Plot c) Pie chart d) Table Chart
- 8. Generate the following charts for a dataset.
 - a) Polar Chart b) Histogram c) Lollipop chart
- 9. Case Study: Perform Exploratory Data Analysis with Personal Email Data

UNIT-III

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

Sample Experiments:

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



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- c) Permutation and Random Sampling
- d) Dummy variables

UNIT-IV

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

Sample Experiments:

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



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UNIT-V

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

Case Study: EDA on Wine Quality Data Analysis

Sample Experiments:

20. Perform hypothesis testing using stats models library
 - a) Z-Test b) T-Test
21. Develop model and Perform Model Evaluation using different metrics such as prediction score, R2 Score, MAE Score, MSE Score.
22. Case Study: Perform Exploratory Data Analysis with Wine Quality Dataset

TEXT BOOKS:

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: Become an expert in exploratory data analysis using R packages, 1st Edition, Packt Publishing, 2019

e-Resources and Digital Material:

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

COURSE OUTCOMES:

1. Understand the fundamentals of exploratory data analysis. (L2)
2. Implement the data visualization using Matplotlib. (L5)
3. Perform univariate data exploration and analysis.
4. Apply bivariate data exploration and analysis. (L3)
5. Use Data exploration and visualization techniques for multivariate and time series data (L3)



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

II B.Tech. II Sem.

L	T	P	C
1	0	2	2

(23A99405) DESIGN THINKING AND INNOVATION

Course Category	Mandatory Course (credit)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

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

UNIT-I INTRODUCTION TO DESIGN THINKING

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

UNIT-II DESIGN THINKING PROCESS

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

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

UNIT-III INNOVATION

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

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

UNIT-IV PRODUCT DESIGN

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

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



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UNIT-V DESIGN THINKING IN BUSINESS PROCESSES

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

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

e- Resources and Digital Material:

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

COURSE OUTCOMES:

1. Define the concepts related to design thinking. (L1, L2)
2. Explain the fundamentals of Design Thinking and innovation (L1, L2)
3. Apply the design thinking techniques for solving problems in various sectors. (L3)
4. Analyse to work in a multidisciplinary environment (L4)
5. Evaluate the value of creativity (L5)

III B.Tech I Semester Course Structure



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

III B.Tech. I Sem. - Course Structure

S.No	Subject Code	Course Category	Name of the Subject	Hours/Week			Credits	Marks		
				Lecture	Tutorial	Practical		Internal	External	Total
1	23A33402	ES	MACHINE LEARNING	3	0	0	3	30	70	100
2	23A05411	ES	OPERATING SYSTEMS	3	0	0	3	30	70	100
3	23A05413	CC	SOFTWARE ENGINEERING	3	0	0	3	30	70	100
4	23A05517	PC	INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS	3	0	0	3	30	70	100
5	23A05520	PE	PE-I:AUTOMATA THEORY AND COMPILER DESIGN	3	0	0	3	30	70	100
6	23A05521	PE	PE-I:OBJECT ORIENTED ANALYSIS AND DESIGN	3	0	0	3	30	70	100
7	23A05522	PE	PE-I:SOFT COMPUTING	3	0	0	3	30	70	100
8	23A32506	PE	PE-I:INTERNET OF THINGS	3	0	0	3	30	70	100
9	23A01501	OE	OE-I:GREEN BUILDINGS	3	0	0	3	30	70	100
10	23A01502	OE	OE-I:CONSTRUCTION TECHNOLOGY AND MANAGEMENT	3	0	0	3	30	70	100
11	23A02503	OE	OE-I:ELECTRICAL SAFETY PRACTICES AND STANDARDS	3	0	0	3	30	70	100
12	23A03504	OE	OE-I:SUSTAINABLE ENERGY TECHNOLOGIES	3	0	0	3	30	70	100
13	23A04527	OE	OE-I:ELECTRONIC CIRCUITS	3	0	0	3	30	70	100
14	23A91513	OE	OE-I:MATHEMATICS FOR MACHINE LEARNING AND AI	3	0	0	3	30	70	100
15	23A92503	OE	OE-I:MATERIALS CHARACTERIZATION TECHNIQUES	3	0	0	3	30	70	100
16	23A93504	OE	OE-I:CHEMISTRY OF ENERGY SYSTEMS	3	0	0	3	30	70	100
17	23A94505	OE	OE-I:ENGLISH FOR COMPETITIVE EXAMINATIONS	3	0	0	3	30	70	100
18	23A95507	OE	OE-I:ENTREPRENEURSHIP AND NEW VENTURE CREATION	3	0	0	3	30	70	100
19	23A33510	ES	MACHINE LEARNING LAB	0	0	3	1.5	30	70	100
20	23A33511	ES	OPERATING SYSTEMS LAB	0	0	3	1.5	30	70	100
21	23A05416	SC	FULL STACK DEVELOPMENT-I (SKILL ENHANCEMENT COURSE)	0	1	2	2	30	70	100
22	23A04526	SC	TINKERING LAB	0	0	2	1	30	70	100

III B.Tech I Semester Syllabus



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

III B.Tech. I Sem.

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3	0	0	3

(23A33402) MACHINE LEARNING

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

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

UNIT-I INTRODUCTION TO MACHINE LEARNING

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

UNIT-II NEAREST NEIGHBOR-BASED MODELS

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

UNIT-III MODELS BASED ON DECISION TREES

Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression. The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)

UNIT-IV LINEAR DISCRIMINANTS FOR MACHINE LEARNING

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



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UNIT-V CLUSTERING

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

e- Resources and Digital Material:

1. <https://www.univerisitiespress.com/machineLearningTheory and Practice>
2. https://onlinecourses.nptel.ac.in/noc25_cs149/preview

COURSE OUTCOMES:

1. Identify machine learning techniques suitable for a given problem.
2. Solve real-world problems using various machine learning techniques.
3. Apply Dimensionality reduction techniques for data preprocessing.
4. Explain what is learning and why it is essential in the design of intelligent machines.
5. Evaluate Advanced learning models for language, vision, speech, decision making etc.



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III B.Tech. I Sem.

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(23A05411) OPERATING SYSTEMS

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

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

UNIT-I OPERATING SYSTEM

Operating System: Operating Systems Overview, System Structures, Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, systems call, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.

UNIT-II PROCESS CONCEPT

Process Concept: Process Concept, Multithreaded Programming, Process Scheduling, Inter-process Communication Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples. Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers' problem, Readers and writers' problem.

UNIT-III MEMORY-MANAGEMENT STRATEGIES, VIRTUAL MEMORY MANAGEMENT

Memory-Management Strategies, Virtual Memory Management: Memory-Management Strategies, Virtual Memory Management Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.



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UNIT-IV DEADLOCKS, FILE SYSTEMS

Deadlocks, File Systems: Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

UNIT-V SYSTEM PROTECTION, SYSTEM SECURITY

System Protection, System Security: System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

TEXT BOOKS:

1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2016
2. Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (Topics: Interprocess Communication and File systems.)

REFERENCE BOOKS:

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

e- Resources and Digital Material:

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

COURSE OUTCOMES:

1. Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication.
2. Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection.
3. Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
4. Illustrate different conditions for deadlock and their possible solutions. Analyze the memory management and its allocation policies.
5. Able to design and implement file systems, focusing on file access methods, directory structure, free space management, and also explore various protection mechanisms,



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III B.Tech. I Sem.

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(23A05413) SOFTWARE ENGINEERING

Course Category	Core Course (CC)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To learn the basic concepts of software engineering and life cycle models
2. To explore the issues in software requirements specification and enable to write SRS documents for software development problems
3. To elucidate the basic concepts of software design and enable to carry out procedural and object oriented design of software development problems
4. To understand the basic concepts of black box and white box software testing and enable to design test cases for unit, integration, and system testing
5. To reveal the basic concepts in software project management

UNIT-I BASIC CONCEPTS IN SOFTWARE ENGINEERING AND SOFTWARE PROJECT MANAGEMENT

Basic concepts in software engineering and software project management: Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halsteads Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.

UNIT-II REQUIREMENTS ANALYSIS AND SPECIFICATION

Requirement's analysis and specification: The nature of software, The Unique nature of Webapps, Software Myths, Requirements gathering and analysis, software requirements specification, Traceability, Characteristics of a Good SRS Document, IEEE 830 guidelines, representing complex requirements using decision tables and decision trees, overview of formal system development techniques, axiomatic specification, algebraic specification.

UNIT-III SOFTWARE DESIGN

Software Design: Good Software Design, Cohesion and coupling, Control Hierarchy: Layering, Control Abstraction, Depth and width, Fan-out, Fan-in, Software design approaches, object oriented vs. function-oriented design. Overview of SA/SD methodology, structured analysis, Data flow diagram, Extending DFD technique to real life systems, Basic Object-oriented concepts, UML Diagrams, Structured design, Detailed design, Design review, Characteristics of a good user interface, User Guidance and Online Help, Mode-based vs Mode-less Interface, Types of user interfaces, Component-based GUI development, User interface design methodology: GUI design methodology.



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UNIT-IV CODING AND TESTING

Coding and Testing: Coding standards and guidelines, code review, software documentation, Testing, Black Box Testing, White Box Testing, debugging, integration testing, Program Analysis Tools, system testing, performance testing, regression testing, Testing Object Oriented Programs.

UNIT-V SOFTWARE QUALITY, RELIABILITY, AND OTHER ISSUES

Software quality, reliability, and other issues: Software reliability, Statistical testing, Software quality and management, ISO 9000, SEI capability maturity model (CMM), Personal software process (PSP), Six sigma, Software quality metrics, CASE and its scope, CASE environment, CASE support in software life cycle, Characteristics of software maintenance, Software reverse engineering, Software maintenance processes model, Estimation maintenance cost. Basic issues in any reuse program, Reuse approach, Reuse at organization level.

TEXT BOOKS:

1. Rajib Mall, Fundamentals of Software Engineering, 5th Edition, PHI, 2018
2. Pressman R, Software Engineering- Practioner Approach, McGraw Hill.

REFERENCE BOOKS:

1. Somerville, Software Engineeringl, Pearson 2.
2. Richard Fairley, Software Engineering Concepts, Tata McGraw Hil
3. Jalote Pankaj, An integrated approach to Software Engineering, Narosa

e-Resources and Digital Material:

1. <http://peterindia.net/SoftwareDevelopment.html>
2. <http://peterindia.net/SoftwareDevelopment.html>

COURSE OUTCOMES:

1. Obtain basic software life cycle activity skills.
2. Design software requirements specifications for given problems.
3. Implement structure, object oriented analysis and design for given problems.
4. Design test cases for given problems.
5. Apply quality management concepts at the application level.

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III B.Tech. I Sem.

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(23A05517) INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS

Course Category	Professional Core course (PC)
Course Enrichment Relevance	Professional Ethics

COURSE OBJECTIVES:

1. Introduce fundamental quantum concepts like superposition and entanglement
2. Understand theoretical structure of qubits and quantum information.
3. Explore conceptual challenges in building quantum computers.
4. Explain principles of quantum communication and computing.
5. Examine real-world applications and the future of quantum technologies.

UNIT-I INTRODUCTION TO QUANTUM THEORY AND TECHNOLOGIES

The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics theoretical comparison, Quantum states and measurement: nature of observation, Overview of quantum systems: electrons, photons, atoms, The concept of quantization: discrete energy levels, Why quantum Strategic, scientific, and technological significance, A snapshot of quantum technologies: Computing, Communication, and Sensing, National and global quantum missions: Indias Quantum Mission, EU, USA, China

UNIT-II THEORETICAL STRUCTURE OF QUANTUM INFORMATION SYSTEMS

What is a qubit Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non-engineering view), Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract, The role of entanglement and nonlocality in systems, Quantum information vs classical information: principles and differences, Philosophical implications: randomness, determinism, and observer role

UNIT-III BUILDING A QUANTUM COMPUTER THEORETICAL CHALLENGES AND REQUIREMENTS

What is required to build a quantum computer (conceptual overview), Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers: Why maintaining entanglement is difficult, Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison), Superconducting circuits, Trapped ions, Photonics, Vision vs reality: what's working and what remains elusive, The role of quantum software in managing theoretical complexities

**UNIT-IV QUANTUM COMMUNICATION AND COMPUTING – THEORETICAL PERSPECTIVE**

Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD), Role of Entanglement in Communication, The Idea of the Quantum Internet – Secure Global Networking, Introduction to Quantum Computing, Quantum Parallelism (Many States at Once), Classical vs Quantum Gates, Challenges: Decoherence and Error Correction, Real-World Importance and Future Potential

UNIT-V APPLICATIONS, USE CASES, AND THE QUANTUM FUTURE

Real-world application domains: Healthcare (drug discovery), Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, PsiQuantum, Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization, Emerging careers in quantum: roles, skillsets, and preparation pathways, Educational and research landscape India's opportunity in the global quantum race

TEXT BOOKS:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

REFERENCE BOOKS:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.
4. Alastair I.M. Rae, Quantum Physics: A Beginner's Guide, Oneworld Publications, Revised Edition, 2005.
5. Eleanor G. Rieffel, Wolfgang H. Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
6. Leonard Susskind, Art Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books, 2014.
7. Bruce Rosenblum, Fred Kuttner, Quantum Enigma: Physics Encounters Consciousness, Oxford University Press, 2nd Edition, 2011.

e-Resources and Digital Material:

1. <https://quantum.ibm.com>
2. <https://www.coursera.org/learn/quantum-mechanics>
3. <https://www.youtube.com/playlist?list=PL1826E60FD05B44E4>
4. edX – The Quantum Internet and Quantum Computers
5. Qiskit Textbook – IBM Quantum



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COURSE OUTCOMES:

1. Explain core quantum principles in a non-mathematical manner.
2. Compare classical and quantum information systems.
3. Identify theoretical issues in building quantum computers.
4. Discuss quantum communication and computing concepts.
5. Recognize applications, industry trends, and career paths in quantum technology.



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III B.Tech. I Sem.

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3	0	0	3

(23A05520) PE-I:AUTOMATA THEORY AND COMPILER DESIGN

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Able to understand the concept of abstract machines, construct FA, Regular Expressions for the regular languages and equivalent FSMs.
2. Able to construct pushdown automata equivalent to Context free Grammars, construct Turing Machines and understand undecidability.
3. Emphasize the concepts learnt in phases of compiler, lexical analyser and Top-down parser.
4. Able to understand the concepts of Bottom-up parser, Intermediate Code Generation
5. Able to understand the concepts of Code optimizer and Code Generation

UNIT-I INTRODUCTION TO AUTOMATA AND REGULAR EXPRESSIONS

Introduction, Alphabets, Strings and Languages, Chomsky Hierarchy, Automata and Grammars, Regular Grammar and Language, Finite Automata, Deterministic finite Automata (DFA), Nondeterministic finite Automata (NFA), Equivalence of NFA and DFA, Minimization of Finite Automata, Regular Expressions, Converting Regular Grammar and Expression into Finite Automata, Pumping lemma for regular sets, Closure properties of regular sets (Without proof).

UNIT-II CONTEXT FREE GRAMMARS AND PUSHDOWN AUTOMATA

Context Free Language, Context Free Grammar, Derivation and Parse tree, Ambiguity, Simplification of CFG's, Chomsky Normal Form, Greibach Normal Form, Push Down Automata (PDA), Design of PDA, Equivalence of PDA and CFL/CFG

UNIT-III TURING MACHINES AND INTRODUCTION TO COMPILERS

Turing Machine, TM Model, Language acceptance, Design of Turing Machine, Compilers, Phases of Compiler, The role of Lexical Analyzer, Input Buffering

UNIT-IV PARSERS AND INTERMEDIATE CODE GENERATION

Parser, Top-Down parsers: Recursive Descent Parsers, Predictive Parsers Bottom-up Parsers: Shift-Reduce Parsing, LR parsers, Intermediate Code Generation: Three address codes.

UNIT-V CODE OPTIMIZATION AND CODE GENERATION

Code Optimization: Peephole optimization, Basic blocks and flow graphs, DAG, Principles of Source Code Optimization, Code Generation: Issues in Design of Code Generation, Simple Code Generator.



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TEXT BOOKS:

1. Introduction to Automata theory languages and Computation, Hopcroft H.E. and Ullman Jeffrey.D, 3/e, 2006, Pearson Education, New Delhi, India.
2. Mishra K L P and Chandrasekaran N, Theory of Computer Science - Automata, Languages and Computation, 2/e, 2007, PHI, New Delhi, India
3. Compilers: Principles, Techniques, and Tools, Updated 2e July 2023 Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Sorav Bansal

REFERENCE BOOKS:

1. Introduction to Languages and Theory of Computation, John C Martin, 1/e, 2009, Tata McGraw Hill Education, Hyderabad, India.
2. Introduction to Theory of Computation, Sipser, 2/e, 2005, Thomson, Australia.
3. Compiler Construction: Principles and Practice, Kenneth C. Loudon, Thomson/ Delmar Cengage Learning, 2006.
4. Lex & yacc, Doug Brown, John Levine and Tony Mason, 2 nd Edition, O'reilly Media
5. Engineering a compiler, Keith Cooper and Linda Torczon, 2 nd Edition, Morgan Kaufmann, 2011.

e-Resources and Digital Material:

COURSE OUTCOMES:

1. Demonstrate knowledge on Automata Theory, Regular Expression and Analyze and Design of finite automata, and prove equivalence of various finite automata.
2. Demonstrate knowledge on context free grammar, Analyze and design of PDA and TM
3. Understand the basic concept of compiler design, and its different phases which will be helpful to construct new tools like LEX, YACC, etc.
4. Ability to implement semantic rules into a parser that performs attribution while parsing and apply error detection and correction methods.
5. Apply the code optimization techniques to improve the space and time complexity of programs while programming and Ability to design a compiler.



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III B.Tech. I Sem.

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3	0	0	3

(23A05521) PE-I:OBJECT ORIENTED ANALYSIS AND DESIGN

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Understand the basic concepts of object-oriented techniques
2. Build the Model of the software system using UML diagrams
3. Elucidate design patterns as templates for good design
4. Learn the object-oriented methodology in software design
5. Explore testing techniques for object-oriented software.

UNIT-I INTRODUCTION

The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. **Case Study:** System Architecture: Satellite-Based Navigation.

UNIT-II INTRODUCTION TO UML

Importance of modelling, principles of modelling, object-oriented modelling, conceptual model of the 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, 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 BEHAVIOURAL MODELLING-I

Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams.

Case Study: Web Application: Vacation Tracking System.

UNIT-V ADVANCED BEHAVIOURAL MODELLING

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, "Object-Oriented Analysis and Design with Applications," Pearson.
2. Grady Booch, James Rumbaugh and Ivar Jacobson, "The Unified Modeling Language User Guide," Pearson.
3. Michael Blaha and James Rumbaugh, "Object-Oriented Modeling and Design with UML," Pearson.



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REFERENCE BOOKS:

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development," Pearson.
2. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language," Addison-Wesley.
3. James Rumbaugh, Ivar Jacobson and Grady Booch, "The Unified Modeling Language Reference Manual," Addison-Wesley.
4. Timothy Lethbridge and Robert Laganière, "Object-Oriented Analysis and Design," McGraw-Hill.
5. Brett McLaughlin, Gary Pollice and David West, "Head First Object-Oriented Analysis and Design," O'Reilly.

COURSE OUTCOMES:

1. Explain the concepts of complex systems, inherent software complexity, organized and disorganized complexity, and apply fundamental principles for designing complex systems and system architectures.
2. Apply the fundamental concepts and principles of object-oriented modelling and UML to develop basic structural models using classes, relationships and UML diagrams.
3. Construct class and object diagrams using advanced structural modelling concepts, including advanced classes, relationships, interfaces, types, roles and packages.
4. Develop behavioural models of software systems using use cases, interaction diagrams and activity diagrams to represent system functionality and workflows.
5. Design advanced behavioural and architectural models using events, signals, state machines, component diagrams and deployment diagrams for complex software systems.

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III B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A05522) PE-I: SOFT COMPUTING

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

Students will get an insight of the intelligent computational approaches. Providing students, the mathematical background to carry out optimization.

UNIT-I INTRODUCTION TO SOFT COMPUTING

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta-Perceptron Network-Adaline Network-Madaline Network.

UNIT-II ARTIFICIAL NEURAL NETWORKS

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

UNIT-III FUZZY SYSTEMS

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures -Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT-IV GENETIC ALGORITHMS

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -



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Convergence of Genetic Algorithm

UNIT-V HYBRID SYSTEMS

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction – Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

TEXT BOOKS:

1. S. Rajsekaran & G.A. VijayalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, 4th Edition, Prentice Hall of India,2003.

REFERENCE BOOKS:



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1. Timothy J Ross ,”Fuzzy Logic with Engineering Applications”, 3rd Edition, John Wiley and Sons,2016.
2. David E. Goldberg ,”Genetic Algorithm in Search Optimization and Machine Learning ”Adission Wesley,2009.
3. Karray, Soft Computing and Intelligent Systems Design: Theory, Tools and Applications, 1st Edition, Pearson Education,2009.

COURSE OUTCOMES:

1. Learn soft computing techniques and their applications.
2. Analyze various neural network architectures.
3. Define the fuzzy systems.
4. Understand the genetic algorithm concepts and their applications
5. Identify and select a suitable Soft Computing technology to solve the problem; construct a solution and implement a Soft Computing solution.

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III B.Tech. I Sem.

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(23A32506) PE-I:INTERNET OF THINGS

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Understand the basics of Internet of Things and protocols.
2. Discuss the requirement of IoT technology
3. Introduce some of the application areas where IoT can be applied.
4. Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management

UNIT-I INTRODUCTION TO IOT

Introduction to IoT: Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates.

UNIT-II PROTOTYPING IOT OBJECTS USING MICROPROCESSOR/MICROCONTROLLER

Prototyping IoT Objects using Microprocessor/Microcontroller: Working principles of sensors and actuators, setting up the board Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

UNIT-III IOT ARCHITECTURE AND PROTOCOL

IoT Architecture and Protocol: Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

UNIT-IV DEVICE DISCOVERY AND CLOUD SERVICES FOR IOT

Device Discovery and Cloud Services for IoT: Device discovery capabilities-Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT-V UAV IOT

UAV IoT: Introduction to Unmanned Aerial Vehicles/Drones, Drone Types. Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

TEXT BOOKS:

1. Vijay Madiseti and ArshdeepBahga, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.



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2. Handbook of unmanned aerial vehicles, K Valavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

REFERENCE BOOKS:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligencel, 1st Edition, Academic Press, 2014.
2. Arshdeep Bahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2013
5. Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011, ISBN: 9781-4493-9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

e-Resources and Digital Material:

1. <https://www.arduino.cc/>
2. <https://www.raspberrypi.org/>
3. <https://nptel.ac.in/courses/106105166/5>
4. <https://nptel.ac.in/courses/108108098/4>

COURSE OUTCOMES:

1. Understand general concepts of Internet of Things.
2. Apply design concept to IoT solutions
3. Analyze various M2M and IoT architectures
4. Evaluate design issues in IoT applications
5. Create IoT solutions using sensors, actuators and Devices

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III B.Tech. I Sem.

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3	0	0	3

(23A01501) OE-I:GREEN BUILDINGS

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand the fundamental concepts of green buildings, their necessity, and sustainable features.
2. To analyze green building concepts, rating systems, and their benefits in India
3. To apply green building design principles, energy efficiency measures, and renewable energy sources.
4. To evaluate air conditioning systems, HVAC designs, and energy modeling for sustainable buildings.
5. To assess material conservation strategies, waste management, and indoor environmental quality in green buildings.

UNIT-I

Introduction to Green Building– Necessity of Green Buildings, Benefits of Green Buildings, Green Building Materials and Equipment in India, Key Requisites for Constructing A Green Building, Important Sustainable Features for Green Buildings.

UNIT-II

Green Building Concepts and Practices– Indian Green Building Council, Green Building Movement in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities and Benefits: Opportunities of Green Buildings, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy-Saving Approaches in Buildings, LEED India Rating System, and Energy Efficiency

UNIT-III

Green Building Design Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximizing System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT-IV

Air Conditioning– Introduction, CII Godrej Green Business Centre, Design Philosophy, Design Interventions, Energy Modeling, HVAC System Design, Chiller Selection, Pump Selection, Selection of Cooling towers, Selection of Air Handling Units, Pre-Cooling of Fresh Air, Interior Lighting Systems, Key Features of The Building, Eco-Friendly Captive Power Generation for Factories, Building Requirements



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

UNIT-V

Material Conservation– Handling of Non-Process Waste, Waste Reduction During Construction, Materials With Recycled Content, Local Materials, Material Reuse, Certified Wood, Rapidly Renewable Building Materials and Furniture. Indoor Environment Quality and Occupational Health– Air Conditioning, Indoor Air Quality, Sick Building Syndrome, tobacco Smoke.

TEXT BOOKS:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by tom woolley and Sam kimings, 2009.

REFERENCE BOOKS:

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009
3. Energy Conservation Building Code ECBC-2020, published by BEE

e- Resources and Digital Material:

1. <https://archive.nptel.ac.in/courses/105/102/105102195/>

COURSE OUTCOMES:

1. Understand the importance of green buildings, their necessity, and sustainable features.
2. Analyze various green building practices, rating systems, and their impact on environmental sustainability.
3. Apply principles of green building design to enhance energy efficiency and incorporate renewable energy sources.
4. Evaluate HVAC systems, energy-efficient air conditioning techniques, and their role in sustainable building design.
5. Assess material conservation techniques, waste reduction strategies, and indoor air quality management in green buildings.

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III B.Tech. I Sem.

L	T	P	C
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(23A01502) OE-I: CONSTRUCTION TECHNOLOGY AND MANAGEMENT

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand project management fundamentals, organizational structures, and leadership principles in construction
2. To analyze manpower planning, equipment management, and cost estimation in civil engineering projects.
3. To apply planning, scheduling, and project management techniques such as CPM and PERT.
4. To evaluate various contract types, contract formation, and legal aspects in construction management.
5. To assess safety management practices, accident prevention strategies, and quality management systems in construction.

UNIT-I

Introduction: Project forms, Management Objectives and Functions; Organizational Chart of A Construction Company; Manager's Duties and Responsibilities; Public Relations; Leadership and Team - Work; Ethics, Morale, Delegation and Accountability.

UNIT-II

Man and Machine: Man-Power Planning, Training, Recruitment, Motivation, Welfare Measures and Safety Laws; Machinery for Civil Engineering., Earth Movers and Hauling Costs, Factors Affecting Purchase, Rent, and Lease of Equipment, and Cost Benefit Estimation.

UNIT-III

Planning, Scheduling and Project Management: Planning Stages, Construction Schedules and Project Specification, Monitoring and Evaluation; Bar-Chart, CPM, PERT, Network-formulation and Time Computation.

UNIT-IV

Contracts: Types of Contracts, formation of Contract – Contract Conditions – Contract for Labour, Material, Design, Construction – Drafting of Contract Documents Based On IBRD/ MORTH Standard Bidding Documents – Construction Contracts – Contract Problems – Arbitration and Legal Requirements Computer Applications in Construction Management: Software for Project Planning, Scheduling and Control.



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UNIT-V

Safety Management – Implementation and Application of QMS in Safety Programs, ISO 9000 Series, Accident Theories, Cost of Accidents, Problem Areas in Construction Safety, Fall Protection, Incentives, Zero Accident Concepts, Planning for Safety, Occupational Health and Ergonomics.

TEXT BOOKS:

1. Construction Project Management, SK. Sears, GA. Sears, RH. Clough, John Wiley and Sons, 6th Edition, 2016.
2. Construction Project Scheduling and Control by Saleh Mubarak, 4th Edition, 2019
3. Pandey, I.M (2021) Financial Management 12th edition. Pearson India Education Services Pvt. Ltd.

REFERENCE BOOKS:

1. Brien, J.O. and Plotnick, F.L., CPM in Construction Management, McGraw Hill, 2010
2. Punmia, B.C., and Khandelwal, K.K., Project Planning and control with PERT and CPM, Laxmi Publications, 2002
3. Construction Methods and Management: Pearson New International Edition 8th Edition Stephens Nunnally.
4. Rhoden, M and Cato B, Construction Management and organization Behavior, Wiley Blackwell, 2016.

e-Resources and Digital Material:

1. <https://archive.nptel.ac.in/courses/105/104/105104161/>
2. <https://archive.nptel.ac.in/courses/105/103/105103093/>

COURSE OUTCOMES:

1. Understand (Cos)project management fundamentals, organizational structures, and leadership principles in construction.
2. Analyze manpower planning, equipment management, and cost estimation in civil engineering projects.
3. Apply planning, scheduling, and project management techniques such as CPM and PERT.
4. Evaluate various contract types, contract formation, and legal aspects in construction management.
5. Assess safety management practices, accident prevention strategies, and quality management systems in construction.

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III B.Tech. I Sem.

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(23A02503) OE-I: ELECTRICAL SAFETY PRACTICES AND STANDARDS

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand the fundamentals of electrical safety, electric shock, physiological effects of electric current, electrical hazards, arc blast, and causes of electrical failures.
2. To understand conductors, insulators, voltage classifications, protection against over voltages and static electricity, electrical safety equipment, and suitable fire extinguishers for electrical safety.
3. To understand and apply grounding and bonding requirements, system and equipment grounding, earthing practices, safe approach distances, and arc-hazard category determination.
4. To develop knowledge of electrical safety practices, first aid, safe handling of electrical appliances and tools, and safety measures in various electrical installations through case studies.
5. To understand the major electrical safety acts, rules, regulations, and standards including NFPA 70E, OSHA, IEEE, NEC, NESC, and statutory requirements of the electrical inspectorate.

UNIT-I INTRODUCTION TO ELECTRICAL SAFETY

Fundamentals of Electrical Safety-Electric Shock-physiological effects of electric current Safety requirements Hazards of electricity-Arc-Blast-Causes for electrical failure.

UNIT-II SAFETY COMPONENTS

Introduction to conductors and insulators- voltage classification -safety against over voltages-safety against static electricity-Electrical safety equipment 's Fire extinguishers for electrical safety.

UNIT-III GROUNDING

General requirements for grounding and bonding- Definitions- System grounding Equipment grounding -The Earth-Earthing Practices-Determining safe approach distance Determining archazard category

UNIT-IV SAFETY PRACTICES

General first aid-Safety in handling hand held electrical appliances tools-Electrical safety in train stations-swimming pools, external lighting installations, medical locations-Case studies.

UNIT-V STANDARDS FOR ELECTRICAL SAFETY

Electricity Acts- Rules & regulations- Electrical standards-NFPA 70 E-OSHA standards IEEE standards-National Electrical Code 2005 – National Electric Safety code NESC - Statutory requirements from electrical inspectorate

TEXT BOOKS:

1. Massimo A.G.Mitolo, "Electrical Safety of Low-Voltage Systems", McGraw Hill, USA,



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2009.

2. Mohamed El-Sharkawi, “Electric Safety - Practice and Standards”, CRC Press, USA, 2014

REFERENCE BOOKS:

1. Kenneth G. Mastrullo, Ray A. Jones, “The Electrical Safety Program Book”, Jones and Bartlett Publishers, London, 2nd Edition, 2011.
2. Palmer Hickman, “Electrical Safety-Related Work Practices”, Jones & Bartlett Publishers, London, 2009.
3. Fordham Cooper, W., “Electrical Safety Engineering”, Butterworth and Company, London, 1986.
4. John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel, “Electrical Safety Hand book, McGraw-Hill, New York, USA, 4th edition, 2012.

COURSE OUTCOMES:

1. Understanding the Fundamentals of Electrical Safety -L2
2. Identifying and Applying Safety Components -L3
3. Analyzing Grounding Practices and Electrical Bonding
4. Applying Safety Practices in Electrical Installations and Environments- L4
5. Evaluating Electrical Safety Standards and Regulatory Compliance -L5

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III B.Tech. I Sem.

L	T	P	C
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(23A03504) OE-I: SUSTAINABLE ENERGY TECHNOLOGIES

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. demonstrate the importance the impact of solar radiation, solar PV modules
2. understand the principles of storage in PV systems
3. discuss solar energy storage systems and their applications.
4. get knowledge in wind energy and bio-mass
5. gain insights in geothermal energy, ocean energy and fuel cells.

UNIT-I

SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems.

SOLAR PV MODULES AND PV SYSTEMS: PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems-Design of Off Grid Solar Power Plant. Installation and Maintenance.

UNIT-II

STORAGE IN PV SYSTEMS: Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System, Battery Maintenance and Measurements, Battery Installation for PV System.

UNIT-III

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.



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UNIT-IV

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects

UNIT-V

GEOTHERMAL ENERGY: Origin, Applications, Types of Geothermal Resources, Relative Merits

OCEAN ENERGY: Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges

FUEL CELLS: Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.

TEXT BOOKS:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH
2. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006

REFERENCE BOOKS:

1. Principles of Solar Engineering - D.Yogi Goswami, Frank Krieth& John F Kreider / Taylor & Francis
2. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd
3. Renewable Energy Technologies -Ramesh & Kumar /Narosa
4. Non-conventional Energy Source- G.D Roy/Standard Publishers

e- Resources and Digital Material:

1. <https://nptel.ac.in/courses/112106318>
2. <https://youtube.com/playlistlist=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=-mwIa2X-SuSiNy13>
3. https://youtube.com/playlistlist=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=Apfjx6oDfz1Rb_N3
4. <https://youtu.be/zx04Kl8y4dE> si=VmOvp_OgqisILTAF

COURSE OUTCOMES:

1. Illustrate the importance of solar radiation and solar PV modules
2. Discuss the storage methods in PV systems
3. Explain the solar energy storage for different applications
4. Understand the principles of wind energy, and bio-mass energy.
5. Attain knowledge in geothermal energy, ocean energy and fuel cells.



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III B.Tech. I Sem.

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(23A04527) OE-I: ELECTRONIC CIRCUITS

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand semiconductor diodes, their characteristics and applications.
2. To explore the operation, configurations, and biasing of BJTs.
3. To study the operation, analysis, and coupling techniques of BJT amplifiers.
4. To learn the operation, applications and uses of feedback amplifiers and oscillators.
5. To analyze the characteristics, configurations, and applications of operational amplifiers.

UNIT-I

Semiconductor Diode and Applications: Introduction, PN junction diode – structure, operation and VI characteristics, Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Positive and Negative Clipping and Clamping circuits (Qualitative treatment only).

Special Diodes: Zener and Avalanche Breakdowns, VI Characteristics of Zener diode, Zener diode as voltage regulator, Construction, operation and VI characteristics of Tunnel Diode, LED, Varactor Diode, Photo Diode.

UNIT-II

Bipolar Junction Transistor (BJT): Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch and Amplifier, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self-Bias, Bias Stability, Bias Compensation using Diodes.

UNIT-III

Single stage amplifiers: Classification of Amplifiers - Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model.

Multistage amplifiers: Different Coupling Schemes used in Amplifiers - RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier; Multistage RC coupled BJT amplifier (Qualitative treatment only)

UNIT-IV

Feedback amplifiers: Concepts of feedback, Classification of feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations (Qualitative treatment only).

Oscillators: Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge Oscillator.



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UNIT-V

Op-amp: Classification of IC'S, basic information of Op-amp, ideal and practical Op-amp, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.

Applications of op-amp: Summing, scaling and averaging amplifiers, Integrator, Differentiator, phase shift oscillator and comparator.

TEXT BOOKS:

1. Electronics Devices and Circuits, J.Millman and Christos. C. Halkias, 3rd edition, Tata McGraw Hill, 2006
2. Electronics Devices and Circuits Theory, David A. Bell, 5th Edition, Oxford University press. 2008.

REFERENCE BOOKS:

1. Electronics Devices and Circuits Theory, R.L.Boylestad, LouisNashelsky and K.Lal Kishore, 12th edition, 2006, Pearson, 2006.
2. Electronic Devices and Circuits, N.Salivahanan, and N.Suresh Kumar, 3rd Edition, TMH, 2012
3. Microelectronic Circuits, S.Sedra and K.C.Smith, 5th Edition, Oxford University Press

COURSE OUTCOMES:

1. Understand semiconductor diodes, their characteristics and applications.
2. Explore the operation, configurations, and biasing of BJTs.
3. Gain knowledge about the operation, analysis, and coupling techniques of BJT amplifiers.
4. Learn the operation, applications and uses of feedback amplifiers and oscillators.
5. Analyze the characteristics, configurations, and applications of operational amplifiers.

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III B.Tech. I Sem.

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(23A91513) OE-I: MATHEMATICS FOR MACHINE LEARNING AND AI

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To provide a strong mathematical foundation for understanding and developing AI/ML algorithms.
2. To enhance the ability to apply linear algebra, probability, and calculus in AI/ML models.
3. To equip students with optimization techniques and graph-based methods used in AI applications.
4. To develop critical problem-solving skills for analysing mathematical formulations in AI/ML.

UNIT-I LINEAR ALGEBRA FOR MACHINE LEARNING(08)

Review of Vector spaces, basis, linear independence, Vector and matrix norms, Matrix factorization techniques, Eigenvalues, eigenvectors, diagonalization, Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

UNIT-II PROBABILITY AND STATISTICS FOR AI (08)

Probability distributions: Gaussian, Binomial, Poisson. Bayes' Theorem, Maximum Likelihood Estimation (MLE), and Maximum a Posteriori (MAP). Entropy and Kullback-Leibler (KL) Divergence in AI, Cross entropy loss, Markov chains.

UNIT-III OPTIMIZATION TECHNIQUES FOR ML (08)

Multivariable calculus: Gradients, Hessians, Jacobians. Constrained optimization: Lagrange multipliers and KKT conditions. Gradient Descent and its variants (Momentum, Adam) Newton's method, BFGS method.

UNIT-IV VECTOR CALCULUS & TRANSFORMATIONS (08)

Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications.

UNIT-V GRAPH THEORY FOR AI (08)

Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models. Introduction to Graph Neural Networks (GNNs).

TEXT BOOKS:

1. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.
2. Pattern Recognition and Machine Learning by Christopher Bishop, Springer.



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REFERENCE BOOKS:

1. Gilbert Strang, Linear Algebra and Its Applications, Cengage Learning, 2016.
2. Jonathan Gross, Jay Yellen, Graph Theory and Its Applications, CRC Press, 2018.

e-Resources and Digital Material:

1. MIT– Mathematics for Machine Learning <https://ocw.mit.edu>
2. Stanford CS229 – Machine Learning Course <https://cs229.stanford.edu/>
3. DeepAI – Mathematical Foundations for AI <https://deepai.org>

COURSE OUTCOMES:

1. Apply linear algebra concepts to ML techniques like PCA and regression. L3 (Apply)
2. Analyze probabilistic models and statistical methods for AI applications. L4 (Analyze)
3. Implement optimization techniques for machine learning algorithms. L3 (Apply)
4. Utilize vector calculus and transformations in AI-based models. L3 (Apply)
5. Develop graph-based AI models using mathematical representations. L5 (Evaluate)

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III B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A92503) OE-I: MATERIALS CHARACTERIZATION TECHNIQUES

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To provide exposure to different characterization techniques.
2. To explain the basic principles and analysis of different spectroscopic techniques.
3. To elucidate the working of Scanning electron microscope - Principle, limitations and applications.
4. To illustrate the working of the Transmission electron microscope (TEM) - SAED patterns and its applications.
5. To educate the uses of advanced electric and magnetic instruments for characterization.

UNIT-I STRUCTURE ANALYSIS BY POWDER X-RAY DIFFRACTION

Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT-II MICROSCOPY TECHNIQUE -1 –SCANNING ELECTRON MICROSCOPY (SEM)

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM

UNIT-III MICROSCOPY TECHNIQUE -2 - TRANSMISSION ELECTRON MICROSCOPY (TEM)

Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy

UNIT-IV SPECTROSCOPY TECHNIQUES

Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT-V ELECTRICAL & MAGNETIC CHARACTERIZATION TECHNIQUES

Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.



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TEXT BOOKS:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2013
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008

REFERENCE BOOKS:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity & Stuart R Stocks, Prentice Hall, 2001 – Science.
3. Practical Guide to Materials Characterization: Techniques and Applications - Khalid Sultan – Wiley – 2021.
4. Materials Characterization Techniques - Sam Zhang, Lin Li, Ashok Kumar - CRC Press - 2008

e-Resources and Digital Material:

1. <https://nptel.ac.in/courses/115/103/115103030/>
2. https://nptel.ac.in/content/syllabus_pdf/113106034.pdf
3. <https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/>

COURSE OUTCOMES:

1. Analyze the crystal structure and crystallite size by various methods L1, L2, L3, L4
2. Analyze the morphology of the sample by using a Scanning Electron Microscope L1, L2, L4
3. Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope L1, L2, L3
4. Explain the principle and experimental arrangement of various spectroscopic techniques L1, L2
5. Identify the construction and working principle of various Electrical & Magnetic Characterization technique L1, L2



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3	0	0	3

(23A93504) OE-I: CHEMISTRY OF ENERGY SYSTEMS

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2. To understand the basic concepts of processing and limitations of Fuel cells & their applications
3. To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications
4. Necessarily of harnessing alternate energy resources such as solar energy and its basic concepts.
5. To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method.

UNIT-I ELECTROCHEMICAL SYSTEMS

Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries- Introduction, Lead-acid, Nickel- cadmium, Lithium-ion batteries and their applications.

UNIT-II FUEL CELLS

Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency and applications.

UNIT-III PHOTO AND PHOTO ELECTROCHEMICAL CONVERSIONS

Photochemical cells Introduction and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions and their applications.

UNIT-IV SOLAR ENERGY

Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications.

UNIT-V HYDROGEN STORAGE

Hydrogen storage and delivery: State-of-the art, Established technologies, Chemical and Physical methods of hydrogen storage, Compressed gas storage, Liquid hydrogen storage, Other storage methods, Hydrogen storage in metal hydrides, metal organic frameworks (MOF), Metal oxide porous structures, hydrogel, and Organic hydrogen carriers.



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TEXT BOOKS:

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins

REFERENCE BOOKS:

1. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services And corporation)
2. Hand book of solar energy and applications by ArvindTiwari and Shyam.
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
4. Hydrogen storage by Levine Klebonoff

COURSE OUTCOMES:

1. Solve the problems based on electrode potential, Describe the Galvanic Cell Differentiate between Lead acid and Lithium-ion batteries, Illustrate the electrical double layer
2. Describe the working Principle of Fuel cell, Explain the efficiency of the fuel cell Discuss about the Basic design of fuel cells, Classify the fuel cell
3. Differentiate between Photo and Photo electrochemical Conversions, Illustrate the photochemical cells, Identify the applications of photochemical reactions, Interpret advantages of photoelectron catalytic conversion.
4. Apply the photo voltaic technology, demonstrate about solar energy and prospects Illustrate the Solar cells, discuss about concentrated solar power
5. Differentiate Chemical and Physical methods of hydrogen storage, Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures Describe the liquification methods.

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3	0	0	3

(23A94505) OE-I:ENGLISH FOR COMPETITIVE EXAMINATIONS

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To enable the students to learn about the structure of competitive English
2. To understand the grammatical aspects and identify the errors
3. To enhance verbal ability and identify the errors
4. To improve word power to answer competitive challenges
5. To make them ready to crack competitive exams

UNIT-I GRAMMAR-1

GRAMMAR-1: Nouns-classification-errors-Pronouns-types-errors-Adjectives-types-errors-Articles-definite-indefiniteDegrees of Comparison-Adverbs-types- errors-Conjunctions-usage Prepositions-usage-Tag Questions, types-identifying errors- Practice

UNIT-II GRAMMAR-2

GRAMMAR-2: Verbs-tenses- structure-usages- negatives- positives- time adverbs-Sequence of tenses--If Clause Voice-active voice and passive voice- reported Speech-Agreement- subject and verb-Modals-Spotting Errors-Practices

UNIT-III VERBAL ABILITY

VERBAL ABILITY: Sentence Completion-Verbal analogies-Word Groups-Instructions-Critical Reasoning-Verbal deduction Select appropriate pair-Reading Comprehension-Paragraph-Jumbles-Selecting the proper statement by reading a given paragraph.

UNIT-IV READING COMPREHENSION AND VOCUBULARY

READING COMPREHENSION AND VOCUBULARY: Competitive Vocabulary: Word Building – Memory Techniques-Synonyms, Antonyms, Affixes-Prefix & Suffix-One- w o r d substitutes-Compound Words-Phrasal Verbs-Idioms and Phrases-Homophones Linking Words-Modifiers-Intensifiers - Mastering Competitive Vocabulary- Cracking the unknowing passage-speed reading techniques- Skimming & Scanning-types of answering–Elimination methods

UNIT-V WRITING FOR COMPETITIVE EXAMINATIONS

WRITING FOR COMPETITIVE EXAMINATIONS: Punctuation- Spelling rules- Word order-Sub Skills of Writing- Paragraph meaning-salient features-types - Note-making, Note-taking, summarizing-precise writing-Paraphrasing-Expansion of proverbs-Essay writing-types

TEXT BOOKS:

1. Wren & Martin, English for Competitive Examinations, S.Chand & Co, 2021
2. Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014.

REFERENCE BOOKS:

1. Hari Mohan Prasad, Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014.



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2. Philip Sunil Solomon, English for Success in Competitive Exams, Oxford 2016
3. Shalini Verma, Word Power Made Handy, S Chand Publications
4. Neira, Anjana Dev & Co. Creative Writing: A Beginner's Manual. Pearson Education India, 2008.
5. Abhishek Jain, Vocabulary Learning Techniques Vol.I&II, RR Global Publishers 2013.
6. Michel Swan, Practical English Usage, Oxford, 2006.

e- Resources and Digital Material:

1. <https://www.grammar.cl/english/parts-of-speech.htm>
2. <https://academicguides.waldenu.edu/writingcenter/grammar/parts-of-speech>
3. <https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active-passive-voice>
4. <https://languagetool.org/insights/post/verb-tenses/>
5. <https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council>
6. <https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx>

COURSE OUTCOMES:

1. Identify the basics of English grammar and its importance L1, L2
2. Explain the use of grammatical structures in sentences L1, L2
3. Demonstrate the ability to use various concepts in grammar and vocabulary and their applications in everyday use and in competitive exams L3
4. Analyze an unknown passage and reach conclusions about it. L4
5. Choose the appropriate form of verbs in framing sentences L5
6. Develop speed reading and comprehending ability thereby perform better in competitive exams L3

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L	T	P	C
3	0	0	3

**(23A95507) OE-I: ENTREPRENEURSHIP AND NEW VENTURE
CREATION**

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To foster an entrepreneurial mind-set for venture creation and intrapreneurial leadership.
2. To encourage creativity and innovation
3. To enable them to learn pitching and presentation skills
4. To make the students understand MVP development and validation techniques to determine Product-Market fit and Initiate Solution design, Prototype for Proof of Concept.
5. To enhance the ability of analyzing Customer and Market segmentation, estimate Market size, develop and validate Customer Persona

UNIT-I ENTREPRENEURSHIP FUNDAMENTALS AND CONTEXT

Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skill sets, attributes and networks while on campus. Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

Understand the concept of Entrepreneur and Entrepreneurship in India Analyze recent trends in Entrepreneurship role in economic development Develop a creative mind set and personality in starting a business.

UNIT-II PROBLEM & CUSTOMER IDENTIFICATION

Understanding and analyzing the macro- Problem and Industry perspective - technological, socioeconomic and urbanization trends and their implication on new opportunities - Identifying passion - identifying and defining problem using Design thinking principles - Analyzing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas. Core Teaching Tool: Several types of activities including Class, game, Gen AI, 'Get out of the Building' and Venture Activity.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to Understand the problem and Customer identification. B.Tech. Analyze problem and validating with potential customer Evaluate customer segmentation and customer personas



UNIT-III SOLUTION DESIGN, PROTOTYPING & OPPORTUNITY ASSESSMENT AND SIZING

Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition - Understanding prototyping and Minimum Viable product (MVP) - Developing a feasibility prototype with differentiating value, features and benefits - Assess relative market position via competition analysis - Sizing the market and assess scope and potential scale of the opportunity. Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

Analyze jobs-to-be-done

Evaluate customer needs to create a strong value proposition Design and draw prototyping and MVP

UNIT-IV BUSINESS & FINANCIAL MODEL, GO-TO-MARKET PLAN

Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure - Lean approach. Business planning: components of Business plan- Sales plan, People plan and financial plan. Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analyzing financial performance. Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt & Equity, Map the Start-up Life-cycle to Funding Options. Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to:

Understand lean approach in business models Apply business plan, sales plan and financial plan

Analyze financial planning, marketing channels of distribution.

Design their own venture and source of funds.

UNIT-V SCALE OUTLOOK AND VENTURE PITCH READINESS

Understand and identify potential and aspiration for scale vis-a-vis your venture idea. Persuasive Storytelling and its key components. Build an Investor ready pitch deck. Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

Understand aspiration for scale

Analyze venture idea and its key components Evaluate and build investors ready pitch

TEXT BOOKS:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha . Entrepreneurship, McGrawHill, 11th Edition.(2020)
2. Ries, E. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business,(2011).
3. Osterwalder, A., & Pigneur, Y. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons. (2010).



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REFERENCE BOOKS:

1. Simon Sinek, Start with Why, Penguin Books limited. (2011)
2. Brown Tim, Change by Design Revised & Updated: How Design Thinking
3. Transforms Organizations and Inspires Innovation, Harper Business. (2019)
4. Namita Thapar (2022) The Dolphin and the Shark: Stories on Entrepreneurship, Penguin Books Limited
5. Saras D. Sarasvathy, (2008) Effectuation: Elements of Entrepreneurial Expertise, Elgar Publishing Ltd.

e-Resources and Digital Material:

Learning resource- Ignite 5.0 Course Wadhvani platform (Includes 200+ components of custom created modular content + 500+ components of the most relevant curated content)

COURSE OUTCOMES:

1. Develop an entrepreneurial mindset and appreciate the concept of entrepreneurship
2. Comprehend the process of problem-opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution L
3. Analyze and refine business models to ensure sustainability and profitability
4. Build Prototype for Proof of Concept and validate MVP of their practice venture idea
5. Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture
6. Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders



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III B.Tech. I Sem.

L	T	P	C
0	0	3	1.5

(23A33510) MACHINE LEARNING LAB

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

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

Software Required: Python/R/Weka

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

1. Compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation.
2. Apply the following Pre-processing techniques for a given dataset.
 - a. Attribute selection
 - b. Handling Missing Values
 - c. Discretization
 - d. Elimination of Outliers
3. Apply KNN algorithm for classification and regression
4. Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results
5. Demonstrate decision tree algorithm for a regression problem
6. Apply Random Forest algorithm for classification and regression
7. Demonstrate Naïve Bayes Classification algorithm.
8. Apply Support Vector algorithm for classification
9. Demonstrate simple linear regression algorithm for a regression problem
10. Apply Logistic regression algorithm for a classification problem
11. Demonstrate Multi-layer Perceptron algorithm for a classification problem
12. Implement the K-means algorithm and apply it to the data you selected. Evaluate



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performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.

13. Demonstrate the use of Fuzzy C-Means Clustering

14. Demonstrate the use of Expectation Maximization based clustering algorithm

COURSE OUTCOMES:

1. Apply statistical measures such as mean, median, mode, variance, and standard deviation, and perform essential data preprocessing techniques on datasets.
2. Implement and evaluate KNN, Decision Tree, Random Forest, Naïve Bayes, and Support Vector Machine algorithms for classification and regression problems.
3. Apply linear regression, logistic regression, and Multi-layer Perceptron algorithms to solve suitable regression and classification problems.
4. Implement and analyze K-means and Fuzzy C-Means clustering algorithms and evaluate clustering performance using appropriate measures.
5. Apply and evaluate machine learning algorithms on selected datasets, analyze their performance, and tune relevant parameters to improve the results.



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L	T	P	C
0	0	3	1.5

(23A33511) OPERATING SYSTEMS LAB

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To familiarize students with the architecture of OS.
2. To provide necessary skills for developing and debugging CPU Scheduling algorithms.
3. To elucidate the process management and scheduling and memory management.
4. To explain the working of an OS as a resource manager, file system manager, process manager, memory manager, and page replacement tool.
5. To provide insights into system calls, file systems and deadlock handling

List of Experiments:

1. Practicing of Basic UNIX Commands.
2. Write programs using the following UNIX operating system calls Fork, exec, getpid, exit, wait, close, stat, opendir and readdir
3. Simulate UNIX commands like cp, ls, grep, etc.,
4. Simulate the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority
5. Implement a dynamic priority scheduling algorithm.
6. Assume that there are five jobs with different weights ranging from 1 to 5. Implement round robin algorithm with time slice equivalent to weight.
7. Implement priority scheduling algorithm. While executing, no process should wait for more than 10 seconds. If the waiting time is more than 10 seconds that process has to be executed for at least 1 second before waiting again.
8. Control the number of ports opened by the operating system with a) Semaphore b) Monitors.
9. Simulate how parent and child processes use shared memory and address space.
10. Simulate sleeping barber problem.
11. Simulate dining philosopher 's problem.
12. Simulate producer-consumer problem using threads.
13. Implement the following memory allocation methods for fixed partition a) First fit b) Worst fit c) Best fit
14. Simulate the following page replacement algorithms a) FIFO b) LRU c) LFU etc.,
15. Simulate Paging Technique of memory management
16. Simulate Bankers Algorithm for Dead Lock avoidance and prevention
17. Simulate the following file allocation strategies a) Sequential b) Indexed c) Linked
18. Simulate all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG



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REFERENCE BOOKS:

1. Operating System Concepts, Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Eighth Edition, John Wiley
2. Operating Systems: Internals and Design Principles, Stallings, Sixth Edition–2009, Pearson Education
3. Modern Operating Systems, Andrew S Tanenbaum, Second Edition, PHI.
4. Operating Systems, S.Haldar, A.A.Aravind, Pearson Education.
5. Principles of Operating Systems, B.L.Stuart, Cengage learning, India Edition.2013-2014
6. Operating Systems, A.S.Godbole, Second Edition, TMH
7. An Introduction to Operating Systems, P.C.P. Bhatt, PHI.

e-Resources and Digital Material:

1. <https://www.cse.iitb.ac.in/~mythili/os/http://peterindia.net/OperatingSystems.html>

COURSE OUTCOMES:

1. Trace different CPU Scheduling algorithms (L2).
2. Implement Bankers Algorithms to Avoid and prevent the Dead Lock (L3).
3. Evaluate Page replacement algorithms (L5).
4. Illustrate the file organization techniques (L4).
5. Illustrate shared memory process (L4).
6. Design new scheduling algorithms (L6)



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0	1	2	2

(23A05416) FULL STACK DEVELOPMENT-I (SKILL ENHANCEMENT COURSE)

Course Category	Skill Oriented Course (SC)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

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

Sample Experiments:

1. Lists, Links and Images

a. Write a HTML program, to explain the working of lists.

Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.

b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.

c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.

d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

2. HTML Tables, Forms and Frames

a. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)

b. Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).

c. Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).

d. Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame □ image, second frame □ paragraph, third frame □ hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

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

a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, <div>, tags.

b. Write a HTML program, to embed audio and video into HTML web page.

c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms

a. Write a program to apply different types of selector forms

i. Simple selector (element, id, class, group, universal)

ii. Combinator selector (descendant, child, adjacent sibling, general sibling)



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- iii. Pseudo-class selector
- iv. Pseudo-element selector
- v. Attribute selector

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

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

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

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

7. Java Script Pre-defined and User-defined Objects

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

8. Java Script Conditional Statements and Loops

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

9. Java Script Functions and Events

- a. Design a appropriate function should be called to display
 - i. Factorial of that number
 - ii. Fibonacci series up to that number
 - iii. Prime numbers up to that number
 - iv. Is it palindrome or not
- b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
 - i. Factorial of that number
 - ii. Fibonacci series up to that number
 - iii. Prime numbers up to that number



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- iv. Is it palindrome or not
- c. Write a program to validate the following fields in a registration page
 - i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
 - ii. Mobile (only numbers and length 10 digits)
 - iii. E-mail (should contain format like [xxxxxxx@xxxxxx.xxx](#))

10. JavaScript Database Connectivity

- a. Introduction to server-side JavaScript with Node.js
- b. Connecting JavaScript applications to MySQL and Mongo DB databases

Text Books:

- 1. John Dean, Web Programming with HTML5, CSS and JavaScript, Jones & Bartlett Learning, 2019.

Reference Books:

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

e-Resources and Digital Material:

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

COURSE OUTCOMES:

- 1. Design Websites.
- 2. Apply Styling to web pages.
- 3. Make Web pages interactive.
- 4. Design Forms for applications.
- 5. Choose Control Structure based on the logic to be implemented.



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III B.Tech. I Sem.

L	T	P	C
0	0	2	1

(23A04526) TINKERING LAB

Course Category	Skill Oriented Course (SC)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. Encourage Innovation and Creativity
2. Provide Hands-on Learning and Impart Skill Development
3. Foster Collaboration and Teamwork
4. Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship
5. Impart Problem-Solving mind-set

List of experiments:

- 1) Make your own parallel and series circuits using breadboard for any application of your choice.
- 2) Design and 3D print a Walking Robot
- 3) Design and 3D Print a Rocket.
- 4) Temperature & Humidity Monitoring System (DHT11 + LCD)
- 5) Water Level Detection and Alert System
- 6) Automatic Plant Watering System
- 7) Bluetooth-Based Door Lock System
- 8) Smart Dustbin Using Ultrasonic Sensor
- 9) Fire Detection and Alarm System
- 10) RFID-Based Attendance System
- 11) Voice-Controlled Devices via Google Assistant
- 12) Heart Rate Monitoring Using Pulse Sensor
- 13) Soil Moisture-Based Irrigation
- 14) Smart Helmet for Accident Detection
- 15) Milk Adulteration Detection System
- 16) Water Purification via Activated Carbon
- 17) Solar Dehydrator for Food Drying
- 18) Temperature-Controlled Chemical Reactor



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- 19) Ethanol Mini-Plant Using Biomass
- 20) Smart Fluid Flow Control (Solenoid + pH Sensor)
- 21) Portable Water Quality Tester
- 22) AI Crop Disease Detection
- 23) AI-based Smart Irrigation
- 24) ECG Signal Acquisition and Plotting
- 25) AI-Powered Traffic Flow Prediction
- 26) Smart Grid Simulation with Load Monitoring
- 27) Smart Campus Indoor Navigator
- 28) Weather Station Prototype
- 29) Firefighting Robot with Sensor Guidance
- 30) Facial Recognition Dustbin
- 31) Barcode-Based Lab Inventory System
- 32) Growth Chamber for Plants
- 33) Biomedical Waste Alert System
- 34) Soil Classification with AI
- 35) Smart Railway Gate
- 36) Smart Bin Locator via GPS and Load Sensors
- 37) Algae-Based Water Purifier
- 38) Contactless Attendance via Face Recognition

Note: A minimum of 8 to 10 experiments must be completed by the students.

COURSE OUTCOMES:



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1. Identify real-world problems and formulate innovative ideas by applying basic engineering and scientific principles
2. Demonstrate hands-on skills in using tools, components, and prototyping equipment (e.g., Arduino, 3D printer, sensors, mechanical kits).
3. Design and develop simple prototypes to test and validate concepts through iterative experimentation.
4. Collaborate effectively in teams to brainstorm, plan, and execute mini-projects with creative and sustainable solutions.
5. Document and present the tinkering process, prototype functionality, and outcomes with clarity, using appropriate technical and visual communication methods.



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III B.Tech. I Sem.

L T P C

(23A99507) EVALUATION OF COMMUNITY SERVICE INTERNSHIP

Course Category	
Course Enrichment Relevance	

COURSE OBJECTIVES:

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

- ☐ To sensitize the students to the living conditions of the people who are around them,
- ☐ To help students to realize the stark realities of the society.
- ☐ To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- ☐ To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- ☐ To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- ☐ To help students to initiate developmental activities in the community in coordination with public and government authorities.
- ☐ To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

EXPECTED OUTCOMES:

Learning Outcomes

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

Personal Outcomes

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

Social Outcomes

- ☐ Reduced stereotypes and greater inter-cultural understanding



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- ☐ Improved social responsibility and citizenship skills
- ☐ Greater involvement in community service after graduation

Career Development

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

Relationship with the Institution

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

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT:

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables



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25. Organic farming
26. Crop rotation
27. Flourey culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling lvel- observation.

III B.Tech II Semester Course Structure



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III B.Tech. II Sem. - Course Structure

S.No	Subject Code	Course Category	Name of the Subject	Hours/Week			Credits	Marks		
				Lecture	Tutorial	Practical		Internal	External	Total
1	23A33506	ES	NATURAL LANGUAGE PROCESSING	3	0	0	3	30	70	100
2	23A32607	ES	PREDICTIVE ANALYTICS	3	0	0	3	30	70	100
3	23A33509	ES	DATA VISUALIZATION	3	0	0	3	30	70	100
4	23A05627	PC	CRYPTOGRAPHY & NETWORK SECURITY	3	0	0	3	30	70	100
5	23A32608	PE	COMPUTER NETWORKS	3	0	0	3	30	70	100
6	23A32609	PE	RECOMMENDER SYSTEMS	3	0	0	3	30	70	100
7	23A32610	ES	DEEP LEARNING	3	0	0	3	30	70	100
8	23A05633	PE	SOFTWARE PROJECT MANAGEMENT	3	0	0	3	30	70	100
9	23A32611	PE	INTRODUCTION TO QUANTUM COMPUTING	3	0	0	3	30	70	100
10	23A32612	PE	COMPUTER VISION	3	0	0	3	30	70	100
11	23A05626	ES	CLOUD COMPUTING	3	0	0	3	30	70	100
12	23A32613	ES	PREDICTIVE ANALYTICS LAB	0	0	3	1.5	30	70	100
13	23A33615	ES	NLP AND DATA VISUALIZATION LAB (USING POWER BI / TABLEAU ETC.,)	0	0	3	1.5	30	70	100
14	23A94403	SC	SOFT SKILLS	1	0	2	2	30	70	100
15	23A99608	MC(NC)	TECHNICAL PAPER WRITING & IPR	2	0	0	0	40	0	40
16	23A01603	OE	DISASTER MANAGEMENT	3	0	0	3	30	70	100
17	23A03605	OE	SUSTAINABILITY IN ENGINEERING PRACTICES	3	0	0	3	30	70	100
18	23A02604	OE	RENEWABLE ENERGY SOURCES	3	0	0	3	30	70	100
19	23A03606	OE	AUTOMATION AND ROBOTICS	3	0	0	3	30	70	100
20	23A04639	OE	DIGITAL ELECTRONICS	3	0	0	3	30	70	100
21	23A91614	OE	OPTIMIZATION TECHNIQUES FOR ENGINEERS	3	0	0	3	30	70	100



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22	23A91609	OE	MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES	3	0	0	3	30	70	100
23	23A92604	OE	PHYSICS OF ELECTRONIC MATERIALS AND DEVICES	3	0	0	3	30	70	100
24	23A93605	OE	CHEMISTRY OF POLYMERS AND APPLICATIONS	3	0	0	3	30	70	100
25	23A94607	OE	ACADEMIC WRITING AND PUBLIC SPEAKING	3	0	0	3	30	70	100
26	23A99609	PC	MINI PROJECT	0	0	0	0	50	0	50
									Total Credits:23	

III-B.Tech II-Semester Syllabus

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III B.Tech. II Sem.

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3	0	0	3

(23A33506) NATURAL LANGUAGE PROCESSING

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP)
2. Discuss approaches to syntax and semantics in NLP.
3. Examine current methods for statistical approaches to machine translation
4. Teach machine learning techniques used in NLP.

UNIT-I INTRODUCTION TO NATURAL LANGUAGE

The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.

UNIT-II GRAMMARS AND PARSING

Grammars and Parsing- Top-Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayes Rule, Shannon game, Entropy and Cross Entropy.

UNIT-III GRAMMARS FOR NATURAL LANGUAGE

Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.

UNIT-IV SEMANTIC INTERPRETATION

Semantic & Logical form, Word senses & ambiguity, The basic logical form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts & embedded sentences, Defining semantics structure model theory. Language Modelling Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modelling Problems, Multilingual and Cross lingual Language Modelling.



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UNIT-V MACHINE TRANSLATION

Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusarsaka Output, Language Bridges. **Multilingual Information Retrieval:** Introduction, Document Pre-processing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources. **Multilingual Automatic Summarization** Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets.

TEXT BOOKS:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications: From Theory To Practice- Daniel M.Bikel and ImedZitouni, Pearson Publications.
3. Natural Language Processing, Apaninian perspective, AksharBharathi, Vineetchaitanya, Prentice-Hall of India

REFERENCE BOOKS:

1. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

COURSE OUTCOMES:

1. Understand the various NLP Applications and Organization of Natural language, able to learn and implement realistic applications using Python.
2. Apply the various Parsing techniques, Bayes Rule, Shannon game, Entropy and Cross Entropy.
3. Understand the fundamentals of CFG and parsers and mechanisms in ATN's.
4. Apply Semantic Interpretation and Language Modelling.
5. Apply the concept of Machine Translation and multilingual Information Retrieval systems and Automatic Summarization.



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(23A32607) PREDICTIVE ANALYTICS

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Discuss the concept Predictive Analytics
2. Illustrate the uses and applications of Predictive Analytics
3. Demonstrate building of Predictive Analytics models

UNIT-I

Overview of Predictive Analytics: What Is Analytics? What Is Predictive Analytics? Business Intelligence Predictive Analytics vs. Business Intelligence, Predictive Analytics vs. Statistics, Predictive Analytics vs. Data Mining, Who Uses Predictive Analytics? , Challenges in Using Predictive Analytics, What Educational Background Is Needed to Become a Predictive Modeler?

Setting Up the Problem: Predictive Analytics Processing Steps: CRISP-DM, Business Understanding, Defining Data for Predictive Modelling, Defining the Target Variable, Defining Measures of Success for Predictive Models, Doing Predictive Modelling Out of Order, Case study- Recovering Lapsed Donors, Fraud Detection

UNIT-II

Data Understanding: What the Data Looks Like, Single Variable Summaries, Data Visualization in One Dimension, Histograms, Multiple Variable Summaries, Data Visualization, Two or Higher Dimensions, The Value of Statistical Significance, Pulling It All Together into a Data Audit.

Data Preparation: Variable Cleaning, Feature Creation

UNIT-III

Item sets and Association Rules: Terminology, Parameter Settings, How the Data Is Organized, Measures of Interesting Rules, Deploying Association Rules, Problems with Association Rules, Building Classification Rules from Association Rules.

Descriptive Modelling: Data Preparation Issues with Descriptive Modelling, Principal Component Analysis, Clustering Algorithms. Interpreting Descriptive Models: Standard Cluster Model Interpretation.

UNIT-IV

Predictive Modelling: Decision Trees, Logistic Regression, Neural Networks, K-Nearest Neighbour, Naïve Bayes, Regression Models, Linear Regression, Other Regression Algorithms: Polynomial Regression, Ridge Regression, Lasso Regression, Support Vector Regression.

Assessing Predictive Models: Batch Approach to Model Assessment, Assessing Regression Models



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UNIT-V

Model Ensembles: Motivation for Ensembles, Bagging, Boosting, Improvements to Bagging and Boosting, Model Ensembles and Occam's Razor, Interpreting Model Ensembles.

Text Mining: Motivation for Text Mining, A Predictive Modelling Approach to Text Mining, structured vs. Unstructured Data, Why Text Mining Is Hard, Data Preparation Steps, Text Mining Features, Modelling with Text Mining Features, Regular Expressions.

Model Deployment: General Deployment Considerations.

Case Studies: Survey Analysis Case Study, Help Desk Case Study, Capital Asset Pricing Model.

TEXT BOOKS:

1. Dean Abbott, Applied Predictive Analytics, Published by Jhon Wiley & Sons, Inc, 2014.

REFERENCE BOOKS:

1. Eric Siegel, Predictive Analytics, Published by Jhon Wiley & Sons, inc, 2013.
2. Data Analytics using Python Kindle Edition by Bharti Motwani, 2020

COURSE OUTCOMES:

1. Visualize and explore data to better understand relationships among variables
2. Understand how ensemble models improve predictions
3. Organize the predictive modelling task and data flow
4. Apply predictive models to generate predictions for new data
5. Choose and implement appropriate performance measures for predictive models



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(23A33509) DATA VISUALIZATION

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Introduce students to the fundamental concepts and importance of data visualization in data analysis and decision-making.
2. Enable students to understand and apply visual perception and design principles for effective visual communication.
3. Develop the ability to use modern visualization tools and techniques to represent data clearly and accurately.
4. Train students to analyze and visualize data patterns, relationships, trends, and uncertainty.
5. Encourage students to present data insights through clear, ethical, and audience-focused visualizations.

UNIT-I

Introduction, the importance of Context, Choosing and effective visual

UNIT-II

Clutter is your enemy, Focus your audience's attention, Lessons in Storytelling

UNIT-III

Communicating data: A step in the process, a model of communication, Three types of communication problems, six principles of communicating data. Introduction to Tableau: Using Tableau, Tableau products, connecting to data. How much and How many: Communicating how much, communicating how many Ratios and Rates: Ratios, Rates

UNIT-IV

Proportions and Percentages: Part to whole, current to historical, actual to target. Mean and Median Variation and Uncertainty: Respecting variation, Variation over time-Control charts, Understanding uncertainty

UNIT-V

Multiple Quantities: Scatter plots, Stacked Bars, Regression and Trend Lines, The Quadrant Chart Changes over time: The origin of time charts, the line chart, the dual axis line chart, the connected scatter plot, the date filed type and seasonality, the timeline, the slopegraph Maps and Location: One special map, circle maps, filled maps, dual encoded maps.

TEXT BOOKS:

1. Cole Nussbaumer Knaflitz, Storytelling with data, Wiley



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2. Ben Jones, Communicating Data with Tableau, O'Reilly

REFERENCE BOOKS:

1. A Julie Steele and Noah Iliinsky, Designing Data Visualizations: Representing Informational Relationships, O'Reilly.
2. Andy Kirk, Data Visualization: A Successful Design Process, PAKT.
3. Scott Murray, Interactive Data Visualization for Web, O'Reilly.

COURSE OUTCOMES:

1. Understand and explain the fundamental concepts, purpose, and types of data visualization, including exploratory and explanatory approaches, and their role in effective decision-making.
2. Apply visual design and perception principles to create clear, audience-focused, and effective data visualizations by minimizing clutter and enhancing visual clarity.
3. Apply effective data communication principles and Tableau features to present insights clearly using appropriate charts, dashboards, and storytelling techniques.
4. Analyze and visualize proportions, percentages, variation, and uncertainty using suitable charts to support accurate comparisons and data-driven decisions.
5. Interpret and visualize relationships among multiple variables and changes over time using advanced charts such as scatter plots, trend lines, and time-series visualizations.



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III B.Tech. II Sem.

L	T	P	C
3	0	0	3

(23A32609) SOCIAL NETWORK ANALYSIS

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Discuss the characteristics of different social networks
2. Demonstrate the functioning of different social networks

UNIT I

Hacking on Twitter data, Micro formats: Semantic Markup and common sense collide

UNIT II

Mailboxes: Oldies but Goodies, Titter: Friends, Followers and Set wise operations

UNIT III

Twitter: The Tweet, the Whole Tweet, and Nothing but the Tweet

UNIT IV

LinkedIn: Clustering your professional network for Fun (and profit)

UNIT V

Face book: The All-in-one Wonder

TEXT BOOKS:

1. Matthew A. Russel, Mining the Social Web, O'Reilly, 2013

REFERENCE BOOKS:

1. Social Network Analysis: A Introduction with an Extensive Implementation to a Large Scale Online Network using Pajek, SeifedineKadry, Mohammed Taie, 2014.
2. An Introduction to Social Network Data Analytics, Charu C. Aggarwal, IBM T. J. Watson Research Center.

ONLINE LEARNING RESOURCES:

1. Social Network Analysis | Coursera

COURSE OUTCOMES:

1. Explore the functionality of different social networks
2. Analyze social networks

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III B.Tech. II Sem.

L	T	P	C
3	0	0	3

(23A05627) CRYPTOGRAPHY & NETWORK SECURITY

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. The concepts of classical encryption techniques and concepts of finite fields and number theory
2. Working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes, and message digests, and public key algorithms
3. Design issues and working principles of various authentication protocols, PKI standards
4. Various secure communication standards including Kerberos, IPsec, TLS and email
5. Concepts of cryptographic utilities and authentication mechanisms to design secure applications

UNIT-I COMPUTER AND NETWORK SECURITY CONCEPTS

Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography, Block Ciphers: Traditional Block Cipher Structure, The Data Encryption Standard, Advanced Encryption Standard: AES Structure, AES Transformation Functions

UNIT-II NUMBER THEORY

The Euclidean Algorithm, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder Theorem, Discrete Logarithms, Finite Fields: Finite Fields of the Form GF(p), Finite Fields of the Form GF(2ⁿ). **Public Key Cryptography:** Principles, Public Key Cryptography Algorithms, RSA Algorithm, Diffie Hellman Key Exchange, Elliptic Curve Cryptography.

UNIT-III CRYPTOGRAPHIC HASH FUNCTIONS

Application of Cryptographic Hash Functions, Requirements & Security, Secure Hash Algorithm, Message Authentication Functions, Requirements & Security, HMAC & CMAC. **Digital Signatures:** NIST Digital Signature Algorithm, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure

UNIT-IV USER AUTHENTICATION

Remote User Authentication Principles, Kerberos. **Electronic Mail Security:** Pretty Good Privacy (PGP) And S/MIME. **IP Security:** IP Security Overview, IP Security Policy, Security Payload, Combining Security Associations, Internet Key Exchange.



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UNIT-V TRANSPORT LEVEL SECURITY

Web Security Requirements, Transport Layer Security (TLS), HTTPS, Secure Shell (SSH) **Fire walls:** Fire wall Character is tics and Access Policy, Types of Fire walls, Fire wall Location and Configurations.

TEXT BOOKS:

1. Cryptography and Network Security – William Stallings, Pearson Education, 8th Edition.
2. Cryptography, Network Security and Cyber Laws–Bernard Menezes, Cengage Learning, 2010 edition.

REFERENCE BOOKS:

1. Cryptography and Network Security- Behrouz A Forouzan, Debdeep Mukhopadhyaya, Mc- Graw Hill, 3rd Edition, 2015.
2. Network Security Illustrated, Jason Albanese and Wes Sonnenreich, MGH Publishers, 2003.

e- Resources and Digital Material:

1. <https://nptel.ac.in/courses/106/105/106105031/lecture>
2. <https://nptel.ac.in/courses/106/105/106105031/lecturehttps://nptel.ac.in/courses/106/105/106105162/lecture> by Dr. Sourav Mukhopadhyay IIT Kharagpur [VideoLecture]
3. <https://www.mitel.com/articles/web-communication-cryptography-and-network-security> web articles by Mitel Power Connections

COURSE OUTCOMES:

1. Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of it fields and number theory
2. Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication
3. Apply the knowledge of cryptographic check sums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
4. Demonstrate the ability to apply user authentication principles including Kerberos for secure authentication
5. Gain proficiency in securing web communications using TLS and HTTPS, manage secure remote access with SSH, and design firewall policies

**SANTHIRAM ENGINEERING COLLEGE****(AUTONOMOUS)****DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE**

III B.Tech. II Sem.

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(23A32608) COMPUTER NETWORKS

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Understand the basic concepts of Computer Networks.
2. Introduce the layered approach for design of computer networks
3. Expose the network protocols used in Internet environment
4. Explain the format of headers of IP, TCP and UDP
5. Familiarize with the applications of Internet
6. Elucidate the design issues for a computer network

UNIT-I COMPUTER NETWORKS AND THE INTERNET

What Is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks (Textbook 2), Reference Models, Example Networks, Guided Transmission Media, Wireless Transmission (Textbook 1)

UNIT-II THE DATA LINK LAYER, ACCESS NETWORKS, AND LANS

Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols (Textbook 1) Introduction to the Link Layer, Error-Detection and -Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks Link Virtualization: A Network as a Link Layer.

UNIT-III THE NETWORK LAYER

Routing Algorithms, Internetworking, The Network Layer in the Internet (Textbook 1)

UNIT-IV THE TRANSPORT LAYER

Connectionless Transport: UDP (Textbook 2), The Internet Transport Protocols: TCP, Congestion Control (Textbook 1)

UNIT-V PRINCIPLES OF NETWORK APPLICATIONS

Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS-The Internet's Directory Service, Peer-to-Peer Applications Video Streaming and Content Distribution Networks (Textbook 2)

TEXT BOOKS:

1. Andrew S.Tanenbaum, David J.Wetherall, Computer Networks, 5th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.



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REFERENCE BOOKS:

1. Forouzan, Data communications and Networking, 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, ShakilAkthar, “Networks for Computer Scientists and Engineers”, Oxford Publishers, 2016.

e- Resources and Digital Material:

1. <https://nptel.ac.in/courses/106105183/25>
2. <http://www.nptelvideos.in/2012/11/computer-networks.html><https://nptel.ac.in/courses/106105183/3>

COURSE OUTCOMES:

1. Identify the software and hardware components of a computer network
2. Design software for a computer network
3. Develop new routing, and congestion control algorithms
4. Assess critically the existing routing protocols
5. Explain the functionality of each layer of a computer network
6. Choose the appropriate transport protocol based on the application requirements.

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(23A32609) RECOMMENDER SYSTEMS

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To provide students with basic concepts and its application in various domain
2. To make the students understand different techniques that a data scientist needs to know for analysing big data
3. To design and build a complete machine learning solution in many application domains.

UNIT-I AN INTRODUCTION TO RECOMMENDER SYSTEMS, NEIGHBORHOOD-BASED COLLABORATIVE FILTERING

Introduction, Goals of Recommender Systems, Basic Models of Recommender Systems, Domain Specific Challenges in Recommender Systems. Advanced Topics and Applications. Introduction, Key Properties of Ratings Matrices, Predicting Ratings with Neighborhood-Neighborhood-Based Collaborative Filtering: Based Methods, Clustering and Neighborhood-Based Methods, Dimensionality Reduction and Neighborhood Methods, Graph Models for Neighborhood-Based Methods, A Regression Modelling View of Neighborhood Methods.

UNIT-II MODEL-BASED COLLABORATIVE FILTERING, CONTENT-BASED RECOMMENDER SYSTEMS

Introduction, Decision and Regression Trees, Rule-Based Collaborative Filtering, Naive Bayes Collaborative Filtering, Using an Arbitrary Classification Model as a Black-Box, Latent Factor Models, Integrating Factorization and Neighborhood Models. Content-Based Recommender Systems: Introduction, Basic Components of Content-Based Systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations, Using Content-Based Models for Collaborative Filtering, Summary.

UNIT-III KNOWLEDGE-BASED RECOMMENDER SYSTEMS, ENSEMBLE BASED AND HYBRID RECOMMENDER SYSTEMS

Introduction, Constraint-Based Recommender Systems, Case-Based Recommenders, Persistent Personalization in Knowledge-Based Systems, Summary. Introduction, Ensemble Methods from the Classification Perspective, Weighted Hybrids, Switching Hybrids, Cascade Hybrids, Feature Augmentation Hybrids, Meta-Level Hybrids, Feature Combination Hybrids, Summary.



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UNIT-IV EVALUATING RECOMMENDER SYSTEMS, CONTEXT-SENSITIVE RECOMMENDER SYSTEMS

Introduction, Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Accuracy Metrics in Offline Evaluation, Limitations of Evaluation Measures, Limitations of Evaluation Measures. Introduction, The Multidimensional Approach, Contextual Prefiltering: A Reduction-Based Approach, Contextual Pre-filtering: A Reduction-Based Approach, Contextual Modelling.

UNIT-V TIME- AND LOCATION-SENSITIVE RECOMMENDER SYSTEMS

Introduction, Temporal Collaborative Filtering, Discrete Temporal Models, Location-Aware Recommender Systems, Location-Aware Recommender Systems Location-Aware Recommender Systems, Summary.

TEXT BOOKS:

1. Charu C. Aggarwal, "Recommender Systems", Springer, 2016.

REFERENCE BOOKS:

1. Francesco Ricci, Lior Rokach, "Recommender Systems Handbook", 2nd ed., Springer, 2015 Edition

e- Resources and Digital Material:

1. Recommendation System - Understanding The Basic Concepts (analyticsvidhya.com)
2. Recommender Systems
3. Coursera

COURSE OUTCOMES:

1. Aware of various issues related to Personalization and Recommendations.
2. Design and implement a set of well-known Recommender System approaches used in E commerce and Tourism industry.
3. Develop new Recommender Systems for a number of domains especially, Education, Health-care.



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(23A32610) DEEP LEARNING

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Demonstrate the major technology trends driving Deep Learning
2. Build, train, and apply fully connected deep neural networks
3. Implement efficient (vectorized) neural networks
4. Analyse the key parameters and hyper parameters in a neural network's architecture

UNIT-I

Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms, Eigen decomposition, Singular Value Decomposition, Principal Components Analysis.

Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, Expectation, Variance and Covariance, Bayes' Rule, Information Theory.

Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.

UNIT-II

Machine Learning: Basics and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning.

Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms.

UNIT-III

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier.

Optimization for Training Deep Models: Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.



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UNIT-IV

Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.

UNIT-V

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models.

TEXT BOOKS:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, MIT Press,2016.
2. Josh Patterson and Adam Gibson, “Deep learning: A practitioner's approach”, O'Reilly Media, First Edition,2017.

REFERENCE BOOKS:

1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O'Reilly, Shroff Publishers,2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly, DouweOsinga, O'Reilly, Shroff Publishers,2019.

e-Resources and Digital Material:

1. <https://keras.io/datasets/>
2. <http://deeplearning.net/tutorial/deeplearning.pdf>
3. <https://arxiv.org/pdf/1404.7828v4.pdf>
4. <https://www.cse.iitm.ac.in/~miteshk/CS7015.html>
5. <https://www.deeplearningbook.org/>
6. <https://nptel.ac.in/courses/106105215>

COURSE OUTCOMES:

1. Demonstrate the mathematical foundation of neural network
2. Describe the machine learning basics
3. Differentiate architecture of deep neural network
4. Build a convolutional neural network
5. Build and train RNN and LSTMs



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(23A05633) SOFTWARE PROJECT MANAGEMENT

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. This course is designed to enable the students to understand the fundamental principles of Software Project management & will also have a good knowledge of the responsibilities of a project manager and how to handle them

UNIT-I CONVENTIONAL SOFTWARE MANAGEMENT

The water fall model, conventional software Management performance Evolution of Software Economics: software Economics. Pragmatic Software Cost Estimation Improving Software Economics: Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation, Achieving Required Quality ,Peer Inspections.

UNIT-II THE OLD WAY AND THE NEW

The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process. Lifecycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases. Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts

UNIT-III WORK FLOWS OF THE PROCESS

Software process work flows, Inter Trans work flows. Check points of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments. Iterative Process Planning: work break down structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning

UNIT-IV PROCESS AUTOMATION

Automation Building Blocks, The Project Environment. Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators Tailoring the Process: Process discriminants. Managing people and organizing teams.

UNIT-V PROJECT ORGANIZATIONS AND RESPONSIBILITIES

Line - of-Business Organizations, Project Organizations, evolution of Organizations. Future Software Project Management: modern Project Profiles, Next generation Software economics, modern process transitions. Case Study: The Command Center Processing and Display System- Replacement(CCPDS-R)

TEXT BOOKS:

1. Software Project Management, Walker Royce, Pearson Education, 2012



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2. Bob Hughes, Mike Cotterell and Rajib Mall Software Project Management, 6th Edition, McGraw Hill Edition, 2017

REFERENCE BOOKS:

1. Pankaj Jaloo Software Project Management in practice, 5th Edition, Pearson Education, 2017.
2. Murali K. Chemuturi, Thomas M. Cagley Jr. Mastering Software Project Management: Best Practices, Tools and Techniques, J. Ross Publishing, 2010
3. Sanjay Mohapatra, Software Project Management, Cengage Learning, 2011

e-Resources and Digital Material:

1. <http://nptel.ac.in/courses/106101061/29>

COURSE OUTCOMES:

1. Describe the fundamentals of Project Management
2. Recognize and use Project Scheduling Techniques
3. Familiarize with Project Control Mechanisms
4. Understand Team Management
5. Recognize the importance of Project Documentation and Evaluation



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(23A32611) INTRODUCTION TO QUANTUM COMPUTING

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To introduce the principles and mathematical foundations of quantum computation.
2. To understand quantum gates, circuits, and computation models.
3. To explore quantum algorithms and their advantages over classical ones.
4. To develop the ability to simulate and write basic quantum programs.
5. To understand real-world applications and the future of quantum computing in AI, cryptography, and optimization.

UNIT-I FUNDAMENTALS OF QUANTUM MECHANICS AND LINEAR ALGEBRA

Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT-II QUANTUM GATES AND CIRCUITS

Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT-III QUANTUM ALGORITHMS AND COMPLEXITY

Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover's Search Algorithm, Shor's Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT-IV QUANTUM PROGRAMMING AND SIMULATION PLATFORMS

Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT-V APPLICATIONS AND FUTURE OF QUANTUM COMPUTING

Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

TEXT BOOKS:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.



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2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

REFERENCE BOOKS:

1. David McMahon, Quantum Computing Explained, Wiley, 2008
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

e- Resources and Digital Material:

1. IBM Quantum Experience and Qiskit Tutorials
2. Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
3. edX – The Quantum Internet and Quantum Computers
4. YouTube – Quantum Computing for the Determined by Michael Nielsen
5. Qiskit Textbook – IBM Quantum

COURSE OUTCOMES:

1. Explain the fundamental concepts of quantum mechanics used in computing.
2. Construct and analyze quantum circuits using standard gates.
3. Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.
4. Develop simple quantum programs using Qiskit or similar platforms.
5. Analyze applications and challenges of quantum computing in real-world domains.



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(23A32612) COMPUTER VISION

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

The objective of this course is to understand the basic issues in computer vision and major approaches to address the methods to learn the Linear Filters, segmentation by clustering, Edge detection, Texture.

UNIT-I LINEAR FILTERS

Introduction to Computer Vision, Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing Filters as Templates, Technique: Normalized Correlation and Finding Patterns, Technique: Scale and Image Pyramids.

UNIT-II EDGE DETECTION

Noise- Additive Stationary Gaussian Noise, Why Finite Differences Respond to Noise, Estimating Derivatives - Derivative of Gaussian Filters, Why Smoothing Helps, Choosing a Smoothing Filter, Why Smooth with a Gaussian? Detecting Edges-Using the Laplacian to Detect Edges, Gradient-Based Edge Detectors, Technique: Orientation Representations and Corners.

UNIT-III TEXTURE

Representing Texture –Extracting Image Structure with Filter Banks, Representing Texture using the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids –The Laplacian Pyramid, Filters in the Spatial Frequency Domain, Oriented Pyramids, Application: Synthesizing Textures for Rendering, Homogeneity, Synthesis by Sampling Local Models, Shape from Texture, Shape from Texture for Planes,

UNIT-IV SEGMENTATION BY CLUSTERING

What is Segmentation, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction. Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering. The Hough Transform, Fitting Lines, Fitting Curves

UNIT-V RECOGNITION BY RELATIONS BETWEEN TEMPLATES

Finding Objects by Voting on Relations between Templates, Relational Reasoning Using Probabilistic Models and Search, Using Classifiers to Prune Search, Hidden Markov Models, Application: HMM and Sign Language Understanding, Finding People with HMM.

TEXT BOOKS:

1. David A. Forsyth, Jean Ponce, Computer Vision – A modern Approach, PHI, 2003.

REFERENCE BOOKS:



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1. Geometric Computing with Clifford Algebras: Theoretical Foundations and Applications in Computer Vision and Robotics, Springer; 1st edition, 2001 by Sommer.
2. Digital Image Processing and Computer Vision, 1/e, by Sonka.
3. Computer Vision and Applications: Concise Edition (With CD) by Jack Academy Press, 2000.

e-Resources and Digital Material:

1. <https://nptel.ac.in/courses/106105216>
2. <https://nptel.ac.in/courses/108103174>

COURSE OUTCOMES:

1. Identify basic concepts, terminology, theories, models and methods in the field of computer vision,
2. Describe known principles of human visual system,
3. Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition,
4. Suggest a design of a computer vision system for a specific problem



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3	0	0	3

(23A05626) CLOUD COMPUTING

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To explain the evolving computer model called cloud computing.
2. To introduce the various levels of services that can be achieved by cloud.
3. To describe the security aspects in cloud.

UNIT-I BASICS OF CLOUD COMPUTING

Introduction to cloud computing: Introduction, Characteristics of cloud computing, Cloud Models, Cloud Services Examples, Cloud Based services and applications

Cloud concepts and Technologies: Virtualization, Load balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined, Network function virtualization, Map Reduce, Identity and Access Management, services level Agreements, Billing. **Cloud Services and Platforms:** Compute Services, Storage Services, Database Services, Application services, Content delivery services, Analytics Services, Deployment and Management Services, Identity and Access Management services, Open Source Private Cloud software.

UNIT-II HADOOP AND PYTHON

Hadoop MapReduce: Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers, Hadoop Cluster setup. **Cloud Application Design:** Reference Architecture for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches. **Python Basics:** Introduction, Installing Python, Python data Types & Data Structures, Control flow, Function, Modules, Packages, File handling, Date/Time Operations, Classes.

UNIT-III PYTHON FOR CLOUD COMPUTING

Python for Cloud: Python for Amazon web services, Python for Google Cloud Platform, Python for windows Azure, Python for MapReduce, Python packages of Interest, Python web Application Frame work, Designing a RESTful web API.

Cloud Application Development in Python: Design Approaches, Image Processing APP, Document Storage App, MapReduce App, Social Media Analytics App.



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UNIT-IV BIG DATA, MULTIMEDIA AND TUNING

Big Data Analytics: Introduction, Clustering Big Data, Classification of Big data Recommendation of Systems.

Multimedia Cloud: Introduction, Case Study: Live video Streaming App, Streaming Protocols, case Study: Video Transcoding App. **Cloud Application Benchmarking and Tuning:** Introduction, Workload Characteristics, Application Performance Metrics, Design Considerations for a Benchmarking Methodology, Benchmarking Tools, Deployment Prototyping, Load Testing & Bottleneck Detection case Study, Hadoop benchmarking case Study.

UNIT-V APPLICATIONS AND ISSUES IN CLOUD

Cloud Security: Introduction, CSA Cloud Security Architecture, Authentication, Authorization, Identity Access Management, Data Security, Key Management, Auditing.

Cloud for Industry, Healthcare & Education: Cloud Computing for Healthcare, Cloud computing for Energy Systems, Cloud Computing for Transportation Systems, Cloud Computing for Manufacturing Industry, Cloud computing for Education.

Migrating into a Cloud: Introduction, Broad Approaches to migrating into the cloud, the seven step model of migration into a cloud.

Organizational readiness and Change Management in The Cloud Age: Introduction, Basic concepts of Organizational Readiness, Drivers for changes: A frame work to comprehend the competitive environment, common change management models, change management maturity models, Organizational readiness self – assessment.

Legal Issues in Cloud Computing: Introduction, Data Privacy and security Issues, cloud contracting models, Jurisdictional issues raised by virtualization and data location, commercial and business considerations, Special Topics.

TEXT BOOKS:

1. Cloud computing A hands-on Approach??? By ArshdeepBahga, Vijay Madiseti, Universities Press, 2016
2. Cloud Computing Principles and Paradigms: By Raj Kumar Buyya, James Broberg, Andrzej Goscinski, Wiley, 2016

REFERENCE BOOKS:

1. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, SThamaraiSelvi, TMH
2. Cloud computing A Hands-On Approach by ArshdeepBahga and Vijay Madiseti.
3. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Tata McGraw Hill, rp2011.
4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O 'Reilly, SPD, rp2011.
6. Essentials of Cloud Computing by K. Chandrasekaran. CRC Press.

COURSE OUTCOMES:

1. Ability to create cloud computing environment



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2. Ability to design applications for Cloud environment
3. Design & develop backup strategies for cloud data based on features.
4. Use and Examine different cloud computing services
5. Apply different cloud programming model as per need.

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III B.Tech. II Sem.

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(23A32613) PREDICTIVE ANALYTICS LAB

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To develop the fundamental understanding and application of Mathematics and Statistics in business organizations
1. Introduction to SPSS, Sorting File, Split File, Compute File, Recode File and Select Cases
- 2 Chi- Square Test (Parametric and Non-Para
- 3 Exploratory Factor Analysis
- 4 Cluster Analysis
- 5 Logistic Regression
- 6 Discriminant Analysis
- 7 Confirmatory Factor Analysis
- 8 Conjoint Analysis
- 9 Time Series
- 10 MANOVA
- 11 Decision Tree Analysis

COURSE OUTCOMES:

1. Students will be able to initiate effective use of SPSS in business problem
2. Student will learn to evaluate and solve the business problems logically
3. Students will be able to avoid risks and spot opportunities.



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III B.Tech. II Sem.

L	T	P	C
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(23A33615) NLP AND DATA VISUALIZATION LAB (USING POWER BI / TABLEAU ETC.,)

Course Category	Engineering Science (ES)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Discuss concepts and principles of data visualization particularly related to decision making.
2. Investigate technologies and practices for visualizing data as part of a data management and analytics system.
3. Apply user interface design principles and practices to develop interactive data visualizations.
4. Design effective dashboard for decision making at various levels.
5. Conduct research on relevant data visualization topics.

PART 1

1. Word Analysis
2. Word Generation
3. Morphology
4. N-Grams
5. N-Grams Smoothing
6. POS Tagging: Hidden Markov Model
7. POS Tagging: Viterbi Decoding
8. Building POS Tagger
9. Chunking
10. Building Chunker

Refer: <https://nlp-iiith.vlabs.ac.in/List%20of%20experiments.html>

Online Learning Resources/Virtual Labs:



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

1. Natural Language Processing in TensorFlow | Coursera

PART 2

List of Experiments:

1. Connecting to the data
2. Formatting and insertion of data
3. Creating worksheets, navigating the sheets, applying filters, aggregating the data
4. Organize the data into dashboards 5. Create story
6. Develop interactive plots in Python
7. Create Time series Data Visualization in Python
8. Visualization of Semi-Structured data
9. Create Sales Growth Dashboard for the tracking of sales team's progress
10. Design Social media Dashboard find how well your sponsored social activating are performing, monitor your PPC campaigns
11. Develop Healthcare Data Dashboard Allows hospital administrators to manage and identify patient hazards from a single screen

References:

1. Andy Kirk, Data Visualization A Handbook for Data Driven Design, Sage Publications, 2016
2. Philipp K. Janert, Gnuplot in Action, Understanding Data with Graphs, Manning Publications, 2010

COURSE OUTCOMES:

1. Understand approaches to syntax and semantics in NLP.
2. Analyse grammar formalism and context free grammars
3. Apply the statistical estimation and statistical alignment models
4. Apply Rule based Techniques, Statistical Machine translation (SMT), word alignment, phrase-based translation
5. Have the skills (experience) of solving specific NLP tasks, which may involve programming in Python, as well as running experiments on textual data.

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III B.Tech. II Sem.

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1	0	2	2

(23A94403) SOFT SKILLS

Course Category	Skill Oriented Course (SC)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To encourage all round development of the students by focusing on soft skills
2. To make the students aware of critical thinking and problem-solving skills
3. To enhance healthy relationship and understanding within and outside an organization
4. To function effectively with heterogeneous teams

UNIT – I: Soft Skills & Communication Skills

Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills - Significance, process, types - Barriers of communication - Improving techniques
 Activities: Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity (The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)
 Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic. Verbal Communication- Oral Presentations-Extempore- brief addresses and speeches- convincing negotiating- agreeing and disagreeing with professional grace. Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

UNIT – II: Critical Thinking

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking - Positive thinking - Reflection Activities: Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT – III: Problem Solving & Decision Making

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles Activities: B.Tech - CSE R23 Regulation 55 Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on



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important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion

UNIT – IV: Emotional Intelligence & Stress Management

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self Regulation – Stress factors – Controlling Stress – Tips Activities: Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.

Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT – V: Corporate Etiquette

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette - Corporate grooming tips - Overcoming challenges Activities Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

NOTE:-

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear.

TEXT BOOKS:

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, K I 2018, esuoH gnihsilbuP lanoitanretnI

REFERENCE BOOKS:

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018
2. Alex K, Soft Skills S. Chand & Co, 2012 (Revised edition)



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3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
5. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher : Vayu Education of India, 2014

e- Resources and Digital Material:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_ybOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7Kl J
3. <https://youtu.be/-Y-R9hDI7IU>
4. <https://youtu.be/gkLsn4ddmTs>
5. <https://youtu.be/2bf9K2rRWwo>
6. <https://youtu.be/FchfE3c2jzc>
7. <https://www.businesstrainingworks.com/training-resource/five-free-business-etiquette-training-game>
8. https://onlinecourses.nptel.ac.in/noc24_hs15/preview
9. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

COURSE OUTCOMES:

1. List out various elements of soft skills
2. Describe methods for building professional image
3. Apply critical thinking skills in problem solving
4. Analyse the needs of an individual and team for well-being
5. Assess the situation and take necessary decisions
6. Create a productive work place atmosphere using social and work-life skills ensuring personal and emotional well-being

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L	T	P	C
2	0	0	0

(23A99608) TECHNICAL PAPER WRITING & IPR

Course Category	Mandatory Course (Non-credit)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To enable the students to practice the basic skills of research paper writing
2. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
3. To practice the basic skills of performing quality literature review
4. To help them in knowing the significance of real-life practice and procedure of Patents.
5. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

UNIT-I

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language - highlighting your findings discussing your limitations -hedging and criticizing -plagiarism and paraphrasing .

UNIT-II

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature-Problems and Framing Research Questions- Synopsis

UNIT-III

Process of research: publication mechanism: types of journals- indexing-seminars conferences- proof reading plagiarism style; seminar & conference paper writing; Methodology-discussion-results- citation rules

UNIT-IV

Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, agencies and treaties, importance of intellectual property rights
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.??



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UNIT-V

Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer. Patent law, intellectual property audits.

TEXT BOOKS:

1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013
2. Meenakshi Raman, Sangeeta Sharma. Technical Communication: Principles and practices. Oxford.

REFERENCE BOOKS:

1. R.Myneni, Law of Intellectual Property, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli, Intellectual Property Rights Tata Mcgraw Hill, 2001
3. P.Naryan, Intellectual Property Law, 3rd Ed, Eastern Law House, 2007.
4. Adrian Wallwork. English for Writing Research Papers Second Edition. Springer Cham Heidelberg New York, 2016
5. Dan Jones, Sam Dragga, Technical Writing Style

e-Resources and Digital Material:

1. <https://theconceptwriters.com.pk/principles-of-technical-writing/>
2. <https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html>
3. <https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html>
4. <https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper-journal/>
5. <https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf>
6. <https://lawbhoomi.com/intellectual-property-rights-notes/>
7. <https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf>

COURSE OUTCOMES:

1. Identify key secondary literature related to their proposed technical paper writing L1, L2
2. Explain various principles and styles in technical writing L1, L2
3. Use the acquired knowledge in writing a research/technical paper L3
4. Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc. L4
5. Evaluate different forms of IPR available at national & international level L5
6. Develop skill of making search of various forms of IPR by using modern tools and techniques. L3, L6



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L T P C

(23A32614) WORKSHOP

Course Category	
Course Enrichment Relevance	

A Department- specific workshop will be conducted after the completion of the III-B.Tech, I-Sem . The Workshop details will be reflected in the III.B.Tech, II-Sem marks memo with 0 credits. And examination for 50 marks shall be conducted on the last day program, and a student must secure a minimum of 40% (20 Marks) to be eligible for the certificate. Student who do not meet the minimum requirement shall appear for a supplementary examination in the subsequent semester.

DOMAIN SPECIFIC AREAS:

1. Data Science and Analytics
2. Machine Learning
3. Deep Learning and Artificial Intelligence
4. Generative AI and Large Language Models
5. Natural Language Processing
6. Big Data Engineering
7. Data Engineering
8. Cloud Computing for Data Science
9. MLOps and AI Deployment
10. Computer Vision
11. Internet of Things and Edge AI
12. Cybersecurity and Data Science
13. Robotics and Intelligent Automation
14. Web and Application Development for Data Science
15. Emerging Industry Applications



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3	0	0	3

(23A01603) DISASTER MANAGEMENT

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
2. To analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
3. To apply wind engineering principles and computational techniques in designing windresistant structures.
4. To evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
5. To assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

UNIT-I

Introduction to Natural Disasters– Brief Introduction to Different Types of Natural Disasters, Occurrence of Disasters in Different Climatic and Geographical Regions, Hazard Maps (Earthquake and Cyclone) of The World and India, Regulations for Disaster Risk Reduction, Post-Disaster Recovery and Rehabilitation (Socioeconomic Consequences).

UNIT-II

Cyclones and Their Impact– Climate Change and Its Impact On Tropical Cyclones, Nature of Cyclonic Wind, Velocities and Pressure, Cyclone Effects, Storm Surges, Floods, and Landslides. Behavior of Structures in Past Cyclones and Windstorms, Case Studies. Cyclonic Retrofitting, Strengthening of Structures, and Adaptive Sustainable Reconstruction. Life-Line Structures Such as Temporary Cyclone Shelters.

UNIT-III

Wind Engineering and Structural Response– Basic Wind Engineering, Aerodynamics of Bluff Bodies, Vortex Shedding, and Associated Unsteadiness Along and Across Wind forces. Lab: Wind Tunnel Testing and Its Salient Features. Introduction to Computational Fluid Dynamics (CFD). General Planning and Design Considerations Under Windstorms and Cyclones. Wind Effects On Buildings, towers, Glass Panels, Etc., and Wind-Resistant Features in Design. Codal Provisions, Design Wind Speed, Pressure Coefficients. Coastal Zoning Regulations for Construction and Reconstruction in Coastal Areas. Innovative Construction Materials and Techniques, Traditional Construction Techniques in Coastal Areas



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UNIT-IV

Seismology and Earthquake Effects– Causes of Earthquakes, Plate Tectonics, Faults, Seismic Waves; Magnitude, Intensity, Epicenter, Energy Release, and Ground Motions. Earthquake Effects– On Ground, Soil Rupture, Liquefaction, Landslides. Performance of Ground and Buildings in Past Earthquakes– Behavior of Various Types of Buildings and Structures, Collapse Patterns; Behavior of Non-Structural Elements Such as Services, Fixtures, and Mountings – Case Studies. Seismic Retrofitting– Weakness in Existing Buildings, Aging, Concepts in Repair, Restoration, and Seismic Strengthening

UNIT-V

Planning and Design Considerations for Seismic Safety– General Planning and Design Considerations; Building forms, Horizontal and Vertical Eccentricities, Mass and Stiffness Distribution, Soft Storey Effects, Etc.; Seismic Effects Related to Building Configuration. Plan and Vertical Irregularities, Redundancy, and Setbacks. Construction Details– Various Types of Foundations, Soil Stabilization, Retaining Walls, Plinth Fill, Flooring, Walls, Openings, Roofs, Terraces, Parapets, Boundary Walls, Underground and Overhead Tanks, Staircases, and Isolation of Structures. Innovative Construction Materials and Techniques. Local Practices– Traditional Regional Responses. Computational Investigation Techniques.

TEXT BOOKS:

1. David Alexander, Natural Disasters, 1st Edition, CRC Press, 2017

REFERENCE BOOKS:

1. Ben Wisner, J.C. Gaillard, and IlanKelman (Editors), Handbook of Hazards and Disaster Risk Reduction and Management, 2nd Edition, Routledge, 2012.
2. Damon P. Coppola, Introduction to International Disaster Management, 4th Edition, Butterworth-Heinemann, 2020.
3. BimalKanti Paul, Environmental Hazards and Disasters: Contexts, Perspectives and Management, 2nd Edition, Wiley-Blackwell, 2020.

e- Resources and Digital Material:

1. <https://nptel.ac.in/courses/124107010>
2. https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

COURSE OUTCOMES:

1. Understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
2. Analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
3. Apply wind engineering principles and computational techniques in designing wind resistant structures.
4. Evaluate earthquake effects on buildings and develop strategies for seismic retrofitting
5. Assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

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L	T	P	C
3	0	0	3

(23A03605) SUSTAINABILITY IN ENGINEERING PRACTICES

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
2. To analyze sustainable construction materials, their durability, and life cycle assessment.
3. To apply energy calculations in construction materials and assess their embodied energy.
4. To evaluate green building standards, energy codes, and performance ratings.
5. To assess the environmental effects of energy use, climate change, and global warming.

UNIT-I INTRODUCTION

Introduction and Definition of Sustainability - Carbon Cycle - Role of Construction Material: Concrete and Steel, Etc. - CO₂ Contribution From Cement and Other Construction Materials.

UNIT-II MATERIALS USED IN SUSTAINABLE CONSTRUCTION

Construction Materials and Indoor Air Quality - No/Low Cement Concrete - Recycled and Manufactured Aggregate - Role of QC and Durability - Life Cycle and Sustainability.

UNIT-III ENERGY CALCULATIONS

Components of Embodied Energy - Calculation of Embodied Energy for Construction Materials - Energy Concept and Primary Energy - Embodied Energy Via-A-Vis Operational Energy in Conditioned Building - Life Cycle Energy Use

UNIT-IV GREEN BUILDINGS

Control of Energy Use in Building - ECBC Code, Codes in Neighboring Tropical Countries - OTTV Concepts and Calculations Features of LEED and TERI GRIHA Ratings - Role of Insulation and Thermal Properties of Construction Materials - Influence of Moisture Content and Modeling - Performance Ratings of Green Buildings - Zero Energy Building

UNIT-V ENVIRONMENTAL EFFECTS

Non-Renewable Sources of Energy and Environmental Impact Energy Norm, Coal, Oil, Natural Gas - Nuclear Energy - Global Temperature, Green House Effects, Global Warming - Acid Rain: Causes, Effects and Control Methods - Regional Impacts of Temperature Change.



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TEXT BOOKS:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.

REFERENCE BOOKS:

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practicesin the Built Environment, Butterworth Heinemann Publishers, 2011.
2. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2012.

e- Resources and Digital Material:

1. <https://archive.nptel.ac.in/courses/105/105/105105157>

COURSE OUTCOMES:

1. Understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
2. Analyze sustainable construction materials, their durability, and life cycle assessment.
3. Apply energy calculations in construction materials and assess their embodied energy
4. Evaluate green building standards, energy codes, and performance ratings.
5. Assess the environmental effects of energy use, climate change, and global warming



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(23A02604) RENEWABLE ENERGY SOURCES

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand solar radiation, solar angles, sunrise and sunset calculations, and the working and applications of flat plate and concentrating solar collectors and thermal energy storage systems.
2. To understand the photovoltaic effect, different PV technologies, PV cells and modules, their electrical characteristics, and the configuration of stand-alone and grid-connected PV systems.
3. To understand the principles of wind energy conversion, types and components of wind machines, aerodynamic forces on wind turbine blades, wind energy estimation, and site selection.
4. To understand the nature, sources, and resources of geothermal energy, along with its advantages, disadvantages, applications, and prospects in India.
5. To understand the principles, operation, energy conversion methods, advantages, limitations, and applications of ocean energy, biomass energy, biogas plants, and fuel cell technologies.

UNIT-I SOLAR ENERGY

Solar radiation - beam and diffuse radiation, solar constant, Sun at Zenith, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

UNIT-II PV ENERGY SYSTEMS

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Solar PV modules from solar cells, mismatch in series and parallel connections design and structure of PV modules, Electrical characteristics of silicon PV cells and modules, Stand-alone PV system configuration, Grid connected PV systems.

UNIT-III WIND ENERGY

Principle of wind energy conversion-Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades- wind data and energy estimation and site selection considerations.

UNIT-IV GEOTHERMAL ENERGY

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geopressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

UNIT-V MISCELLANEOUS ENERGY TECHNOLOGIES

Ocean Energy: Tidal Energy-Principle of working, Operation methods, advantages and limitations. Wave Energy-Principle of working, energy and power from waves, wave energy conversion devices, advantages and limitations. Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations

TEXT BOOKS:

1. G. D. Rai, -Non-Conventional Energy Sources,4th Edition, Khanna Publishers,



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2000.



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2. Chetan Singh Solanki -Solar Photovoltaics fundamentals, technologies and applications 2nd Edition PHI Learning Private Limited. 2012.

REFERENCE BOOKS:

1. Stephen Peake, Renewable Energy Power for a Sustainable Future, Oxford International Edition, 2018.
2. S. P. Sukhatme, Solar Energy, 3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008
3. B H Khan ,Non-Conventional Energy Resources, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
4. S. Hasan Saeed and D.K.Sharma,Non-Conventional Energy Resources,3rd Edition, S.K.Kataria& Sons, 2012.
5. G. N. Tiwari and M.K.Ghosal,Renewable Energy Resource: Basic Principles and Applications, Narosa Publishing House, 2004

e- Resources and Digital Material:

1. <https://nptel.ac.in/courses/103103206>
2. <https://nptel.ac.in/courses/108108078>

COURSE OUTCOMES:

1. Understand principle operation of various renewable energy sources.
2. Identify site selection of various renewable energy sources.
3. Analyze various factors affecting on solar energy measurements, wind energy conversion techniques, Geothermal, Biomass, Tidal Wave and Fuel cell energies L3
4. Design of Solar PV modules and considerations of horizontal and vertical axis Wind energy systems.
5. Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power.

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3	0	0	3

(23A03606) AUTOMATION AND ROBOTICS

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Fundamentals of industrial automation, production types, automation strategies, and hardware elements used in modern manufacturing processes.
2. Understanding of automated manufacturing systems, and strategies for improving productivity and flexibility in industrial automation.
3. Knowledge of industrial automation and robotics, sensors, and end-effector design for modern manufacturing environments.
4. Explain industrial automation and robotics, and trajectory planning for intelligent and efficient manufacturing applications.
5. Familiarity of industrial automation and robotics, and practical applications in manufacturing processes.

UNIT-I INTRODUCTION TO AUTOMATION

Introduction to Automation, Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

UNIT-II AUTOMATED FLOW LINES

Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT-III INTRODUCTION TO INDUSTRIAL ROBOTICS

Introduction to Industrial Robotics, Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers. Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.



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UNIT-IV MANIPULATOR K I N E M A T I C S

Manipulator Kinematics, Homogenous transformations as applicable to rotation and translation - D-H notation, forward inverse kinematics. Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton Euler formulations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

UNIT-V ROBOT PROGRAMMING

Robot Programming, Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages. Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS:

1. Automation, Production systems and CIM, M.P. Groover/Pearson Edu..
2. Industrial Robotics - M.P. Groover, TMH

REFERENCE BOOKS:

1. Robotics, FuKS, McGrawHill, 4th edition, 2010.
2. An Introduction to Robot Technology, P. Coiffet and M. Chironze, Kogam Page Ltd. 1983 London
3. Robotic Engineering, Richard D. Klafter, Prentice Hall
4. Robotics, Fundamental Concepts and analysis - A. Shrivastava Ghosal, Oxford Press, 1/e, 2006
5. Robotics and Control, Mittal RK & Nagrath IJ, TMH.

e-Resources and Digital Material:

1. <https://www.youtube.com/watch?v=yxZm9WQJUA0&list=PLRLB5WCqU54UJG45UnazSYmn mhl-gt76o>
2. <https://www.youtube.com/watch?v=6f3bvIhSWyM&list=PLRLB5WCqU54X5Vy4DwjfSODT 3ZJ gwEjyE>

COURSE OUTCOMES:

1. Understand and analyze the structure and functions of automated manufacturing systems, and evaluate hardware components for efficient production
2. Analyze and design automated flow lines with or without buffer storage, perform quantitative evaluations, apply assembly line balancing techniques.
3. Classify robot configurations, select suitable actuators and sensors, analyze and apply automation and robotics principles to optimize production efficiency and flexibility.
4. Apply kinematic and dynamic modeling using D-H notation and select appropriate hardware and control strategies for real-world industrial scenario to analyze and design automated and robotic systems.
5. Design, program, and implement robotic systems, understand and apply robotics technology to manufacturing tasks.



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3	0	0	3

(23A04639) DIGITAL ELECTRONICS

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. To analyze combinational circuits like adders, subtractors, and code converters.
3. To explore combinational logic circuits and their applications in digital design.
4. To understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. To gain knowledge about programmable logic devices and digital IC's.

UNIT-I LOGIC SIMPLIFICATION AND COMBINATIONAL LOGIC DESIGN

Review of Boolean Algebra and De Morgan 's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, ExNOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT-II INTRODUCTION TO COMBINATIONAL DESIGN 1

Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

UNIT-III COMBINATIONAL LOGIC DESIGN 2

Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT-IV SEQUENTIAL LOGIC DESIGN

Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.

UNIT-V PROGRAMMABLE LOGIC DEVICES

ROM, Programmable Logic Devices (PLA and PAL). **Digital IC's:** Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de-multiplexer (74x155), comparator (74x85).

TEXT BOOKS:

1. Digital Design, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999
2. Switching theory and Finite Automata Theory, ZviKohavi and NirahK.Jha, 2nd Edition, Tata McGraw Hill, 2005.



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REFERENCE BOOKS:

1. Fundamentals of Logic Design, Charles H Roth, Jr., 5th Edition, Brooks/Cole Cengage Learning, 2004.

COURSE OUTCOMES:

1. Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. Analyze combinational circuits like adders, subtractors, and code converters.
3. Explore combinational logic circuits and their applications in digital design
4. Understand sequential logic circuits, including latches, flip-flops, counters, and shift registers
5. Gain knowledge about programmable logic devices and digital IC's.



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III B.Tech. II Sem.

L	T	P	C
3	0	0	3

(23A91614) OPTIMIZATION TECHNIQUES FOR ENGINEERS

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand and apply linear programming concepts, formulate linear programming problems, and solve them using the Simplex, Two-Phase Simplex, and Big-M methods.
2. To understand and apply duality concepts, duality theorems, the Dual Simplex Method, transportation and assignment problems, and complementary slackness in linear programming.
3. To understand and apply unconstrained nonlinear optimization techniques, including random search, descent, Fletcher–Powell, and grid search methods for minimization problems.
4. To understand and apply constrained optimization techniques, including random search, complex method, sequential linear programming, feasible direction methods, and Zoutendijk's method.
5. To understand and solve unconstrained and constrained geometric programming problems using differential calculus, arithmetic-geometric inequality, primal-dual programming, and mixed inequality constraints

UNIT-I LINEAR PROGRAMMING I

Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two-phase Simplex Method, Big-M method.

UNIT-II LINEAR PROGRAMMING II

Duality in Linear Programming:

Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and assignment problem, Complementary slackness Theorem

UNIT-III NON-LINEAR PROGRAMMING

Unconstrained optimization techniques: Introduction: Classification of Unconstrained minimization methods,

Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method

UNIT-IV NON-LINEAR PROGRAMMING

Constrained optimization techniques: Introduction, Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

UNIT-V GEOMETRIC PROGRAMMING

Unconstrained Minimization Problems: solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.

Constrained minimization Problems: Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

TEXT BOOKS:



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1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.



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2. J. C. Panth, Introduction to Optimization Techniques, (7-e) Jain Brothers, New Delhi.

REFERENCE BOOKS:

1. Harvey M. Wagner, Principles of Operation Research, Printice-Hall of India Pvt. Ltd. New Delhi.
2. Peressimi A.L., Sullivan F.E., Vhl, J. J. Mathematics of Non-linear Programming, Springer Verlag.

e- Resources and Digital Material:

1. https://onlinecourses.nptel.ac.in/noc24_ee122/preview
2. <https://archive.nptel.ac.in/courses/111/105/111105039/>
3. https://onlinecourses.nptel.ac.in/noc21_ce60/preview

COURSE OUTCOMES:

1. Understand the meaning, purpose, tools of Operations Research and linear programming in solving practical problems in industry.
2. Interpret the transportation models' solutions and infer solutions to the real-world problems.
3. Develop mathematical skills to analyze and solve nonlinear programming models arising from a wide range of applications.
4. Apply the concept of non-linear programming for solving the problems involving non-linear constraints and objectives
5. Apply the concept of unconstrained geometric programming for solving the problems involving non-linear constraints and objectives

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III B.Tech. II Sem.

L	T	P	C
3	0	0	3

(23A91609) MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To provide students with essential linear algebra foundations including vector spaces, inner products, and operators for quantum mechanical applications.
2. To develop understanding of the transition from finite-dimensional systems to infinite dimensional function spaces and Hilbert space concepts
3. To establish quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution principles.
4. To enable students to apply quantum mechanical principles to solve problems in simple quantum systems and understand statistical interpretation.
5. To introduce advanced concepts in composite systems, measurement processes, and modern perspectives in quantum mechanics.

UNIT-I LINEAR ALGEBRA FOUNDATION FOR QUANTUM MECHANICS

Vector spaces definition and examples ($\mathbb{R}^2$, $\mathbb{R}^3$, function spaces), Inner products (dot product, orthogonality, normalization), Linear operators (matrices, eigenvalues, eigenvectors), Finite-dimensional examples (2x2 matrices, spin-1/2 systems), Dirac notation introduction, Change of basis (transformations, unitary matrices).

UNIT-II FROM FINITE TO INFINITE DIMENSIONS

Function spaces (L^2 space, square-integrable functions), Inner products for functions (dx), Orthogonal function sets (Fourier series, basis functions), Introduction to Hilbert space concept (complete inner product spaces), Position and momentum representations (wave functions), Operators on functions (d/dx, multiplication by x).

UNIT-III QUANTUM MECHANICAL FORMALISM

Mathematical formulation (states as vectors, observables as operators), Measurement theory (Born rule, expectation values, probabilities), Uncertainty relations (mathematical derivation from commutators), Time evolution (Schrodinger equation, unitary evolution).

UNIT-IV APPLICATIONS AND STATISTICAL INTERPRETATION

Simple applications (infinite square well, harmonic oscillator), Statistical interpretation (ensembles, pure vs mixed states), Measurement process (von Neumann measurement scheme).



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UNIT-V ADVANCED TOPICS

Composite systems (tensor products basic introduction), Reversibility and irreversibility (unitary evolution vs measurement), Thermodynamic connections (equilibrium states, entropy), Modern perspectives (decoherence, measurement problem conceptual).

TEXT BOOKS:

1. David J. Griffiths, Darrell F. Schroeter, Introduction to Quantum Mechanics, 3rd Edition, Cambridge University Press (2018).
2. R. Shankar, Principles of Quantum Mechanics, 2nd Edition, Kluwer Academy/Plenum Publishers (1994).

REFERENCE BOOKS:

1. George. F. Simmons, Introduction to Topology and Modern Analysis, MedTech Science Press
2. Gilbert Strang, Linear Algebra and Its Applications, 4th Edition, Cengage Learning (2006)
3. John von Neumann and Robert T Beyer, Mathematical Foundations of Quantum Mechanics, Princeton Univ. Press (1996).

e-Resources and Digital Material:

1. [https://eclass.uoa.gr/modules/document/file.php/CHEM248/Griffiths%20 - %20Introduction%20to%20Quantum%20Mechanics%203rd%20ed%202018.pdf](https://eclass.uoa.gr/modules/document/file.php/CHEM248/Griffiths%20-%20Introduction%20to%20Quantum%20Mechanics%203rd%20ed%202018.pdf)
2. [https://fisica.net/mecanica-quantica/Shankar%20 - %20Principles%20of%20quantum%20mechanics.pdf](https://fisica.net/mecanica-quantica/Shankar%20-%20Principles%20of%20quantum%20mechanics.pdf)

COURSE OUTCOMES:

1. Understand vector spaces, inner products, and linear operators with applications to quantum systems
2. Apply linear algebra concepts to function spaces and analyze the transition from finite to infinite dimensional systems.
3. Analyze quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution
4. Apply quantum mechanical principles to solve problems in simple quantum systems and evaluate statistical interpretations.
5. Evaluate advanced concepts in composite systems and synthesize understanding of measurement processes and modern quantum theory.

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III B.Tech. II Sem.

L	T	P	C
3	0	0	3

(23A92604) PHYSICS OF ELECTRONIC MATERIALS AND DEVICES

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To make the students to understand the concept of crystal growth, defects in crystals and thin films
2. To provide insight into various semiconducting materials and their properties
3. To develop a strong foundation in semiconductor physics and device engineering.
4. To elucidate excitonic and luminescent processes in solid-state materials.
5. To understand the principles, technologies, and applications of modern display systems.

UNIT-I FUNDAMENTALS OF MATERIALS SCIENCE

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

UNIT-II SEMICONDUCTORS

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, change of electron-hole concentration-Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects

UNIT-III PHYSICS OF SEMICONDUCTOR DEVICES

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions, Transistors, MOSFETs.

UNIT-IV EXCITONS AND LUMINESCENCE

Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Inter-band luminescence, Direct and indirect gap materials. Photoluminescence: General Principles of photoluminescence, Excitation and relaxation, OLED, Quantum-dot. Electro-luminescence: General Principles of electroluminescence, light emitting diode, diode laser.

UNIT-V DISPLAY DEVICES

LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

TEXT BOOKS:



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1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd., 4th edition, 2021
2. Semiconductor physics & devices: basic principles, 4th Edition, McGraw-Hill, 2012.

REFERENCE BOOKS:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning, 6th edition
2. Electronic Materials Science- Eugene A. Irene, Wiley, 2005
3. Electronic Components and Materials, Grover and Jamwal, Dhanpat Rai and Co., New Delhi., 2012.
4. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd. 2nd Edition, 2011

e- Resources and Digital Material:

1. <https://nptel.ac.in/courses/113/106/113106062>
2. https://onlinecourses.nptel.ac.in/noc20_ph24/preview

COURSE OUTCOMES:

1. Understand crystal growth and thin film preparation
2. Summarize the basic concepts of semiconductors
3. Illustrate the working of various semiconductor devices
4. Analyze various luminescent phenomena and the devices based on these concepts
5. Explain the working of different display devices

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III B.Tech. II Sem.

L	T	P	C
3	0	0	3

(23A93605) CHEMISTRY OF POLYMERS AND APPLICATIONS

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand the basic principles of polymers
2. To understand natural polymers and their applications
3. To impart knowledge to the students about synthetic polymers, their preparation and importance.
4. To enumerate the applications of hydrogel polymers
5. To enumerate applications of conducting and degradable polymers in engineering.

UNIT-I POLYMERS-BASICS AND CHARACTERIZATION

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

UNIT-II NATURAL POLYMERS & MODIFIED CELLULOSICS

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins. Modified cellulosic: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics-PES, PAES, PEEK, PEA.

UNIT-III SYNTHETIC POLYMERS

Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers (PE, PVC), Butadiene polymers (BUNA-S, BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins

UNIT-IV HYDROGELS OF POLYMER NETWORKS

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.



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UNIT-V CONDUCTING AND DEGRADABLE POLYMERS

Conducting polymers: Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping, Applications.

Degradable polymers: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, Nylon-6, Polyesters, applications.

TEXT BOOKS:

1. A Text book of Polymer science, Billmayer
2. Polymer Chemistry – G.S.Mishra
3. Polymer Chemistry – Gowarikar

REFERENCE BOOKS:

1. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
2. Advanced Organic Chemistry, B.Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

COURSE OUTCOMES:

1. Classify the polymers, Explain polymerization mechanism, Differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer
2. Describe the physical and chemical properties of natural polymers and Modified celluloses.
3. Differentiate Bulk, solution, Suspension and emulsion polymerization, Describe fibers and elastomers, Identify the thermosetting and thermo polymers.
4. Identify types of polymer networks, Describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery
5. Explain classification and mechanism of conducting and degradable polymers

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III B.Tech. II Sem.

L	T	P	C
3	0	0	3

(23A94607) ACADEMIC WRITING AND PUBLIC SPEAKING

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To encourage all round development of the students by focusing on writing skills
2. To make the students aware of non-verbal skills
3. To develop analytical skills
4. To deliver effective public speeches

UNIT-I INTRODUCTION TO ACADEMIC WRITING

Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing

UNIT-II ACADEMIC JOURNAL ARTICLE

Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof Reading - Plagiarism

UNIT-III ESSAY & WRITING REVIEWS

Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review- SoP

UNIT-IV PUBLIC SPEAKING

Introduction, Nature, characteristics, significance of Public Speaking Presentation
4 Ps of Presentation Stage Dynamics Answering Strategies Analysis of Impactful Speeches-
Speeches for Academic events

UNIT-V PUBLIC SPEAKING AND NON-VERBAL DELIVERY

Body Language – Facial Expressions-Kinesics – Oculistics – Proxemics – Haptics – Chronemics -
Paralanguage - Signs

TEXT BOOKS:

1. Critical Thinking, Academic Writing and Presentation Skills: MG University Edition Paperback 1 January 2010 Pearson Education; First edition (1 January 2010)
2. Pease, Allan & Barbara. The Definitive Book of Body Language RHUS Publishers, 2016

REFERENCE BOOKS:



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

1. Alice Savage, Masoud Shafiei Effective Academic Writing, 2Ed., 2014 . Oxford University Press
2. Shalini Verma, Body Language, S Chand Publications 2011
3. Sanjay Kumar and Pushpalata, Communication Skills 2E 2015, Oxford.
4. Sharon Gerson, Steven Gerson, Technical Communication Process and Product, Pearson, New Delhi, 2014
5. Elbow, Peter. Writing with Power. OUP USA, 1998

COURSE OUTCOMES:

1. Understand various elements of Academic Writing L1, L2
2. Identify sources and avoid plagiarism L1, L2
3. Demonstrate the knowledge in writing a Research paper L3, Analyse different types of essays L4
4. Assess the speeches of others and know the positive strengths of speakers L5
5. Build confidence in giving an impactful presentation to the audience L3

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III B.Tech. II Sem.

L	T	P	C
0	0	0	0

(23A99609) MINI PROJECT

Course Category	Professional Core course (PC)
Course Enrichment Relevance	Entrepreneurship

A one-week Department-specific workshop will be conducted in the gap period between III-B.Tech, I-sem completion and commencement of III-B.Tech, II-sem. And the students will do a Mini Project based the acquired knowledge. Finally, a student has to submit a project report and it will be evaluated by PRC members for 50 marks.

IV B.Tech I Semester Course Structure



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IV B.Tech. I Sem. - Course Structure

S.No	Subject Code	Course Category	Name of the Subject	Hours/Week			Credits	Marks		
				Lecture	Tutorial	Practical		Internal	External	Total
1	23A32715	CC	BIG DATA ANALYTICS	3	0	0	3	30	70	100
2	23A95708		BUSINESS ETHICS AND CORPORATE GOVERNANCE (MC-II)	2	0	0	2	30	70	100
3	23A95709		E-BUSINESS (MC-II)	2	0	0	2	30	70	100
4	23A95710		MANAGEMENT SCIENCE(MC-II)	2	0	0	2	30	70	100
5	23A05741	SC	SOFTWARE ARCHITECTURE & DESIGN PATTERNS (PE-IV)	3	0	0	3	30	70	100
6	23A05742	PE	BLOCKCHAIN TECHNOLOGY(PE-IV)	3	0	0	3	30	70	100
7	23A05630	PE	DEVOPS (PE-IV)	3	0	0	3	30	70	100
8	23A32716	PE	NOSQLDATABASES (PE-IV)	3	0	0	3	30	70	100
9	23A05629	PE	CYBERSECURITY (PE-IV)	3	0	0	3	30	70	100
10	23A05746	PE	AGILE METHODOLOGIES (PE-V)	3	0	0	3	30	70	100
11	23A32717	PE	EXPERT SYSTEMS (PE-V)	3	0	0	3	30	70	100
12	23A05745	PE	REINFORCEMENT LEARNING (PE-V)	3	0	0	3	30	70	100
13	23A32718	PE	HIGH PERFORMANCE COMPUTING (PE-V)	3	0	0	3	30	70	100
14	23A05749	PE	INTRODUCTION TO LARGE LANGUAGE MODELS (PE-V)	3	0	0	3	30	70	100
15	23A01704	OE	BUILDING MATERIALS AND SERVICES (OE-III)	3	0	0	3	30	70	100
16	23A01705	OE	ENVIRONMENTAL IMPACT ASSESSMENT (OE-III)	3	0	0	3	30	70	100
17	23A02705	OE	SMART GRID TECHNOLOGIES (OE-III)	3	0	0	3	30	70	100
18	23A03707	OE	3D PRINTING TECHNOLOGIES (OE-III)	3	0	0	3	30	70	100
19	23A04519	OE	MICROPROCESSORS AND MICROCONTROLLERS (OE-III)	3	0	0	3	30	70	100
20	23A91716	OE	WAVELET TRANSFORMS AND ITS APPLICATIONS (OE-III)	3	0	0	3	30	70	100
21	23A92705	OE	SMART MATERIALS AND DEVICES (OE-III)	3	0	0	3	30	70	100



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22	23A92706	OE	INTRODUCTION TO QUANTUM MECHANICS (OE-III)	3	0	0	3	30	70	100
23	23A93706	OE	GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (OE-III)	3	0	0	3	30	70	100
24	23A95711	OE	EMPLOYABILITY SKILLS (OE-III)	3	0	0	3	30	70	100
25	23A01706	OE	GEO-SPATIAL TECHNOLOGIES (OE-IV)	3	0	0	3	30	70	100
26	23A01707	PE	SOLID WASTE MANAGEMENT (OE-IV)	3	0	0	3	30	70	100
27	23A02706	OE	ELECTRIC VEHICLES (OE-IV)	3	0	0	3	30	70	100
28	23A03708	OE	TOTAL QUALITY MANAGEMENT (OE-IV)	3	0	0	3	30	70	100
29	23A04755	OE	TRANSDUCERS AND SENSORS (OE-IV)	3	0	0	3	30	70	100
30	23A91715	OE	FINANCIAL MATHEMATICS (OE-IV)	3	0	0	3	30	70	100
31	23A32611	OE	INTRODUCTION TO QUANTUM COMPUTING(OE-IV)	3	0	0	3	30	70	100
32	23A92707	OE	SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS (OE-IV)	3	0	0	3	30	70	100
33	23A93707	OE	CHEMISTRY OF NANOMATERIALS ANDAPPLICATIONS (OE-IV)	3	0	0	3	30	70	100
34	23A95712	OE	LITERARYVIBES (OE-IV)	3	0	0	3	30	70	100
35	23A05525	SC	FULL STACK DEVELOPMENT-II (SKILL ENHANCEMENT COURSE)	0	1	2	2	30	70	100
36	23A95713	MC(NC)	GENDER SENSITIZATION (AC)	2	0	0	0	30	0	30



IV B.Tech I Semester Syllabus

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IV B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A32715) BIG DATA ANALYTICS

Course Category	Core Course (CC)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Provide an overview of an exciting growing field of big data analytics.
2. Introduce the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, HIVE, Cassandra, Spark.
3. Teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
4. Optimize business decisions and create competitive advantage with Big Data analytics

UNIT-I

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics

UNIT-II

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharing and replication, consistency, relaxing consistency, version stamps, Working with Cassandra ,Table creation, loading and reading data.

UNIT-III

Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance, with data replication, High availability, Data locality, Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization. Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.



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UNIT-IV

Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames ,RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers- Standalone Mode, Spark on YARN , Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

UNIT-V

Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and State full Processing - Event Time, State full Processing, Windows on Event Time- Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

TEXT BOOKS:

1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and AmbigaDhiraj
2. SPARK: The Definitive Guide, Bill Chambers and Matei Zaharia, O Reilley, 2018 Edition
3. Business Intelligence and Analytic Trends for Today s Businesses, Wiley,2013
4. P. J. Sadalage and M. Fowler, NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence, Addison-Wesley Professional,2012
5. Tom White, Hadoop: The Definitive Guide, Third Edition, O Reilley,2012

REFERENCE BOOKS:

1. Hadoop Operations, O Reilley, Eric Sammer,2012
2. Programming Hive, O Reilley, E. Capriolo, D. Wampler, and J. Rutherglen,2012
3. HBase: The Definitive Guide, O Reilley, Lars George,2011
4. Cassandra: The Definitive Guide, O Reilley, Eben Hewitt,2010
5. Programming Pig, O Reilley, Alan Gates,2011

COURSE OUTCOMES:

1. Illustrate on big data and its use cases from selected business domains.
2. Interpret and summarize on NoSQL,Cassandra
3. Analyze the HADOOP and Map Reduce technologies associated with big data analytics and explore on Big Data applications Using Hive.
4. Make use of Apache Spark, RDDs etc. to work with datasets.
5. Assess real time processing with Spark Streaming.

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IV B.Tech. I Sem.

L	T	P	C
2	0	0	2

(23A95708) BUSINESS ETHICS AND CORPORATE GOVERNANCE (MC-II)

Course Category	Management Elective
Course Enrichment Relevance	Entrepreneurship

COURSE OBJECTIVES:

1. To make the student understand the principles of business ethics
2. To enable them in knowing about the ethics in management
3. To facilitate the student's role in corporate culture
4. To impart knowledge about the fair-trade practices
5. To encourage the student in knowing about the corporate governance

UNIT-I ETHICS

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior. Value systems - Business Ethics - Types, Characteristics, Factors, Contradictions and Ethical Practices in Management - Corporate Social Responsibility – Issues of Management – Crisis Management

LEARNING OUTCOMES: - After completion of this unit student will

- ☐ Understand the meaning of loyalty and ethical Behavior
- ☐ Explain various types of ethics
- ☐ Analyze issues & crisis of management

UNIT-II ETHICS IN MANAGEMENT

Introduction- Ethics in production, finance, Human resource management and Marketing Management - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures - Culture and Individual Ethics – professional ethics and technical ethics.

LEARNING OUTCOMES: - After completion of this unit student will

- ☐ Understand the meaning of ethics in various areas of management
- ☐ Compare and contrast professional ethics and technical ethics
- ☐ Develop ethical values in self and organization



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

UNIT-III CORPORATE CULTURE

Introduction - Meaning, definition, Nature, and significance – Key elements of corporate culture, shared values, beliefs and norms, rituals, symbols and language - Types of corporate culture, hierarchical culture, market driven culture – Organization leadership and corporate culture, leadership styles and their impact on culture, transformational leadership and culture change.

LEARNING OUTCOMES: - After completion of this unit student will

- ☐ Define corporate culture
- ☐ Understand the key elements of corporate culture
- ☐ Analyze organization leadership and corporate culture

UNIT-IV LEGAL FRAME WORK

Law and Ethics -Agencies enforcing Ethical Business Behavior - Legal Impact – Environmental Protection, Fair Trade Practices, legal Compliances, Safeguarding Health and wellbeing of Customers – Corporate law, Securities and financial regulations, corporate governance codes and principles

LEARNING OUTCOMES: - After completion of this unit student will

- ☐ Understand Law and Ethics
- ☐ Analyze Different fair-trade practices
- ☐ Make use of Environmental Protection and Fair-Trade Practices

UNIT-V CORPORATE GOVERNANCE

Introduction - Meaning – Corporate governance code, transparency & disclosure -Role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work - Corporate scams - Committees in India and abroad, corporate social responsibility. BoDs composition, Cadbury Committee - Various committees - Reports - Benefits and Limitations.

LEARNING OUTCOMES: - After completion of this unit student will

- ☐ Understand corporate governance code
- ☐ Analyze role of auditors, board of directors and shareholders in corporate governance
- ☐ Implementing corporate social responsibility in India.

TEXT BOOKS:

1. Murthy CSV: Business Ethics and Corporate Governance, HPH July 2017
2. Bholananth Dutta, S.K. Podder – Corporation Governance, VBH. June 2010

REFERENCE BOOKS:

1. . Dr. K. Nirmala, KarunakaraReaddy. Business Ethics and Corporate Governance, HPH
2. H.R.Machiraju: Corporate Governance, HPH, 2013
3. K. Venkataramana, Corporate Governance, SHBP.
4. N.M.Khandelwal. Indian Ethos and Values for Managers

e-Resources and Digital Material:

1. https://onlinecourses.nptel.ac.in/noc21_mg46/



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2. <https://archive.nptel.ac.in/courses/110/105/110105138/>
3. https://onlinecourses.nptel.ac.in/noc21_mg54/
4. https://onlinecourses.nptel.ac.in/noc22_mg54/
5. <https://archive.nptel.ac.in/courses/109/106/109106117/>

COURSE OUTCOMES:

1. Understand the Ethics and different types of Ethics L2
2. Understand business ethics and ethical practices in management L2
3. Understand the role of ethics in management L2
4. Apply the knowledge of professional ethics & technical ethics L3
5. Analyze corporate law, ethics, codes & principles L4
6. Evaluate corporate governance & corporate scams L5

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IV B.Tech. I Sem.

L	T	P	C
2	0	0	2

(23A95709) E-BUSINESS (MC-II)

Course Category	Management Elective
Course Enrichment Relevance	Entrepreneurship

COURSE OBJECTIVES:

1. To provide knowledge on emerging concept on E-Business related aspect
2. To understand various electronic markets & business models
3. To impart the information about electronic payment systems & banking.
4. To create awareness on security risks and challenges in E-commerce.
5. To the students aware on different e-marketing channels & strategies.

UNIT-I ELECTRONIC BUSINESS

Introduction – Nature, meaning, significance, functions and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)-Advantages & Disadvantages of E-Commerce –E-Commerce and E-Business, Internet Services, Online Shopping- E-Commerce Opportunities for Industries.

Learning Outcomes: -After completion of this unit student

- ☐ Understand the concept of E-Business
- ☐ Contrast and compare E-Commerce & E-Business
- ☐ Evaluate opportunities of E-commerce for industry

UNIT-II ELECTRONIC MARKETS AND BUSINESS MODELS

Introduction –E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals -Business Models- Business to Business (B2B)-Business to Customers(B2C) - Business to Government(B2G)-Auctions-B2B Portals in India

Learning Outcomes: -After completion of this unit student will

- ☐ Understand the concept of business models
- ☐ Contrast and compare Vertical portal and Horizontal portals
- ☐ Analyze the B2B, B2C and B2G model

UNIT-III ELECTRONIC PAYMENT SYSTEMS

:

Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, ewallets, UPI, and crypto currencies -Smart cards and digital wallets: Features and usage - Electronic Fund Transfer (EFT): Role in business transactions - Infrastructure requirements and regulatory aspects of e-payments

Learning Outcomes: -After completion of this unit student will

- ☐ Understand the Electronic payment system
- ☐ Contrast and compare EFT and smart cards
- ☐ Analyze debit card and credit cards



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UNIT-IV E-SECURITY

Security risks and challenges in electronic commerce - Cyber threats - Phishing, hacking, identity theft, and malware - Digital Signatures & Certificates - Security protocols over public networks (HTTP, SSL, TLS) - Firewalls in securing e-business platforms.

Learning Outcomes: -After completion of this unit student will

- ☐ Understand E-Security
- ☐ Contrast and compare security protocols and public network
- ☐ Evaluate on Digital signature

UNIT-V E-MARKETING

:

Introduction – Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Market Research – E-marketing planning: Online branding, social media marketing, and email marketing - E-business strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (eCRM) E-supply chain management (e-SCM)

Learning Outcomes: -After completion of this unit student will

- ☐ Understand the concept of online marketing
- ☐ Apply the knowledge of online marketing
- ☐ Compare e-CRM and e-SCM

TEXT BOOKS:

1. Arati Oturkar & Sunil Khilari. E-Business. Everest Publishing House, 2022
2. P.T.S Joseph. E-Commerce, Fourth Edition, Prentice Hall of India, 2011

REFERENCE BOOKS:

1. Debjani, Kamallesh K Bajaj. E-Commerce, Second Edition Tata McGraw-Hill???, 2005
2. Dave Chaffey. E-Commerce E-Management, Second Edition, Pearson, 2012.
3. Henry Chan. E-Commerce Fundamentals and Application, Raymond Leatham Wiley India 2007
4. S. Jaiswal. E-Commerce Galgotia Publication Pvt Ltd., 2003.

e-Resources and Digital Material:

1. <https://www.slideshare.net/fatimahAlkreem/e-businessppt-67935771>
2. <https://www.slideshare.net/VikramNani/e-commerce-business-models>
3. <https://www.slideshare.net/RiteshGoyal/electronic-payment-system>
4. <https://www.slideshare.net/WelingkarDLP/electronic-security>
5. <https://www.slideshare.net/Ankitha2404/emarketing-ppt>

COURSE OUTCOMES:

1. Remember E-Business & its nature, scope and functions. L1
2. Understand E-market-Models which are practicing by the organizations L2
3. Apply the concepts of E-Commerce in the present globalized world. L3
4. Analyze the various E-payment systems & importance of net banking. L4
5. Evaluate market research strategies & E-advertisements. L5
6. Understand importance of E-security & control L2

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IV B.Tech. I Sem.

L	T	P	C
2	0	0	2

(23A95710) MANAGEMENT SCIENCE (MC-II)

Course Category	Management Elective
Course Enrichment Relevance	Entrepreneurship

COURSE OBJECTIVES:

1. To provide fundamental knowledge on Management, Administration, Organization & its concepts.
2. To make the students understand the role of management in Production.
3. To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts.
4. To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management.
5. To make the students aware of the contemporary issues in modern management.

UNIT-I INTRODUCTION TO MANAGEMENT

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Elton Mayo's Human relations - **Organizational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- ☐ Understand the concept of management and organization.
- ☐ Apply the concepts & principles of management in real life industry.
- ☐ Analyze the organization chart & structure of an enterprise.

UNIT-II OPERATIONS MANAGEMENT

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- **Material Management** - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - **Marketing Management** - Concept - Meaning - Nature Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- ☐ Understand the core concepts of Operations Management.
- ☐ Apply the knowledge of Quality Control, Work-study principles in real life industry.
- ☐ Evaluate Materials departments & Determine EOQ.
- ☐ Analyze Marketing Mix Strategies for an enterprise.
- ☐ Create and design advertising and sales promotion.



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UNIT-III HUMAN RESOURCES MANAGEMENT (HRM)

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Job Analysis - Human Resource Planning (HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process - Employee Training and Development - methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration.

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- ☐ Understand the concepts of HRM, Recruitment, Selection, Training & Development.
- ☐ Analyze the need of training.
- ☐ Evaluate performance appraisal.
- ☐ Design the basic structure of salaries and wages.

UNIT-IV STRATEGIC & PROJECT MANAGEMENT

Definition & Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - Project Management - Network Analysis - Program Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- ☐ Understand Mission, Objectives, Goals & strategies for an enterprise.
- ☐ Apply SWOT Analysis to strengthen the project.
- ☐ Analyze Strategy formulation and implementation.
- ☐ Evaluate PERT and CPM Techniques

UNIT-V CONTEMPORARY ISSUES IN MANAGEMENT

Customer Relations Management (CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management (SCM) - Enterprise Resource Planning (ERP) - Performance Management – employee engagement and retention - Business Process Re-engineering and Benchmarking - Knowledge Management – change management – sustainability and corporate social responsibility.

LEARNING OUTCOMES At the end of the Unit, the students will be able to

- ☐ Understand modern management techniques.
- ☐ Apply Knowledge in Understanding in TQM, SCM.
- ☐ Analyze CRM, BPR.
- ☐ Evaluate change management & sustainability.

TEXT BOOKS:

1. Frederick S. Hillier, Mark S. Hillier. Introduction to Management Science, October 26, 2023.
2. A.R Aryasri, Management Science, TMH, 2019.

REFERENCE BOOKS:

1. Stoner, Freeman, Gilbert. Management, Pearson Education, New Delhi, 2019.
2. Koontz & Weihrich, Essentials of Management, 6/e, TMH, 2005.



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3. Thomas N.Duenning & John M.Ivancevich, Management Principles and Guidelines, Biztantra.
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
5. Samuel C.Certo, Modern Management, 9/e, PHI, 2005.

e-Resources and Digital Material:

1. <https://www.slideshare.net/slideshow/introduction-to-management-and-organization-231308043/231308043>
2. <https://nptel.ac.in/courses/112107238>
3. <https://archive.nptel.ac.in/courses/110/104/110104068/>
4. <https://archive.nptel.ac.in/courses/110/105/110105069/>
5. https://onlinecourses.nptel.ac.in/noc24_mg112/

COURSE OUTCOMES:

1. Remember the concepts & principles of management and designs of organization in a practical world L1
2. Understand the knowledge of Work-study principles & Quality Control techniques in industry L2
3. Apply the process of Recruitment & Selection in organization. L3
4. Analyze the concepts of HRM & different training methods. L4
5. Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT. L5
6. Create awareness on contemporary issues in modern management & technology. L3

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IV B.Tech. I Sem.

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3	0	0	3

**(23A05741) SOFTWARE ARCHITECTURE & DESIGN PATTERNS
(PE-IV)**

Course Category	Skill Oriented Course (SC)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

- To understand the concept of patterns and the Catalog.
- To discuss the Presentation tier design patterns and their affect on: sessions, client access, validation and consistency.
- To understand the variety of implemented bad practices related to the Business and Integration tiers.

UNIT-I

Envisioning Architecture: The Architecture Business Cycle, what is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views. Creating an Architecture: Quality Attributes, achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

UNIT-II

Analyzing Architectures: Architecture Evaluation, Architecture design decision making, ATAM, CBAM. Moving from one system to many: Software Product Lines, Building systems from off the shelf components, Software architecture in future.

UNIT-III

Patterns: Pattern Description, Organizing catalogs, role in solving design problems, Selection and usage. Creational and Structural patterns: Abstract factory, builder, factory method, prototype, singleton, adapter, bridge, composite, façade, flyweight.

UNIT-IV

Behavioural patterns: Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy. template method, visitor.

UNIT-V

Case Studies: A-7E – A case study in utilizing architectural structures, The World Wide Web - a case study in interoperability, Air Traffic Control – a case study in designing for high availability, Celsius Tech – a case study in product line development

TEXT BOOKS:



SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

1. Software Architecture in Practice, second edition, Len Bass, Paul Clements & Rick Kazman, Pearson Education, 2003.
2. Design Patterns, Erich Gamma, Pearson Education.

REFERENCE BOOKS:

1. Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Software Design, David Budgen, second edition, Pearson education, 2003
4. Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007
5. Design Patterns in Java, Steven John Metsker& William C. Wake, Pearson education, 2006
6. J2EE Patterns, Deepak Alur, John Crupi& Dan Malks, Pearson education, 2003.
7. Design Patterns in C#, Steven John metsker, Pearson education, 2004

COURSE OUTCOMES:

- To understand the concept of patterns and the Catalog.
- To discuss the Presentation tier design patterns and their affect on: sessions, client access, validation and consistency.
- To understand the variety of implemented bad practices related to the Business and Integration tiers.

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IV B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A05742) BLOCKCHAIN TECHNOLOGY (PE-IV)

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Understand how block chain systems (mainly Bit coin and Ethereum) work and to securely interact with them.
2. Design, build, and deploy smart contracts and distributed applications.
3. Integrate ideas from block chain technology into their own projects.

UNIT-I INTRODUCTION

Introduction, Scenarios, Challenges Articulated, Blockchain, Blockchain Characteristics, Opportunities Using Blockchain, History of Blockchain. Evolution of Blockchain: Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Blockchain Evolution, Consortia, Forks, Public Blockchain Environments, Type of Players in Blockchain Ecosystem, Players in Market.

UNIT-II BLOCKCHAIN CONCEPTS

Blockchain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on blockchain, data storage on blockchain, wallets, coding on blockchain: smart contracts, peer-to-peer network, types of blockchain nodes, risk associated with blockchain solutions, life cycle of blockchain transaction.

UNIT-III ARCHITECTING BLOCKCHAIN SOLUTIONS

Architecting Blockchain solutions: Introduction, Obstacles for Use of Blockchain, Blockchain Relevance Evaluation Framework, Blockchain Solutions Reference Architecture, Types of Blockchain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Blockchain Solutions, Architecture Considerations, Architecture with Blockchain Platforms, Approach for Designing Blockchain Applications.

UNIT-IV ETHEREUM BLOCK CHAIN IMPLEMENTATION

Ethereum Block chain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, My Ether Wallet, Ethereum Networks/Environments, Infura, Ether scan, Ethereum Clients, Decentralized Application, Metamask, Tuna Fish Use Case Implementation, Open Zeppelin in Contracts.



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UNIT-V HYPER LEDGER BLOCK CHAIN IMPLEMENTATION

Hyperledger Blockchain Implementation: Introduction, Use Case – Car Ownership Tracking, Hyperledger Fabric, Hyperledger Fabric Transaction Flow, FabCar Use Case Implementation, Invoking Chain code Functions Using Client Application.

Advanced Concepts in Blockchain: Introduction, Inter Planetary File System (IPFS), Zero Knowledge Proofs, Oracles, Self-Sovereign Identity, Blockchain with IoT and AI/ML Quantum Computing and Blockchain, Initial Coin Offering, Blockchain Cloud Offerings, Blockchain and its Future Potential.

TEXT BOOKS:

1. Ambadas, Arshad SarfarzAriff, Sham —Blockchain for Enterprise Application Developers, Wiley, 2020
2. Andreas M. Antonopoulos, —Mastering Bitcoin: Programming the Open Blockchain, O'Reilly, 2017

REFERENCE BOOKS:

1. Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill.
2. Blockchain: Blueprint for a New Economy, Melanie Swan, O'Reilly.

e-Resources and Digital Material:

1. <https://github.com/blockchainedindia/resources>

COURSE OUTCOMES:

1. Explain the fundamental concepts, characteristics, evolution, types, and applications of blockchain technology.
2. Understand and apply blockchain concepts such as hashing, Merkle trees, consensus, mining, wallets, tokens, smart contracts, nodes, and transaction processing.
3. Analyze and design suitable blockchain architectures and solutions for different enterprise and application use cases.
4. Develop and test decentralized applications and smart contracts using the Ethereum blockchain ecosystem and its development tools.
5. Implement and evaluate blockchain applications using Hyperledger Fabric and understand advanced concepts such as IPFS, Zero Knowledge Proofs, Oracles, Self-Sovereign Identity, IoT, and AI/ML integration with blockchain.

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IV B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A05630) DEVOPS (PE-IV)

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. Understand collaboration and productivity by automating infrastructure and workflows kflows.
2. Familiarize with continuous measuring applications performance

UNIT-I

Dev Ops: An Overview, Dev Ops: Origins, Dev Ops: Roots, Dev Ops: Practices Dev Ops: Culture.
Adopting Dev Ops: Developing the Playbook. Developing a Business Case for a Dev Ops: Developing the Business Case.

UNIT-II

Completing the Business Model Canvas, Customer Segments, Value Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, Cost Structures. Dev Ops Plays for Optimizing the delivery Pipeline: Dev Ops as an optimization Exercise, Core Themes, The Dev Ops Plays, Specializing Core Plays.

UNIT-III

Dev Ops Plays for Driving Innovation: Optimize to Innovate, The Uber Syndrome, Innovation and the Role of Technology, Core Themes, play: Build a Dev Ops Platform, play: Deliver Microservices Architectures, play: DevOps an API Economy, play: Organizing for Innovation.

UNIT-IV

Scaling Dev Ops for the Enterprise: Core Themes, play: Dev Ops Center of Competency, play: Developing Culture of Innovation at Scale, play: Developing a Culture of continuous Improvement, play: Team Models for Dev Ops, play: Standardization of Tools and Process, play: Security Considerations for Dev Ops, Play: Dev Ops and Outsourcing.

UNIT-V

Leading Dev Ops Adoption in the Enterprise: Play: Dev Ops as a transformation Exercise, play: Developing a Culture of Collaboration and Trust, play: Dev Ops Thinking for the Line of Business, play: starting with Pilot Projects, Play: Rearing Unicorns on an Aircrafts Carrier. Appendix Case Study: Example Dev Ops Adoption Roadmap Organization Background, Roadmap Structure, Adoption Roadmap



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TEXT BOOKS:

1. Sanjeev Sharma, The DevOps Adoption Playbook, Published by John Wiley & Sons, Inc.2017.

REFERENCE BOOKS:

1. Sanjeev Sharma & Bernie Coyne, DevOps for Dummies, Published by John Wiley & Sons, Inc.
2. Michael Huttermann, DevOps for Developers, Apress publishers,2012.

e-Resources and Digital Material:

1. Learning DevOps with Terraform Infrastructure Automation Course Udemy

COURSE OUTCOMES:

1. Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT serviceability
2. Describe Dev Ops &Dev Sec Ops methodologies and their key concepts
3. Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models
4. Set up complete private infrastructure using version control systems and CI/CD tools

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IV B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A32716) NOSQL DATABASES (PE-IV)

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand the fundamentals of NoSQL databases, their types, including column-oriented, key/value, document, and graph databases, and their applications using simple database examples and language bindings.
2. To understand and perform CRUD operations in NoSQL data stores, including creating, accessing, updating, and deleting records using appropriate language bindings.
3. To understand the storage architectures of column-oriented, document, and key/value databases, including HBase, Memcached, Redis, and eventually consistent non-relational databases.
4. To understand and apply query and data management operations in MongoDB, HBase, Redis, and other NoSQL stores, including schema and data evolution, import, and export operations.
5. To understand and implement database indexing and ordering concepts in MongoDB, CouchDB, and Apache Cassandra for efficient data access and retrieval.

UNIT-I INTRODUCTION TO NOSQL

Introduction to NoSQL: Definition and Introduction, Sorted Ordered Column-Oriented Stores, Key/Value Stores, Document Databases, Graph Databases, Examining Two Simple Examples, Location Preferences Store, Car Make and Model Database, Working with Language Bindings.

UNIT-II INTERACTING WITH NOSQL

If NoSql Then What, Language Bindings for NoSQL Data Stores, Performing Crud Operations, Creating Records, Accessing Data, Updating and Deleting Data

UNIT-III NOSQL STORAGE ARCHITECTURE

Working With Column-Oriented Databases, HBase Distributed Storage Architecture, Document Store Internals, Understanding Key/Value Stores In Memcached And Redis, Eventually Consistent NonRelational Databases.

UNIT-IV NOSQL STORES

Similarities Between SqlAndMongodb Query Features, Accessing Data from Column-Oriented Databases Like Hbase, Querying Redis Data Stores, Changing Document Databases, Schema Evolution In Column-Oriented Databases, Hbase Data Import And Export, Data Evolution In Key/Value Stores.

UNIT-V INDEXING AND ORDERING DATA SETS

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

TEXT BOOKS:

1. . Shashank Tiwari, Professional NoSQL, Wrox Press, Wiley, 2011, ISBN: 978-0-470-94224-6.
2. PramodSadalage and Martin Fowler, NoSQL Distilled, Addison-Wesley



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

Professional, 2012.

REFERENCE BOOKS:

1. Dan McCreary and Ann Kelly, Making Sense of NoSQL, Manning Publications, 2013.
2. Gaurav Vaish, Getting Started with NoSQL, Packt Publishing, 2013.



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COURSE OUTCOMES:

1. Discuss what type of NoSQL database to implement based on business requirements (key-value, document, full text, graph, etc.)
2. Apply NoSQL data modeling from application specific queries
3. Use Atomic Aggregates and denormalization as data modeling techniques to optimize query processing.
4. Distinguish various NOSQL database stores.
5. Apply Indexing Techniques of NoSQL.

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IV B.Tech. I Sem.

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3	0	0	3

(23A05629) CYBER SECURITY (PE-IV)

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. The course is designed to provide awareness on different cybercrimes, cyber offenses, tools and methods used in cybercrime.

UNIT-I INTRODUCTION TO CYBERCRIME

Introduction, Cybercrime, and Information Security, who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT-II CYBER OFFENSES

How Criminals Plan Them:

Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT-III CYBERCRIME

Mobile and Wireless Devices:

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT-IV TOOLS AND METHODS USED IN CYBERCRIME

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT-V CYBER SECURITY

Organizational Implications:

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

TEXT BOOKS:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

REFERENCE BOOKS:



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1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john)Wu, J.David Irwin. CRCPress T&F Group Online.

COURSE OUTCOMES:

1. Classify the cybercrimes and understand the Indian ITA 2000.
2. Analyse the vulnerabilities in any computing system and find the solutions.
3. Predict the security threats of the future.
4. Investigate the protection mechanisms.
5. Design security solutions for organizations.

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IV B.Tech. I Sem.

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(23A05746) AGILE METHODOLOGIES (PE-V)

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
2. To provide good understanding of software design and a set of software technologies and APIs
3. To carry out detailed examination and demonstration of Agile development and testing techniques
4. To discuss Agile software development

UNIT-I AGILE METHODOLOGY

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

UNIT-II AGILE PROCESSES

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

UNIT-III AGILITY AND KNOWLEDGE MANAGEMENT

Agile Information Systems – Agile Decision Making - Earls Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment, leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

UNIT-IV AGILITY AND REQUIREMENTS ENGINEERING

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.



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UNIT-V AGILITY AND QUALITY ASSURANCE

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.

TEXT BOOKS:

1. David J. Anderson and Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
2. Hazza and Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.

REFERENCE BOOKS:

1. Craig Larman, —Agile and Iterative Development: A Managers Guide, Addison-Wesley, 2004.
2. Kevin C. Desouza, —Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.

e-Resources and Digital Material:

1. <https://www.nptelvideos.com/video.php?id=904>

COURSE OUTCOMES:

1. Realize the importance of interacting with business stakeholders in determining the requirements for a software system.
2. Perform iterative software development processes: how to plan them, how to execute them.
3. Point out the impact of social aspects on software development success.
4. To analyse the Impact of Agile Processes in Requirements Engineering.
5. Show how agile approach for software quality assurance.

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(23A32717) EXPERT SYSTEMS (PE-V)

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. Understand the fundamental concepts of Artificial Intelligence, knowledge-based systems, and the importance of knowledge representation, organization, manipulation, and acquisition.
2. Develop knowledge of different knowledge representation techniques using propositional logic, first-order predicate logic, inference rules, resolution, and rule based representations.
3. Analyze methods for handling inconsistencies, incomplete knowledge, and uncertainty using truth maintenance systems, default reasoning, probabilistic reasoning, Bayesian inference, and Dempster-Shafer theory.
4. Understand and apply structured knowledge representation techniques such as semantic networks, frames, conceptual dependencies, scripts, and object-oriented representations.
5. Understand knowledge organization and management techniques, including indexing, retrieval, memory organization, expert system architectures, knowledge acquisition, validation, and expert system development tools.

UNIT-I OVERVIEW OF ARTIFICIAL INTELLIGENCE

Definition & Importance of AI.

Knowledge: General Concepts: Introduction, Definition and Importance of Knowledge, Knowledgebase Systems, And Representation of Knowledge, Knowledge Organization, Knowledge Manipulation, And Acquisition of Knowledge.**UNIT-II KNOWLEDGE REPRESENTATION**

Introduction, Syntax and Semantics for Propositional logic, Syntax and Semantics for FOPL, Properties of WFFs, Conversion to Clausal Form, Inference Rules, The Resolution Principle, no deductive Inference Methods, Representations Using Rules.

UNIT-III DEALING WITH INCONSISTENCIES AND UNCERTAINTIES

Introduction, Truth Maintenance Systems, Default Reasoning and the Closed World Assumption, Predicate Completion and Circumscription, Modal and Temporal Logics.

Probabilistic Reasoning: Introduction, Bayesian Probabilistic Inference, Possible World Representations, Dumpster-Shafer Theory, Ad-Hoc Methods**UNIT-IV STRUCTURED KNOWLEDGE**

Graphs, Frames and Related Structures: Introduction, Associative Networks, Frame Structures, Conceptual Dependencies and Scripts.

Object-Oriented Representations: Introduction, Overview of Objects, Classes, Messages and Methods, Simulation Example using an OOS Program.**UNIT-V KNOWLEDGE ORGANIZATION AND MANAGEMENT**

Introduction, Indexing and Retrieval Techniques, Integrating Knowledge in Memory, Memory Organization Systems.

Expert Systems Architectures: Introduction, Rule Based System Architecture, Non-Production System Architecture, dealing with uncertainty, Knowledge Acquisition and Validation, Knowledge System Building Tools.**TEXT BOOKS:**



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1. Dan W. Patterson - Introduction to Artificial Intelligence and Expert Systems, PHI, New Delhi, 2006.

REFERENCE BOOKS:

1. E. Rich & K. Knight - Artificial Intelligence, 2/e, TMH, New Delhi, 2005.
2. P.H. Winston - Artificial Intelligence, 3/e, Pearson Edition, New Delhi, 2006.
3. D.W. Rolston, - Principles of AI & Expert System Development, TMH, New Delhi.

COURSE OUTCOMES:

1. Explain the fundamentals of Artificial Intelligence, knowledge-based systems, and knowledge representation techniques.
2. Apply propositional logic, first-order predicate logic, and inference mechanisms for knowledge representation and reasoning.
3. Analyze uncertainty and inconsistency using probabilistic reasoning, truth maintenance systems, and Bayesian inference.
4. Develop structured knowledge representations using semantic networks, frames, scripts, and object-oriented approaches.
5. Design and evaluate expert system architectures, knowledge acquisition methods, and knowledge management techniques for intelligent applications.

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IV B.Tech. I Sem.

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(23A05745) REINFORCEMENT LEARNING (PE-V)

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To learn RL task formulation (action space, state space, environment definition).
2. To learn Tabular based solutions (dynamic programming, Monte Carlo, temporal-difference).
3. To learn Function approximation solutions (Deep Q-networks).
4. To learn Policy gradient from basic (REINFORCE) towards advanced topics (proximal policy optimization, deep deterministic policy gradient, etc.).
5. To learn Model-based reinforcement learning.

UNIT-I

Introduction: Course logistics and overview. Origin and history of Reinforcement Learning research. Its connections with other related fields and with different branches of machine learning.

Probability Primer: Brush up of Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence.

UNIT-II

Markov Decision Process: Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.

Prediction and Control by Dynamic Programming: Overview of dynamic programming for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evaluation and value iteration algorithms, DP extensions.



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UNIT-III

Monte Carlo Methods for Model Free Prediction and Control: Overview of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling.

TD Methods: Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0), TD(1) and TD(λ), k step estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants.

UNIT-IV

Function Approximation Methods: Getting started with the function approximation methods, Revisiting risk minimization, gradient descent from Machine Learning, Gradient MC and Semi-gradient TD (0) algorithms, Eligibility trace for function approximation, after states, Control with function approximation, Least squares, Experience replay in deep Q-Networks.

UNIT-V

Policy Gradients: Getting started with policy gradient methods, Log-derivative trick, Naive REINFORCE algorithm, bias and variance in Reinforcement Learning, Reducing variance in policy gradient estimates, baselines, advantage function, actor-critic methods.

TEXT BOOKS:

1. Sutton, Richard S., and Andrew G. Barto. Reinforcement learning: An introduction. MIT press, 2018.
2. Leon-Garcia, Alberto. Probability and random processes for electrical engineering. Pearson Education India, 1994.

REFERENCE BOOKS:

1. Murphy, Kevin P. Machine learning: a probabilistic perspective. MIT press, 2012.

e-Resources and Digital Material:

1. A brief introduction to reinforcement learning (freecodecamp.org).
2. Reinforcement learning – GeeksforGeeks.

COURSE OUTCOMES:

1. Formulate Reinforcement Learning problems.
2. Apply various Tabular Solution Methods to Markov Reward Process Problems.
3. Apply various Iterative Solution methods to Markov Decision Process Problems.
4. Comprehend Function approximation methods.

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IV B.Tech. I Sem.

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(23A32718) HIGH PERFORMANCE COMPUTING (PE-V)

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. To improve the system performance.
2. To learn various distributed and parallel computing architecture.
3. To learn different computing technologies.

UNIT-I

Grid Computing: Data & Computational Grids, Grid Architectures And Its Relations To Various Distributed Technologies. Autonomic Computing, Examples Of The Grid Computing Efforts (Ibm).

UNIT-II

Cluster Setup & Its Advantages, Performance Models & Simulations; Networking Protocols & I/O, Messaging Systems. Process Scheduling, Load Sharing And Balancing; Distributed Shared Memory, Parallel I/O.

UNIT-III

Example Cluster System – Beowulf; Cluster Operating System: Compass And Nanos Pervasive Computing Concepts & Scenarios; Hardware & Software; Human – Machine Interface.

UNIT-IV

Device Connectivity; Java for Pervasive Devices; Application Examples

UNIT-V

Classical Vs Quantum Logic Gates; One, Two & Three Qubit Quantum Gates; Fredkin&Toffoli Gates; Quantum Circuits; Quantum Algorithms.

TEXT BOOKS:

1. Selected Topics In Advanced Computing|| Edited By Dr. P. Padmanabham And Dr. M.B. Srinivas, 2005 Pearson Education.

REFERENCE BOOKS:

1. J. Joseph & C. Fellenstien: __Grid Computing __, Pearson Education.
2. J. Burkhardt et.al: __pervasive computing__Pearson Education.
3. Marineras:‘ Approaching quantum computing’, Pearson Education.
4. Raj kumarBuyya: ‘High performance cluster computing ‘, Pearson Education.



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5. Nielsen & Chung L: 'Quantum computing and Quantum Information', Cambridge University Press.
6. A networking approach to Grid Computing, Minoli, Wiley.

COURSE OUTCOMES:

1. Understanding the concepts in grid computing.
2. Ability to set up cluster and run parallel applications.
3. Ability to understand the cluster projects and cluster OS.
4. Understanding the concepts of pervasive computing & quantum computing.

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IV B.Tech. I Sem.

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**(23A05749) INTRODUCTION TO LARGE LANGUAGE MODELS
(PE-V)**

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. To introduce the fundamentals of Large Language Models (LLMs), their characteristics, working mechanisms, and evolution.
2. To provide an overview of Natural Language Processing (NLP) and Neural Networks as foundational technologies for LLMs.
3. To explore various language models, including statistical and neural approaches, along with their limitations. rn different computing technologies
4. To understand different prompting strategies used in LLMs and their impact on performance
5. To examine advanced topics such as reasoning, handling long contexts, model editing, and hallucination in LLMs.

UNIT-I INTRODUCTION

Definition of LLMs, Key Characteristics of LLMs, How LLMs work, Evolution of Language Modelling Technologies, Evolution of LLMs, Applications of LLMs.

UNIT-II AN OVERVIEW OF NLP AND NEURAL NETWORKS

NLP: NLP Pipeline, Morphology, Tokenization. Neural Networks: The Perceptron, Multi-layer Perceptron, Training Neural Networks.

UNIT-III LANGUAGE MODELS

Statistical Language Model, Smoothing, Evaluation of Language Model, Limitations of Statistical Language Models. Neural Language Models: Convolutional Neural Networks, Recurrent Neural Networks, Limitations of Neural Language Models.

UNIT-IV PROMPTING STRATEGIES IN LLMS

Prompt Engineering: Prompt shape, Manual Template Engineering, Automated Template Learning, Continuous Prompts, Prompt Application, Chain-of-Thoughts, Tree-ofThoughts, Graph-of-Thoughts.

UNIT-V ADVANCED TOPICS IN LARGE LANGUAGE MODELS

Reasoning with LLMs, Handling long context in LLMs, Model Editing, Hallucination in LLMs, Self-Evolving LLMs.

TEXT BOOKS:

1. Tanmoy Chakraborty, Introduction to Large Language Models, Wiley India, 1st Edition, 2025. ISBN: 9789363864740.



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2. Dan Jurafsky and James H. Martin, Speech and Language Processing, 2nd edition, Pearson Press, 2008.

REFERENCE BOOKS:

1. Jacob Eisenstein, Natural Language Processing, First edition, The MIT Press, 2019.
2. Research papers published in conferences/journals like Association for Computational Linguistics (ACL).

COURSE OUTCOMES:

1. Define Large Language Models (LLMs) and describe their key characteristics.
2. Explain the working principles of LLMs, including training and inference processes.
3. Analyze the evolution of language modeling technologies and their transition to modern LLMs.
4. Evaluate different applications of LLMs across various domains.
5. Compare different LLM architectures based on their capabilities and limitations.

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IV B.Tech. I Sem.

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(23A01704) BUILDING MATERIALS AND SERVICES (OE-III)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.
2. To analyze the composition, manufacturing process, and properties of cement and admixtures.
3. To apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
4. To evaluate masonry, mortars, finishing techniques, and formwork systems.
5. To assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

UNIT-I

Stones and Bricks, Tiles: Building Stones – Classifications and Quarrying – Properties – Structural Requirements – Dressing. Bricks – Composition of Brick Earth – Manufacture and Structural Requirements, Fly Ash, Ceramics. Timber, Aluminum, Glass, Paints and Plastics: Wood - Structure – Types and Properties – Seasoning – Defects; Alternate Materials for Timber – GI / Fibre – Reinforced Glass Bricks, Steel & Aluminum, Plastics.

UNIT-II

Cement & Admixtures: Types of Cement - Ingredients of Cement – Manufacture – Chemical Composition – Hydration - Field & Lab Tests – Fineness – Consistency – Initial & Final Setting – Soundness. Admixtures – Mineral & Chemical Admixtures – Uses

UNIT-III

Building Components: Lintels, Arches, Walls, Vaults – Stair Cases – Types of Floors, Types of Roofs – Flat, Curved, Trussed; Foundations – Types; Damp Proof Course; Joinery – Doors – Windows – Materials – Types.

UNIT-IV

Mortars, Masonry and Finishing 's Mortars: Lime and Cement Mortars Brick Masonry – Types – Bonds; Stone Masonry – Types; Composite Masonry – Brick-Stone Composite; Concrete, Reinforced Brick. Finishers: Plastering, Pointing, Painting, Claddings – Types – Tiles – ACP. form Work: Types: Requirements – Standards – Scaffolding – Design; Shoring, Underpinning



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UNIT-V

Building Services: Plumbing Services: Water Distribution, Sanitary – Lines & Fittings; Ventilations: Functional Requirements Systems of Ventilations. Air-Conditioning - Essentials and Types; Acoustics – Characteristic – Absorption – Acoustic Design; Fire Protection – Fire Hazards – Classification of Fire-Resistant Materials and Constructions.

TEXT BOOKS:

1. Building Materials and Construction – Arora & Bindra, Dhanpat Roy Publications.
2. Building Materials and Construction by G C Sahu, Joygopal Jena McGraw hill Pvt Ltd 2015.

REFERENCE BOOKS:

1. Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) Ltd., New Delhi.
2. P. C. Varghese, Building Materials, Prentice Hall of India, 2015.
3. N. Subramanian, Building Materials Testing and Sustainability, Oxford Higher Education, 2019.
4. R. Chudley, Construction Technology, Longman Publishing Group, 1973.
5. S. K. Duggal, Building Materials, Oxford & IBH Publishing Co. Ltd., New Delhi, 2019.

e-Resources and Digital Material:

1. <https://archive.nptel.ac.in/courses/105/102/105102088/>

COURSE OUTCOMES:

1. Understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.
2. Analyze the composition, manufacturing process, and properties of cement and admixtures.
3. Apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
4. Evaluate masonry, mortars, finishing techniques, and formwork systems.
5. Assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

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IV B.Tech. I Sem.

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(23A01705) ENVIRONMENTAL IMPACT ASSESSMENT (OE-III)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Environment & Sustainability

COURSE OBJECTIVES:

1. Understand the principles, methodologies, and significance of Environmental Impact Assessment (EIA).
2. Analyze the impact of developmental activities on land use, soil, and water resources.
3. Evaluate the impact of development on vegetation, wildlife, and assess environmental risks.
4. Develop environmental audit procedures and assess compliance with environmental regulations.
5. Understand and apply environmental acts, notifications, and legal frameworks in EIA studies.

UNIT-I CONCEPTS AND METHODOLOGIES OF EIA

Initial Environmental Examination, Elements of EIA, - Factors Affecting E-I-A Impact Evaluation and Analysis, Preparation of Environmental Base Map, Classification of Environmental Parameters- Criteria for The Selection of EIA Methodology, E I A Methods, Ad Hoc Methods, Matrix Methods, Network Method Environmental Media Quality Index Method, Overlay Methods and Cost/Benefit Analysis.

UNIT-II IMPACT OF DEVELOPMENTAL ACTIVITIES AND LAND USE

Introduction and Methodology for The Assessment of Soil and Ground Water, Delineation of Study Area, Identification of Actives. Procurement of Relevant Soil Quality, Impact Prediction, Assessment of Impact Significance, Identification and Incorporation of Mitigation Measures. E I A in Surface Water, Air and Biological Environment: Methodology for The Assessment of Impacts On Surface Water Environment, Air Pollution Sources, Generalized Approach for Assessment of Air Pollution Impact.

UNIT-III ASSESSMENT OF IMPACT ON VEGETATION, WILDLIFE AND RISK ASSESSMENT

Introduction - Assessment of Impact of Development Activities On Vegetation and Wildlife, Environmental Impact of Deforestation – Causes and Effects of Deforestation - Risk Assessment and Treatment of Uncertainty-Key Stages in Performing An Environmental Risk Assessment- Advantages of Environmental Risk Assessment.



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UNIT-IV ENVIRONMENTAL AUDIT

Introduction - Environmental Audit & Environmental Legislation Objectives of Environmental Audit, Types of Environmental Audit, Audit Protocol, Stages of Environmental Audit, Onsite Activities, Evaluation of Audit Data and Preparation of Audit Report.

UNIT-V ENVIRONMENTAL ACTS AND NOTIFICATIONS

The Environmental Protection Act, The Water Preservation Act, The Air (Prevention & Control of Pollution Act), Wild Life Act - Provisions in The EIA Notification, Procedure for Environmental Clearance, Procedure for Conducting Environmental Impact Assessment Report-Evaluation of EIA Report. Environmental Legislation Objectives, Evaluation of Audit Data and Preparation of Audit Report. Post Audit Activities, Concept of ISO and ISO 14000.

TEXT BOOKS:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication, Hyderabad 2nd edition 2011.
2. Environmental Impact Assessment, by Canter Larry W., McGraw-Hill education Edition (1996).

REFERENCE BOOKS:

1. Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G. McGraw Hill International Editions, New York 1985.
2. Environmental Science and Engineering, by Suresh K. Dhaneja, S.K., Katania & Sons Publication, New Delhi.
3. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers.
4. Environmental Pollution and Control, by H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi.

e-Resources and Digital Material:

1. <https://archive.nptel.ac.in/courses/124/107/124107160/>

COURSE OUTCOMES:

1. Apply various methodologies for conducting Environmental Impact Assessments.
2. Analyze the impact of land-use changes on soil, water, and air quality.
3. Evaluate the environmental impact on vegetation, wildlife, and conduct risk assessments.
4. Develop environmental audit reports and assess compliance with environmental policies.
5. Interpret and apply environmental acts and regulations related to EIA.

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(23A02705) SMART GRID TECHNOLOGIES (OE-III)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. To understand the evolution, need, architecture, enabling technologies, deployment experiences, and roadmap of Smart Grid systems with emphasis on the Indian context.
2. To understand synchro phasor technology and the structure, functions, benefits, and applications of Phasor Measurement Units (PMUs) and Phasor Data Concentrators (PDCs) in wide area monitoring and blackout analysis.
3. To understand the features, functions, classifications, and specifications of smart meters, along with AMR, AMI, communication protocols, and demand-side management applications.
4. To understand Smart Grid communication systems and the principles of radio, mobile, power line, and optical fibre communication, along with communication protocols used in Smart Grid applications.
5. To understand Smart Grid applications involving renewable integration, distributed generation, energy storage, electric vehicles, and protective relaying, and to identify cybersecurity issues, risks, requirements, and assessment methodologies.

UNIT-I INTRODUCTION TO SMART GRID

Evolution of Electric Grid – Need for Smart Grid – Difference between conventional & smart grid – Overview of enabling technologies – International experience in Smart Grid deployment efforts – Smart Grid Road map for India – Smart Grid Architecture.

UNIT-II WIDE AREA MONITORING SYSTEM

Fundamentals of Synchro phasor Technology – concept and benefits of Wide Area Monitoring System – Structure and functions of Phasor Measuring Unit (PMU) and Phasor Data Concentrator (PDC) – Road Map for Synchro phasor applications (NAPSI) – Operational experience and Blackout analysis using PMU - Case study on PMU.

UNIT-III SMART METERS

Features and functions of Smart Meters – Functional specification – category of Smart Meters – Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers and benefits – AMI protocol – Demand Side Integration: Peak load, Outage and Power Quality management.

UNIT-IV INFORMATION AND COMMUNICATION TECHNOLOGY

Overview of Smart Grid Communication system – Modulation and Demodulation Techniques: Radio Communication – Mobile Communication – Power Line Communication – Optical Fibre Communication – Communication Protocol for Smart Grid.

UNIT-V SMART GRID APPLICATIONS AND CYBER SECURITY

Applications: Overview and concept of Renewable Integration – Introduction to distributed generation - Role of Protective Relaying in Smart Grid – House Area Network – Advanced Energy Storage Technology: Flow battery – Fuel cell – SMES – Super capacitors – Plug – in Hybrid electric Vehicles - Cyber Security: Security issues in DG, Distribution Automation, AMI, Electric Vehicle Management Systems – Approach to assessment of smart grid cyber security risks



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– Methodologies. Cyber Security requirements – Smart Grid Information Model.

TEXT BOOKS:

1. James Momoh, "SMART GRID: Fundamentals of Design and Analysis", John Wiley and Sons, New York, 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & Sons, New Jersey, 2012.

REFERENCE BOOKS:

1. Power Grid Corporation of India Limited, "Smart Grid Primer", 1st Edition, Power Grid Corporation of India Limited, Bangalore, India, 2013.
2. Fereidoon.P. Sioshansi, "Smart Grid – Integrating Renewable, Distributed and Efficient Energy", 1st Edition, Academic Press, USA, 2011.
3. Stuart Borlase, "Smart Grids: Infrastructure, Technology and Solutions", 1st Edition, CRC Press Publication, England, 2013.
4. Phadke A G, Thorp J S, "Synchronized Phasor Measurements and Their Applications", 1st Edition, Springer, Newyork, 2012.

COURSE OUTCOMES:

1. Understanding the Concept and Evolution of Smart Grids. L2
2. Analyzing Wide Area Monitoring System and Synchro phasor Technology. L4
3. Applying Smart Metering and Advanced Metering Infrastructure (AMI) Concepts. L3
4. Evaluating Information and Communication Technology (ICT) Systems in Smart Grids. L5
5. Designing Smart Grid Applications and Cybersecurity Measures. L6

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IV B.Tech. I Sem.

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(23A03707) 3D PRINTING TECHNOLOGIES (OE-III)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Entrepreneurship

COURSE OBJECTIVES:

1. Understand the fundamental concepts of prototyping and distinguish between traditional and rapid prototyping methods.
2. Demonstrate the working principles, materials, and applications of solid-, liquid-, and powder-based RP systems.
3. Define the processes and classifications of rapid tooling and reverse engineering techniques.
4. Identify common errors in 3D printing and evaluate pre-processing, processing, and post-processing issues.
5. Familiarize RP-related software and its role in applications such as design, manufacturing, and medical fields.

UNIT-I INTRODUCTION TO 3D PRINTING

Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

UNIT-II SOLID AND LIQUID BASED RP SYSTEMS

Working Principle, Materials, Advantages, Limitations and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereo lithography (SLA), Direct Light Projection System (DLP) and Solid Ground Curing (SGC).

UNIT-III POWDER BASED & OTHER RP SYSTEMS

Powder Based RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS) and Electron Beam Melting (EBM). Other RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Three-Dimensional Printing (3DP), Ballistic Particle Manufacturing (BPM) and Shape Deposition Manufacturing (SDM).

UNIT-IV RAPID TOOLING & REVERSE ENGINEERING

Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods. Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.



SANTHIRAM ENGINEERING COLLEGE

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UNIT-V ERRORS IN 3D PRINTING AND APPLICATIONS

Pre-processing, processing and post-processing errors, Part building errors in SLA, SLS, etc. Software: Need for software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP. Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

TEXT BOOKS:

1. Chee Kai Chua and Kah Fai Leong, —3D Printing and Additive Manufacturing Principles and Applications| 5/e, World Scientific Publications, 2017.
2. Ian Gibson, David W Rosen, Brent Stucker, —Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing|, Springer, 2/e, 2010.

REFERENCE BOOKS:

1. Frank W.Liou, —Rapid Prototyping & Engineering Applications|, CRC Press, Taylor & Francis Group, 2011.
2. Rafiq Noorani, —Rapid Prototyping: Principles and Applications in Manufacturing|, John Wiley&Sons, 2006.

e-Resources and Digital Material:

1. <https://nptel.ac.in/courses/112/104/112104265/>
2. <https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/>
3. <https://www.youtube.com/watch?v=NkC8TNts4B4>.
4. https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
5. <https://lecturenotes.in/subject/197>
6. <https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf>

COURSE OUTCOMES:

1. Define and explain the evolution and need for rapid prototyping in modern product development.
2. Compare and contrast various 3D printing technologies based on working principles, materials, and limitations.
3. Apply knowledge of rapid tooling and reverse engineering techniques for industrial and design applications.
4. Diagnose and interpret different types of errors encountered in 3D printing processes and recommend solutions.
5. Use RP-specific software tools to manipulate STL files and prepare models for printing in real-world scenarios.

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IV B.Tech. I Sem.

L	T	P	C
3	0	0	3

**(23A04519) MICROPROCESSORS AND MICROCONTROLLERS
(OE-III)**

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To comprehend the architecture, operation, and configurations of the 8086 microprocessors.
2. To get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
3. To study the interfacing of 8086 with memory, peripherals, and controllers for various applications.
4. To learn the architecture, instruction set, and programming of the 8051 microcontrollers.
5. To understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

UNIT-I 8086 ARCHITECTURE

Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT-II 8086 PROGRAMMING

Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT-III 8086 INTERFACING

Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDs, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT-IV MICROCONTROLLER

Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.



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UNIT-V INTERFACING MICROCONTROLLER

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface-Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors.

TEXT BOOKS:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition, 1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

REFERENCE BOOKS:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

COURSE OUTCOMES:

1. Gain knowledge on the architecture, operation, and configurations of the 8086 microprocessors.
2. Get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
3. Know the interfacing of 8086 with memory, peripherals, and controllers for various applications.
4. Learn the architecture, instruction set, and programming of the 8051 microcontrollers.
5. Understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

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IV B.Tech. I Sem.

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3	0	0	3

**(23A91716) WAVELET TRANSFORMS AND ITS APPLICATIONS
(OE-III)**

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand the fundamental concepts of wavelets, wavelet expansion systems, wavelet transforms, Haar scaling functions and wavelets, and the Discrete, Discrete-Time, and Continuous Wavelet Transforms.
2. To understand and apply signal spaces, scaling functions, multiresolution analysis, wavelet functions, the Discrete Wavelet Transform, Parseval's theorem, and wavelet expansion representations.
3. To understand and implement the analysis and synthesis of filter banks using filtering, down-sampling, up-sampling, lattices, and lifting techniques for the Discrete Wavelet Transform.
4. To analyze multiresolution and time-frequency representations, periodic and nonperiodic Discrete Wavelet Transforms, and the numerical complexity of wavelet transform techniques.
5. To understand and analyze orthogonal, biorthogonal, and tight frame bases and apply matrix representations to Fourier series, sine expansions, and frame-based signal representations.

UNIT-I WAVELETS

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform-Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform- The Discrete-Time and Continuous Wavelet Transforms.

UNIT-II A MULTIREOLUTION FORMULATION OF WAVELET SYSTEMS

Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

UNIT-III FILTER BANKS AND THE DISCRETE WAVELET TRANSFORM

Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating - Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - -Different Points of View.

UNIT-IV TIME-FREQUENCY AND COMPLEXITY

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

UNIT-V BASES AND MATRIX EXAMPLES

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

TEXT BOOKS:

1. C. Sidney Burrus, Ramesh A. Gopinath, —Introduction to Wavelets and Wavelets Transforms, Prentice Hall, (1997).



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2. James S. Walker, —A Primer on Wavelets and their Scientific Applications, CRC Press, (1999).

REFERENCE BOOKS:

1. RaghuveerRao, —Wavelet Transforms, Pearson Education, Asia



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2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.

e-Resources and Digital Material:

1. <http://users.rowan.edu/~polikar/WAVELETS/WTtutorial.html>
2. <http://www.wavelet.org/>
3. [http://www.math.hawaii.edu/~dave/Web/Amara s%20Wavelet%20Page.htm](http://www.math.hawaii.edu/~dave/Web/Amara%20Wavelet%20Page.htm)
4. <https://jqichina.wordpress.com/wp-content/uploads/2012/02/ten-lectures-ofwaveletsefbc88e5b08fe6b3a2e58d81e8aeb2efbc891.pdf>

COURSE OUTCOMES:

1. Understand wavelets and wavelet basis and characterize continuous and discrete wavelet transforms.
2. Illustrate the multi resolution analysis and scaling functions.
3. Implement discrete wavelet transforms with multirate digital filters.
4. Understand multi resolution analysis and identify various wavelets and evaluate their time- frequency resolution properties.
5. Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields.

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IV B.Tech. I Sem.

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(23A92705) SMART MATERIALS AND DEVICES (OE-III)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To provide exposure to smart materials and their engineering applications.
2. To impart knowledge on the basics and phenomenon behind the working of smart materials.
3. To explain the properties exhibited by smart materials.
4. To educate various techniques used to synthesize and characterize smart materials.
5. To identify the required smart material for distinct applications/devices.

UNIT-I INTRODUCTION TO SMART MATERIALS

Historical account of the discovery and development of smart materials, Shape memory materials, chromoactive materials, magnetorheological materials, photoactive materials, Polymers and polymer composites (Basics).

UNIT-II PROPERTIES OF SMART MATERIALS

Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT-III SYNTHESIS OF SMART MATERIALS

Chemical route: Chemical vapor deposition, Sol-gel technique, Hydrothermal method, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT-IV CHARACTERIZATION TECHNIQUES

Powder X-ray diffraction, Raman spectroscopy (RS), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM).

UNIT-V SMART MATERIALS BASED DEVICES

Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

TEXT BOOKS:

1. YaserDahman, Nanotechnology and Functional Materials for Engineers-, Elsevier, 2017.
2. E. Zschech, C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005.



SANTHIRAM ENGINEERING COLLEGE

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REFERENCE BOOKS:

1. Gauenzi,P.,Smart Structures, Wiley, 2009.
2. Mahmood Ali of khazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014.
3. Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0, Chaudhery Mustansar Hussain, Paolo Di Sia, Springer,2022.
4. Fundamentals of Smart Materials,Mohsen Shahinpoor, Royal Society of Chemistry, 2020.

e-Resources and Digital Material:

1. NPTEL course link: https://onlinecourses.nptel.ac.in/noc22_me17/preview

COURSE OUTCOMES:

1. Identify key discoveries that led to modern applications of shape memory materials, describe the two phases in shape memory alloys.
2. Describe how different external stimuli (light, electricity, heat, stress, and magnetism) influence smart material properties.
3. Summarize various types of synthesis of smart materials.
4. Analyze various characterization techniques used for smart materials.
5. Interpret the importance of smart materials in various devices.

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IV B.Tech. I Sem.

L	T	P	C
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(23A92706) INTRODUCTION TO QUANTUM MECHANICS (OE-III)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. To understand the fundamental differences between classical and quantum mechanics.
2. To study wave-particle duality, uncertainty principle, and their implications.
3. To learn and apply Schrödinger equations to basic quantum systems.
4. To use operator formalism and mathematical tools in quantum mechanics.
5. To explore angular momentum, spin and their quantum mechanical representations.

UNIT-I PRINCIPLES OF QUANTUM MECHANICS

Introduction: Limitations of classical Mechanics, Difficulties with classical theories of black body radiation and origin of quantum theory of radiation. Wave-particle duality: de Broglie wavelength, Heisenberg uncertainty principle. Schrödinger time independent and time dependent wave equation, Solution of the time dependent Schrödinger equation, Concept of stationary states, Physical significance of wave function (ψ), Orthogonal, Normalized and Orthonormal functions.

UNIT-II ONE DIMENSIONAL PROBLEMS AND SOLUTIONS

Potential step – Reflection and Transmission at the interface. Potential well: Square well potential with rigid walls, Square well potential with finite walls. Potential barrier: Penetration of a potential barrier (tunneling effect). Periodic potential and Harmonic oscillator, Energy eigen functions and eigen values.

UNIT-III OPERATOR FORMALISM

Operators, Operator Algebra, Eigen values and Eigen vectors, Postulates of quantum mechanics, Matrix representation of wave functions and linear operators.

UNIT-IV MATHEMATICAL TOOLS FOR QUANTUM MECHANICS

The concept of row and column matrices, Matrix algebra, Hermitian operators – definition. Dirac's bra and ket notation, Expectation values, Heisenberg (operator) representation of harmonic oscillator, Ladder operators and their significance.

UNIT-V ANGULAR MOMENTUM AND SPIN

Angular momentum operators: Definition. Eigen functions and Eigen values of AM operators. Matrix representation of angular momentum operators, System with spin half ($1/2$), Spin angular momentum, Pauli's spin matrices. Clebsch-Gordon coefficients. Rigid Rotator: Eigen functions and Eigen values.



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TEXT BOOKS:

1. Quantum Mechanics. Vol 1, A. MessiaNoth-Holland Pub. Co., Amsterdam, (1961).
2. A Text Book of Quantum Mechanics. P.M.Mathews and K.Venkatesam, Tata McGraw Hill, New Delhi,(1976).
3. Introduction to Quantum Mechanics. R.H.Dicke and J.P.Witke, Addison-Wisley Pub.Co.Inc.,London, (1960).
4. Quantum Mechanics. S.L.Gupta, V.Kumar, H.V.Sarama and R.C.Sharma, Jai PrakashNath& Co, Meerut, (1996).

REFERENCE BOOKS:

1. Quantum Mechanics. L.I. Schiff, McGraw Hill Book Co., Tokyo, (1968).
2. Introduction to Quantum Mechanics. Richard L. Liboff, Pearson Education Ltd (Fourth Edn.) 2003.

e-Resources and Digital Material:

1. <https://archive.nptel.ac.in/courses/115/101/115101107/>
2. <https://archive.nptel.ac.in/courses/122/106/122106034/>
3. <https://nptel.ac.in/courses/115106066>

COURSE OUTCOMES:

1. Explain the key principles of quantum mechanics and wave-particle duality.
2. Apply Schrödinger equations to solve one-dimensional quantum problems.
3. Solve quantum mechanical problems using operator and matrix methods.
4. Evaluate quantum states using Dirac notation and expectation values.
5. Analyze angular momentum and spin systems using Pauli matrices and operators.

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IV B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A93706) GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (OE-III)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Environment & Sustainability

COURSE OBJECTIVES:

1. To Understand Principle And Concepts Of Green Chemistry.
2. To Understand The Types Of Catalysis And Industrial Applications.
3. To Apply Green Solvents In Chemical Synthesis.
4. To Enumerate Different Sourced Of Green Energy.
5. To Apply Alternative Greener Methods For Chemical Reactions.

UNIT-I PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY

Introduction, Green chemistry Principles, sustainable development and green chemistry, E factor, atom economy, atom economic Reactions: Rearrangement and addition reactions and atom un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

UNIT-II CATALYSIS AND GREEN CHEMISTRY

Introduction, Types of catalysis, Heterogeneous catalysis: Basics of Heterogeneous Catalysis, Zeolite and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, and Phase transfer catalysis, Bio-catalysis and Photo-catalysis with examples.

UNIT-III GREEN SOLVENTS IN CHEMICAL SYNTHESIS

Green Solvents: Concept, Tools and techniques for solvent selection, supercritical fluids: Super critical carbondioxide, super critical water, Polyethylene glycol (PEG), Ionic liquids, Recycling of green solvents.

UNIT-IV EMERGING GREENER TECHNOLOGIES

Biomass as renewable resource, Energy: Energy from Biomass, Solar Power, Chemicals from Renewable Feedstock's, Chemicals from Fatty Acids, Polymers from Renewable Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency, Mechanochemical synthesis.

UNIT-V ALTERNATIVE GREENER METHODS

Photochemical Reactions - Examples, Advantages and Challenges, Photo redox catalysis, single electron transfer reactions (SET), Examples of Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

TEXT BOOKS:

1. M. Lancaster, Green Chemistry An Introductory Text, Royal Society Of Chemistry, 2002.
2. Paul T. Anastas And John C. Warner, Green Chemistry Theory And Practice, 4th Edition, Oxford University Press, Usa.

REFERENCE BOOKS:

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
2. Edited by Alvise Perosa and Maurizio Selva, Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013.

COURSE OUTCOMES:

1. Apply the Green chemistry Principles for day-to-day life as well as synthesis, describe the sustainable development and green chemistry, explain economic and un-economic reactions, Demonstrate Polymer recycling.
2. Explain Heterogeneous catalyst and its applications in Chemical and Pharmaceutical Industries, Differentiate Homogeneous and Heterogeneous catalysis, Identify the importance of Bio and Photo Catalysis, Discuss Transition metal and Phase transfer Catalysis.
3. Demonstrate Green solvents and importance, Discuss Supercritical carbondioxide, Explain Supercritical water, recycling of green solvents.
4. Describe importance of Biomass and Solar Power, Illustrate Sonochemistry, Apply Green Chemistry for Sustainable Development; discuss the importance of Renewable resources, mechanochemical synthesis.
5. Discuss Alternative green methods like Photoredox catalysis, single electron transfer reactions (SET), Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

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IV B.Tech. I Sem.

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3	0	0	3

(23A95711) EMPLOYABILITY SKILLS (OE-III)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. To encourage all round development of the students by focusing on productive skills
2. To make the students aware of Goal setting and writing skills
3. To enable them to know the importance of presentation skills in achieving desired goals.
4. To help them develop organizational skills through group activities
5. To function effectively with heterogeneous teams

UNIT-I GOAL SETTING AND SELF-MANAGEMENT

Definition, importance, types of Goal Setting – SMART Goal Setting – Advantages-Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOC Analysis

UNIT-II WRITING SKILLS

Definition, significance, types of writing skills – Resume writing Vs CV Writing - E-Mail writing, Cover Letters - E-Mail Etiquette -SoP (Statement of Purpose).

UNIT-III TECHNICAL PRESENTATION SKILLS

Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics –Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation

UNIT-IV GROUP PRESENTATION SKILLS

Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality ManifestationGroup Discussion-Debate –Corporate Etiquette

UNIT-V JOB CRACKING SKILLS

Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success – Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews

TEXT BOOKS:

1. Sabina Pillai, Agna Fernandez. Soft Skills & Employability Skills, 2014.Cambridge Publisher.
2. Alka Wadkar. Life Skills for Success, Sage Publications, 2016.



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REFERENCE BOOKS:

1. Gangadhar Joshi. Campus to Corporate Paperback, Sage Publications. 2015.
2. Sherfield Montgomery Moody, Cornerstone Developing Soft Skills, Pearson Publications. 4 Ed. 2008.
3. Shikha Kapoor. Personality Development and Soft Skills - Preparing for Tomorrow .1 Edition, Wiley, 2017.
4. M. Sen Gupta, Skills for Employability, Innovative Publication, 2019.
5. Steve Duck and David T McMahan, The Basics of Communication Skills A Relational Perspective, Sage press, 2012.

e-Resources and Digital Material:

1. <https://youtu.be/gkLsn4ddmTs>
2. <https://youtu.be/2bf9K2rRWwo>
3. <https://youtu.be/FchfE3c2jzc>
4. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KIJ
5. <https://www.youtube.com/c/skillopedia/videos>
6. https://onlinecourses.nptel.ac.in/noc25_hs96/preview
7. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

COURSE OUTCOMES:

1. Understand the importance of goals and try to achieve them L1, L2
2. Explain the significance of self-management L1, L2
3. Apply the knowledge of writing skills in preparing eye-catching resumes L3
4. Analyse various forms of Presentation skills L4
5. Judge the group behaviour appropriately L5
6. Develop skills required for employability. L3, L6

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IV B.Tech. I Sem.

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3	0	0	3

(23A01706) GEO-SPATIAL TECHNOLOGIES (OE-IV)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand raster-based spatial analysis techniques, including query, overlay, and cost-distance analysis.
2. To analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
3. To apply network analysis techniques for geocoding, shortest path analysis, and location allocation problems.
4. To evaluate surface and geostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
5. To assess GIS customization, Web GIS, and mobile mapping techniques for real-world applications.

UNIT-I RASTER ANALYSIS

Raster Data Exploration: Query Analysis - Local Operations: Map Algebra, Reclassification, Logical and Arithmetic Overlay Operations—Neighborhood - Operations: Aggregation, Filtering – Extended Neighborhood-Operations- Zonal Operations - Statistical Analysis – Cost Distance Analysis-Least Cost Path.

UNIT-II VECTOR ANALYSIS

Non-Topological Analysis: Attribute Database Query, Structured Query Language, Co-Ordinate Transformation, Summary Statistics, Calculation of Area, Perimeter and Distance – topological Analysis: Reclassification, Aggregation, Overlay Analysis: Point-In-Polygon, Line-In-Polygon, Polygon-On-Polygon: Clip, Erase, Identity, Union, Intersection – Proximity Analysis: Buffering.

UNIT-III NETWORK ANALYSIS

Network – Introduction - Network Data Model – Elements of Network - Building A Network Database - Geocoding – Address Matching - Shortest Path in A Network – Time and Distance Based Shortest Path Analysis – Driving Directions – Closest Facility Analysis – Catchment / Service Area Analysis-Location-Allocation Analysis.

UNIT-IV SURFACE AND GEOSTATISTICAL ANALYSIS

Surface Data – Sources of X,Y, Z Data – DEM, TIN – Terrain Analysis – Slope, Aspect, Viewshed, Watershed Analysis: Watershed Boundary, Flow Direction, Flow Accumulation, Drainage Network, Spatial Interpolation: IDW, Spline, Kriging, Variogram.



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UNIT-V CUSTOMISATION, WEB GIS, MOBILE MAPPING

Customisation of GIS: Need, Uses, Scripting Languages –Embedded Scripts – Use of Python Script - Web GIS: Web GIS Architecture, Advantages of Web GIS, Web Applications- Location Based Services: Emergency and Business Solutions - Big Data Analytics.

TEXT BOOKS:

1. Kang – Tsung Chang, Introduction to Geographical Information System, 4th Ed., Tata McGraw Hill Edition, 2008.
2. Lo, C.P. and Yeung, Albert K.W., Concepts and Techniques of Geographic Information Systems Prentice Hall, 2002.

REFERENCE BOOKS:

1. Michael N. Demers, Fundamentals of Geographic Information Systems, Wiley, 2009.
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasaraju, —An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.
3. John Peter Wilson, The Handbook of Geographic Information Science, Blackwell Pub., 2008.

e-Resources and Digital Material:

1. <https://archive.nptel.ac.in/courses/105/105/105105202/>
2. https://onlinecourses.nptel.ac.in/noc19_cs76/preview

COURSE OUTCOMES:

1. Understand raster-based spatial analysis techniques, including query, overlay, and cost distance analysis.
2. Analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
3. Apply network analysis techniques for geocoding, shortest path analysis, and location allocation problems.
4. Evaluate surface and geostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
5. Assess GIS customization, Web GIS, and mobile mapping techniques for real-world applications.

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IV B.Tech. I Sem.

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(23A01707) SOLID WASTE MANAGEMENT (OE-IV)

Course Category	Professional Elective (PE)
Course Enrichment Relevance	Environment & Sustainability

COURSE OBJECTIVES:

1. To understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
2. To analyze engineering systems for solid waste collection, storage, and transportation.
3. To apply resource and energy recovery techniques for sustainable solid waste management.
4. To evaluate landfill design, construction, and environmental impact mitigation strategies.
5. To assess hazardous waste management techniques, including biomedical and e-waste disposal.

UNIT-I SOLID WASTE

Definitions, Types of Solid Wastes, Sources of Solid Wastes, Characteristics, and Perspectives; Properties of Solid Wastes, Sampling of Solid Wastes, Elements of Solid Waste Management - Integrated Solid Waste Management, Solid Waste Management Rules 2016.

UNIT-II ENGINEERING SYSTEMS FOR SOLID WASTE MANAGEMENT

Solid Waste Generation; On-Site Handling, Storage and Processing; Collection of Solid Wastes; Stationary Container System and Hauled Container Systems – Route Planning - Transfer and Transport; Processing Techniques;

UNIT-III ENGINEERING SYSTEMS FOR RESOURCE AND ENERGY RECOVERY

Processing Techniques; Materials Recovery Systems; Recovery of Biological Conversion Products Composting, Pre and Post Processing, Types of Composting, Critical Parameters, Problems With Composting - Recovery of Thermal Conversion Products; Pyrolysis, Gasification, RDF - Recovery of Energy From Conversion Products; Materials and Energy Recovery Systems.

UNIT-IV LANDFILLS

Evolution of Landfills – Types and Construction of Landfills – Design Considerations – Life of Land Pollution and Control – Monitoring Landfills – Landfills Reclamation.

UNIT-V HAZARDOUS WASTE MANAGEMENT

Sources and Characteristics, Effects on Environment, Risk Assessment Disposal of Hazardous Wastes Secured Landfills, Incineration - Monitoring Biomedical Waste Disposal, E-Waste Management, Nuclear Wastes, Industrial Waste Management.



SANTHIRAM ENGINEERING COLLEGE

(AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

TEXT BOOKS:

1. Tchobanoglous G, Theisen H and Vigil SA _Integrated Solid Waste Management, Engineering Principles and Management Issues‘M c G r a w -Hill, 1993.
2. Vesilind PA, Worrell W and Reinhart D, _Solid Waste Engineering‘Brooks/Cole Thomson Learning Inc., 2002.

REFERENCE BOOKS:

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, _Environmental Engineering ‘, McGraw Hill Inc., New York, 1985.
2. Qian X, Koerner RM and Gray DH, _Geotechnical Aspects of Landfill Design and Construction‘Prentice Hall, 2002.

e-Resources and Digital Material:

1. <https://archive.nptel.ac.in/courses/105/103/105103205/>
2. <https://archive.nptel.ac.in/courses/120/108/120108005/>

COURSE OUTCOMES:

1. Understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
2. Analyze engineering systems for solid waste collection, storage, and transportation.
3. Apply resource and energy recovery techniques for sustainable solid waste management.
4. Evaluate landfill design, construction, and environmental impact mitigation strategies.
5. Assess hazardous waste management techniques, including biomedical and e-waste.

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IV B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A02706) ELECTRIC VEHICLES (OE-IV)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Environment & Sustainability

COURSE OBJECTIVES:

1. Remember and understand the differences between conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs.
2. Analyze various EV configurations, parameters of EV systems and Electric vehicle dynamics.
3. Analyze the basic construction, operation and characteristics of fuel cells and battery charging techniques in HEV systems.
4. Design and analyze the various control structures for Electric vehicle.

UNIT-I INTRODUCTION TO EV SYSTEMS AND ENERGY SOURCES

Past, Present and Future of EV - EV Concept- EV Technology- State-of-the Art of EVs- EV configuration- EV system- Fixed and Variable gearing- Single and multiple motor drive-In-wheel drives- EV parameters: Weight, size, force and energy, performance parameters. Electro mobility and the environment- History of Electric power trains-Carbon emissions from fuels- green houses and pollutants- Comparison of conventional, battery, hybrid and fuel cell electric systems.

UNIT-II EV PROPULSION AND DYNAMICS

Choice of electric propulsion system- Block diagram- Concept of EV Motors- Single and multi-motor configurations- Fixed and variable geared transmission- In-wheel motor configuration- Classification - Electric motors used in current vehicle applications - Recent EV Motors- Vehicle load factors- Vehicle acceleration.

UNIT-III FUEL CELLS

Introduction of fuel cells- Basic operation- Model - Voltage, power and efficiency- Power plant system – Characteristics- Sizing - Example of fuel cell electric vehicle - Introduction to HEV- Brake specific fuel consumption - Comparison of Series-Parallel hybrid systems-Examples.

UNIT-IV BATTERY CHARGING AND CONTROL

Battery charging: Basic requirements- Charger architecture- Charger functions- Wireless charging- Power factor correction.

Control: Introduction- Modeling of electro mechanical system- Feedback controller design approach- PI controller 's designing- Torque-loop, Speed control loop compensation- Acceleration of battery electric vehicle.



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UNIT-V ENERGY STORAGE TECHNOLOGIES

Role of Energy Storage Systems- Thermal- Mechanical-Chemical- Electrochemical-Electrical - Efficiency of energy storage systems- Super Capacitors-Superconducting Magnetic Energy Storage (SMES)- SOC- SoH -fuel cells - G2V- V2G- Energy storage in Micro-grid and Smart grid- Energy Management with storage systems- Battery SCADA.

TEXT BOOKS:

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001, 1st Edition.
2. Ali Emadi, —Advanced Electric Drive Vehicles, CRC Press, 2017, 1st Edition.

REFERENCE BOOKS:

1. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2021, 3rd Edition.
2. Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt, Energy Storage in Power Systems, Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016, 1st Edition.
3. A.G.Ter-Gazarian, —Energy Storage for Power Systems, the Institution of Engineering and Technology (IET) Publication, UK, (ISBN – 978-1-84919-219-4), Second Edition, 2011.
4. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, —Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004, 1st Edition.
5. James Larminie, John Lowry, —Electric Vehicle Technology Explained, Wiley, 2003, 2nd Edition.

e-Resources and Digital Material:

1. <https://nptel.ac.in/courses/108/102/108102121/>
2. <https://nptel.ac.in/syllabus/108103009>

COURSE OUTCOMES:

1. To understand and differentiate between Conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs. -L2
2. Understand Various dynamics of Electric Vehicles. -L2
3. To remember and understand various configurations in parameters of EV system and dynamic aspects of EV. -L1
4. To analyze fuel cell technologies in EV and HEV systems. -L3
5. To analyze the battery charging and controls required of EVs. -L3

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IV B.Tech. I Sem.

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(23A03708) TOTAL QUALITY MANAGEMENT (OE-IV)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Entrepreneurship

COURSE OBJECTIVES:

1. Familiarize the basic concepts of Total Quality Management.
2. Expose with various quality issues in Inspection.
3. Gain Knowledge on quality control and its applications to real time.
4. Understand the extent of customer satisfaction by the application of various quality concepts.
5. Demonstrate the importance of Quality standards in Production.

UNIT-I INTRODUCTION

Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

UNIT-II HISTORICAL REVIEW

Historical Review: Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

UNIT-III TQM PRINCIPLES

Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDCA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures Basic Concepts, Strategy, Performance Measure Case studies.

UNIT-IV TQM TOOLS

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

UNIT-V QUALITY SYSTEMS

Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.



SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

TEXT BOOKS:

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005.
3. Joel E.Ross , Total Quality Management, Third Edition, CRC Press, 2017.

REFERENCE BOOKS:

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.
2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993.
3. Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015.
4. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995.

e-Resources and Digital Material:

1. <https://www.youtube.com/watch?v=VD6tXadibk0>
2. <https://www.investopedia.com/terms/t/total-quality-management-tqm.asp>
3. <https://blog.capterra.com/what-is-total-quality-management/>
4. <https://nptel.ac.in/courses/110/104/110104080/>
5. https://onlinecourses.nptel.ac.in/noc21_mg03/preview
6. <https://nptel.ac.in/courses/110/104/110104085/>

COURSE OUTCOMES:

1. Define and develop on quality Management philosophies and analyze quality costs frameworks.
2. Understanding of the historical development of Total Quality Management (TQM), implementation, and real-world applications through case studies.
3. Evaluate the cost of poor quality, process effectiveness and efficiency to analyze areas for improvement.
4. Apply benchmarking and business process reengineering to improve management processes.
5. Demonstrate the set of indications to evaluate performance excellence of an organization.

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IV B.Tech. I Sem.

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3	0	0	3

(23A04755) TRANSDUCERS AND SENSORS (OE-IV)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To understand characteristics of Instrumentation System and the operating principle of motion transducers.
2. To explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
3. To provide knowledge on flow transducers and their applications.
4. To study the working principles of pressure transducers
5. To introduce working principle and applications of force and sound transducers.

UNIT-I INTRODUCTION

General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.

Motion Transducers: Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers.

UNIT-II TEMPERATURE TRANSDUCERS

Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics. Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors.

UNIT-III FLOW TRANSDUCERS

Bernoulli 's principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

UNIT-IV PRESSURE TRANSDUCERS

Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high- and low-pressure measurement.

UNIT-V FORCE AND SOUND TRANSDUCERS

Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone.

TEXT BOOKS:



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

1. A.K. Sawhney, —A course in Electrical and Electronics Measurements and Instrumentation, Dhanpat Rai & Co. 3rd edition Delhi, 2010.
2. Rangan C.S, Sarma G.R and Mani V S V, —Instrumentation Devices and Systems, TATA McGraw Hill publications, 2007.

REFERENCE BOOKS:

1. Doebelin. E.O, Measurement Systems Application and Design, McGraw Hill International, New York, 2004.
2. Nakra B.C and Chaudhary K. K , Instrumentation Measurement and Analysis, Second Edition, Tata McGraw-Hill Publication Ltd.2006.

COURSE OUTCOMES:

1. Understand characteristics of Instrumentation System and the operating principle of motion transducers.
2. Explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
3. Gain knowledge on flow transducers and their applications.
4. Learn the working principles of pressure transducers.
5. Understand the working principle and applications of force and sound transducers.

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IV B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A91715) FINANCIAL MATHEMATICS (OE-IV)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. To provide mathematical foundations for financial modelling, risk assessment and asset pricing.
2. To introduce stochastic models and their applications in pricing derivatives and interest rate modelling.
3. To develop analytical skills for fixed-income securities, credit risk, and investment strategies.
4. To equip students with computational techniques for pricing financial derivatives.

UNIT-I ASSET PRICING AND RISK MANAGEMENT

Fundamental financial concepts: Returns, arbitrage, valuation, and pricing. Asset/Liability management, investment income, capital budgeting, and contingent cash flows. One-period model: Securities, payoffs, and the no-arbitrage principle. Option contracts: Speculation and hedging strategies, CAP Model, Efficient market hypothesis.

UNIT-II STOCHASTIC MODELS IN FINANCE

Random Walks and Brownian Motion. Introduction to Stochastic Differential Equations (SDEs): Drift and diffusion. Ito calculus: Ito's Lemma, Ito Integral, and Ito Isometry.

UNIT-III INTEREST RATE AND CREDIT MODELLING

Interest rate models and bond markets. Short-rate models: Vasicek, Cox-Ingersoll-Ross (CIR), Hull & White models, Credit risk modelling: Hazard function and hazard rate.

UNIT-IV FIXED-INCOME SECURITIES AND BOND PRICING

Characteristics of fixed-income products: Yield, duration, and convexity. Yield curves, forward rates, and zero-coupon bonds. Stochastic interest rate models and bond pricing PDE. Yield curve fitting and calibration techniques, Mortgage-Backed Securities.

UNIT-V EXOTIC OPTIONS AND COMPUTATIONAL FINANCE

Stochastic volatility models and the Feynman-Kac theorem. Exotic options: Barriers, Asians, and Look backs. Monte Carlo methods for derivative pricing, Black-Scholes-Merton model: Derivation and applications.

TEXT BOOKS:

1. Ales Cerny, Mathematical Techniques in Finance: Tools for Incomplete Markets, Princeton University Press.
2. S.R. Pliska, Introduction to Mathematical Finance: Discrete-Time Models, Cambridge University Press.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

REFERENCE BOOKS:

1. Ioannis Karatzas & Steven E. Shreve, Methods of Mathematical Finance, Springer, New York.
2. John C. Hull, Options, Futures, and Other Derivatives, Pearson.

e-Resources and Digital Material:

1. MIT– Mathematics for Machine Learning <https://ocw.mit.edu>
2. Coursera – Financial Engineering and Risk Management (Columbia University) <https://www.coursera.org/>
3. National Stock Exchange (NSE) India – Financial Derivatives <https://www.nseindia.com/>

COURSE OUTCOMES:

1. Explain fundamental financial concepts, including arbitrage, valuation, and risk. L2 (Understand)
2. Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs), in financial contexts. L3 (Apply)
3. Analyze mathematical techniques for pricing options and financial derivatives. L4 (Analyze)
4. Evaluate interest rate models and bond pricing methodologies. L5 (Evaluate)
5. Utilize computational techniques such as Monte Carlo simulations for financial modeling. L3 (Apply)

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IV B.Tech. I Sem.

L	T	P	C
3	0	0	3

(23A32611) INTRODUCTION TO QUANTUM COMPUTING (OE-IV)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To introduce the principles and mathematical foundations of quantum computation.
2. To understand quantum gates, circuits, and computation models.
3. To explore quantum algorithms and their advantages over classical ones.
4. To develop the ability to simulate and write basic quantum programs.
5. To understand real-world applications and the future of quantum computing in AI, cryptography, and optimization.

UNIT-I FUNDAMENTALS OF QUANTUM MECHANICS AND LINEAR ALGEBRA

Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT-II QUANTUM GATES AND CIRCUITS

Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT-III QUANTUM ALGORITHMS AND COMPLEXITY

Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover's Search Algorithm, Shor's Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT-IV QUANTUM PROGRAMMING AND SIMULATION PLATFORMS

Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT-V APPLICATIONS AND FUTURE OF QUANTUM COMPUTING

Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

TEXT BOOKS:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, 175 Cambridge University Press, 10th Anniversary Edition, 2010



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING & DATA SCIENCE

2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

REFERENCE BOOKS:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

e-Resources and Digital Material:

1. IBM Quantum Experience and Qiskit Tutorials.
2. Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley.
3. edX – The Quantum Internet and Quantum Computers
4. YouTube – Quantum Computing for the Determined by Michael Nielsen
5. Qiskit Textbook – IBM Quantum

COURSE OUTCOMES:

1. Explain the fundamental concepts of quantum mechanics used in computing.
2. Construct and analyze quantum circuits using standard gates.
3. Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.
4. Develop simple quantum programs using Qiskit or similar platforms.
5. Analyze applications and challenges of quantum computing in real-world domains.

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IV B.Tech. I Sem.

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3	0	0	3

(23A92707) SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS (OE-IV)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Employability

COURSE OBJECTIVES:

1. To provide exposure to various kinds of sensors and actuators and their engineering applications.
2. To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators.
3. To explain the operating principles of various sensors and actuators.
4. To educate the fabrication of sensors.
5. To explain the required sensor and actuator for interdisciplinary application.

UNIT-I INTRODUCTION TO SENSORS AND ACTUATORS

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching. Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Pneumatic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

UNIT-II TEMPERATURE AND MECHANICAL SENSORS

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo resistive sensors: Thermistors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Piezoresistive, Variable Reluctance Sensor (VRP).

UNIT-III OPTICAL AND ACOUSTIC SENSORS

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo resistors-based sensors, Photomultipliers, Infrared sensors: thermal, Passive Infra-Red, Fiber based sensors and Thermopiles Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones

UNIT-IV MAGNETIC AND ELECTROMAGNETIC SENSORS

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magnetostrictive sensors and actuators.



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UNIT-V CHEMICAL AND RADIATION SENSORS

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors. Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission).

TEXT BOOKS:

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015.
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999.

REFERENCE BOOKS:

1. Sensors and Transducers- D.Patranabis, Prentice Hall of India (Pvt) Ltd. 2003.
2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999.
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.

e-Resources and Digital Material:

1. NPTEL course link: https://onlinecourses.nptel.ac.in/noc21_ee32/preview

COURSE OUTCOMES:

- Classify different types of Sensors and Actuators along with their characteristics
- Summarize various types of Temperature and Mechanical sensors
- Illustrates various types of optical and mechanical sensors
- Analyze various types of Optical and Acoustic Sensors
- Interpret the importance of smart materials in various devices

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IV B.Tech. I Sem.

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(23A93707) CHEMISTRY OF NANOMATERIALS AND APPLICATIONS (OE-IV)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. To understand basics and characterization of nanomaterials.
2. To understand synthetic methods of nanomaterials.
3. To apply various techniques for characterization of nanomaterials.
4. To understand Studies of Nano-structured Materials
5. To enumerate the applications of advanced nanomaterials in engineering

UNIT-I BASICS AND CHARACTERIZATION OF NANOMATERIALS

Introduction, Scope of nanoscience and nanotechnology, nanoscience in nature, classification of nanostructured materials, importance of nanomaterials.

UNIT-II SYNTHESIS OF NANOMATERIALS

Top-Down approach, Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapor deposition method, electrodeposition method, high energy ball milling method. Synthetic Methods: Bottom-Up approach, Sol-gel synthesis, microemulsions or reverse micelles, co precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

UNIT-III TECHNIQUES FOR CHARACTERIZATION

Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

UNIT-IV STUDIES OF NANO-STRUCTURED MATERIALS

Synthesis, properties and applications of the following nanomaterials -fullerenes, carbon nanotubes, 2D-nanomaterial (Graphene), core-shell, magnetic nanoparticles, thermoelectric materials, non-linear optical materials.

UNIT-V ADVANCED ENGINEERING APPLICATIONS OF NANOMATERIALS

Applications of Nano Particle, nanorods, nano wires, Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

TEXT BOOKS:

1. NANO: The Essentials: T Pradeep, MaGraw-Hill, 2007.



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2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, Baldev Rai, BB Rath and James Murday, Univ. Press, 2012.

REFERENCE BOOKS:

1. Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.
2. Nanostructures & Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007.
3. Nanomaterials

COURSE OUTCOMES:

1. Classify the nanostructure materials; describe scope of nanoscience and importance technology.
2. Describe the top-down approach, explain aerosol synthesis and plasma arc technique, Differentiate chemical vapor deposition method and electrode position method, Discuss about high energy ball milling.
3. Discuss different technique for characterization of nanomaterial, Explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis
4. Explain synthesis and properties and applications of nanomaterials, Discuss about fullerenes and carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, nonlinear optical materials.
5. Illustrate advanced engineering applications of Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

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IV B.Tech. I Sem.

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(23A95712) LITERARY VIBES (OE-IV)

Course Category	Open Elective (OE)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. To inculcate passion for aesthetic sense and reading skills.
2. To encourage respecting others' experiences and creative writing.
3. To explore emotions, communication skills and critical thinking.
4. To educate how books serve as the reflection of history and society.
5. To provide practical wisdom and duty of responding to events of the times.

UNIT-I POETRY

1. Ulysses- Alfred Lord Tennyson
2. Ain't I woman?-Sojourner Truth
3. The Second Coming-W.B. Yeats
4. Where the Mind is Without Fear-Rabindranath Tagore

UNIT-II DRAMA

Twelfth Night- William Shakespeare:

1. Shakespeare -life and works
2. Plot & sub-plot and Historical background of the play
3. Themes and Criticism
4. Style and literary elements
5. Characters and characterization

UNIT-III SHORT STORY

1. The Luncheon - Somerset Maugham
2. The Happy Prince-Oscar Wilde
3. Three Questions – Leo Tolstoy
4. Grief –Antony Chekov

UNIT-IV PROSE ESSAY AND AUTOBIOGRAPHY

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1. My struggle for an Education-Booker T Washington
2. The Essentials of Education-Richard Livingstone
3. The story of My Life-Helen Keller
4. Student Mobs-JB Priestly

**UNIT-V NOVEL HARD TIMES- CHARLES DICKENS**

:

1. Charles Dickens-Life and works
2. Plot and Historical background of the novel
3. Themes and criticism
4. Style and literary elements
5. Characters and characterization

TEXT BOOKS:

1. Charles Dickens.Hard Times. (Sangam Abridged Texts) Vantage Press, 1983.
2. DENT JC.William Shakespeare. Twelfth Night. Oxford University Press,2016.

REFERENCE BOOKS:

1. WJ Long.History of English Literature, Rupa Publications India; First Edition (4 October 2015).
2. RK Kaushik And SC Bhatia. Essays, Short Stories and One Act Plays, Oxford University Press .2018.
3. Dhanvel, SP. English and Soft Skills, Orient Blackswan,2017.
4. New Horizon, Pearson publications, New Delhi 2014.
5. Vimala Ramarao, Explorations Volume-II, Prasaraanga Bangalore University,2014.
6. Dev Neira, Anjana & Co. Creative Writing: A Beginner's Manual.Pearson India, 2008.

e-Resources and Digital Material:

1. <https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses>
2. <https://smartenglishnotes.com/2021/11/28/the-luncheon-summary-characters-themes-and-irony>
3. <https://www.litcharts.com/lit/twelfth-night/themes>
4. <https://sirjitutorials.com/where-the-mind-is-without-fear-poem-notes-explanation/>
5. https://englishliterature.education/articles/poetry-analysis/the-second-coming-by-w-b-yeats-critical-analysis-summary-and-line-by-line-explanation/#google_vignette

COURSE OUTCOMES:

1. Identify genres, literary techniques and creative uses of language in literary texts.
2. Explain the relevance of themes found in literary texts to contemporary, personal and cultural values and to historical forces.
3. Apply knowledge and understanding of literary texts when responding to others' problems and their own and make evidence-based arguments.
4. Analyze the underlying meanings of the text by using the elements of literary texts.
5. Evaluate their own work and that of others critically.
6. Develop as creative, effective, independent and reflective students who are able to make informed choices in process and performance.

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IV B.Tech. I Sem.

L	T	P	C
0	1	2	2

**(23A05525) FULL STACK DEVELOPMENT-II (SKILL
ENHANCEMENT COURSE)**

Course Category	Skill Oriented Course (SC)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. Make use of Modern- day JavaScript with ES6 standards for designing Dynamic web pages
2. Building robust & responsive User Interfaces using popular JavaScript library `_React.js` '. Building robust backend APIs using `_Express.js`'
3. Establishing the connection between frontend (React) User interfaces and backend APIs (Express) with Data Bases (My SQL)
4. Familiarize students with GitHub for remote repository hosting and collaborative development.

Experiments covering the Topics:

- Introduction to DOM (Document Object Model), Ecma Script (ES6) standards and features like Arrow functions, Spread operator, Rest operator, Type coercion, Type hoisting, String literals, Array and Object Destructuring.
- Basics of React. js like React Components, JSX, Conditional rendering Differences between Real DOM and Virtual DOM.
- Important React.js concepts like React hooks, Props, react forms, Fetch API, Iterative rendering using JavaScript map () function.
- JavaScript runtime environment node. js and its uses, Express. js and Routing, Micro-Services architecture and MVC architecture, database connectivity using (My SQL)
- Introduction to My SQL, setting up MySQL and configuring, Databases, My SQL queries, subqueries, creating My SQL driver for database connectivity to Express. js server.
- Introduction to Git and GitHub and upload project& team collaboration

Sample Experiments:**1. Introduction to Modern JavaScript and DOM**

- a. Write a JavaScript program to link JavaScript file with the HTML page



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- b. Write a JavaScript program to select the elements in HTML page using selectors
- c. Write a JavaScript program to implement the event listeners
- d. Write a JavaScript program to handle the click events for the HTML button elements
- e. Write a JavaScript program to With three types of functions
 - i. Function declaration ii. Function definition iii. Arrow functions

2. Basics of React. js

- a. Write a React program to implement a counter button using react class components
- b. Write a React program to implement a counter button using react functional components
- c. Write a React program to handle the button click events in functional component
- d. Write a React program to conditionally render a component in the browser
- e. Write a React program to display text using String literals

3. Important concepts of React. js

- a. Write a React program to implement a counter button using React use State hook
- b. Write a React program to fetch the data from an API using React use Effect hook
- c. Write a React program with two react components sharing data using Props.
- d. Write a React program to implement the forms in react
- e. Write a React program to implement the iterative rendering using map() function.

4. Introduction to Git and GitHub

a. Setup

- o Install Git on local machine.
- o Configure Git (user name, email).
- o Create GitHub account and generate a personal access token.

b. Basic Git Workflow

- o Create a local repository using git init
- o Create and add files → git add .
- o Commit files → git commit -m "Initial commit"
- o Connect to GitHub remote → git remote add origin
- o Push to GitHub → git push -u origin main

c. Branching and Collaboration

- o Create a branch → git checkout -b feature1
- o Merge branch to main → git merge feature1
- o Resolve merge conflicts (guided)

5. Upload React Project to GitHub



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- o Create a new React app using `npx create-react-app myapp`
- o Initialize a git repo and push to GitHub
- o Use .gitignore to exclude node_modules
- o Create multiple branches: feature/navbar, feature/form
- o Practice merge and pull requests (can use GitHub GUI)

6. Introduction to Node.js and Express.js

- a. Write a program to implement the `_hello world_` message in the route through the browser using Express
- b. Write a program to develop a small website with multiple routes using Express.js
- c. Write a program to print the `_hello world_` in the browser console using Express.js
- d. Write a program to implement the CRUD operations using Express.js
- e. Write a program to establish the connection between API and Database using Express – My SQL driver

7. Introduction to My SQL

- a. Write a program to create a Database and table inside that database using My SQL Command line client
- b. Write a My SQL queries to create table, and insert the data, update the data in the table
- c. Write a My SQL queries to implement the subqueries in the My SQL command line client
- d. Write a My SQL program to create the script files in the My SQL workbench
- e. Write a My SQL program to create a database directory in Project and initialize a database. sql file to integrate the database into API

8. Team Collaboration Using GitHub

- o Form groups of 2–3 students
- o Create a shared GitHub repo
- o Assign tasks and work in branches
- o Use Issues, Pull Requests, and Code Reviews
- o Document code with README.md

TEXT BOOKS:

1. Web Design with HTML, CSS, JavaScript and JQuery Set Book by Jon Duckett
- Professional JavaScript for Web Developers Book by Nicholas C. Zakas.
2. John Dean, Web Programming with HTML5, CSS and JavaScript, Jones & Bartlett Learning, 2019.
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.
4. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites by Robin Nixon.
5. AZAT MARDAN, Full Stack Java Script: Learn Backbone.js, Node.js and MongoDB. 2015.

REFERENCE BOOKS:

1. Full-Stack JavaScript Development by Eric Bush.
2. Programming the World Wide Web, 7th Edition, Robert W. Sebesta, Pearson, 2013.
3. Tomasz Dyl, Kamil Przeorski, Maciej Czarnecki, Mastering Full Stack React Web Development 2017.



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e-Resources and Digital Material:

1. <https://ict.iitk.ac.in/product/full-stack-developer-html5-css3-js-bootstrap-php-4/>
2. <https://www.w3schools.com/html>
3. <https://www.w3schools.com/css>
4. <https://www.w3schools.com/js/>
5. <https://www.w3schools.com/nodejs>
6. <https://www.w3schools.com/typescript>

COURSE OUTCOMES:

1. Building fast and interactive UIs
2. Applying Declarative approach for developing web apps
3. Understanding ES6 features to embrace modern JavaScript
4. Building reliable APIs with Express. Js
5. Create and manage Git repositories, track changes, and push code to GitHub.

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IV B.Tech. I Sem.

L	T	P	C
2	0	0	0

(23A95713) GENDER SENSITIZATION (AC)

Course Category	Mandatory Course (Non-credit)
Course Enrichment Relevance	Skill Development

COURSE OBJECTIVES:

1. To enable students to understand the gender related issues, vulnerability of women and men.
2. To familiarize them about constitutional safeguard for gender equality
3. To expose the students to debates on the politics and economics of work
4. To help students reflect critically on gender violence
5. To make them understand that gender identities and gender relations are part of culture as they shape the way daily life is lived in the family as well as wider community and the workplace.

UNIT-I UNDERSTANDING GENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

UNIT-II GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences- Declining Sex Ratio- Demographic Consequences-Gender Spectrum -

UNIT-III GENDER AND LABOUR

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

UNIT-IV GENDER-BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence

UNIT-V GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language- Just Relationships

TEXT BOOKS:



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1. A.Suneetha, Uma Bhargubanda, et al. Towards a World of Equals: A Bilingual Textbook on Gender, Telugu Akademi, Telangana, 2015.
2. Butler, Judith. Gender Trouble: Feminism and the Subversion of Identity. UK Paperback Edn. March 1990

REFERENCE BOOKS:

1. Wtatt, Robin and Massood, Nazia, Broken Mirrors: The dowry Problems in India, London : Sage Publications, 2011
2. Datt, R. and Kornberg, J.(eds), Women in Developing Countries, Assessing Strategies for Empowerment, London: Lynne Rienner Publishers, 2002
3. Brush, Lisa D., Gender and Governance, New Delhi, Rawat Publication, 2007
4. Singh, Directi, Women and Politics World Wide, New Delhi, Axis Publications, 2010
5. Raj Pal Singh, Anupama Sihag, Gender Sensitization: Issues and Challenges (English, Hardcover), Raj Publications, 2019
6. A.Revathy& Murali, Nandini, A Life in Trans Activism(Lakshmi Narayan Tripathi). The University of Chicago Press, 2016

e-Resources and Digital Material:

1. https://onlinecourses.swayam2.ac.in/nou24_hs53/preview
2. <https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-gender-roles-and-stereotypes>
3. <https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408>
4. <https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-can-it-be-redressed>
5. https://onlinecourses.swayam2.ac.in/nou25_ge38/preview
6. <https://gender.study/psychology-of-gender/culture-impact-gender-roles-identities/>

COURSE OUTCOMES:

1. Understand the basic concepts of gender and its related terminology L1, L2
2. Identify the biological, sociological, psychological and legal aspects of gender. L1, L2
3. Use the knowledge in understanding how gender discrimination works in our society and how to counter it. L3
4. Analyze the gendered division of labour and its relation to politics and economics. L4
5. Appraise how gender-role beliefs and sharing behaviour are associated with more well-being in all culture and gender groups L5
6. Develop students' sensibility with regard to issues of gender in contemporary India L3



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IV B.Tech. I Sem.

L T P C

(23A32719) EVALUATION OF INDUSTRY INTERNSHIP

Course Category	
Course Enrichment Relevance	

The Industry Internship program helps students gain expertise in Industrial Practices and apply their academic knowledge to understand real world problems. In this regard, the Govt. of India, the Govt. of Andhra Pradesh and the university are emphasizing the importance of Industry Internship as a vital component of professional education.

As per the university directions, the Industry Internship at the end of 3rd year 2nd semester shall be carried out in physical mode(offline) at recognized industries, organizations, or companies outside the college premises. And it is evaluated in IV-B.Tech, I-sem for 100 marks.

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IV B.Tech II Semester

Course Structure

S.No	Subject Code	Course Category	Name of the Subject	Hours/Week			Credits	Marks		
				Lecture	Tutorial	Practical		Internal	External	Total
01	23A32820		Internship	--	--	--	4	--	--	--
02	23A32821		Project	--	--	--	8	60	140	200
TOTAL							12			

IV B.Tech. II Semester

S.NO.	Course Code	Title	Category	L	T	P	Credits
01	23A32820	Internship	--	-	-	-	4
02	23A32821	Project	--	-	-	-	8
Total							12

SANTHIRAM ENGINEERING COLLEGE

Highlights of the College

- Received Autonomous Status.
- Accredited by NBA for the Departments of ECE and CSE.
- Accredited by NAAC with Grade-A (3.2 score)
- Recognized as Q-Mentor College by APSCHE, for guiding HEIs for accreditation.
- Listed as one of the Best Engineering College with AA+ Grade by Career 360 in the year 2023.
- Recognized in GOLD CATEGORY by AICTE-CII Survey for the years 2017 & 2018 and also in PLATINUM CATEGORY in the year 2020.
- Received TWO University Gold Medals from JNTUA, Ananthapuramu.
- Received NINE Prathibha Awards from the Govt of A.P.
- SIX Patents were granted and SIX patents were approved under AICTE-KAPILA Scheme.
- Received around 50 Lakhs worth of funding projects under various schemes of UGC, AICTE, IEEE, IE and etc.



ACADEMIC REGULATIONS

B.TECH CSD(32) R-23

SREC MOTTO:

Education for Peace and Progress

SREC VISION:

To become a nucleus for pursuing technical education and pool industrial research and developmental activities with social-conscious and global standards.

SREC MISSION:

- To provide Advanced Educational Programs and prepare students to achieve success and take leading roles in their chosen fields of specialization by arising a self-sustained University.
- To establish postgraduate programs in the current and Advanced Technologies.
- To establish an R&D Consultancy through developing Industry Institute Interaction, building up exceptional infrastructure.
- To propel every individual, realize and act for the technical development of the society.

website: www.srecnandyal.edu.in

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