



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

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

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

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

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

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

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

1. Award of the Degree

- (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:
- (i) Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).
 - (ii) Registers for 160 credits and secures all 160 credits.
- (b) **Award of B.Tech. degree with Honors** if he/she fulfils the following:
- (i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 160 credits.
 - (ii) Registering for Honors is optional.
 - (iii) Honors is to be completed simultaneously with B.Tech. programme.
2. Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. This clause shall be read along with clause 1 a) i).

3. Admissions

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

4. Program related terms

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

Credit Definition:

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

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

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

5. Semester/Credits:

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

ii) The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.

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

6. Structure of the Undergraduate Programme

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

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

7. Course Classification:

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

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

8. Programme Pattern

- i. Total duration of the of B. Tech (Regular) Programme is four academic years.
- ii. Each academic year of study is divided into two semesters.
- iii. Minimum number of instruction days in each semester is 90 days.
- iv. There shall be mandatory student induction program for freshers, with a three-week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.
- v. Health/wellness/yoga/sports and NSS /NSS /Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduate students.
- vi. Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.
- vii. Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.
- viii. Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.

- ix. Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.
- x. A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for B.Tech. Degree with a Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.
- xi. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.
- xii. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.
- xiii. Students shall undergo mandatory summer internships, for a minimum of eight weeks duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year.
- xiv. There shall also be mandatory full internship in the final semester of the programme along with the project work.
- xv. Undergraduate degree with Honors is introduced by the University for the students having good academic record.
- xvi. Each college shall take measures to implement Virtual Labs (<https://www.vlab.co.in>) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.
- xvii. Each college shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.
- xviii. Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

9. Evaluation Process

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

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

Theory Courses

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

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

a) Continuous Internal Evaluation

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

Note:

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

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

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

For Example:

Marks obtained in first mid: 25

Marks obtained in second mid: 20

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

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

Marks obtained in first mid: Absent

Marks obtained in second mid: 25

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

b) End Examination Evaluation:

End examination of theory subjects shall have the following pattern:

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

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

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

Practical Courses

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

- b) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.
- c) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the record/viva and 15 marks for the internal test.
- d) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.
 - Procedure: 20 marks
 - Experimental work & Results: 30 marks
 - Viva voce: 20 marks.

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

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

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

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

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

- f) There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, a re-

examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

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

10. Skill oriented Courses

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

11. Massive Open Online Courses (MOOCs):

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

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

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

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

12. Credit Transfer Policy

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

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

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

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

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

13. Academic Bank of Credits (ABC)

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

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

14. Mandatory Internships

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

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate of successful completion from industry shall be included in the report. The report and the oral presentation shall carry 50% weightage

each. It shall be evaluated for 50 external marks. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University.

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

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

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

15. Guidelines for offering a Minor

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

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

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

16. Guidelines for offering Honors

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a

specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

- i) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
- ii) A student shall earn additional 15 credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).
- iii) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.
- iv) The concerned Principal of the college shall arrange separate class work and timetable of the courses offered under Honors program.
- v) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.
- vi) Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.
- vii) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.
- viii) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.
- ix) A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree programme.
- x) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- xi) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

Enrolment into Honors:

- i) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline
- ii) The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for Honors.
- iii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.

- iv) Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.
- v) Honors is to be completed simultaneously with a Major degree program.

Registration for Honors:

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

17. Attendance Requirements:

- i) A student shall be eligible to appear for the University external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.
- ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.
- iii) A stipulated fee shall be payable towards condonation of shortage of attendance to the University.
- iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
- v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.
- vi) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
- vii) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

18. For induction programme attendance shall be maintained as per AICTE norms. Promotion Rules:

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

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

- ii) A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any *decimal* fraction should be **rounded off** to **lower** digit) up to in the subjects that have been studied up to III semester.
- iii) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any *decimal* fraction should be **rounded off** to **lower** digit) in the subjects that have been studied up to V semester.
And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.
- iv) When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

19. Grading:

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

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

Structure of Grading of Academic Performance

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

- i) A student obtaining Grade 'F' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.
- ii) For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

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

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

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

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

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

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

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

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

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

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

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

Award of Class:

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

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

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

20. With-holding of Results

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

21. Multiple Entry / Exit Option

(a) Exit Policy:

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

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

(b) Entry Policy:

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

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

22. Gap Year Concept:

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

23. Transitory Regulations

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

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

24. Minimum Instruction Days for a Semester:

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

25. Medium of Instruction:

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

26. Student Transfers:

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

27. General Instructions:

- i. The academic regulations should be read as a whole for purpose of any interpretation.
- ii. Malpractices rules-nature and punishments are appended.
- iii. Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.
- iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- v. The Universities may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Universities.
- vi. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Vice-Chancellor / Head of the institution is final.

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

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

1. Award of the Degree

- (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:
 - (i) Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).
 - (ii) Registers for 120 credits and secures all 120 credits.
- (b) **Award of B.Tech. degree with Honors** if he/she fulfils the following:
 - (i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 120 credits.
 - (ii) Registering for Honors is optional.
 - (iii) Honors is to be completed simultaneously with B.Tech. programme.

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

3. Minimum Academic Requirements

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

- i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.
- ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester.

And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. Course Pattern

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



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

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B. Tech (Regular-Full time)

B. TECH-CSE, IT, CSE(DS), CSE(AI), CSE(CS), CSE(AI&ML), AI&DS, AI&ML

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

&

B.Tech. (Lateral Entry Scheme)

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

B.TECH. - COURSE STRUCTURE – R23
(Applicable from the academic year 2023-24 onwards)

INDUCTION PROGRAMME

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

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

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

I Year-I Semester

L	T	P	C
3	0	0	3

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

Course Objectives:

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

Course Outcomes:

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

- develop matrix algebra techniques that is needed by engineers for practical applications.
- to find the eigen values and eigen vectors and solve the problems by using linear transformation
- learn important tools of calculus in higher dimensions.
- familiarize with functions of several variables which is useful in optimization.
- familiarize with double and triple integrals of functions of several variables in two and three dimensions.

UNIT - I: Matrices

Rank of a matrix by echelon form, normal form. Cauchy –Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method

System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

UNIT- II: Linear Transformation and Orthogonal Transformation:

Eigen values, Eigen vectors and their properties (without Proof), Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation

UNIT- III : Calculus

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

UNIT- IV : Partial differentiation and Applications (Multi variable calculus)

Partial derivatives, total derivatives, chain rule, change of variables, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT – V : Multiple Integrals (Multi variable Calculus)

Duble integrals - change of variables (Cartesian and Polar coordinates), Change of order of integration, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Text books:

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

Reference Books:

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

L	T	P	C
3	0	0	3

I Year-I Semester

ENGINEERING PHYSICS
(Common for all branches of Engineering)

Course Objectives:

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

Course Outcomes:

- CO1: Analyze the intensity variation of light due to polarization, interference and diffraction.
 CO2: Familiarize with the basics of crystals and their structures.
 CO3: Explain fundamentals of quantum mechanics and apply it to one dimensional motion of particles.
 CO4: Summarize various types of polarization of dielectrics and classify the magnetic materials.
 CO5: Explain the basic concepts of Quantum Mechanics and the band theory of solids.
 CO6: Identify the type of semiconductor using Hall effect.

UNIT I Wave Optics

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

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

UNIT II Crystallography and X-ray diffraction

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

X-ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods

UNIT III Dielectric and Magnetic Materials

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

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

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

UNIT IV Quantum Mechanics and Free electron Theory

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

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

UNIT V Semiconductors

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

Textbooks:

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

Reference Books:

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

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

I Year-I Semester

L	T	P	C
2	0	0	2

COMMUNICATIVE ENGLISH
(Common to All Branches of Engineering)

Course Objectives:

The main objective of introducing this course, *Communicative English*, is to facilitate using Listening, Reading, Speaking and Writing skills effectively by the students. It should result in their better comprehending abilities, oral presentations, reporting useful information and with enhanced knowledge of grammatical structures and vocabulary. This course helps the students in using speaking and writing (productive) skills more efficiently and to make them industry-ready

Course Outcomes

- **By the end of the course the students will have** Learned how to understand the context, topic, and specific information from social or transactional dialogues.
- Remedially learn applying grammatical structures to formulate sentence sand use appropriate words and correct word forms.
- Using discourse markers to speak clearly on a specific topic in formal as well as informal discussions.(not required)
- Improved communicative competence in formal and informal contexts and for social and academic purposes.
- Critically comprehending and appreciatingeading /listening texts and to write summaries based on global comprehension of these texts.
- Writing coherent paragraphs essays, letters/e-mails and resume.

Instructions:

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

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

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

7. Use as many supplementary materials as possible in various modes (Audio, visual and printed versions) in the classroom so that the students get multimode input and will know how to use language skills in the absence of the teacher.

UNIT I

Lesson: HUMAN VALUES: A Power of a Plate of Rice by Ifeoma Okoye (Short story)

- Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
- Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
- Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information.
- Writing:** Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.(That has to be part of the bridge course- 2 weeks before the actual academic programme starts)
- Grammar:** Parts of Speech, Basic Sentence Structures-forming questions
- Vocabulary:** Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II

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

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

UNIT III

Lesson: BIOGRAPHY: Steve Jobs

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

UNIT IV

Lesson: INSPIRATION: The Toys of Peace by Saki

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

UNIT V

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

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

Textbooks:

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

Suggestion: Instead of giving the syllabus in the form of textbooks it would be better to procure the soft copies of individual texts (stories or poems or biographies and non-fiction texts) by the university and make them available on the university website for registered students to access and download

Reference Books:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Web Resources:

GRAMMAR:

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

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

VOCABULARY

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

L	T	P	C
3	0	0	3

I Year-I Semester

BASIC CIVIL & MECHANICAL ENGINEERING
(Common to All branches of Engineering)

Course Objectives:

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

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

- CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.
- CO2: Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.
- CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.
- CO4: Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.
- CO5: Understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.

UNIT I

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

UNIT II

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

UNIT III

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

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

Textbooks:

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

Reference Books:

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

PART B: BASIC MECHANICAL ENGINEERING

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

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

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

CO1: Understand the different manufacturing processes.

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

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

CO4: Describe the basics of robotics and its applications.

UNIT I

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

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

UNIT II

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

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

UNIT III

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

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

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

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

Textbooks:

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

Reference Books:

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

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

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

UNIT-I Introduction to Computer Problem Solving:

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

UNIT-II Introduction to C Programming:

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

UNIT-III Arrays:

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

UNIT-IV Functions:

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

UNIT-V

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

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

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

Course Outcomes:

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

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

Text Books:

1. A Structured Programming Approach Using C, Forouzan, Gilberg, Cengage.
2. How to solve it by Computer, R. G. Dromey, and Pearson Education.
3. Programming In C A-Practial Approach. Ajay Mittal, Pearson

References:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. Computer Programming. Reema Thareja, Oxford University Press
3. The C Programming Language, Dennis Richie And Brian Kernighan, Pearson Education.
4. Programming In C, Ashok Kamthane, Second Edition, Pearson Publication.
5. Let us C ,YaswanthKanetkar, 16th Edition,BPB Publication.
6. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008

Web References:

1. <http://www.c4learn.com/>
2. <http://www.geeksforgeeks.org/c/>
3. <http://nptel.ac.in/courses/122104019/>
4. <http://www.learn-c.org/>
5. <https://www.tutorialspoint.com/cprogramming/>

I Year-I Semester

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COMMUNICATIVE ENGLISH LAB
(Common to All Branches of Engineering)

Course Objectives:

The main objective of introducing this course, *Communicative English Laboratory*, is to expose the students to a variety of self-instructional, learner friendly modes of language learning.(That can be for theory paper) is to train the students in oral communication skills in real situations. Students will get trained in the basic communication skills and also make them ready to face job interviews. They will be helped to overcome the mother tongue/local language influence and neutralize their accent which makes their speech more intelligible to all listeners.

Course Outcomes:

By the end of the course, the students will be have

- Understand the different aspects of the English language oral communication with emphasis on Listening and Speaking S skills.
- Apply communication skills through various language learning activities.
- Analyze the English speech sounds, stress, rhythm and intonation for better listening and speaking comprehension.
- Evaluate and exhibit professionalism in participating in debates and group discussions with polite turn taking strategies and sound more professional while communicating with others
- Create effective resonate and prepare them to face interviews communicate appropriately in corporate settings.

List of Topics:

1. Vowels & Consonants(Not rules but use of them in various syllable structures)
2. Neutralization/Accent Rules(No rules again, required more practice)
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. (This can be part of theory course)Resume Writing, Cover letter, SOP
6. Group Discussions-methods & practice
7. Debates- Methods & Practice
8. PPT Presentations/ Poster Presentation
9. Interviews Skills

Suggested Software:

- Walden InfoTech
- Young India Films

Reference Books:

1. Meenakshi Raman, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.(This can be for theory and not for lab)
2. Samson T : Innovate with English, Foundations
3. Grant Taylor: English Conversation Practice, Tata McGraw-Hill EducationIndia,2016
4. Jayashree, M Let's Hear them Speak: Developing Listening-Speaking skills in English. Sage Publications

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

Web Resources:

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. <https://www.britishcouncil.in/english/online>
5. <http://www.letstalkpodcast.com/>
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. <https://www.youtube.com/c/ArnelsEverydayEnglish/featured>
8. <https://www.youtube.com/c/engvidAdam/featured>
9. <https://www.youtube.com/c/EnglishClass101/featured>
10. <https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists>
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw
12. <https://www.linguahouse.com/en-GB>
13. <https://www.ted.com/watch/ted-ed>

Voice & Accent:

1. <https://www.youtube.com/user/letstalkaccent/videos>
2. <https://www.youtube.com/c/EngLanguageClub/featured>
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2jic5Xwp_IA

I Year-I Semester

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ENGINEERING PHYSICS LAB

(Common to All Branches of Engineering)

Course Objectives:

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

Course Outcomes: The students will be able to

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

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

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

List of Experiments:

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

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

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

References:

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

Web Resources

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

I Year-I Semester

L	T	P	C
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ENGINEERING WORKSHOP
(Common to All branches of Engineering)

Course Objectives:

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

Course Outcomes:

CO1: Identify workshop tools and their operational capabilities.

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

CO3: Apply fitting operations in various applications.

CO4: Apply basic electrical engineering knowledge for House Wiring Practice

SYLLABUS

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

Textbooks:

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

Reference Books:

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

I Year-I Semester

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IT WORKSHOP

(Common to all branches of Engineering)

Course Objectives:

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

Course Outcomes:

CO1: Perform Hardware troubleshooting.

CO2: Understand Hardware components and inter dependencies.

CO3: Safeguard computer systems from viruses/worms.

CO4: Document/ Presentation preparation.

CO5: Perform calculations using spreadsheets.

PC Hardware & Software Installation

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

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

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

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

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

Internet & World Wide Web

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

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

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

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

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

LaTeX and WORD

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

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

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

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

EXCEL

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

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

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

LOOKUP/VLOOKUP

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

POWER POINT

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

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

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

AI TOOLS – Chat GPT

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

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

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

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

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

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

Reference Books:

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

I Year-I Semester

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COMPUTER PROGRAMMING LAB

(Common to All branches of Engineering)

Course Objectives:

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

Course Outcomes:

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

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

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

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

UNIT I

WEEK 1

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

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

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

WEEK 2

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

Suggested Experiments /Activities:

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

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

Developing the algorithms/flowcharts for the following sample programs

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

WEEK 3

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

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

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

UNIT II

WEEK 4

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

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:

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

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

WEEK 5

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

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

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

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

WEEK 6

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

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

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

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

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

UNIT III

WEEK 7:

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

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7: 1D Array manipulation, linear search

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

WEEK 8:

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

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort

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

UNIT IV

WEEK 9:

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

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

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

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

WEEK 10:

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

Suggested Experiments/Activities:

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

Lab10 : Bitfields, linked lists

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

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

UNIT V

WEEK 11:

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

Suggested Experiments/Activities:

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

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

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

WEEK 12:

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

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

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

WEEK 13:

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

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

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

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

WEEK14:

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

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

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

Textbooks:

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

Reference Books:

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

I Year-I Semester

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HEALTH AND WELLNESS, YOGA AND SPORTS

(Common to All branches of Engineering)

Course Objectives:

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

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

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

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

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

CO4: Assess current personal fitness levels.

CO5: Develop Positive Personality

UNIT I

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

Activities:

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

UNIT II

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

Activities:

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

UNIT III

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

Activities:

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

Reference Books:

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

General Guidelines:

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

Evaluation Guidelines:

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

I Year-II Semester

L	T	P	C
3	0	0	3

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

(Common to All Branches of Engineering)

Course Objectives:

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

Course Outcomes:

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

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

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

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

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

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

UNIT – III : Partial Differential Equations

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

UNIT - IV : Vector differentiation

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

UNIT –V : Vector integration

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

Textbooks:

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

Reference Books:

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

I Year-II Semester

L	T	P	C
3	0	0	3

CHEMISTRY

(Common to EEE, ECE, CSE, IT & allied branches)

Course Objectives:

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches.

Course Outcomes: At the end of the course, the students will be able to:**CO1:** Compare the materials of construction for battery and electrochemical sensors.**CO2:** Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.**CO3:** Explain the principles of spectrometry, slc in separation of solid and liquid mixtures.**CO4:** Apply the principle of Band diagrams in the application of conductors and semiconductors.**CO5:** Summarize the concepts of Instrumental methods.**UNIT I Structure and Bonding Models:**

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2 , particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O₂ and CO, etc. π -molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II Modern Engineering materials

Semiconductors – Introduction, basic concept, application

Super conductors-Introduction basic concept, applications.

Supercapacitors: Introduction, Basic Concept-Classification – Applications.

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

UNIT III Electrochemistry and Applications

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

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

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

including cell reactions; Fuel cells, hydrogen-oxygen fuel cell— working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT IV Polymer Chemistry

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

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

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

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

UNIT V Instrumental Methods and Applications

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

Textbooks:

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

Reference Books:

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

I Year-II Semester

L	T	P	C
1	0	4	3

ENGINEERING GRAPHICS

(Common to All branches of Engineering)

Course Objectives:

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

Course Outcomes:

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

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

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

CO4: Explain principles behind development of surfaces.

CO5: Prepare isometric and perspective sections of simple solids.

UNIT I

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

Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutives, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

UNIT II

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

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

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

UNIT III

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

UNIT IV

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

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

UNIT V

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

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

Textbook:

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

Reference Books:

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

I Year-II Semester

L	T	P	C
3	0	0	3

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common to All branches of Engineering)

Course Objectives

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

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

Course Outcomes:

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

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

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

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

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

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I DC & AC Circuits

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

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

UNIT II Machines and Measuring Instruments

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

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

UNIT III Energy Resources, Electricity Bill & Safety Measures

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

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

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

Textbooks:

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

Reference Books:

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

Web Resources:

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

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

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

UNIT I SEMICONDUCTOR DEVICES

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

UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION

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

UNIT III DIGITAL ELECTRONICS

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

Textbooks:

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

Reference Books:

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

I Year-II Semester

L	T	P	C
3	0	0	3

DATA STRUCTURES

(Common to CSE, IT & allied branches)

Course Objectives:

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc.
Dequeues: Introduction to dequeues (double-ended queues), Operations on dequeues and their applications.

UNIT V

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversals
Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

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

- Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
- Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
- Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
- Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.
- Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees
- Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

Textbooks:

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

Reference Books:

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

L	T	P	C
0	0	2	1

I Year-II Semester**CHEMISTRY LAB**

(Common to EEE, ECE, CSE, IT & allied branches)

Course Objectives:

- Verify the fundamental concepts with experiments.

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

- CO1: Determine the cell constant and conductance of solutions.
 CO2: Prepare advanced polymer Bakelite materials.
 CO3: Measure the strength of an acid present in secondary batteries.
 CO4: Analyse the IR spectra of some organic compounds.
 CO5: Calculate strength of acid in Pb-Acid battery.

List of Experiments:

1. Measurement of $10Dq$ by spectrophotometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

Reference:

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

I Year-II Semester

L	T	P	C
0	0	3	1.5

ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP

(Common to All branches of Engineering)

Course Objectives:

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

Course Outcomes:

CO1: Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.

CO2: Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.

CO3: Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.

CO4: Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.

CO5: Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
 - Provide some exercises so that hardware tools and instruments are learned to be used by the students.
2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
 - Provide some exercises so that measuring instruments are learned to be used by the students.
3. Components:
 - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.

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

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

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

Reference Books:

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

Note: Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING LAB

Course Objectives:

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

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

CO1: Identify & testing of various electronic components.

CO2: Understand the usage of electronic measuring instruments.

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

CO4: Explain the operation of a digital circuit.

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers

4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

References:

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

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

I Year-II Semester

L	T	P	C
0	0	3	1.5

DATA STRUCTURES LAB
(Common to CSE, IT & allied branches of Engineering)

Course Objectives:

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

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

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

Exercise 2: Linked List Implementation

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

Exercise 3: Linked List Applications

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

Exercise 4: Double Linked List Implementation

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

Exercise 5: Stack Operations

- i) Implement a stack using arrays and linked lists.
- ii) Write a program to evaluate a postfix expression using a stack.
- iii) Implement a program to check for balanced parentheses using a stack.

Exercise 6: Queue Operations

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

- ii) Develop a program to simulate a simple printer queue system.
- iii) Solve problems involving circular queues.

Exercise 7: Stack and Queue Applications

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

Exercise 8: Binary Search Tree

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

Exercise 9: Hashing

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

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

- Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
- Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
- Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
- Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between dequeues and priority queues, and apply them appropriately to solve data management challenges.
- Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees
- Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

Textbooks:

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

Reference Books:

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

I Year-II Semester

L	T	P	C
0	0	1	0.5

NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE

(Common to All branches of Engineering)

Course Objectives:

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

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

- CO1:** Understand the importance of discipline, character and service motto.
- CO2:** Solve some societal issues by applying acquired knowledge, facts, and techniques.
- CO3:** Explore human relationships by analyzing social problems.
- CO4:** Determine to extend their help for the fellow beings and downtrodden people.
- CO5:** Develop leadership skills and civic responsibilities.

UNIT I Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

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

UNIT II Nature & Care**Activities:**

- i) Best out of waste competition.
- ii) Poster and signs making competition to spread environmental awareness.
- iii) Recycling and environmental pollution article writing competition.
- iv) Organising Zero-waste day.
- v) Digital Environmental awareness activity via various social media platforms.
- vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
- vii) Write a summary on any book related to environmental issues.

UNIT III Community Service**Activities:**

- i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities-experts-etc.

- ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
- iii) Conducting consumer Awareness. Explaining various legal provisions etc.
- iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
- v) Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

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

General Guidelines:

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

Evaluation Guidelines:

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

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

B.TECH. – ARTIFICIAL INTELLIGENCE AND MACHINE LERANING

B.Tech.– II Year I Semester

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

B.Tech.– II Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Management Elective - I	Managerial Economics & Financial Analysis	2	0	0	2
2	Basic Science	Probability & Statistics	3	0	0	3
3	Professional Core	Machine Learning	3	0	0	3
4	Professional Core	Database Management Systems	3	0	0	3
5	Professional Core	Digital Logic & Computer Organization	3	0	0	3
6	Professional Core	AI & ML Lab	0	0	3	1.5
7	Professional Core	Database Management Systems Lab	0	0	3	1.5
8	SEC	Full Stack Development -1	0	1	2	2
9	ES	Design Thinking & Innovation	1	0	2	2
Total			15	1	12	21
Mandatory Community Service Project Internship of 08weeks duration during summer Vacation						



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

DISCRETE MATHEMATICS & GRAPH THEORY

Course Objectives:

- To understand mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional, predicate logic, and truth tables.
- To understand about elementary of combinatorics, the principle of inclusion and exclusion and the pigeonhole principle.
- To expose the students to Binary relations, posets, Hasse diagram, lattice, and discuss various properties of relations.
- To understand Algebraic structures like groups, semigroups, monoids.
- To introduce generating functions and recurrence relations.

Course Outcomes:

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

Unit-I:

Mathematical Logic & Statement Calculus

Statements and Connectives: statements, connectives, compound statements (Formulas), well-formed formulas, truth tables, tautologies, equivalence of formulas, converse, contrapositives & inverse of an implication, duality law, tautological implications, Normal forms: Principal disjunctive and conjunctive normal forms; Statement calculus: Validity of an argument using truth tables and rules of inference, consistency of premises, indirect method of proof.

Unit-II:

Predicates & Predicate Calculus

Predicate calculus: Predicates, statement of functions, variables and quantifiers, predicate formulas, free and bound variables, universe of discourse, valid formulas and equivalences involving quantifiers, rules of inference, theory of inference for predicate calculus

Unit-III:

Combinatorics, Set Theory, Posets and Lattices

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

Relations: Binary relation, properties, equivalence relation, partition of a set, equivalence



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

classes Partial ordering: Partial order relation, partially ordered set(poset), Chanhassen diagrams, Lattices.

Unit-IV:

Algebraic Structures

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

Unit-V:

Recurrence Relations & Generating Functions

Recurrence Relations: Formation, iterative method of solving recurrence relations, solving homogeneous and non-homogeneous recurrence relations by characteristic roots method; Generating Functions: Generating functions of sequences, calculation of coefficients of expansions, solving recurrence relations by generating functions

Textbooks:

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

Reference Books:

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



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VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

**UNIVERSAL HUMAN VALUES- UNDERSTANDING
HARMONY & HUMAN ETHICAL CONDUCT**

Course Objectives:

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

Course Outcomes:

- By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I	Introduction to Value Education (6 lectures and 3 tutorials for practice session) Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Lecture 2: Understanding Value Education Tutorial 1: Practice Session PS1 Sharing about Oneself Lecture 3: self-exploration as the Process for Value Education Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations Tutorial 2: Practice Session PS2 Exploring Human Consciousness Lecture 5: Happiness and Prosperity – Current Scenario Lecture 6: Method to Fulfill the Basic Human Aspirations
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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

- UNIT II** Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
 Lecture 7: Understanding Human being as the Co-existence of the self and the body.
 Lecture 8: Distinguishing between the Needs of the self and the body
 Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
 Lecture 9: The body as an Instrument of the self
 Lecture 10: Understanding Harmony in the self
 Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
 Lecture 11: Harmony of the self with the body
 Lecture 12: Programme to ensure self-regulation and Health
 Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body
- UNIT III** Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
 Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
 Lecture 14: 'Trust' – the Foundational Value in Relationship
 Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
 Lecture 15: 'Respect' – as the Right Evaluation
 Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
 Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
 Lecture 17: Understanding Harmony in the Society
 Lecture 18: Vision for the Universal Human Order
 Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal
- UNIT IV** Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
 Lecture 19: Understanding Harmony in the Nature
 Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
 Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
 Lecture 21: Realizing Existence as Co-existence at All Levels
 Lecture 22: The Holistic Perception of Harmony in Existence
 Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence
- UNIT V** Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
 Lecture 23: Natural Acceptance of Human Values
 Lecture 24: Definitiveness of (Ethical) Human Conduct
 Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
 Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
 Lecture 26: Competence in Professional Ethics
 Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

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

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

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

Practice Sessions for UNIT I – Introduction to Value Education

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness

PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body

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

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

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

PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

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

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

Readings:

Textbook and Teachers Manual

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

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

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal

9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

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

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

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PRINCIPLES OF ARTIFICIAL INTELLIGENCE

Pre-requisite:

1. Knowledge in Computer Programming.
2. A course on “Mathematical Foundations of Computer Science”.
3. Background in linear algebra, data structures and algorithms, and probability.

Course Objectives:

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

UNIT - I

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

UNIT - II

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

UNIT - III

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

UNIT - IV

Logic concepts: First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

UNIT - V

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

Textbooks:

1. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, Second Edition, Pearson Education.
2. Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, McGraw Hill

Reference Books:

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

Online Learning Resources:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS

Course Objectives:

The main objectives of the course is to

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

UNIT – I:

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

AVL Trees – Creation, Insertion, Deletion operations and Applications

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

UNIT – II:

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

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

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

UNIT – III:

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

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

UNIT – IV:

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

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

UNIT – V:

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

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

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

Textbooks:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

Reference Books:

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

Online Learning Resources:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

OBJECT-ORIENTED PROGRAMMING THROUGH JAVA

Course Objectives:

The learning objectives of this course are to:

- identify Java language components and how they work together in applications
- learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- understand how to design applications with threads in Java
- understand how to use Java APIs for program development

UNIT I:

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

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final,

Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

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

UNIT II:

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

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

UNIT III:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

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, Result Set Interface

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

Text Books:

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

References Books:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

Online Resources:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB

Course Objectives:

The objectives of the course is to

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

Experiments covering the Topics:

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

Sample Programs:

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

Reference Books:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

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

Online Learning Resources:

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



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VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

OBJECT-ORIENTED PROGRAMMING THROUGH JAVA LAB

Course Objectives:

The aim of this course is to

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

Experiments covering the Topics:

- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

Sample Experiments:

Exercise – 1:

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

Exercise - 2

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

Exercise - 3

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

Exercise - 4

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

Exercise - 5

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

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 ()**
- 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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

PYTHON PROGRAMMING

(Skill Enhancement Course)

Course Objectives:

The main objectives of the course are to

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

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

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

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

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
 - i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators 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 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.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

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.

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

Sample Experiments:

18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

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

Online Learning Resources/Virtual Labs:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

ENVIRONMENTAL SCIENCE

Course Objectives:

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

UNIT I

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

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

UNIT II

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

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

Biodiversity and its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-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.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

UNIT III

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

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

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

UNIT IV

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

UNIT V

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

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

Textbooks:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company



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VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

References:

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice Hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice Hall of India Private limited.



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VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course Objectives:

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

Course Outcomes:

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

UNIT - I Managerial Economics

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

UNIT - II Production and Cost Analysis

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

UNIT - III Business Organizations and Markets

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

UNIT - IV Capital Budgeting

Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method,



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VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR)
Method (sample problems)

UNIT - V Financial Accounting and Analysis

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

Reference Books:

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

Online Learning Resources:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

PROBABILITY & STATISTICS

Course Outcomes:

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

- Acquire knowledge in finding the analysis of the data quantitatively or categorically and various statistical elementary tools
- Develop skills in designing mathematical models involving probability, random variables and the critical thinking in the theory of probability and its applications in real life problems.
- Apply the theoretical probability distributions like binomial, Poisson, and Normal in the relevant application areas.
- Analyze to test various hypotheses included in theory and types of errors for large samples.
- Apply the different testing tools like t-test, F-test, chi-square test to analyze the relevant real-life problems.

UNIT I:

Descriptive statistics

Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Measures of Central tendency, Measures of Variability (spread or variance) Skewness, Kurtosis, correlation, correlation coefficient, rank correlation, regression coefficients, method of least squares, regression lines.

UNIT II:

Probability

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

UNIT III:

Probability distributions

Probability distributions: Binomial, Poisson and Normal-their properties (Chebyshevs inequality). Approximation of the binomial distribution to normal distribution.

UNIT IV:

Estimation and Testing of hypothesis, large sample tests

Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems of fit.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

UNIT V:

Small sample tests

Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), χ^2 - test for goodness of fit, χ^2 - test for independence of attributes.

Textbooks:

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

Reference Books:

1. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education. Scientists,8th Edition, Pearson 2007.
2. S. Ross, a First Course in Probability, Pearson Education India, 2002.
3. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.

Online Learning Resources:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

MACHINE LEARNING

Course Objectives:

The objectives of the course is to

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

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

UNIT-II: Nearest Neighbour-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 Neighbour Classifier, Radius Distance Nearest Neighbour 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 Perceptron’s (MLPs), Backpropagation for Training an MLP.

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

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.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

DATABASE MANAGEMENT SYSTEMS

Course Objectives:

The main objectives of the course is to

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

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

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

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

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

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

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

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

Text Books:

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

Reference Books:

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

Web-Resources:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

DIGITAL LOGIC & COMPUTER ORGANIZATION

Course Objectives:

The main objectives of the course is to

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

UNIT – I:

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

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

UNIT – II:

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

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

UNIT – III:

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

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

UNIT – IV:

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

UNIT – V:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

Textbooks:

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

Reference Books:

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

Online Learning Resources:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

AI & ML LAB

Course Objectives:

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

Software Required for ML: Python/R/Weka

List of Experiments

1. Pandas Library
 - a) Write a python program to implement Pandas Series with labels.
 - b) Create a Pandas Series from a dictionary.
 - c) Creating a Pandas Data Frame.
 - d) Write a program which makes use of the following Pandas methods
 - i) describe () ii) head () iii) tail () iv) info ()
2. Pandas Library: Visualization
 - a) Write a program which use pandas inbuilt visualization to plot following graphs:
 - i. Bar plots ii. Histograms iii. Line plots iv. Scatter plots
3. Write a Program to Implement Breadth First Search using Python.
4. Write a program to implement Best First Searching Algorithm
5. Write a Program to Implement Depth First Search using Python.
6. Write a program to implement the Heuristic Search
7. Write a python program to implement A* and AO* algorithm. (Ex: find the shortest path)
8. Apply the following Pre-processing techniques for a given dataset.
 - a. Attribute selection
 - b. Handling Missing Values
 - c. Discretization
 - d. Elimination of Outliers
9. Apply KNN algorithm for classification and regression
10. Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results
11. Apply Random Forest algorithm for classification and regression
12. Demonstrate Naïve Bayes Classification algorithm.
13. Apply Support Vector algorithm for classification



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

14. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**
VIZIANAGARAM – 535 003 Andhra Pradesh (India)
(Established by Andhra Pradesh Act No.22 of 2021)

DATABASE MANAGEMENT SYSTEMS LAB

Course Objectives:

This Course will enable students to

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

Experiments covering the topics:

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

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, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5.
 - i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
 - ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

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/Suggested Reading:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

**FULL STACK DEVELOPMENT – 1
(Skill Enhancement Course)**

Course Objectives:

The main objectives of the course are to

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

Experiments covering the Topics:

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

Sample Experiments:

1. Lists, Links and Images

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

2. HTML Tables, Forms and Frames

- Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)
- Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
- Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

- 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
 - Simple selector (element, id, class, group, universal)
 - Combinator selector (descendant, child, adjacent sibling, general sibling)
 - Pseudo-class selector
 - Pseudo-element selector
 - Attribute selector

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

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

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

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

7. JavaScript Pre-defined and User-defined Objects

- a. Write a program using document object properties and methods.
- b. Write a program using window object properties and methods.
- c. Write a program using array object properties and methods.
- d. Write a program using math object properties and methods.
- e. Write a program using string object properties and methods.
- f. Write a program using regex object properties and methods.
- g. Write a program using date object properties and methods.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

- h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. JavaScript Conditional Statements and Loops

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

9. Javascript Functions and Events

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

Text Books:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

Web Links:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

DESIGN THINKING & INNOVATION

Course Objectives:

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

Course Outcomes:

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

UNIT I

Introduction to Design Thinking

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

UNIT II

Design Thinking Process

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

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

UNIT III

Innovation

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

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

UNIT IV

Product Design

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

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

UNIT V

Design Thinking in Business Processes

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

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

Textbooks:

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

Reference Books:

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

Online Learning Resources:

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



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY - GURAJADA -
VIZIANAGARAM**

VIZIANAGARAM – 535 003 Andhra Pradesh (India)

(Established by Andhra Pradesh Act No.22 of 2021)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

B.Tech. – III Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Information Retrieval Systems	3	0	0	3
2	Professional Core	Computer Networks	3	0	0	3
3	Professional Core	Deep Learning with Applications	3	0	0	3
4	Professional Elective-I	1. Software Engineering 2. Digital Twin 3. Mobile Edge Computing 4. Optimization Techniques 5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
5	Open Elective- I	Open elective offered by other department	3	0	0	3
6	Professional Core	Information Retrieval & Deep Learning Lab	0	0	3	1.5
7	Professional Core	Computer Networks Lab	0	0	3	1.5
8	Skill Enhancement course	NodesJS	0	1	2	2
9	ES	Tinkering Lab	0	0	2	1
10	Evaluation of Community Service Internship		-	-	-	2
Total			14	1	10	23

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

B.Tech.– III Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Operating System	3	0	0	3
2	Professional Core	Automata Theory & Compiler Design	3	0	0	3
3	Professional Core	Computer Vision	3	0	0	3
4	Professional Elective-II	Software Testing Methodology Cryptography & Network Security Internet of Things Recommender Systems Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
5	Professional Elective-III	Software Project Management Ethical AI Data Visualization Soft computing Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
6	Open Elective – III	Open elective offered by other department	3	0	0	3
7	Professional Core	Computer Vision Lab	0	0	3	1.5
8	Professional Core	Operating System lab	0	0	3	1.5
9	Skill Enhancement course	Soft skills	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	-
Total			20	1	8	23
Mandatory Industry Internship of 08 weeks duration during summer vacation						

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

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

(AI & ML)

B.Tech. – IV Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Natural Language Programming	3	0	0	3
2	Management Course-II	Management Science Human resource Management Entrepreneurship &Incubation	2	0	0	2
3	Professional Elective-IV	1. Federated Learning 2. NoSQL databases 3. Quantum Computing 4. Computational Neuroscience 5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
4	Professional Elective-V	1. Agile methodologies 2. Big Data Analytics 3. Reinforcement Learning 4.High-performance Computing (HPC) 5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
5	Open Elective-III	Open elective offered by other department	3	0	0	3
6	Open Elective-IV	Open elective offered by other department	3	0	0	3
7	Skill Enhancement Course	Prompt Engineering	0	1	2	2
8	AuditCourse	Gender Sensitization	2	0	0	-
9	Internship	Evaluation of Industry Internship	-	-	-	2
Total			19	1	02	21

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

B.Tech.– IV Year II Semester

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

OPEN ELECTIVES OFFERED BY CSE (AI & ML) TO OTHER BRANCHES:

OPEN ELECTIVE –I	OPEN ELECTIVE -II
<ol style="list-style-type: none">1. Introduction to Artificial Intelligence2. Exploratory Data Analysis with Python3. Web Technologies	<ol style="list-style-type: none">1. Fundamentals of Data Base Management System2. JAVA Programming3. Social Media Analytics
OPEN ELECTIVE –III	OPEN ELECTIVE -IV
<ol style="list-style-type: none">1. Introduction to Machine Learning2. Data Wrangling and Pre-processing3. Block Chain Technologies	<ol style="list-style-type: none">1. Internet of Things2. Fundamentals of Cloud Computing3. Cyber Security



III Year I Semester	INFORMATION RETRIEVAL SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

1. Implement text indexing and retrieval systems for efficient information access.
2. Evaluate the performance of information retrieval systems using key metrics.
3. Analyse and preprocess textual and semi-structured datasets for meaningful insights.
4. Apply text similarity measures for effective comparison and clustering of documents.
5. Understand the principles of search engines and implement text classification models.

SYLLABUS:

Unit- I

Overview of text retrieval systems, Boolean retrieval, the term vocabulary and postings list,

Dictionaries and tolerant retrieval, Index construction and compression

Unit-II

Retrieval models and implementation: Vector Space Models, Vector Space Model,

TF-IDF Weight, Evaluation in information retrieval

Unit-III

Query expansion and feedback, Relevance feedback, pseudo relevance feedback, Query

Reformulation

Unit-IV

Probabilistic models; statistical language models, Okapi/BM25; Language models,

KL-divergence, Smoothing.

Unit-V

Text classification & Text clustering, The text classification problem, Naive Bayes text classification, k-nearest neighbors, Support vector Machine, Feature Selection, Vector-space clustering; K-means algorithm, Hierarchical clustering, DBSCAN algorithm, PAM and PAMK EM algorithm

Course Outcomes:

1. Understand the fundamentals of text retrieval systems, including Boolean retrieval and index construction.
2. Gain knowledge of retrieval models like Vector Space Model, TF-IDF, and the evaluation metrics in information retrieval.
3. Learn techniques for query expansion, feedback, and reformulation in information retrieval systems.
4. Understand probabilistic models, including statistical language models and Okapi/BM25, for efficient



**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

text retrieval.

5. Apply text classification and clustering algorithms, such as Naive Bayes, K-means, and DBSCAN, for text analysis tasks.

Text Books:

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, Introduction to Information Retrieval, Cambridge University Press. 2008. <http://nlp.stanford.edu/IR-book/informationretrieval-book.html>
2. ChengXiang Zhai, Statistical Language Models for Information Retrieval (Synthesis Lectures Series on Human Language Technologies), Morgan & Claypool Publishers, 2008.

IT R20 Course Structure & Syllabus

E-Link:

1. <http://www.morganclaypool.com/doi/abs/10.2200/S00158ED1V01Y200811HLT001>

Reference Books:

1. Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theory and Implementation, Springer, 2004.
2. Soumen Chakrabarti, Mining the Web : Discovering Knowledge from Hypertext Data, Morgan – Kaufmann Publishers, 2002.
3. Christopher D Manning, Prabhakar Raghavan, Hinrich Schütze, An Introduction to Information Retrieval By Cambridge University Press, England, 2009



III Year I Semester	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

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

UNIT – I: Introduction:

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

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

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

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

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

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

UNIT-V: Transport Layer & Application Layer: Process to Process Delivery -User Datagram - Protocol (UDP) - Transmission Control Protocol (TCP) -

Congestion Control- Quality of services (QOS) - Integrated Services - Domain Name Space (DNS) - FTP – HTTP- WWW & HTTP.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COURSE OUTCOMES:

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



III Year I Semester	Deep Learning with Applications	L	T	P	C
		3	0	0	3

Course Objectives:

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

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

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

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

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

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

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

Course Outcomes:

Students will be able to:

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

Text Books:

- 1) " Deep Learning (Adaptive Computation and Machine Learning series", Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2017.
- 2) Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.

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VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

3) “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, Nikhil Buduma, Nicholas Locascio, O'Reilly Media, 2017.

Reference Books:

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



III Year I Semester	Professional Elective-I 1. Software Engineering	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on the

1. To understand the software life cycle models.
2. To understand the software requirements and SRS document.
3. To understand the importance of modeling and modelling languages.
4. To design and develop correct and robust software products.

UNIT – I:

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

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

UNIT - II:

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

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

UNIT – III:

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

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

UNIT - IV:

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

UNIT - V:

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

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

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

1. Course Outcomes:

2. Define and develop a software project from requirement gathering to implementation.
3. Obtain knowledge about principles and practices of software engineering.
4. Focus on the fundamentals of modelling a software project.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
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5. Obtain basic knowledge of coding
6. Obtain knowledge about estimation maintenance and reuse of software systems.

Text Books:

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

References:

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

Web References:

<https://nptel.ac.in/courses/106/105/106105182/>



III Year I Semester	Professional Elective-I 2. Digital Twin	L	T	P	C
		3	0	0	3

Course Objectives

1. To introduce the concept of Digital Twin and its significance in modern engineering and technology.
2. To understand the architecture and components of Digital Twin systems.
3. To explore the role of sensors, IoT, AI, and data analytics in enabling Digital Twins.
4. To examine real-world applications of Digital Twins across industries such as manufacturing, healthcare, and smart cities.
5. To develop skills in designing and implementing basic Digital Twin models using simulation tools and platforms.

UNIT I:

Introduction to Digital Twin: Introduction to the concept of Digital Twin – Evolution, definitions, and relevance in the context of Industry 4.0. Types of Digital Twins – Product Twin, Process Twin, and System Twin. Overview of components: physical entity, digital representation, and data connection. Role of sensors, data acquisition, and IoT in enabling Digital Twins. Benefits and challenges in Digital Twin implementation.

UNIT II:

Digital Twin Architecture and Technologies: Core architecture of Digital Twin systems. Enabling technologies – Internet of Things (IoT), Cloud Computing, Edge Computing, Artificial Intelligence (AI), and Machine Learning (ML). Communication protocols and middleware platforms. Data integration from heterogeneous sources. Synchronization between physical and virtual entities.

UNIT III:

Modeling and Simulation in Digital Twin: System modeling techniques – CAD models, physics-based models, and data-driven models. Simulation frameworks and tools. Real-time monitoring and predictive analytics. Feedback loops and control systems. Integration with simulation software (ANSYS, MATLAB/Simulink, etc.). Model calibration and validation.

UNIT IV:

Data Analytics and Visualization: Role of Big Data and real-time data analytics in Digital Twins. Data storage, preprocessing, and analysis techniques. Application of machine learning algorithms for fault prediction, anomaly detection, and optimization. Visualization tools and dashboards. Augmented Reality (AR) and Virtual Reality (VR) integration.

UNIT V:

Applications and Case Studies: Application of Digital Twin in manufacturing, predictive maintenance, healthcare systems, energy sector, automotive, aerospace, and smart cities. Case studies on Siemens, GE Digital, and Microsoft Azure Digital Twins. Emerging trends, standards, and future directions. Ethical considerations and cybersecurity in Digital Twin environments.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
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COURSE OUTCOMES:

1. Understand the fundamental principles and architecture of Digital Twin systems.
2. Apply enabling technologies like IoT, AI, and cloud computing in developing Digital Twin models.
3. Design and simulate real-world systems using Digital Twin modeling techniques.
4. Analyze and visualize real-time data for decision-making using machine learning and visualization tools.
5. Evaluate and apply Digital Twin technologies across various industrial domains through case studies.

TEXT BOOKS:

1. Grieves, M., & Vickers, J. (2017). Digital Twin: Mitigating Unpredictable, Undesirable Emergent Behavior in Complex Systems. Springer.
2. Rajiv Pandey, et al. (2021). Digital Twin Technology: Concepts and Applications. CRC Press.
3. Manoj Kumar Tiwari & Nilesh N. (2020). Digital Twin Development and Deployment on the Cloud: Developing Cloud-Friendly Dynamic Models using Simulink/Simscape. Academic Press.

REFERENCE BOOKS:

1. Parlikad, A.K., et al. (2022). Digital Twins for Smart Cities. Institution of Engineering and Technology.
2. Peters, S. (2021). The Digital Twin: Bringing Industry 4.0 to Life. McGraw Hill.
3. Boschert, S., & Rosen, R. (2021). Digital Twin – Fundamental Concepts to Applications. Springer.



III Year I Semester	Professional Elective-I 3. Mobile Edge Computing	L	T	P	C
		3	0	0	3

Course Objectives (COs)

1. Understand the evolution and fundamentals of Mobile Edge Computing (MEC).
2. Explore the architecture, components, and deployment models of MEC systems.
3. Analyze the integration of AI/ML techniques within edge environments.
4. Examine real-world applications of MEC across various domains like IoT, AR/VR, and smart cities.
5. Identify security, privacy, and performance challenges in MEC systems and explore emerging trends.

UNIT I – Introduction to Mobile Edge Computing

Evolution from Cloud Computing to Edge Computing, Definition and Architecture of MEC, Characteristics and Benefits of MEC, MEC vs Mobile Cloud Computing, Role of 5G in MEC, MEC Use Cases Overview, Edge Nodes, Edge Data Centers, and Deployment Models

UNIT II – MEC Architecture and Components

MEC Reference Architecture (ETSI), Components: Edge Server, Orchestrator, User Equipment, Communication Protocols (REST, MQTT, CoAP), Integration with IoT, Cloud, and 5G, Virtualization and Containerization at the Edge (Docker, Kubernetes)

UNIT III – AI/ML in Mobile Edge Computing

Role of AI/ML at the Edge, Inference vs Training in Edge Environments, Use of TinyML, ONNX, TensorFlow Lite, Edge TPU

Case Studies: Real-time object detection at the edge, Predictive maintenance in smart factories, Personalized content delivery using edge AI

UNIT IV – Applications and Use Cases

Smart Cities and Edge Analytics, Augmented/Virtual Reality (AR/VR) over MEC, Edge-based Autonomous Vehicles, Industrial IoT (IIoT) with MEC, Healthcare and Remote Patient Monitoring, MEC for Video Analytics and Surveillance

UNIT V – Security, Challenges, and Future Trends

Security & Privacy Challenges in MEC, Trust Models and Data Protection at the Edge, Network Slicing & QoS in 5G Edge Networks, Standardization (ETSI, 3GPP), Emerging Trends: Edge Federations, Serverless Edge, AI Ops at Edge, Research Directions & Career Opportunities

Course Outcomes

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VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

After completing this course, students will be able to:

1. Explain the key concepts and architecture of Mobile Edge Computing.
2. Design and evaluate MEC systems and their integration with AI/ML technologies.
3. Implement edge-based AI models for real-time data processing.
4. Analyze and propose MEC solutions for domain-specific problems (e.g., healthcare, autonomous systems).
5. Assess security, scalability, and future directions of MEC in AI-driven ecosystems.

TEXTBOOKS BOOKS:

1. **"Mobile Edge Computing: Principles and Applications"** Yan Zhang, Mehdi Bennis, Mário Costa Springer.
2. **"Edge Computing: A Primer"**, Jie Cao, Quan Zhang, Weisong Shi, SpringerBriefs in Computer Science
3. **"Multi-Access Edge Computing in Action"**,ETSI (European Telecommunications Standards Institute)

REFERENCE BOOKS:

1. **"Edge AI: Convergence of Edge Computing and Artificial Intelligence"**,Xiaofei Wang, Yi Pan, Springer
◆ Focuses on deploying AI models at the edge—ideal for AI & ML integration in MEC.
2. **"Architecting the Internet of Things"**,Dieter Uckelmann, Mark Harrison, Florian Michahelles, Springer



III Year I Semester	Professional Elective-I 4. Optimization Techniques	L	T	P	C
		3	0	0	3

Course Objectives:

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

UNIT I:

Introduction and Classical Optimization Techniques: Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems.

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

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

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

UNIT IV: Nonlinear Programming: Unconstrained cases, One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method, Univariate method, Powell’s method and steepest descent method.
Constrained cases– Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods, Introduction to convex Programming Problem.

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

TEXT BOOKS:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

REFERENCE BOOKS:

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

COURSE OUTCOMES:

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

1. State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.
2. Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.
3. Apply and Solve transportation and assignment problem by using Linear programming Simplex method.
4. Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions
5. Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.

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



**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

III Year I Semester	Information Retrieval & Deep Learning Lab	L	T	P	C
		3	0	0	3

Software Required :

Python 3.7+, Jupyter Notebook, TensorFlow, Keras, PyTorch, Scikit-learn, NLTK, NumPy, Pandas, Matplotlib, Seaborn, Google Colab (optional), Anaconda (optional).

LIST OF EXPERIMENTS:

1. Implement a simple document retrieval system using Boolean retrieval. Pre-process documents to create a term vocabulary and postings list.
2. Implement an inverted index with basic compression techniques (e.g., delta encoding, variable byte encoding).
3. Apply smoothing techniques like Laplace or Jelinek-Mercer smoothing to improve the performance of language models.
4. Implement a Naive Bayes classifier to classify documents into predefined categories.
5. Implement K-Nearest Neighbors (KNN) for document classification based on feature vectors.
6. Implement K-Means clustering to group similar documents into clusters based on their feature vectors.
7. Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.
8. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset
9. Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset.
10. Design a neural network for predicting house prices using Boston Housing Price dataset.
11. Build a Convolution Neural Network for MNIST Hand written Digit Classification.
12. Build a Convolution Neural Network for simple image (dogs and Cats) Classification
13. Implement a Recurrent Neural Network for IMDB movie review classification problem.

TEXT BOOKS:

1. "Introduction to Information Retrieval" by Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, Cambridge University Press, 2008.
2. "Statistical Language Models for Information Retrieval" by ChengXiang Zhai, Morgan & Claypool Publishers, 2008.
3. Reza Zadeh and BharathRamsundar, "Tensorflow for Deep Learning", O'Reilly publishers, 2018

REFERENCE BOOKS:

1. "Information Storage and Retrieval Systems: Theory and Implementation" by Gerald J. Kowalski, Mark T. Maybury, Springer, 2004.
2. "Mining the Web: Discovering Knowledge from Hypertext Data" by Soumen Chakrabarti, Morgan Kaufmann Publishers, 2002.
3. "An Introduction to Information Retrieval" by Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, Cambridge University Press, 2009.

LINK:

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



III Year I Semester	COMPUTER NETWORKS LAB	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

1. Understand and implement data link layer framing techniques, including character and bit stuffing.
2. Develop client-server applications and protocols using C programming for network communication.
3. Explore error-detection methods by implementing CRC (Cyclic Redundancy Check) polynomials.
4. Apply and implement graph algorithms such as Dijkstra's algorithm for routing and pathfinding.
5. Simulate and understand routing protocols such as Distance Vector Routing and OSPF in network systems.

LIST OF EXPERIMENTS:

- 1) Implement the data link layer framing methods such as character stuffing and bit stuffing.
- 2) Write a program to develop a DNS client server to resolve the given hostname.
- 3) Implement on a data set of characters the three CRC polynomials – CRC-12, CRC-16 and CRC-CCIP.
- 4) Implement Dijkstra's algorithm to compute the Shortest path in a graph.
- 5) Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table at each node using distance vector routing algorithm
- 6) Take an example subnet of hosts. Obtain broadcast tree for it.
- 7) Write a client-server application for chat using UDP
- 8) Implement programs using raw sockets (like packet capturing and filtering)
- 9) Write a program to perform sliding window protocol.
- 10) Get the MAC or Physical address of the system using Address Resolution Protocol.
- 11) Simulate the Implementing Routing Protocols using border gateway protocol(BGP)
- 12) Simulate the OPEN SHORTEST PATH FIRST routing protocol based on the cost assigned to the path.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

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

(AI & ML)

COURSE OUTCOMES:

1. Apply data link layer framing methods like character and bit stuffing to handle data transmission efficiently.
2. Develop and test a DNS client-server application to resolve domain names using C programming.
3. Implement and evaluate CRC-12, CRC-16, and CRC-CCIP for error detection on datasets of characters.
4. Implement Dijkstra's algorithm to compute the shortest path in a graph and understand routing protocols.
5. Simulate and calculate routing tables using distance vector routing and broadcast tree creation for network subnets.



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

Course Objectives:

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

Unit I

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

Unit II

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

Unit III

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

Unit IV

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

Unit V

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

Course Outcomes:

- Understand the Node's unique approach to asynchronous development.
- Understand the Node Package Manager (npm) and Modules.
- Implement NodeJS applications with the Express frame work and Connect Middleware.
- Learning-depth practices for debugging and testing NodeJS applications.

Deploy NodeJS applications in the cloud or on your own system

TEXT BOOKS:

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

REFERENCE BOOKS:

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



**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

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

Course Objective

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

This lab provides a platform to seed, fertilize and encourage the spirit of curiosity and innovation among young minds. It is a work place where students can give shape to their ideas.

Course Outcome:

In the tinkering lab, students able to

1. Apply prior knowledge to develop and conceptualize scientific methods and engineering techniques.
2. Analyze real-world problems through self-directed exploration and iterative experimentation.
3. Design and develop technical experiments or prototypes with available financial and mentoring support.
4. *Evaluate and refine self-initiated projects by learning from failures, feedback, and performance metrics.*
5. Create innovative, application-oriented solutions by integrating technical skills, creativity, and exploratory learning.

List of Sample Projects:

- Face Recognition Door lock System
- Hand gesture recognition
- Text to speech
- Smart City
- Private chat room
- Android app controlled roboticarm
- Smart Traffic System
- Vehicle Accident Alarm System
- Smart dustbin
- Surveillance BOT
- Automatic Water Gardening System
- e-Mirror
- Smart Parking System

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

- Service Bot
- Drone Surveillance
- Wallpaintingrobot
- Home automation
- Automated wheelchair
- AnyInnovativeIdea–RealTime application

Expectations from the Lab:

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



III Year II Semester	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I:

OPERATING SYSTEMS OBJECTIVES AND FUNCTIONS:

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

UNIT II:

PROCESS CONCEPTS:

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

UNIT III:

SYSTEM MODEL:

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



UNIT IV:

LOGICAL AND PHYSICAL ADDRESS SPACE:

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

UNIT V:

FILE SYSTEM IMPLEMENTATION AND DISK SCHEDULING:

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

COURSE OUTCOMES:

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

TEXT BOOK:

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

REFERENCE BOOKS:

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



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

COURSE Objectives:

- Automata and compiler Design mainly deal with the languages which are formal and regular and also deals with grammar present in the machine.
- A compiler is a program that accepts a program in source language and converts into a machine understandable format.
- The push down automata is the major one it's a five-tuple set containing states, alphabets, transition function and accept states.
-

UNIT - I:

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

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

UNIT - II:

Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification. **Semantics:** Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements.

UNIT - III:

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

UNIT - IV:

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

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

UNIT - V:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

TEXT BOOKS:

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

REFERENCES:

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

COURSE Outcomes:

1. Graduate should be able to understand the concept of abstract machines and their power to recognize the languages.
2. Attains the knowledge of language classes & grammars relationship among them with the help of chomsky hierarchy.
3. Ability to understand the design of a compiler given features of the languages.



III Year II Semester	COMPUTER VISION	L	T	P	C
		3	0	0	3

Course Objective:

To Recognize and describe both the theoretical and practical aspects of computing with images and to Connect issues from Computer Vision to Human Vision

UNIT-I

Introduction: What is computer vision, A brief history, Image Formation, Geometric primitives and transformations, Photometric image formation, The digital camera.

UNIT-II

Feature detection and matching: Points and patches, Feature detectors, Feature descriptors, Feature matching, Feature tracking, Application: Performance-driven animation, Edges, Application: Edge editing and enhancement, Lines, Application: Rectangle detection.

UNIT-III

Segmentation: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods, Application: Medical image segmentation.

UNIT-IV

Feature-based alignment: 2D and 3D feature-based alignment, Pose estimation, Geometric intrinsic calibration, Calibration patterns, Vanishing points, Application: Single view metrology, Rotational motion, Radial distortion.

UNIT-V

Recognition: Object detection, Face detection, Pedestrian detection, Face recognition, Eigenfaces, Active appearance and 3D shape models, Application: Personal photo collections, Instance recognition, Category recognition, Context and scene understanding.

Course Outcomes:

1. Provide an introduction to computer vision including fundamentals of image formation
2. Enumerate the concepts of Feature detection and Matching
3. Discuss about Image Segmentation Techniques
4. Discuss applications of Feature based alignment like pose estimation
5. Discuss different recognition techniques.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

Text Books:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010.
2. Rafael C. Gonzalez "Digital Image Processing", Pearson Education; Fourth edition (2018)

Reference Books:

1. Forsyth /Ponce, "Computer Vision: A Modern Approach", Pearson Education India; 2nd edition (2015)
2. S.Nagabhushana, "Computer Vision and Image Processing", New Age International Pvt Ltd; First edition (2005)



III Year II Semester	Professional Elective-II 1. Software Testing Methodology	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on the

1. Describe the principles and procedures for designing testcases.
2. Provide supports to debugging methods.
3. Acts as the reference for software testing techniques and strategies.

UNIT-I:

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

UNIT-II:

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

UNIT-III:

Paths, Path Products and Regular Expressions:

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

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

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

UNIT-IV:

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

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

UNIT-V:

Software Testing Tools: Introduction to Testing, Automated Testing, Concepts of Test Automation, Introduction to list of tools like Win Runner, Load Runner, Jmeter, Selenium. About Win Runner, Using Win runner, Mapping the GUI, Recording Test, Working with Test, Enhancing Test, Checkpoints, Test Script

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

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Language, putting it all together, Running and Debugging Tests, Analyzing Results, Batch Tests, Rapid Test Script Wizard.

Course Outcomes:

The students should be able to:

1. Define Software testing terminology and methodology
2. Discuss and classify various testing techniques for conducting different types of software testing
3. Apply different software testing techniques.
4. Construct test cases by understanding test suite management and software quality management.
5. Demonstrate modern software testing tools and testing of Object-Oriented Software and Webbased software

TEXT BOOKS:

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

REFERENCES:

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



III Year II Semester	Professional Elective-II 2. Cryptography & Network Security	L	T	P	C
		3	0	0	3

Course Objectives

In this course, the following principles and practice of cryptography and network security are covered:

1. Classical systems, symmetric block ciphers (DES, AES, other contemporary symmetric ciphers)
2. Public-key cryptosystems (RSA, El Gamal, and ECC),
3. Algorithms for factoring and discrete logarithms, cryptographic protocols, hash functions, authentication, keymanagement, key exchange, signature schemes.
4. The fundamental aspects of Email and web security, viruses, firewalls, cyberlaws, and other topics are discussed.

UNIT-I: Introduction and Mathematical Background

Security Goals, Attacks, Services and Mechanisms, Model for Network Security, Cryptography and Cryptanalysis, Symmetric vs. Asymmetric Ciphers, Substitution vs. Transposition Ciphers, Stream vs. Block ciphers. Number Theory: Primes, Coprimes, Primality Test, GCD (Euclid's algorithm), Groups and Fields, Discrete Logarithmic Problem. Modular Arithmetic: Basics, Congruence, Fermat's little theorem, Euler's theorem, Computing Inverse, Chinese Remainder Theorem

UNIT-II: Symmetric Ciphers

Classic Ciphers, Confusion, and Diffusion, Feistel Structure, DES, Modes of operation, Triple DES, IDEA, Blowfish, AES

UNIT-III: Public Key Cryptography

RSA(algorithm, performance, and attacks), Diffie Hellman Key Exchange, El Gamal (encryption and signatures), Elliptic Curve Cryptography (Elliptic Curves, encryption, key exchange, and signatures)

UNIT-IV: Key Management and Authentication

Cryptographic Hash, Message Authentication Codes, Digital Signatures, X.509 certificates, PKI, One Way Authentication, Mutual Authentication, Centralised Authentication, Kerberos

UNIT-V: Network Security and Malware

IPsec (Transport vs. Tunnel, AH, ESP, Security Associations, IKE), SSL, Firewalls and Intrusion Detection Systems, DoS and DDoS, Buffer Overflow, Format Sting Vulnerabilities, The IT Act 2000: Aim and Objectives, Scope, Offences and Punishments

Course Outcomes

1. To be familiar with information security awareness and a clear understanding of its importance.
2. To master fundamentals of secret-key and public-key cryptographic systems.
3. To master protocols that provide security and authentication services.
4. To be familiar with network security threats and countermeasures.
5. To be familiar with different types of cyber-crimes and cyberlaws.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

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(AI & ML)**

TEXTBOOKS:

1. Cryptography and Network Security: Principles and Practice, Sixth Edition, William Stallings, Pearson, 7th edition.
2. Cryptography and Network Security, Third Edition, Behrouz A Forouzan, Debdeep Mukhopadhyay, Mc Graw Hill.
3. Cryptography, Network Security and Cyber Laws, Bernard L. Menezes, Ravinder Kumar, Cengage.

REFERENCES BOOKS:

1. Introduction to Computer Networks & Cyber Security, Chwan Hwa Wu, J. David Irwin, CRC Press.
2. Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, Wiley Dreamtech.
3. Everyday Cryptography, Fundamental Principles & Applications, Keith Martin, Oxford.



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

COURSE OBJECTIVES

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

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

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

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

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

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

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

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

UNIT- IV:

Introduction to Python programming, Introduction to Raspberry Pi:

Specifications, Basic Architecture, Raspberry Pi OS Setup,

Implementation of IoT with Raspberry Pi.

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

Platforms for data collection and storage:

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

UNIT- V:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

COURSE OUTCOMES:

TEXT BOOKS:

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

REFERENCE BOOKS:

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



III Year II Semester	Professional Elective-II 4. Recommender Systems	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

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

Unit 1:

Introduction: Overview of Information Retrieval, Retrieval Models, Search and Filtering Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

Unit 2:

Content-based Filtering: High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, pre-processing and feature extraction, Obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Unit 3:

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

Unit 4:

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

Unit 5:

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations. Types of Recommender Systems: Recommender systems in personalized web search, knowledge-based recommender system, Social tagging recommender systems, Trust-centric recommendations, Group recommender systems.

COURSE OUTCOMES

After completion of course, students would be able to:

1. Design recommendation system for a particular application domain.
2. Evaluate recommender systems on the basis of metrics such as accuracy, rank accuracy, diversity, product coverage, and serendipity

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

TEXT BOOKS:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: AnIntroduction, Cambridge University Press (2011), 1sted.
2. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer (2016), 1sted.

REFERENCES:

1. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender SystemsHandbook, Springer(2011), 1sted.
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer



III Year II Semester	Professional Elective-III 1. Software Project Management	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on the

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

UNIT-I:

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

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

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

UNIT-II:

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

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

UNIT-III:

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

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

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

UNIT-IV:

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

UNIT-V:

Effort Estimation and Scheduling: Effort Estimation, Scheduling.

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



**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

Course Outcomes: The students should be able to:

1. Estimate overall cost of a software project.
2. Explain software development process.
3. Distinguish workflows of process.
4. Design project organization structure & analyze quality.
5. Estimate effort and schedule needed for project.

Text Books:

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

References:

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



III Year II Semester	Professional Elective-III 2. Ethical AI	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I:

Introduction to Ethics and AI:

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

UNIT II:

Fairness, Bias, and Discrimination:

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

UNIT III:

Transparency, Explainability, and Accountability:

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

UNIT IV:

Privacy, Surveillance, and Consent:

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

UNIT V:

Societal Impacts and Future of Ethical AI:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

COURSE OUTCOMES:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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



III Year II Semester	Professional Elective-III 3. Data Visualization	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

Unit 1: INTRODUCTION TO VISUALIZATION

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

UNIT 2: VISUALIZING DISTRIBUTIONS

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

UNIT 3: VISUALIZING ASSOCIATIONS & TIME SERIES

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

UNIT 4: VISUALIZING UNCERTAINTY

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



UNIT 5: PRINCIPLE OF PROPORTIONAL INK

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

COURSE OUTCOMES

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

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

TEXTBOOKS

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

REFERENCE BOOKS

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

EBOOKS

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

MOOC

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



**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

III Year II Semester	Professional Elective-III 4. Soft Computing	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

This course will cover fundamental concepts used in Soft computing:

- The concepts of Fuzzy logic (FL) will be covered first, followed by Artificial Neural Networks (ANNs) and optimization techniques using Genetic Algorithm (GA).
- Applications of Soft Computing techniques to solve a number of real life problems will be covered to have hands on practices.
- The course will provide exposure to theory as well as practical systems and software used in soft computing.

SYLLABUS:

UNIT-I

Introduction to Soft Computing : Concept of computing systems."Soft" computing versus "Hard" computing
Characteristics of Soft computing
Some applications of Soft computing techniques

UNIT-II

Fuzzy logic : Introduction to Fuzzy logic.Fuzzy sets and membership functions.Operations on Fuzzy sets.Fuzzy relations, rules, propositions, implications and inferences.Defuzzification techniques.Fuzzy logic controller design.Some applications of Fuzzy logic.

UNIT-III

Genetic Algorithms: Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques ,Basic GA framework and different GA architectures.GA operators: Encoding, Crossover, Selection, Mutation, etc. Solving single-objective optimization problems using GAs.

UNIT-IV

Multi-objective Optimization Problem Solving :Concept of multi-objective optimization problems (MOOPs) and issues of solving them.Multi-Objective Evolutionary Algorithm (MOEA).Non Pareto approaches to solve MOOPs,Pareto-based approaches to solve MOOPs,Some applications with MOEAs.

UNIT-V

Artificila Neural Networks : Biological neurons and its working.Simulation of biolgical neurons to problem soloving.Different ANNs architectures.Trainging techniques for ANNs.Applications of ANNs to solve some real life problems.

Course Outcomes:

After completing this course, you will be able to learn:

- Fuzzy logic and its applications.
- Artificial neural networks and its applications.
- Solving single-objective optimization problmes using GAs.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

- Solving multi-objective optimization problems using Evolutionary algorithms(MOEAs).
- Applications of Soft computing to solve problems in varieties of application domains.

Text Books:

1. Fuzzy Logic: A Practical approach, F. Martin, McNeill, and Ellen Thro, AP Professional, 2000.
2. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Wiley, 2010.

Reference Books:

1. Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, Nikola K. Kasabov, MIT Press, 1998.
2. Fuzzy Logic for Embedded Systems Applications, Ahmed M. Ibrahim, Elsevier Press, 2004.

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



**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

III Year II Semester	COMPUTER VISION LAB	L	T	P	C
		0	0	3	1.5

Course Objectives

1. To introduce students to the foundational concepts and applications of computer vision.
2. To enable understanding of image formation, feature extraction, and transformation techniques.
3. To provide knowledge on segmentation, object recognition, and visual analysis methods.
4. To develop the ability to implement and evaluate computer vision algorithms for real-world tasks.
5. To expose students to cutting-edge research and industry applications in computer vision.

List of experiments:

1. Implement image acquisition and display using OpenCV.
2. Detect and extract keypoints using Harris and SIFT.
3. Perform feature matching between two images using FLANN.
4. Apply Canny edge detection and visualize results.
5. Implement line detection using Hough Transform.
6. Segment an image using mean shift clustering.
7. Perform image segmentation using graph cuts.
8. Estimate homography and align images (image stitching).
9. Calibrate a camera using a chessboard pattern and OpenCV.
10. Implement face recognition using Eigenfaces.
11. Detect pedestrians in video using HOG + SVM.
12. Build a simple scene recognition model using a pre-trained CNN

Course Outcomes

1. Students will understand the theoretical foundation and workflow of computer vision systems.
2. Students will be able to implement and evaluate feature extraction and matching algorithms.
3. Students will apply image segmentation techniques for practical use cases.
4. Students will develop the ability to perform calibration and feature-based alignment.
5. Students will build systems capable of detecting and recognizing objects and people in images and video.

Textbooks

1. Richard Szeliski, *Computer Vision: Algorithms and Applications*, Springer.
2. E. R. Davies, *Computer Vision: Principles, Algorithms, Applications, Learning*, Academic Press.
3. Simon J. D. Prince, *Computer Vision: Models, Learning, and Inference*, Cambridge University Press.

Reference Books

1. Gary Bradski and Adrian Kaehler, *Learning OpenCV: Computer Vision with the OpenCV Library*, O'Reilly.
2. David A. Forsyth and Jean Ponce, *Computer Vision: A Modern Approach*, Pearson.
3. Mark Nixon and Alberto Aguado, *Feature Extraction and Image Processing for Computer Vision*, Academic Press.



**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

III Year II Semester	Operating System Lab	L	T	P	C
		0	0	3	1.5

Course objectives:

- To implement process scheduling algorithms to understand CPU management and process execution efficiency.
- To apply memory management techniques by simulating various allocation and deal location algorithms.
- To identify and implement solutions for critical section problems and virtual memory management using appropriate algorithms.
- To develop file allocation strategies by implementing common file organization algorithms.
- To understand and write shell scripts for automating basic tasks in a Unix/Linux environment.

List of Experiments:

1. Simulate the following CPU scheduling algorithms
 - a) Round Robin b) SJF c) FCFS d) Priority
2. Multiprogramming-Memory management-
Implementation of fork (), wait (), exec() and exit (), System calls
3. Simulate the following
 - a) Multiprogramming with a fixed number of tasks (MFT)
 - b) Multiprogramming with a variable number of tasks (MVT)
4. Simulate Bankers Algorithm for Dead Lock Avoidance
5. Simulate Bankers Algorithm for Dead Lock Detection.
6. Simulate the following page replacement algorithms.
 - a) FIFO b) LRU c) LFU
7. Simulate the following File allocation strategies
 - a) Sequenced b) Indexed c) Linked
8. Write a program to simulate producer and consumer problem using semaphores
9. Write program to create a thread using pthreads library and let it run its function.
10. Write a program to illustrate concurrent execution of threads using pthreads library.

Course Outcomes:

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VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

- Simulate various CPU process scheduling algorithms to analyze system performance.
- Implement system calls for process creation, management, and inter-process communication.
- Apply different memory management techniques including paging, segmentation, and allocation methods.
- Simulate page replacement, banker's algorithm, and file allocation strategies to evaluate their efficiency.
- Implement synchronization mechanisms in concurrent programming and demonstrate multithreading concepts for safe process execution

Text Books:

1. Operating System -Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley
2. The ultimate guide Unix, Sumiton das, McGraw-Hill Higher Education, 3rd Edition, January 21, 2012



**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

III Year II Semester	Soft Skills (Skill Enhancement Course)	L	T	P	C
		0	1	2	2

Course Objectives

- Encourage use of a wide range of grammatical structures and vocabulary in speech and writing
- Demonstrate good writing skills for effective paraphrasing, argumentative essays, and formal correspondence
- Provide training and opportunities to develop fluency in English through participation informal group discussions and presentations using audio-visual aids
- Knowing the best practices at the workplace to perform well in the interview. ➤ Encouraging smart self-learning, communication skills that focus on employability.

Course Outcomes

- understand the grammatical forms of English and the use of these forms in specific communicative and career context
- use a wide range of reading comprehension strategies appropriate to texts, to retrieve information
- strengthen their ability to write paragraphs, essays, emails and summaries ➤ improve their speaking ability in English both in terms of fluency and comprehensibility by participating in Group discussion and oral assignments
- prepare their own resume and answer interview related questions unhesitatingly with acceptable soft skills

Unit 1 Preparing for Written Assessment [6 Hours] Grammar: Articles: Know how to use different types of Articles, use articles appropriately in context Identify errors in the use of articles, **Prepositions:** Learn to use prepositions in context, Identifying errors in the use of prepositions, Look at the different functions of Prepositions, **Tenses:** understand the different form of tense used in sentences, know the various purposes of using different Tense forms, Use appropriate tense forms of verbs in context, Identify the errors in the use of tense forms, **Concord:** Know how to identify Subject-Verb-Agreement in sentences, Use SVA appropriately in Context, identify the errors in the use of SVA, **Voices:** Know when to use Active or Passive Voice, Convert Active sentences to Passive ones, Relative Clause:

Know what relative pronouns are, know when to use relative clauses, know the functions of Relative Clauses.

Soft Skills: Leadership: Introduction to Leadership, Leadership Power, Leadership Styles, Leadership in Administration. **Interpersonal Relations:** Introduction to Interpersonal Relations, Analysis of different ego states, Analysis of Transactions, Analysis of Strokes, Analysis of Life position

Learning Outcomes

At the end of the module, the learners will be able to



**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

- Comprehend the factors that influence use of grammar and vocabulary in speech and writing(L3)
- Produce a range of valid grammatical sentences in the real world situations and professional environment.(L3)
- develop employability skills through Leadership skills and interpersonal skills (L3)

Unit 2 Reading Comprehension [6 Hours]

Purposes & Strategies of Reading:know the general purpose of Reading,assess your skills of reading ,develop reading Strategies **Skimming for details:**Skim through a variety of passages, understand how skimming will orient you to the text, **Identifying main Ideas:**Identify the main ideas in the give text,Look for supporting statements in a passage, understand how the writer supports main ideas with details **Scanning for information:**Scan passages for factual information, understand how scanning can help find certain answers quickly,know how to look for factual answers,**drawing inferences:**Understand how to draw inferences,infer meanings while reading passages, **vocabulary:**Learn strategies to understand difficult words used in the passage,Apply strategies of reading to understand a variety of passages,**practise tests**

Soft Skills:Communication: Introduction to Communication, Flow of Communication, Listening, Barriers of Communication, How to overcome barriers of communication. **Stress Management:**Introduction to Stress, Causes of Stress, Impact Stress, Managing Stress

Learning Outcomes

At the end of the module, the learners will be able to

- assess the reading skill by developing reading strategies (L3)
- Understand the skimming & scanning techniques orients to identify the theme,purpose and statements.(L2)
- develop employability skills through communication skills and stress management(L3)

Unit 3 Writing paragraphs & Essays [6 Hours]

Features of Good Writing:understand what makes a piece of writing good,Analyse & discuss some samples of good & bad writing, **Gathering Ideas:** Discuss various techniques for gathering ideas before you start writing, practice some of the techniques that can be used in the Prewriting stage ,**Purposes of Writing:**understand the importance of purpose of writing,explore various purpose of writing,choose content & language based on the purpose **Writing for Specific audience:**Study ways of tailoring content to suit a target audience,analyse text to deduce the target audience,discuss how language is used to suit the target audience **organizing ideas:**understand the importance of organising ideas in a text,Learn the different ways of organising ideas,practice organising ideas while writing **Writing an introduction:**Know the importance of a good introduction, understand the different ways in which writers catch the attention of readers, **Developing supporting ideas:**Learn how to develop your ideas in a paragraph, discuss a variety of supporting ideas ,**Writing a conclusion:**Learn the different parts of a conclusion, Practice writing an



**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

effective conclusion **Using linkers:** Learn the different types of Linkers or cohesive devices, Discuss why it is important to use connectors in writing, **Choosing the right words:** Discuss why writers make a careful choice of language, Learn how to select language to make the intended impact, **Writing film & book reviews:** Learn the different categories of books & films, Know the elements which go into analysing books & films, Write your own film & book reviews **Common errors in writing, editing & proofreading.:** Practice correcting errors in basic sentence structure, Learn to proof-read & edit your draft before writing the final version

Soft Skills: Group Dynamics and Team Building: Importance of groups in organization, Interactions in group, Group Decision Taking, Team Building, Interaction with the Team, How to build a good team?

Learning Outcomes

At the end of the module, the learners will be able to

- understand the use of passive voice in academic writing (L2)
- use appropriate vocabulary to express ideas and opinions (L2)
- develop employability skills through group dynamics and team building (L3)

Unit 4 Preparing for oral Assignment [6 Hours]

Group Discussion: Group Discussions as a tool for selection, skills for GD, Leadership & Problem-Solving Skills, Types of GD, Group Dynamics, Roles & Functions: Beginning, Presenting, Elaborating, Roles & Functions: Clarifying, Synthesising & Challenging, Roles & Functions: Agreeing, Disagreeing & Summarizing., Etiquette: Body Language & Time Management, GD Activities

Soft Skills: Conflict Management: Introduction to Conflict, Causes of Conflict, Managing Conflict **Time Management:** Time as a Resource, Identify Important Time Wasters, Individual Time Management Styles, Techniques for better Time Management.

Learning Outcomes

At the end of the module, the learners will be able to

- participate in group discussions using appropriate conventions and language strategies and develop advanced listening skills for in-depth understanding of academic text (L3) ➤ collaborate with a partner to make discussions (L2)
- develop employability skills through conflict management and time management (L3)

Unit 5 Interview Skills [6 Hours]

Purpose of interviews: Know what recruiters looking for during Interviews, Become familiar with the process of career search, understand your skills, interests, achievements and attitude better **Preparing a Resume:** Understand what a job application is, know the details to be included in a CV, Know how to lay out details of a CV & prepare CV on your own **Writing a Cover Letter:** Study the information which is included in a cover letter. Learn how to organise information in a cover letter **,Before and at the interview:** Learn how to prepare for an interview, learn how to behave during the interview, discuss what the



**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

interviewer might assess you on **Answering FAQs about yourself & your families**: Learn how to answer questions about yourself & family, Learn how to identify & talk about your strengths and Weaknesses **Answering FAQs about Likes & Dislikes**: Learn to choose interests which will be relevant to your Interview. learn to speak about your likes & Dislikes **Answering FAQs about Justifying your candidature**: Know what you need to say to answer a question about yourself, Be able to answer questions about your suitability for a job **Answering FAQs about Priorities, Attitudes & Biases**: Understand what your priorities will be in a job & learn to talk about them, learn to correct understanding of your attitude, biases & prejudice, if any, towards others, know positive qualities that are valued at work **Answering FAQs about Professional goals**: Become aware of the things you need to keep in mind while choosing a job, Set goals for your professional growth & plan how to achieve them **Public Speaking: Planning, Practice & Delivery**: Plan one minute speeches on simple topics, understand how to capture the audience's attention, be able to create strong closing statements.

Soft Skills: Motivation: Introduction to Motivation, Relevance and types of Motivation, Motivating subordinates, Analysis of Motivation

Learning Outcomes

At the end of the module, the learners will be able to

- prepare a CV with a cover letter to seek internship/ job (L2)
- understand the structure of Interviews and familiar with frequently asked questions while interview and how to respond to it (L3)
- develop employability skills through motivation and analysis of motivation (L3)

The learners will demonstrate their knowledge and abilities through completion of the following required assessments while or at the end of this course. —1 Quiz, 1 GD, 2 Activities on Interview Readiness and Softskills, 1 Personal Interview

Quiz: (10M)

Quiz is conducted on Grammar, Vocabulary and Reading Comprehension. The Quiz consists of 50 questions and will be scaled down to 10 Marks. Duration of the quiz is 1hr 30 Min only and it is Computer Based Test (CBT)

Resume: (10 M)

Each student is required to submit 3 independently written Resumes during the course. Specific requirements for each one are accessed on the following

Link: <https://docs.google.com/document/d/1W15961dOEnIxnMm9BKyO8L9WIa7nPbEfg>

[R-9DT_m Rg/edit?usp=sharing](https://docs.google.com/document/d/1W15961dOEnIxnMm9BKyO8L9WIa7nPbEfg/edit?usp=sharing)



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

COURSE OBJECTIVES:

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

UNIT I:

Introduction to Technical Writing:

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

UNIT II:

Research Process and Writing Tools:

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

UNIT III:

Publication Ethics and Plagiarism:

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

UNIT IV:

Introduction to Intellectual Property Rights (IPR):

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

UNIT V:

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

COURSE OUTCOMES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

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

(AI & ML)

TEXT BOOKS:

1. Ritu Arora (2020). Technical Writing and Professional Communication. McGraw-Hill Education.
2. Neeraj Pandey & Khushdeep Dharni (2014). Intellectual Property Rights. PHI Learning.
3. Gopalkrishnan, N. S. & Agitha, T. G. (2009). Principles of Intellectual Property. Eastern Book Company.

REFERENCE BOOKS:

1. WIPO (2016). Understanding Intellectual Property: A Guide for Beginners. World Intellectual Property Organization.
2. Day, R. A., & Gastel, B. (2012). How to Write and Publish a Scientific Paper. Cambridge University Press.
3. Deborah Bouchoux (2012). Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets. Cengage Learning.



IV Year I Semester	Natural Language Programming	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT-I

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

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

Unit-II

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

Unit-III

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

Unit-IV

Predicate-Argument Structure

Predicate-Argument Structure, Meaning Representation Systems, Software.

Unit-V

Discourse Processing: Cohension, Reference Resolution, Discourse Cohension and Structure

Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language Specific Modeling Problems, Multilingual and Crosslingual Language Modeling .

COURSE OUTCOMES:

1. Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

2. Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
3. Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
4. Able to design, implement, and analyze NLP algorithms
5. Able to design different language modeling Techniques.

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M.Bikel and Imed Zitouni, Pearson Publication
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

REFERENCE BOOKS:

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



IV Year I Semester	Management Course- II	L	T	P	C
	Management Science Human resource Management Entrepreneurship & Incubation	2	0	0	2

Course Objectives:

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

Course outcomes:

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

Unit-I: Fundamentals of Entrepreneurship

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

Application: Case lets: Business cases of young entrepreneurs.

Unit-II: Ideation and Evaluation of Business Ideas

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

Case lets : Business cases of OYO.

Activity: Collection of novel business ideas.

Unit-III: Feasibility Analysis and Business plan

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

Activity:

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



**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

Unit-IV: Business Incubation and start-ups

Fundamentals of business incubation-Services of incubators -Start-ups-meaning, significance - start up strategy-Present scenario of startups.

Activity:

- Evaluating new start- ups in India
- Analysis on Shark Tank India program

Unit-V: Financial resources

Sources of finance–Bootstrapping-Government Support–MSMEs-Crowd Funding–Venture Capitalists & Angel Investors - Schemes for women entrepreneurs

Activity: Business plan final version

Contemporary Topics:

1. Green Business
2. Niche Markets
3. New perspectives in rural enterprises

Text Books:

4. T.V Rao, Donald F.Kuratko, Entrepreneurship, A South-Asian Perspective, Cengage Learning, 1st edition, 2012.
5. Datsy Davies, Indian Startups, Amazon Asia- Pacific Holdings Private Limited, 1st Edition, 2016

Reference Books:

1. P.N.Rath,Sarjue Pandita, Entrepreneurship :Startup India & Standup India, Lexicon Publishing House, 2018
2. MadhurimaLall, ShikhaSahai, Entrepreneurship, Excel Books(P)Ltd.2008
3. Rajeev Roy, Entrepreneurship, Oxford Higher Education.2011
4. H.Nandan, Fundamentals of Entrepreneurship, PHIL earning(P)Ltd,2013



IV Year I Semester	Professional Elective - IV	L	T	P	C
	1.Federated Learning	3	0	0	3

COURSE OBJECTIVES:

1. To introduce the fundamentals of Federated Learning and its need in privacy-preserving machine learning.
2. To understand the architectures, protocols, and algorithms used in Federated Learning systems.
3. To study optimization and communication challenges associated with distributed learning.
4. To explore privacy, security, and trust mechanisms in Federated Learning environments.
5. To apply Federated Learning techniques in real-world applications such as mobile devices, healthcare, and finance.

UNIT I:

Introduction to Federated Learning: Fundamentals of distributed and decentralized learning. Evolution and definition of Federated Learning (FL). Motivation for FL – data privacy, regulatory constraints, and edge computing. Federated vs centralized learning. Components of FL – clients, server, and communication rounds. Real-world scenarios and case studies in Google Gboard and healthcare.

UNIT II:

Federated Learning Algorithms and Architectures: Basic algorithms – Federated Averaging (FedAvg), FedProx, and SCAFFOLD. Model update and aggregation mechanisms. System architecture – client-server model, cross-device and cross-silo FL. Client selection strategies. Asynchronous and synchronous learning in FL environments.

UNIT III:

Optimization and Communication Efficiency: Challenges in training models across heterogeneous clients. Techniques for reducing communication cost – model compression, quantization, sparsification. Handling non-IID (independent and identically distributed) data. Personalization strategies. Impact of client availability and system heterogeneity.

UNIT IV:

Privacy, Security, and Trust in FL: Threats in Federated Learning – inference attacks, data poisoning, and model poisoning. Secure aggregation and encryption techniques – homomorphic encryption, differential privacy, secure multiparty computation. Trust frameworks and incentive mechanisms. Blockchain-enabled Federated Learning.

UNIT V:

Applications and Future Directions: Applications in mobile computing, healthcare, banking, autonomous vehicles, and IoT. Case studies on real-world Federated Learning deployments. Frameworks and tools – TensorFlow Federated, PySyft, Flower. Current research trends and open challenges. Ethical considerations and regulatory compliance (GDPR, HIPAA).

COURSE OUTCOMES:

1. Understand the key principles, motivations, and applications of Federated Learning.
2. Apply suitable FL algorithms for different learning scenarios with privacy constraints.
3. Analyze and optimize Federated Learning systems under communication and data constraints.
4. Evaluate security and privacy-preserving techniques used in distributed ML.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

5. Design Federated Learning models for real-world applications using appropriate tools and frameworks.

TEXT BOOKS:

1. Qiang Yang, Yang Liu, Tianjian Chen, Yongxin Tong (2019). Federated Machine Learning: Concept and Applications. Springer.
2. Jakub Konečný, Brendan McMahan et al. (2021). Advances and Open Problems in Federated Learning. NOW Publishers.
3. Rieke, Nicola, et al. (2020). The Future of Digital Health with Federated Learning. Springer.

REFERENCE BOOKS:

1. Peter Kairouz et al. (2021). Federated Learning: Strategies for Improving Communication Efficiency. arXiv preprint.
2. Mehdi Mohri, Gary Sivek, Ananda Theertha Suresh (2019). Agnostic Federated Learning. Proceedings of ICML.
3. Brendan McMahan et al. (2020). TensorFlow Federated: Machine Learning on Decentralized Data. Google AI Blog & Documentation.



IV Year I Semester	Professional Elective - IV	L	T	P	C
	2.NOSQL DATABES	3	0	0	3

COURSE OBJECTIVES:

From the course the student will

1. To understand the basic concepts and the applications of database systems. To master the basics of SQL and construct queries using SQL.
2. To understand the relational database design principles.
3. To become familiar with the basic issues of transaction processing and concurrency control.
4. To become familiar with database storage structures and access techniques.

UNIT I

Introduction to NoSQL: Definition And Introduction, Sorted Ordered Column-Oriented Stores, Key/Value Stores, Document Databases, Graph Databases, Examining Two Simple Examples, Location Preferences Store, Car Make And Model Database, Working With Language Bindings.

UNIT II

Interacting with NoSQL: If NoSql Then What, Language Bindings 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 Non-Relational Databases.

UNIT IV

NoSQL Stores: Similarities Between Sql And MongoDB Query Features, Accessing Data From Column-Oriented Databases Like Hbase, Querying Redis Data Stores, Changing Document Databases, Schema Evolution In Column-Oriented Databases, Hbase Data Import And Export, Data Evolution In Key/Value Stores.

UNIT V

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

COURSE OUTCOMES:

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

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

TEXT BOOKS:

- 1) Pramod Sadalage and Martin Fowler, NoSQL Distilled, Addison-Wesley Professional, 2012.
- 2) Dan McCreary and Ann Kelly, Making Sense of NoSQL, Manning Publications, 2013.

REFERENCE BOOKS:

- 1) Shashank Tiwari, Professional NoSQL, Wrox Press, Wiley, 2011, ISBN: 978-0-470-94224-6 Gaurav Vaish, Getting Started with NoSQL, Packt Publishing, 2013.



IV Year I Semester	Professional Elective - IV	L	T	P	C
	3.Quantum Computing	3	0	0	3

Course Description:

The objective of this course is to impart necessary knowledge of Quantum Computing Technologies to the learner, so that he/she can develop and implement algorithms and write programs using these algorithms to design and develop Quantum machines which is a cutting-edge technology. Students will solve quantum computing problems with the knowledge gain during this coursework

Course Educational Objectives:

- Introduce the working of a Quantum Computing program, its architecture and program model
- Teach universal gates circuits on available simulators
- Illustrate the advantage of super position and entanglement
- Create an understanding of quantum algorithms to solve real world quantum problems
- Demonstrate the applications of quantum computing

Course Outcomes:

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

Unit-I: INTRODUCTION TO QUANTUM COMPUTING

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

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

UNIT-II: QUANTUM CIRCUITS BUILDING BLOCKS FOR QUANTUM PROGRAM

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



**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

UNIT-III: TENSORPRODUCTS, TELEPORTATION AND SUPERDENSE CODING

Tensor Products, Multi Q-Bit system, Super Position, Entanglement, Decoherence, quantum teleportation, no-cloning theorem super dense coding(10thchapterofBook2), Quantum Fourier transformations and its applications (5.1., 5.2., 5.3.)

UNIT-IV: QUANTUM ALGORITHMS

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

UNIT-V: QUANTUM ERRORS & QUANTUM COMPUTING APPLICATIONS

Single- Qubit error, Quantum Operations and Krauss Operations. Quantum Machine Learning (SVM), Quantum Cryptography (QKD, Post-Quantum Cryptography (Chapter 8, 10, 12)

Textbook(s):

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

Reference(s):

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



IV Year I Semester	4.Computational Neuroscience Professional Elective-IV	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the interdisciplinary foundations of computational neuroscience combining biology, computer science, and mathematics.
2. To understand the structure and function of the brain from a computational modeling perspective.
3. To explore neural coding, neural networks, and mathematical modeling of brain activity.
4. To study various brain models from single neurons to large-scale neural circuits.
5. To apply computational methods to simulate and analyze neuronal dynamics and behavior.

UNIT-I:

Introduction to Neuroscience and Neural Systems: Overview of neuroscience – neurons, synapses, and brain architecture. Neuron anatomy and electrophysiology. Communication between neurons – action potentials, ion channels, and neurotransmitters. Organization of the central and peripheral nervous systems. Introduction to brain regions and cognitive functions. Motivation for computational modeling of neural systems.

UNIT-II:

Modeling Single Neurons: Mathematical models of neuron dynamics – Hodgkin-Huxley model, integrate-and-fire model. Ion channel dynamics and membrane potentials. Numerical simulation of neuron models. Comparison of biologically realistic vs. simplified neuron models. Synaptic integration and postsynaptic potentials.

UNIT-III:

Neural Coding and Information Processing: Concepts of neural coding – rate coding, temporal coding, population coding. Encoding and decoding information in the brain. Signal representation in the nervous system. Information theory in neuroscience – entropy, mutual information, and efficient coding hypothesis. Role of noise and variability in neural responses.

UNIT-IV:

Artificial and Biological Neural Networks: Network models of interconnected neurons. Recurrent neural networks, Hopfield networks, and attractor dynamics. Learning rules – Hebbian learning, STDP (Spike-Timing Dependent Plasticity). Computational modeling of memory, learning, and decision-making. Comparison with artificial neural networks and deep learning models.

UNIT-V:

Cognitive and Behavioral Modeling: Computational approaches to perception, motor control, and attention. Large-scale brain modeling and simulation platforms (e.g., NEURON, NEST, Brian2). Brain-computer interfaces. Case studies of computational models in visual processing, auditory systems, and sensory-motor integration. Future directions in computational neuroscience and brain-inspired computing.

COURSE OUTCOMES:

1. Understand the biological basis of neural systems and how they are modeled computationally.
2. Simulate and analyze the behavior of single neurons using mathematical models.
3. Interpret neural codes and apply information theory to brain signal processing.
4. Construct and analyze simple neural networks based on biological principles.
5. Apply computational techniques to study cognition, perception, and motor functions in the brain.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

TEXT BOOKS:

1. Peter Dayan & L.F. Abbott (2001). *Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems*. MIT Press.
2. Thomas Trappenberg (2010). *Fundamentals of Computational Neuroscience*. Oxford University Press.
3. Eugene M. Izhikevich (2007). *Dynamical Systems in Neuroscience: The Geometry of Excitability and Bursting*. MIT Press.

REFERENCE BOOKS:

1. Wulfram Gerstner & Werner M. Kistler (2002). *Spiking Neuron Models: Single Neurons, Populations, Plasticity*. Cambridge University Press.
2. Bard Ermentrout & David Terman (2010). *Mathematical Foundations of Neuroscience*. Springer.
3. Christof Koch (1999). *Biophysics of Computation: Information Processing in Single Neurons*. Oxford University Press.



IV Year I Semester	1.Agile methodologies Professional Elective-V	L	T	P	C
		3	0	0	3

Course Objectives:

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

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

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
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Agile Project Management and Scaling-Agile Metrics and KPIs, Agile Team Dynamics and Roles, Scaling Agile: Safe, Less, Spotify Model, Agile in Distributed Teams, Agile Tools: JIRA, Trello, Azure DevOps.

TEXT BOOKS :

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

REFERENCE BOOKS:

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



IV Year I Semester	2.Big Data Analytics Professional Elective-V	L	T	P	C
		3	0	0	3

Course Objectives

The objectives of this course is to acquire knowledge on the

- i. Necessity of Big data analysis and challenges in Big data analysis
- ii. Descriptive, Predictive, Real-time analysts is of big data
- iii. Programming tools PIG & HIVE in Hadoop echo system

UNITI: Introduction:

Introduction to big data: Introduction to Big Data platform, Challenges of conventional systems, intelligent data analysis, Nature of data, Analytic processes and tools, Analysis vs. Reporting. Role of Big Data in AI/ML & IoT and Introduction to Data Lakes vs Data Warehouses

UNITII: Stream Processing:

Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies - Real Time Sentiment Analysis - Stock Market Predictions- Real-time Fraud Detection.

UNIT III: Introduction to Hadoop:

Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analyzing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment. Introduction to YARN (Yet Another Resource Negotiator), Limitations of Hadoop vs Modern Frameworks like Spark

UNITIV: Frameworks and Applications:

Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and Zoo Keeper.

UNIT V: Predictive Analytics and Visualizations:

Predictive Analytics, Simple linear regression, Multiple linear Regressions, Interpretation of regression coefficients, Visualizations, Visual data analysis techniques, interaction techniques, Systems and application

Course Outcomes

The students should be able to:

- i. Understand and Illustrate characteristics of big data and big data challenges in different domains including social media, transportation, finance and medicine
- ii. Demonstrate stream processing on real time applications



**(Applicable from the academic year 2024-25 and onwards)
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- iii. Do Big data processing using Map reduce on Hadoop
- iv. Do Big data processing using PIG scripts and Hive QLqueries
- v. Understand Predictive analysis of big data.

Text Books

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

Reference Books

- 1. BillFranks,“TamingtheBigDataTidalWave:FindingOpportunitiesinHugeData Streams with Advanced Analytics”, John Wiley& sons,2012.
- 2. . PaulZikopoulos, DirkdeRoos, KrishnanParasuraman, ThomasDeutsch, JamesGiles, David Corrigan, “Harness the Power of Big Data: The IBM Big Data Platform”, Tata McGrawHillPublications, 2012.
- 3. ArshdeepBahgaandVijayMadiseti,“BigDataScience&Analytics:AHands On Approach “, VPT,2016.
- 4. BartBaesens,“AnalyticsinaBigDataWorld:TheEssentialGuidetoDataScienceand its Applications (WILEY Big Data Series)”, John Wiley & Sons,2014.



IV Year I Semester	3.Reinforcement Learning Professional Elective-V	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the fundamentals of Reinforcement Learning (RL) and its relevance in artificial intelligence.
2. To enable students to understand the mathematical foundations of Markov Decision Processes (MDPs) and Bellman Equations.
3. To explore key learning methods such as Q-learning, policy gradients, and actor-critic models.
4. To study model-based reinforcement learning and deep RL techniques.
5. To provide insight into real-world applications, ethics, and advanced topics like meta-learning and multi-agent environments.

UNIT-I:

Introduction and Basics of RL , Defining RL Framework and Markov Decision Process, Polices, Value Functions and Bellman Equations, Exploration vs. Exploitation, Code Standards and Libraries used in RL (Python/Keras/Tensor flow)

UNIT-II:

Tabular methods and Q-networks, Planning through the use of Dynamic Programming and Monte Carlo, Temporal-Difference learning methods (TD(0), SARSA, Q-Learning) ,Deep Q- networks (DQN, DDQN, Dueling DQN, Prioritised Experience Replay)

UNIT-III:

Introduction to policy- based methods: Vanilla Policy Gradient, REINFORCE algorithm and stochastic policy search, Actor-critic methods (A2C, A3C) ,Advanced policy gradient (PPO, TRPO, DDPG)

UNIT-IV:

Model-based RL approach: Analytic gradient computation, Sampling-based planning, Model-based data generation, Value-equivalence prediction, Model-based policy optimization. Model-based RL approach Recent Advances and Applications .

UNIT-V:

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

Course Outcomes:

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

1. Understand the Basic concepts of Reinforcement learning.
 2. Implement tabular methods to solve classical control problems.
 3. Understand the policy gradient methods from vanillato more complex cases.
 4. Apply various model based RL approaches to solve real world applications.
- Recognize current advanced techniques and applications in RL

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM



VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

**(Applicable from the academic year 2024-25 and onwards)
(AI & ML)**

Text Books:

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

Reference books:

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



	Professional Elective - V	L	T	P	C
IV Year I Semester	4.High Performance Computing (HPC)	3	0	0	3

Course Objectives

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

Course Outcomes

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

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

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

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

UNIT IV: Introduction to MPI programming: MPI primitives such as MPI_ Send, MPI-Recv, MPI_ Init, MPI-Finalize, etc., Application of MPI to Trapezoidal rule, Collective Communication primitives in MPI, MPI derived data types, Performance evaluation of MPI programs, Parallel sorting algorithms, Tree search solved using MPI, Programming Assignments.

UNIT V: Introduction to GPU computing, Graphics pipelines, GPGPU, Data Parallelism and CUDA C Programming, CUDA Threads Organization, Simple Matrix multiplication using CUDA, CUDA memories. Bench Marking and Tools



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

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for High Performance Computing Environments, Numerical Linear Algebra
Routines BLAS for Parallel Systems evaluation.

Text Books

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

Reference Books

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

IV Year I Semester	Prompt Engineering (Skill oriented Course)	L	T	P	C
		0	1	2	2

Course Objectives:

Equip learners with the skills to design, optimize, and evaluate prompts for diverse tasks using LLMs in real-world applications.

Course Outcomes:

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

Week-1

Introduction to Prompt Engineering

What is a prompt?, Types of language models (ChatGPT, Claude, Gemini, etc.), Prompting paradigms: zero-shot, few-shot, chain-of-thought

Activity:

- Exploring ChatGPT or OpenAI Playground
- Basic prompt crafting and analysis

Week-2

Foundations of Prompt Crafting

Role of clarity, context, and constraints, Prompt templates and best practices, Role-playing and persona-based prompting

Activity:

- Rewrite/improve prompts for clarity and output quality
- Use templates for different tasks (e.g., summarize, explain, translate)

Week-3

Task-Specific Prompting

Categories-Text generation (creative writing, marketing), Classification and extraction (e.g., sentiment analysis, data extraction), Question answering and summarization

Activity:

- Design prompts for each category
- Evaluate and iterate based on outputs

Week-4 and 5

Advanced Prompting Techniques

Chain-of-thought reasoning, Step-by-step breakdowns, Self-consistency and verification,
System prompts and role instructions

Activity:

- Use multi-step prompts for logical reasoning or math
- Build a guided assistant with structured response flows

Week-6 and 7

Prompt Evaluation & Iteration

Evaluation metrics (fluency, relevance, coherence), A/B testing and prompt tuning, Limitations
of LLMs and prompt robustness

Activity:

- Compare prompt variants
- Analyze hallucinations and mitigate errors

Week-8 and 9

APIs and Automation

Using the OpenAI API (or other LLM APIs), Prompt injection defense basics, Automating tasks
with prompts (scripts, tools)

Activity:

- Build a simple prompt-based app (e.g., email assistant or quiz generator)
- Use prompt chaining via API

Week-10

Capstone Project

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

WEB REFERENCES

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

WEB REFERENCES

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

IV Year I Semester	Gender Sensitization Audit course	L	T	P	C
		0	1	2	2

Course: Objectives

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

UNIT - I: UNDERSTANDING GENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men
- Preparing for Womanhood. Growing up Male. First lessons in Caste.

UNIT – II: GENDER ROLES AND RELATIONS

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

UNIT – III: GENDER AND LABOUR

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

UNIT – IV: GENDER - BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: “*Chupulu*”.
Domestic Violence: Speaking Out Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-“I Fought for my Life....”

UNIT – V: GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks- The Brave Heart.

COURSE OUTCOMES:

1. Students will have developed a better understanding of important issues related to gender in contemporary India.
2. Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
3. Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
4. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
5. Students will develop a sense of appreciation of women in all walks of life.