VISHNU INSTITUTE OF TECHNOLOGY: BHIMAVARAM
Approved by AICTE, New Delhi: Affiliated to JNT University, Kakinada.
Vishnupur, Bhimavaram-534202:: West Godavari Dist. A.P.
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE STRUCTURE AND SYLLABUS

For

B. Tech

COMPUTER SCIENCE AND ENGINEERING

(Applicable for batches admitted from 2019-2020)

VISION OF THE INSTITUTION

To ignite the minds of the students through academic excellence so as to bring about social transformation and prosperity.

MISSION OF THE INSTITUTION

1. To expand the frontiers of knowledge through Quality Education.
2. To provide valued added Research and Development.
3. To embody a spirit of excellence in Teaching, Creativity, Scholarship and Outreach.
4. To provide a platform for synergy of Academy, Industry and Community.
5. To inculcate high standards of Ethical and Professional Behavior.

VISION OF CSE DEPARTMENT

To build a strong teaching-learning base with a flair for innovation and research that responds to the dynamic needs of the software industry and the society.

MISSION OF CSE DEPARTMENT

1. To provide strong foundation both in theory and applications of Computer Science & Engineering, so as to solve real-world problems
2. To empower students with state-of-art knowledge and up to date technological skills, making them globally competent
3. To promote research, innovation and entrepreneurship with focus on industry and social outreach
4. To foster civic minded leadership with ethics and values among students

PROGRAM EDUCATIONAL OBJECTIVES OF CSE DEPARTMENT

1. Graduates will have knowledge of mathematics, science, engineering fundamentals, and in-depth studies in Computer Science Engineering, and will be able to apply them for formulating, analysing and solving real world problems.
2. Graduates will succeed in earning coveted entry level positions in leading Computer Software and Hardware Firms in India and abroad.
3. Graduates will succeed in the pursuit of advanced degrees and research in engineering or other fields and will have skills for continued, independent, lifelong learning and professional development throughout life.
4. Graduates will have good communication skills, leadership qualities, ethical values and will be able to work in teams with due attention to their social responsibilities.

PROGRAM OUTCOMES OF CSE DEPARTMENT

1. An ability to apply knowledge of computing, mathematics, science and engineering fundamentals to the solution of complex engineering problems.
2. An ability to formulate and analyse a problem, and define the computing requirements appropriate to its solution using basic principles of mathematics, science and computer engineering.
3. An ability to design, implement, and evaluate a computer based system, process, component, or software to meet the desired needs.
4. An ability to design and conduct research based experiments, perform analysis and interpretation of data and provide valid conclusions.
5. An ability to use current techniques, skills, and tools necessary for computing practice.
6. An understanding of legal, health, security, cultural and social issues, and thereby ones responsibility in their application in Professional Engineering practice.
7. An understanding of the impact of professional engineering solutions on environmental context and the need for sustainable development.
8. An understanding and commitment towards the professional and ethical responsibilities of an engineer.
9. An ability to function effectively as an individual, and as a team member/leader in accomplishing a common goal.
10. An ability to communicate effectively, make effective presentations and write and comprehend technical reports and publications.
11. An ability to learn and adopt new technologies, and use them effectively towards continued professional development throughout the life.

12. An understanding of engineering and management principles and their application to manage projects in the software industry.

PROGRAM SPECIFIC OUTCOMES OF CSE DEPARTMENT

1. An ability to demonstrate basic knowledge in databases, programming languages and algorithm analysis in the development of software applications.

2. An ability to design and develop projects using open source tools and efficient data structures.

B.Tech. FOUR YEAR DEGREE COURSE

R19 Regulations

(Applicable for the batches admitted from 2019-2020)

VISHNU INSTITUTE OF TECHNOLOGY: BHIMAVARAM

(Autonomous)

Approved by AICTE & Affiliated to JNTUK, Kakinada

Accredited with A++ Grade by NAAC & NBA

Vishnupur, Bhimavaram, West Godavari Dist., Andhra Pradesh, India. PIN - 534202

Email: info@vishnu.edu.in, Website: www.vishnu.edu.in

THE DEGREE OF BACHELOR OF TECHNOLOGY - REGULAR
(With effect from 2019-20)

RB 0.0	**TITLE AND DURATION OF THE COURSE**
	The course shall be called the degree course in Bachelor of Technology, abbreviated as B.Tech.
	The course shall be of four academic years duration divided into eight semesters, each semester having duration of minimum 16 weeks.
	The calendar of events in respect of the course shall be fixed by the Institute from time to time.
	The external examination in all the subjects shall be conducted at the end of each semester for all the eight semesters.
	Students joining the B.Tech. programme shall have to complete the programme in a stipulated time frame of 8 years from the date of joining and students joining the B.Tech. Programme in the third semester directly through Lateral Entry Scheme (LES) shall have to complete the programme in a stipulated time frame of 6 years from the date of joining. Otherwise, they shall forfeit their seat in B.Tech. Programme and their admission shall stand cancelled.
	When a student is detained for lack of credits / shortage of attendance, he/she may be re-admitted into the same semester / year in which he/she has been detained. However, the academic regulations under which he/she was first admitted shall continue to be applicable.
RB 1.0	**ELIGIBILITY FOR ADMISSION**
RB 1.1	Admissions are done as per the norms prescribed by the Government. The Government orders issued from time to time in this regard shall prevail.
RB 1.2	The Candidate shall be an Indian National.
RB 1.3	The Candidate should have passed the qualifying examination, i.e., Intermediate or equivalent on the date of admission.
RB 1.4	Seats in each programme in the college are classified into CATEGORY-A (70% of intake) and CATEGORY – B (30% of intake) besides lateral entry.
RB 1.5	Category 'A' Seats shall be filled by the Convener, EAMCET Admissions. Category 'B' Seats shall be filled by the College as per the guidelines of Andhra Pradesh State Council of Higher Education. 'Lateral Entry' candidates shall be admitted into the Third semester directly based on the rank secured by the candidate in Engineering Common Entrance Test (ECET) in accordance with the instructions given by the Convener, ECET and the Government of Andhra Pradesh.
RB 2.0	**AWARD OF B.TECH. DEGREE**
RB 2.1	A Regular Student shall be declared eligible for the award of the B.Tech. Degree, if he/she pursues a course of study in not less than four and not more than eight academic years. A Lateral Entry Student admitted into III semester shall be declared eligible for the award of the B.Tech. Degree, if he/she pursues a course of study in not less than three and not more than six academic years.

RB 2.2	Each discipline of the B.Tech. programme is designed to have a total of 160 credits and the student shall have to complete the courses and earn all credits as per the requirements for award of the degree. Students joining the B.Tech. programme in the third semester directly through Lateral Entry Scheme (LES) shall have to complete the courses, excluding first year courses and credits as per the requirements for award of the degree.
RB 2.3	The B.Tech. Degree shall be conferred on a candidate who has satisfied the following requirements. A Regular student (four year programme) should register for 160 credits. In order to become eligible for the award of B.Tech. Degree, the student must obtain 160 credits. A Lateral Entry student should register for (160- first Year credits) credits and should obtain all the credits. However, it is mandatory for the students to complete the noncredit courses
RB 3.0	**MINIMUM INSTRUCTION DAYS**
RB 3.1	The minimum instruction days for each semester shall be 90 working days.
RB 4.0	**COURSES OF STUDY**
	Branch Code- Branch Abbreviation 01-CE (Civil Engineering) 02-EEE (Electrical and Electronics Engineering) 03-ME (Mechanical Engineering) 04-ECE (Electronics and Communication Engineering) 05-CSE (Computer Science & Engineering) 12-IT (Information Technology)
RB 4.1	**Groups of Courses:** The Courses in the B.Tech. Programme is of four kinds: Core, Professional Elective, Open Elective, and Mandatory Audit Course. **Core Course:** These are courses which are to be compulsorily studied by a student and it is the core requirement to complete the programme in a said branch. **Professional Elective Course:** A student can choose a course (subject) from a pool of courses of branch concerned, which add proficiency to the students. **Open Elective Course:** These are the courses offered by the other branches. These courses are designed to lead to knowledge enhancement in multi disciplinary domains. **Mandatory Audit Course**: These courses allow a student to attend classes without the benefit of a grade for a course. An undergraduate student who audits a course does so, for the purpose of self-enrichment and academic exploration.
RB 5.0	**DISTRIBUTION AND WEIGHTAGE OF MARKS**
RB 5.1	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. The Project-I shall be evaluated for 50 marks, Project-II evaluated for 200 marks, , Socially Relevant Projects for 50 marks, internship for 50 marks and seminar for 50 marks.
RB 5.2	For theory subjects, the distribution shall be 40 marks for Internal Evaluation and 60 marks for the End Examinations.

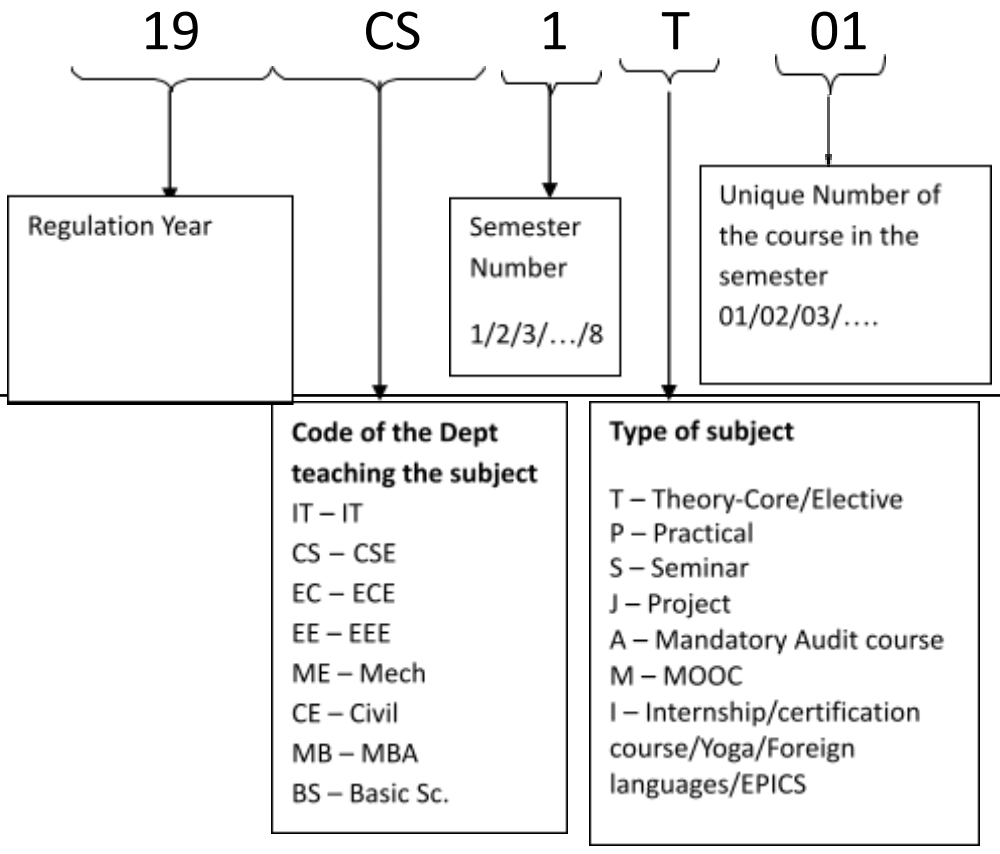
RB 5.3	The Internal evaluation 40 marks shall be awarded as follows: 20 marks for Descriptive, 10 marks for Quiz and 10 marks for Assignment. The descriptive examination is for 90 minutes duration conducted for 30 marks. Each descriptive examination question paper consists of three questions (either - or type) from three units. Three questions to be answered, one from each unit. The descriptive examination conducted for 30 Marks is to be brought down to total marks of 20. The quiz examination is for 20 minutes duration (Conducted with 20 multiple choice questions with a weightage of ½ Mark each). Thought provoking questions shall be covered in Quiz examination. After every two Units, one Assignment/Tutorial shall be conducted. Two questions from each Unit and maximum of 4 questions must be set in Assignment. Assignment/Tutorial consists of Theory, Design, Analysis, Simulation, Algorithms, Drawing, etc. as the case may be. Out of the 3 Assignments / tutorials, average of best of the 2 Assignments shall be considered for awarding of marks. For theory subjects, during the semester there shall be 2 MID tests. As the syllabus is framed for 6 units, the First MID examination (both descriptive and quiz) is conducted on the first three units and Second MID examination (both descriptive and quiz) is considered from last three units of each subject. Average of two Mid tests (both descriptive and quiz) shall be considered as final marks of the MID. Eg: A student got 18 marks out of 20 marks in Descriptive-1, 8 marks out of 10 marks in Quiz-1 and 8 marks out of 20 marks in Descriptive-2 and 2 marks out of 10 marks in Quiz-2. Assignment-1 = 9 out of 10, Assignment-2 = 4 out of 10 and Assignment-3 = 10 out of 10. The student Internal marks are = ((26+10)/2 + ((9+10)/2) = 27.5 is rounded to 28 marks out of 40 marks. If a student is absent from any one MID examination, he/she can appear for a Grand Test after MID-2. The Grand Test will be conducted with questions covering the entire syllabus. The marks in the grand test is reduced to 30 marks and to be considered for the respective MID.
RB 5.4	The end semester examination is conducted for 60 marks. It consists of 6 questions (either - or type) with 10 marks each. For design subjects (like Design Drawing Concrete Structures, Steel Structures, Building Planning and Drawing), the pattern will consist of 2 parts (part-A and B), where in part-A 2 questions will be given with each question carrying 24 marks, out of which the student has to answer one question and part-B consists of 6 questions with each question carrying 12 marks each, out of which the student has to answer 3 questions.
RB 5.5	For practical subjects, there shall be continuous evaluation during the semester for 40 internal marks. Out of the 40 marks for internal, day-to-day work 15 marks, Record 10 marks and 15 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted for 60 marks by the internal examiner and the external examiner.
RB 5.6	For the subject having design and/or drawing (such as Engineering Graphics, Engineering Drawing, Machine Drawing, Design Drawing Concrete Structures, Steel Structures, Building Planning and Drawing), the distribution shall be 40 marks for internal evaluation (20 marks for day–to–day work, and 20 marks for MID tests) and 60 marks for end examination. The average of 2 MIDs shall be considered as final marks of the MID.
RB 5.7	For the seminar, the student shall collect the information on a specialized topic and prepare a technical report showing his/her understanding over the topic, and submit to the department, which shall be evaluated by the Departmental Committee consisting of the Head of the Department, a seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.

RB 5.8	Out of a total of 200 marks for the Project-II, 80 marks shall be for Internal Evaluation and 120 marks for the End Semester Examination. The End Semester Examination (Viva – Voce) shall be conducted by the Committee. The Committee consists of an external examiner, Head of the Department and Supervisor of the Project. The evaluation of project work shall be conducted at the end of the Eighth semester. The Internal Evaluation marks shall be on the basis of two seminars given by each student on the topic of his/her project and evaluated by an Internal Committee, consisting of Head of the department, the supervisor of the project and a senior faculty member.	
RB 5.9	For the Project-I, 50 marks shall be for the Internal Evaluation. Viva- Voce shall be conducted by the Committee. The Committee consists of the Head of the Department, one Senior Faculty Member and the Supervisor of the Project. The Viva–Voce may be conducted along with respective semester lab external examinations. There shall be no external examination for mini projects.	
RB 5.10	Laboratory marks and the internal marks awarded by the department are not final. The marks are subjected to be scrutinized and scaled by the Institute wherever it is felt desirable. The internal and laboratory marks awarded by the department shall be referred to a Committee if required. The Committee shall arrive at a scaling factor and the marks shall be scaled as per the scaling factor. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved for two years after the final examinations of that semester in the respective departments as per the norms of the Institute and shall be produced to the Committees as and when they ask for.	
RB 6.0	**PROGRAMME STRUCTURE**	
	Basic Science Courses	15-16%
	Engineering Science Courses	10-19%
	Humanities and Social Science Courses	6-9%
	Professional Core Courses	31-40%
	Professional Elective Courses	7-13%
	Project / Internships / Certification Courses/ Seminar	8-9%
	Open Elective Courses	5-10%
	Mandatory Audit Courses	-
RB 7.0	**SCHEME OF INSTRUCTION FOR I, II, III AND IV YEARS**	
RB 7.1	The Schemes of Instruction and syllabi of all B.Tech. programmes are given separately, which are approved by the BOS concerned and the Academic Council.	
RB 8.0	**CONTACT HOURS AND CREDITS**	
RB 8.1	One hour of lecture/Tutorial is equivalent to one credit and one hour of practical work/field work is equivalent to 0.5 credit**.**	
RB 8.2	**THEORY / TUTORIAL CLASSES** Each course is prescribed with a fixed number of lecture periods per week. During lecture periods, the course instructor shall deal with the concepts of the course. For certain courses, tutorial periods are prescribed in order to give exercises to the students and to closely monitor their learning abilities and achievements.	
RB 8.3	**LABORATORY / DRAWING COURSES** A minimum prescribed number of experiments/drawings/jobs/programmes have to be performed by students, who shall complete these in all aspects and get each experiment evaluated by the teacher concerned and certified by the Head of the Department concerned at the end of the semester.	

RB 9.0	MEDIUM OF INSTRUCTION
	The Medium of Instruction and examination is in English.

RB 10	ATTENDANCE REQUIREMENTS
RB 10.1	In each semester, the candidate has to put in a minimum attendance of 75% with a provision of condonation of 10% of the attendance by the Principal on the specific recommendation of the HOD, showing some reasonable cause such as medical grounds, participation in University level sports, cultural activities, seminars, workshops, paper presentation etc.
RB 10.2	Students, having shortage of attendance and got condonation for attendance, shall have to pay requisite fee towards condonation.
RB 10.3	Shortage of attendance below 65% in aggregate shall not be condoned.
RB 10.4	Students whose shortage of attendance is not condoned will be detained and the student has to re-register for that semester when it is offered by the department.
RB 10.5	Rules for calculation of attendance for the re-admitted candidates who were detained for want of attendance or who had break – in study for various reasons: a) No. of classes conducted shall be counted from the day one of the semester concerned, irrespective of the date of payment of tuition fee. b) They should submit a written request to the Principal, along with a challan paid towards tuition and other fee, for re-admission before the commencement of class-work. c) Student should come to know about the date of commencement of class-work of the semester into which he/she wishes to get re-admission. The information regarding date of commencement of class-work for each semester is available in the college notice boards/ website.
RB 11.0	**CONDITIONS FOR PASS AND AWARD OF CREDITS FOR A COURSE**
RB 11.1	A candidate shall be declared to have passed in individual theory/drawing course if he/she secures a minimum of 40% aggregate marks (40 marks out of 100, Internal and semester end examination marks put together), subject to a minimum of 35% marks (21 marks out of 60) in semester end examination. For successful completion of mandatory audit course, the student must get a satisfactory grade from the department offering the course. If fails, he/she has to reappear whenever the course is offered.
RB 11.2	A candidate shall be declared to have passed in individual lab/project course if he/she secures a minimum of 40% aggregate marks (Internal and semester end examination marks put together), subject to minimum of 35% marks in semester end examination.
RB 11.3	The student has to pass the failed course by appearing the supplementary examination as per the requirement for the award of degree.
RB 11.4	On passing a course of a programme, the student shall earn assigned credits in that course.
RB 12.0	**TRANSITORY REGULATIONS**
RB 12.1	A candidate, who is detained or discontinued in the semester, on readmission shall be required to pass all the courses in the curriculum prescribed for such batch of students in which he/she joins subsequently. However, exemption shall be given to those candidates who have already passed in such courses in the earlier semester(s) and substitute subject may be offered as approved by College Academic Committee and ratified by the Academic Council.

RB 12.2	A student shall be eligible for promotion to the next semester of B.Tech. programme, if he/she satisfies the conditions as stipulated in Regulation RB10.
RB 12.3	A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of the credits up to either II year I semester or II year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester. A student shall be promoted from III year to IV year if he fulfils the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester. **For Lateral Entry Candidates** A student shall be promoted from III year to IV year if he fulfils the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.
RB 13.0	**COURSE CODE AND COURSE NUMBERING SCHEME:** The subject codes shall be given by the Department teaching the subject. Each subject code contains 8 characters. The 8 Characters for each subject shall be coded as per the following guidelines.



While giving the subject codes the Departments can follow the following steps.

i. Collect the requirements from various Departments.(subjects which they have to teach for other Departments)

ii. Prepare a list of all the subjects the Departments have to teach in that semester (for their Department as well as the other Departments based on the requirements they have collected in point i.)

iii. Give subject codes to all these subjects following the guidelines given.

iv. Communicate these subject codes(identified in point i) to various Departments.

	v. Use the subject codes identified in point iii to the subjects in their course structure.
RB 14.0	**CONSOLIDATED GRADE CARD**
	A consolidated grade card containing credits and grades obtained by the candidate shall be issued after completion of the four year B.Tech. Programme.
RB 15.0	**METHOD OF AWARDING LETTER GRADES AND GRADE POINTS FOR A COURSE**
RB 15.1	A letter grade and grade point shall be awarded to the student in each course based on his/her performance as per the grading system given below

Marks Range Theory/Lab (Max – 100)	Marks Range for subjects with Max – 50	Letter Grade	Level	Grade Point
≥ 90	≥ 45	O	Outstanding	10
≥ 80 < 90	≥ 40 < 45	S	Excellent	9
≥ 70 < 80	≥ 35 < 40	A	Very Good	8
≥ 60 < 70	≥ 30 < 35	B	Good	7
≥ 50 < 60	≥ 25 < 30	C	Fair	6
≥ 40 < 50	≥ 20 < 25	D	Satisfactory	5
< 40	< 20	F	Fail	0
			Absent	0

RB 15.2	**Calculation of Semester Grade Points Average(SGPA)* for semester:** **The Performance of each student at the end of each semester is indicated in terms of SGPA. The SGPA is calculated as below:** $SGPA\ (S_i) = \sum(C_i \times G_i) / \sum C_i$ (for all courses passed in that semester) Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course. * SGPA is calculated for the candidates who passed all the courses in that semester
RB 15.3	**Calculation of Cumulative Grade Points Average (CGPA)** The CGPA is calculated as below: $CGPA = \sum(C_i \times S_i) / \sum C_i$ (for entire programme) Where S_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts
RB 15.4	Equivalent Percentage for CGPA is = (CGPA-0.75) x 10
RB 16.0	**REVALUATION** As per the notification issued by the Controller of Examination, the student can submit the application for revaluation, along with the fee receipt for revaluation of his/her answer script(s) of theory course(s), if he/she is not satisfied with the Grade obtained. The Controller of Examination shall arrange for revaluation of those answer script(s).

RB 16.1	For Revaluation, a new external examiner, other than the first examiner, shall re-evaluate the answer script(s). If there is any change in marks (below 15% of the maximum External marks) the highest of the two marks will be considered and if there is any change in marks (Equal or above 15% of the maximum External marks), the script will be evaluated by the third valuator. The marks of all the three valuators are compared and the average of two nearer marks will be awarded to the student.
RB 17.0	**SUPPLEMENTARY EXAMINATIONS.**
	Supplementary examinations shall be conducted twice in an academic year, along with regular semester end examinations.
RB 18.0	**READMISSION CRITERIA.**
	A candidate, who is detained in a semester due to lack of attendance/ credits, has to obtain written permission from the Principal for readmission in the same semester after duly fulfilling all the required norms stipulated by the college in addition to paying an administrative fee of Rs.1,000/-
RB 19.0	**BREAK IN STUDY.**
	Student, who discontinues his/her studies for whatsoever may be the reason, can get readmission into appropriate semester of B.Tech. programme after break-in study only with the prior permission of the Principal of the College provided, such candidate shall follow the transitory regulations applicable to such batch in which he/she joins. An administrative fee of Rs.1000/- per year of break in study in addition to the prescribed tuition fee and special fee has to be paid by the candidate to condone his/her break in study.
RB 20.0	**AWARD OF DIVISION.**
	The award of division for the candidates who admitted into respective B.Tech. programmes in the year 2019-2020 and onwards should be as per JNTUK regulations.
	For the purpose of awarding First Class with Distinction, the student must get CGPA within 4 years in case of candidates admitted through EAMCET & Management Quota or within 3 years in case of Lateral Entry candidates admitted through ECET, without appearing for any supplementary examinations. Detained candidates are not eligible for the award of First Class with Distinction. For the purpose of awarding First, Second and Pass Class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of course shall be considered.
RB 21.0	**BETTERMENT /IMPROVEMENT OF CUMULATIVE GRADE POINT AVERAGE**
RB 21.1	A candidate, after becoming eligible for the award of the Degree, may reappear for the external Examination in any of the theory courses as and when conducted, for the purpose of improving the CGPA. But this reappearance shall be within a period of two academic years after becoming eligible for the award of the Degree, subject to fulfillment of Regulation RB 2.0.
RB 21.2	However, this facility shall not be availed by a candidate to reappear either for Internal Examination or for Semester End Examinations in Practical courses (including Project Viva-voce) and also for Semester End Examinations evaluated internally for the purpose of improvement.

RB 21.3	Modified Grade Card and New Consolidated Grade Card shall be issued after incorporating new Grades and Credits.
RB 22.0	**ADVANCED SUPPLEMENTARY EXAMINATIONS**
	Candidate(s), who fails in Theory or Lab courses of 4th year second semester, can appear for advanced supplementary examinations conducted within one month after declaration of the revaluation results. However, those candidates who fail in this advanced supplementary examinations of IV year second semester shall appear for subsequent examination along with regular candidates in the examinations conducted at the end of the respective academic year.
RB 23.0	**MALPRACTICES** The Principal/chief superintendent shall refer the cases of malpractices in internal assessment tests and Semester End Examinations to a Malpractice Enquiry Committee, constituted for the purpose. The Principal shall take necessary action, against the erring students based on the recommendations of the Committee as per JNTUK Malpractice regulations.
RB 24.0	The physically challenged candidates who have availed additional examination time and a scribe during their Intermediate/EAMCET examinations shall be given similar concessions on production of relevant proof/documents.
RB 25.0	The students who are suffering from contagious diseases are not allowed to appear either internal or Semester end examinations with other students. A separate room will be allotted for such type of students.
RB 26.0	The students who participate in coaching/tournaments held at State/National/International levels through University / Indian Olympic Association during Semester end external examination period shall be promoted to subsequent semesters till the entire course is completed as per the guidelines of University Grants Commission Letter No. F. 1-5/88 (SPE/PES), dated 18-08-1994.
RB 27.0	The Principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the Heads of the Departments in an appropriate manner, and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of Regulation, approved in the Heads of the Departments meetings, shall be reported to the Academic Council for ratification.
RB 28.0	The Academic Council, from time to time, may revise or amend or change the Regulations, schemes of examination and/or syllabi.
RB 29.0	**ELECTIVES** Minimum 20% of intake of students is compulsory for offering regular electives.
RB 30.0	**INTERNSHIP** For internship, minimum period shall be one month. However, it can be completed in 3 to 4 slots /intervals which shall be a minimum of five day slot.

MALPRACTICES RULES

Disciplinary Action for / Improper Conduct in Examinations

S.NO	Nature of Malpractices / Improper conduct	Punishment
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
1.(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and held with the Institution.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Institution examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Institution examinations. The continuation of the course by the candidate is

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

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

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.

2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
   (i) A show cause notice shall be issued to the college.
   (ii) Impose a suitable fine on the college.
   (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

* * * *

VISHNU INSTITUTE OF TECHNOLOGY

(AUTONOMOUS)

(Approved by AICTE & Affiliated to JNTU-Kakinada)

(Accredited by NBA& NAAC 'A' Grade)

Vishnupur, BHIMAVARAM – 534 202

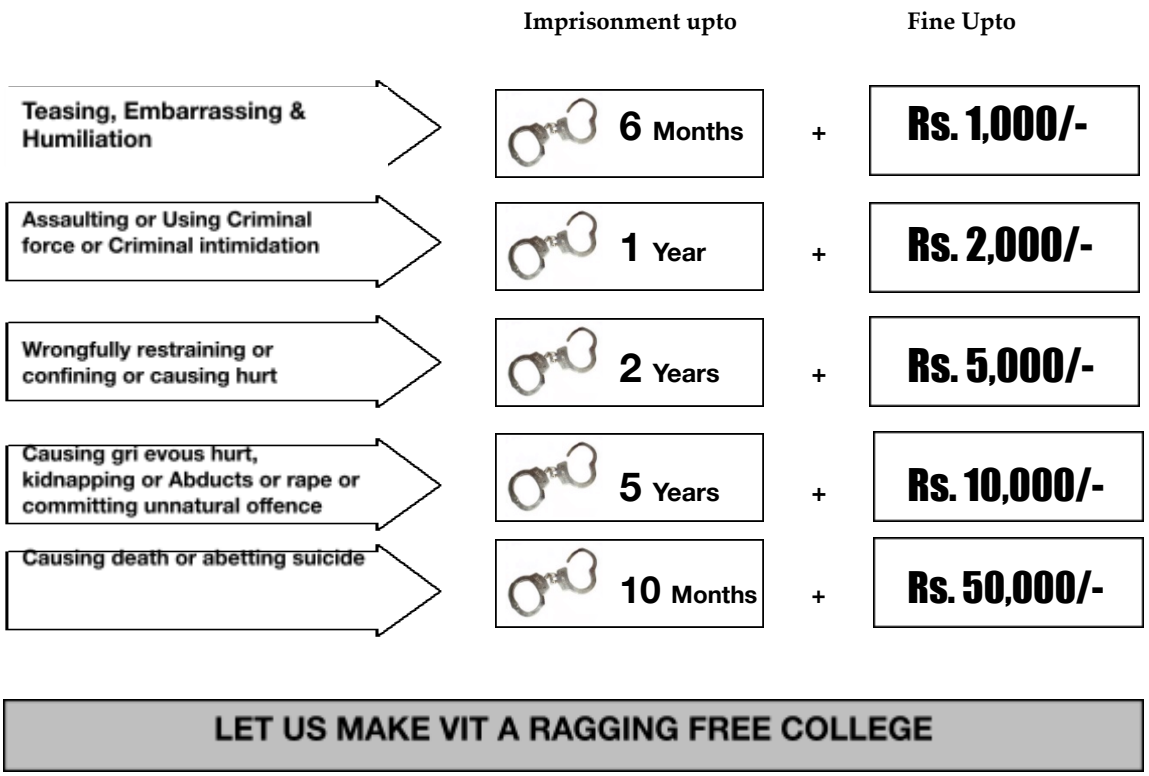
Ragging

Prohibition of ragging in Educational institutions Act 26 of 1997

Salient Features

Ragging within or outside any educational institution is prohibited.

Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student.



LET US MAKE VIT A RAGGING FREE COLLEGE

VISHNU INSTITUTE OF TECHNOLOGY

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Vishnupur, BHIMAVARAM – 534 202

ABSOLUTELY NOT TO RAGGING

1. **Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.**
2. **Ragging entails heavy fines and/or imprisonment.**
3. **Ragging invokes suspension and dismissal from the College.**
4. **Outsiders are prohibited from entering the College and Hostel without permission.**
5. **Girl students must be in their hostel rooms by 7.00 p.m.**
6. **All the students must carry their Identity Cards and show them when demanded.**
7. **The Principal and the Wardens may visit the Hostels and inspect the rooms any time.**

LET US MAKE VIT A RAGGING FREE COLLEGE

B.Tech (CSE)
R19 Course Structure

VISHNU INSTITUTE OF TECHNOLOGY: BHIMAVARAM

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Vishnupur, Bhimavaram-534202:: West Godavari Dist. A.P.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Vishnupur, Bhimavaram-534202:: West Godavari Dist. A.P

R19 Course Structure for B.Tech.(CSE) (With effect from 2019-2020)

I YEAR I SEMESTER								
S. No	**Course Code**	**Subjects**	**L**	**T**	**P**	**C**	**I**	**E**
1	19BS1T02	Mathematics-I (Linear Algebra and Calculus)	2	1	-	3	40	60
2	19BS1T05	Applied Chemistry	3	-	-	3	40	60
3	19CS1T01	Problem Solving and Programming Using Python	3	-	-	3	40	60
4	19EE1T01	Elements of Electrical and Electronic Engineering	3	-	-	3	40	60
5	19ME1P01	Engineering Graphics and Design	1	-	3	2.5	40	60
6	19BS1P04	Applied Chemistry Lab	-	-	3	1.5	40	60
7	19CS1P01	Problem Solving and Programming Lab	-	-	3	1.5	40	60
8	19EE1P01	Electrical and Electronic Engineering Lab	-	-	3	1.5	40	60
9	19BS1A02	Environmental Science	3	-	-	-	0	0
		Total	**15**	**1**	**12**	**19**	**320**	**480**
							800	

I YEAR II SEMESTER								
S. No	**Course Code**	**Subjects**	**L**	**T**	**P**	**C**	**I**	**E**
1	19BS2T01	Communicative English	2	-	-	2	40	60
2	19BS2T06	Mathematics –II (Probability and Statistics)	3	1	-	4	40	60
3	19BS2T03	Applied Physics	3	-	-	3	40	60
4	19CS2T01	AI Tools, Techniques and Applications	2	1	-	3	40	60
5	19BS2P01	English Communication Skills Lab	-	-	3	1.5	40	60
6	19BS2P02	Applied Physics Lab	-	-	3	1.5	40	60
7	19CS2P01	AI Tools, Techniques and Applications Lab	-	-	3	1.5	40	60
8	19CS2P02	Computer Programming Lab	-	-	3	1.5	40	60
9	19CS2P03	Engineering Workshop and IT Workshop	-	-	3	1.5	40	60
10	19BS2A01	Constitution of India / Essence of Indian Traditional Knowledge	3	-	-	-	0	0
		Total	**13**	**2**	**15**	**19.5**	**360**	**540**
							900	

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II YEAR I SEMESTER								
S. No	**Course Code**	**Subjects**	**L**	**T**	**P**	**C**	**I**	**E**
1	19IT3T01	Discrete Mathematical Structures	2	1	-	3	40	60
2	19CS3T02	Internet of Things (IoT)	3	-	-	3	40	60
3	19CS3T03	Data Structures and Algorithms	3	-	-	3	40	60
4	19CS3T01	Computer Organization & Architecture	3	-	-	3	40	60
5	19CS3T04	Object Oriented Programming through Java	3	-	-	3	40	60
6	19BS3A01	Quantitative Aptitude - I	3	-	-	0	0	0
7	19CS3P01	Internet of Things Lab	-	-	3	1.5	40	60
8	19CS3P02	Data Structures and Algorithms Lab	-	-	3	1.5	40	60
9	19CS3P03	Object Oriented Programming through Java Lab	-	-	3	1.5	40	60
		Total	**17**	**1**	**9**	**19.5**	**320**	**480**
							800	

II YEAR II SEMESTER								
S. No	**Course Code**	**Subjects**	**L**	**T**	**P**	**C**	**I**	**E**
1	19CS4T01	Software Engineering	3	-	-	3	40	60
2	19CS4T02	E-Commerce	3	-	-	3	40	60
3	19CS4T03	Database Management Systems	3	-	-	3	40	60
4	19CS4T04	Web Technologies	3	-	-	3	40	60
5	19EC4T05	Digital Logic Design	3	-	-	3	40	60
6	19BS4T02	Logical Reasoning	3	-	-	0	0	0
7	19CS4J01	Socially Relevant Project (15 Hrs/Sem)	-	-	1	0.5	20	30
8	19BS4P01	Business English Communication Lab	-	-	3	1.5	40	60
9	19CS4P01	Design Thinking & Product Innovation Lab	-	-	3	1.5	40	60
10	19CS4P02	DBMS Lab	-	-	3	1.5	40	60
11	19CS4P03	Web Technologies Lab	-	-	3	1.5	40	60
		Total	**18**	**0**	**13**	**21.5**	**380**	**570**
							950	

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III YEAR I SEMESTER								
S. No	**Course Code**	**Subjects**	**L**	**T**	**P**	**C**	**I**	**E**
1	19CS5T01	Formal Languages & Automata Theory (FLAT)	3	-	-	3	40	60
2	19CS5T02	Design and Analysis of Algorithms	3	-	-	3	40	60
3	19CS5T03	Operating Systems	3	-	-	3	40	60
Professional Elective-I								
4	19CS5T07	1. Software Testing Methodologies	3	-	-	3	40	60
	19CS5T05	2. Natural Language Processing						
	19CS5T04	3. Full Stack Web Development						
		4. Human Computer Interaction						
Open Elective-I								
5	19OE5T06	1. Electronic Devices and Circuits(EDC)	3	-	-	3	40	60
	19OE5T02	2. Robotics						
	19OE5T07	3. Embedded Systems						
	19EC5T01	4. Integrated Circuits and Applications						
	19OE5T12	5. Statistics with R Programming						
6	19BS5T01	Mathematics-III (Differential Calculus and Number Theory & Applications)	2	1	-	3	40	60
7	19CS5J01	Socially Relevant Projects (15 Hrs /Sem)	-	-	1	0.5	20	30
8	19BS5T02	Quantitative Aptitude II	2	-	-	1	20	30
9	19CS5P02	PE-I Lab (Full Stack Web Development Lab/NLP Lab)	-	-	3	1.5	40	60
10	19CS5P01	Operating System & Language Processor Lab	-	-	3	1.5	40	60
		Total	**19**	**1**	**7**	**22.5**	**360**	**540**
							900	

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III YEAR II SEMESTER								
S. No	**Course Code**	**Subjects**	**L**	**T**	**P**	**C**	**I**	**E**
1	19CS6T01	Computer Networks	3	-	-	3	40	60
2	19CS6T02	Data Science & Visualization	3	1	-	4	40	60
3	19CS6T03	Compiler Design	3	-	-	3	40	60
Professional Elective II								
4	19CS6T04	1. Software Project Management	3	-	-	3	40	60
	19CS6T05	2. Big Data Analytics						
	19IT6T05	3. NoSql Databases						
	19CS6T06	4. Multimedia and Animation						
Open Elective II								
5	19OE6T13	1. Digital Image Processing	3	-	-	3	40	60
	19OE6T14	2. Green Building Technologies						
	19OE6T15	3. Information Theory and Coding						
	19OE6T16	4. Principles of Signal Processing						
	19OE6T17	5. MAT LAB Programming and ML Tool Box						
6	19CS6P01	CN Lab	-	-	3	1.5	40	60
7	19CS6P02	Data Science Lab	-	-	3	1.5	40	60
8	19BS6P01	Advanced English Communication Skills Lab	-	-	3	1.5	40	60
9	19CS6J01	Socially Relevant Projects (15 hrs / semester)	-	-	1	0.5	20	30
10	19CS6I01	Industrial Training/ Internship/ Research Projects in National Laboratories/Academic Institutions *	-	-	-	-	-	-
		Total	**15**	**1**	**10**	**21**	**340**	**510**
							850	

VISHNU
UNIVERSAL LEARNING

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IV YEAR I SEMESTER								
S. No	**Course Code**	**Subjects**	**L**	**T**	**P**	**C**	**I**	**E**
1	19CS7T01	Network Security and Cryptography	3	-	-	3	40	60
Professional Elective III / MOOC*								
2	19IT7T01	1. Software Architectures	3	-	-	3	40	60
	19CS7T02	2. Deep Learning						
	19CS7T03	3. Dev Ops						
	19IT7T03	4. Augmented Reality and Virtual Reality						
Professional Elective IV / MOOC*								
3	19CS7T04	1. UML & DP	3	-	-	3	40	60
	19CS7T05	2. Data Mining						
	19CS7T06	3. Micro Services						
	19IT7T06	4. Game Development						
Open Elective III / MOOC*								
4	19OE7T11	1. Rapid Manufacturing Processes	3	-	-	3	40	60
	19OE7T12	2. Biomedical Engineering						
	19OE7T13	3. Remote Sensing and GIS						
	19OE7T14	4. TV Engineering						
	19OE7T15	5. Control Systems						
Humanities Elective I / MOOC*								
5	19HS7T01	1. Management Science	3	-	-	3	40	60
	19HS7T05	2. Life Sciences for Engineering						
	19HS7T06	3. Foreign Language						
6	19CS7P01	Network Security Lab	-	-	3	1.5	40	60
7	19CS7P02	PE Lab	-	-	3	1.5	40	60
8	19CS7J01	Project I (Mini Project)	-	-	2	1	20	30
9	19CS7I01	Industrial Training/Internship/Research Projects in National Laboratories/Academic Institutions	-	-	-	2	20	30
		Total	**15**	**0**	**8**	**21**	**320**	**480**
							800	

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IV YEAR II SEMESTER								
S. No	**Course Code**	**Subjects**	**L**	**T**	**P**	**C**	**I**	**E**
Professional Elective V								
1	19CS8T01	1. Real-Time Systems	3	-	-	3	40	60
	19CS8T02	2. Smart Agents and Applications						
	19CS8T03	3. Mobile Application Development						
	19CS8T04	4. BlockChain Technologies						
Open Elective IV								
2	19OE8T12	1. Entrepreneurship	3	-	-	3	40	60
	19OE8T11	2. Nanotechnology						
	19OE8T13	3. Electronic Measurements and Instrumentation						
	19OE8T14	4. Principles of Communication Systems						
	19OE8T15	5. Digital Control Systems						
Humanities Elective II								
3	19HS8T01	1. Managerial Economics and Financial Analysis	3	-	-	3	40	60
	19HS8T02	2. IPR & PE						
	19HS8T03	3. Education, Technology and Society						
4	19CS8J01	Project II	-	-	14	7	80	120
		Total	**9**	**0**	**14**	**16**	**200**	**300**
							500	

* Note: The MOOC Subjects are to be selected from the state-of-the-art technical subjects, identified by BOS, by the time the student reaches IV B.Tech.

Total Course Credits = 38.5 + 41 + 43.5 + 37=160 Credits

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Professional Electives

S.No	Professional Elective I	L	T	P	C	I	E
1	Software Testing Methodologies	3	-	-	3	40	60
2	Natural Language Processing						
3	Full Stack Web Development						
4	Human Computer Interaction						
	Professional Elective II						
1	Software Project Management	3	-	-	3	40	60
2	Big Data Analytics						
3	NoSql Databases						
4	Multimedia and Animation						
	Professional Elective III						
1	Software Architectures	3	-	-	3	40	60
2	Deep Learning						
3	Dev Ops						
4	Augmented Reality and Virtual Reality						
	Professional Elective IV						
1	UML & DP	3	-	-	3	40	60
2	Data Mining						
3	Micro Services						
4	Game Development						
	Professional Elective V						
1	Real-Time Systems	3	-	-	3	40	60
2	Smart Agents and Applications						
3	Mobile Application Development						
4	BlockChain Technologies						

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Open Electives

S.No	Open Elective I	L	T	P	C	I	E
1	Electronic Devices and Circuits(EDC)	3	-	-	3	40	60
2	Robotics						
3	Embedded Systems						
4	Integrated Circuits and Applications						
5	Statistics with R Programming						
	Open Elective II						
1	Digital Image Processing	3	-	-	3	40	60
2	Green Building Technologies						
3	Information Theory and Coding						
4	Principles of Signal Processing						
5	MATLAB Programming and ML Tool Box						
	Open Elective III						
1	Rapid Manufacturing Processes	3	-	-	3	40	60
2	Biomedical Engineering						
3	Remote Sensing and GIS						
4	TV Engineering						
5	Control Systems						
	Open Elective IV						
1	Entrepreneurship	3	-	-	3	40	60
2	Nanotechnology						
3	Electronic Measurements and Instrumentation						
4	Principles of Communication Systems						
5	Digital Control Systems						

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Humanities Electives							
S.No	**Humanities Elective I**	**L**	**T**	**P**	**C**	**I**	**E**
1	Management Science	3	-	-	3	40	60
2	Life Sciences for Engineering						
3	Foreign Language						
Humanities Elective II							
1	Managerial Economics and Financial Analysis	3	-	-	3	40	60
2	IPR & PE						
3	Education, Technology and Society						

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I B.Tech I SEMESTER

CSE

R19 SYLLABUS

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Year / Semester	I B. Tech / I Sem	L	T	P	C
Regulation	R19	2	1	0	3
Subject	Mathematics-I (Linear Algebra & Calculus)				

Course Objectives: To enable the students to

1. Know the importance of matrices to solve linear equations using matrices
2. Identify and solve various differential equations using corresponding methods
3. Apply methods of solving higher order linear differential equations
4. Comprehend the theory of maxima and minima of a function of two variables.
5. Analyze the techniques of tracing the curves and evaluate the lengths, areas, volumes of objects using multiple integrals

Course Outcomes: After completing this course, the students will be able to

1. Solve linear system of equations in engineering problems
2. Find Eigenvalues and Eigenvectors of a matrix in engineering studies.
3. Model engineering problems as a differential equation and solve analytically.
4. Model engineering problems as a differential equation and solve analytically the higher order differential equations.
5. Find out the local /global optimum of functions of several variables.
6. Compute areas, surface areas and volumes.

UNIT –I: Matrices - Linear system of equations

Introduction, Different types of matrices, Rank-Echelon form - Normal form, Solution of a System of Linear Equations – Non-homogeneous and homogeneous equations, Gauss- Jordan method, Gauss – Elimination Method, LU Decomposition, Applications of electric circuits.

UNIT- II: Eigen values - Eigen vectors

Eigen values - Eigen vectors – Properties– Cayley-Hamilton Theorem - finding inverse and power of a matrix by using Cayley-Hamilton theorem, Diagonalization of matrices, Spectral Decomposition, Principal Component Analysis and Singular Value Decomposition

UNIT –III: Differential Equations of First Order and First Degree

Differential equations of first order and first degree–Exact and Non - exact differential equations, Linear and Bernoulli differential equations. Orthogonal trajectories, Newton's Law of cooling, Law of natural growth and decay-R and R-C Circuits.

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UNIT –IV: Linear Differential Equations of Higher Order

Higher order homogeneous and non - homogenous linear differential equations with constant coefficients - Particular integrals for the functions of type e^{ax}, sin(ax+b), cos(ax+b), Polynomial of x, e^{ax} V(x), L-C-R Circuits

Unit – V: Partial Differentiation

Functions of several variables- Partial derivatives, Total derivative, Chain rule, Change of variables, Jacobians, Functional dependence. Generalized Mean Value theorem –Taylor's theorem and Maclaurin's theorem (without proof) for a function of two variables, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers

Unit –VI: Multiple Integrals and Applications

Review of Curve tracing-Cartesian-Polar and Parametric curves

Multiple integrals - double integrals - change of variables (Cartesian and Polar coordinates), Change of order of integration and Evaluation of triple integrals, computing area, surface areas and volume.

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 42nd Ed., Khanna Publishers, New Delhi, 2012
2. Erwin. Kreyszig, Advanced Engineering Mathematics,9th Ed., Wiley, 2012

References:

1. T.K.V.Iyengar, B. Krishna Gandhi, S. Ranganathan and M.V.S.S.N.Prasad, Engineering Mathematics, Volume-I, 12th Ed., S. Chand Publishers, 2014
2. B. V. Ramana, Engineering Mathematics, 4th Ed., Tata McGraw Hill, New Delhi, 2009
3. D. S. Chandrasekharaiah, Engineering Mathematics, Volume 1, Prism Publishers, 2010
4. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, reprint, 2008.

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Year / Semester	I B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Applied Chemistry				

Course Objectives:

1. Plastics are nowadays used in household appliances; also, they are used as composites in aerospace industries.
2. Fuels as a source of energy are a basic need of any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence they are introduced.
3. The basics for the construction of galvanic cells. Also, if corrosion is to be controlled, one has to understand the mechanism of corrosion which itself is explained by electrochemical theory.
4. With the increase in demand, a wide variety of materials are coming up; some of them have excellent engineering properties and these materials are introduced.
5. Understanding of crystal structures will help to understand the conductivity, semiconductors and superconductors.
6. With the increase in demand for power and also with depleting sources of fossil fuels, the demand for alternative sources of fuels is increasing. Some of the prospective fuel sources are introduced.

Course Outcomes: After completing this course, the students will be able to

1. The advantages and limitations of plastic materials and their use in design would be understood.
2. Fuels which are used commonly and their economics, advantages and limitations are discussed.
3. Reasons for corrosion and some methods of corrosion control would be understood.
4. The students would be now aware of materials like nano-materials and fullerenes and their uses. Similarly, liquid crystals and superconductors are understood.
5. The importance of green synthesis is well understood and how they are different from conventional methods is also explained.
6. Conductance phenomenon is better understood.
7. The students are exposed to some of the alternative fuels and their advantages and limitations.

UNIT -I: HIGH POLYMERS AND PLASTICS

Polymerization: Introduction- Methods of polymerization -Thermoplastics and Thermosetting plastics – Compounding and fabrication (4/5 techniques)- Preparation, properties and applications of polyethylene, PVC, Bakelite, Teflon. Conducting polymers, Fiber Reinforced Plastics and Biodegradable Polymers.

Elastomers – Natural rubber - vulcanization – Synthetic rubbers: Buna S, Buna N and Thiokol –

Applications of elastomers.

UNIT -II: FUEL TECHNOLOGY

Fuels: - Introduction – Calorific value - HCV and LCV – Bomb calorimeter – Numerical problems – Coal — Proximate and ultimate analysis –Significance of the analyses – Liquid fuels – Petroleum-Refining – Cracking – Petrol knocking – Diesel knocking - Octane and Cetane ratings – Anti-knock agents –Gaseous fuels – Natural gas, LPG and CNG – Biofuels- Biodiesel and Power alcohol

UNIT -III: ELECTROCHEMICAL CELLS AND CORROSION

Galvanic cells (Construction and working) – Electrochemical series and uses of this series- Standard electrodes (Hydrogen and Calomel electrodes) Batteries: Dry Leclanche Cell - Ni-Cd cells - Li cells.

Corrosion: - Definition – Theories of Corrosion (dry & wet corrosion) – Formation of galvanic cells by different metals, differential aeration - waterline corrosion – Pitting corrosion - Factors which influence the rate of corrosion - Protection from corrosion: Methods of application on metals (Galvanizing, Tinning, Electroplating, Electroless plating)

UNIT -IV: CHEMISTRY OF ADVANCED MATERIALS

Nano materials: - Introduction – Bottom up and Top down approach- Sol gel method- Self assembled layers Characterisation of nano materials by BET and TEM - Carbon nanotubes and fullerenes: Types, Preparation (Arc discharge and Laser ablation and Chemical Vapour Deposition methods) properties and applications

Liquid crystals: - Introduction – Types – Applications

Superconductors: - Type-I & Type-II, properties & applications.

Green synthesis: - Principles – Aqueous phase method, Supercritical fluid Extraction method and Bio catalytic methods of synthesis-Applications.

UNIT -V: SOLID STATE CHEMISTRY

Types of solids – Crystal defects- Frenkel and Schottky defects – Spinel and Inverse spinel.

Hall effect and applications.

Semiconductors: Preparation of pure semiconductors by Zone refining, distillation and Czochralskicrytal pulling technique- Doping- Epitaxy, diffusion and Ion implantation technique- Intrinsic and Extrinsic semiconductors - Applications.

Insulators: Electrical Insulators and their applications.

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UNIT -VI: NON-CONVENTIONAL ENERGY SOURCES

Solar Energy: - Introduction, application of solar energy – photovoltaic cell: design, working and its importance.

Hydropower include setup a hydropower plant (schematic diagram)

Geothermal energy: Introduction-schematic diagram of a geothermal power plant

Tidal and wave power: Introduction- Design and working-movement of tides and their effect on sea level.

Biomass energy

Fuel Cells*:* - Introduction - cell representation, H_2-O_2 fuel cell: Design and working, advantages and limitations. Types of fuel cells: methanol-oxygen - phosphoric acid fuel cells.

Text Books:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publication Co.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.

Reference Books:

1. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015 edition.
2. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition.

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Year / Semester	I B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Problem Solving and Programming using Python				

Course Objectives:

To Enable the Students to

1. Introduce programming through Visual programming tool – Code.org
2. Teach problem solving through Flow charts
3. Elucidate problem solving through python programming language
4. Introduce function-oriented programming paradigm through python
5. Train in development of solutions using modular concepts
6. Teach practical Pythonic solution patterns

Course Outcomes: Student should be able to

1. Visually describe programming logic using flowcharts.
2. Develop Python programs for numerical and text based problems.
3. Express and evaluate logic of simple programs.
4. Choose relevant python data structure to solve problems.
5. Develop simple static pages in html, css and serve them through flask
6. Build and deploy basic web apps using JS, Flask, cloud storage, and GIT.

UNIT – I: Knowing the Computer and Learn Coding Constructs by Visual Tools

Definition and Block Diagram of a Computer. Principle of Abstraction, Memory hierarchy Operating System, System Calls and Interrupt definition. - Base conversion. Representing various data types in computer memory using bits (from integer (including negative), floating points etc. to text, images, audio and video). Language Hierarchy – Machine Language to High level. Compiler vs interpreter.

UNIT – II: Computational Thinking through Flowcharting

Simple logic building through flowcharting. Flowchart symbols, Input/Output, Assignment, operators, conditional if, repetition.

Example problems: Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD of 2 numbers. Fibonacci generation, prime number generation. Minimum, Maximum and average of n numbers, Linear search, Binary Search.

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UNIT – III:

Computational Thinking, Algorithm, Pseudocode, Time/Space complexity. Only Big O notation.

Python: Numbers, Variables, operators, expressions, Input/Output statements, Conditional If, while and for loops, basic math functions, User defined Functions, parameters to functions, positional, keyword and default arguments, recursion.

Example problems: problems from unit 2, Sieve of eratosthenes, finding LCM, factorization, checking power of 2, checking for perfect-square, factorial, a^b, sqrt with binary search etc.

UNIT -IV

Python Sequences: List and List Operations, Using Lists to represent Matrices, Strings, String operations, Tuples, Exceptions and Debugging.

Example problems: counting characters, words and sentences in text, search and replace, finding median, max, min, mean, Matrix multiplication, sum of diagonals, dutch national flag, implementing linear, binary search, bubble sort

UNIT – V: Data Structures and Idiomatic Programming in Python

Dictionaries, Sets, Files. Modules, Packages and namespaces. Classes and Objects. Lambda functions, Comprehensions.

Example Problems: find unique/distinct elements in a string/list, sorting words in text based on frequency, finding common elements in two lists, count occurrences of some text in a file, etc.

UNIT -VI: Web Application Development

How the internet works. Intro to Web 1.0, 2.0 and 3.0. Simple web applications using HTML5, CSS3, JavaScript (very basic DOM manipulation only) and Flask. Storing data in cloud data stores. Deploying app on GCP. Intro to Source Control and GIT.

Text Books:

1. Think Python: How to Think Like a Computer Scientist , Allen B. Downey, 2nd Edition

Reference Books:

1. Core python programming, W Chun Pearson
2. Python programming a modern approach, Vamsi Kurama, pearson

Web resources:

1. https://studio.code.org/s/20-hour/
2. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
3. https://snakify.org

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Year / Semester	I B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Elements of Electrical and Electronic Engineering				

Course Objectives:

1 To learn the basic principles of electrical law's and analysis of networks.
2 To understand the principle of operation and construction details of DC machines.
3 To understand the principle of operation and construction details of the transformer.
4 To study the operation of PN junction diodes, half wave, full wave rectifiers and OP-AMPs.
5 To learn the operation of PNP and NPN transistors and various amplifiers.

Course Outcomes: After completing this course, the students will be able to

1. Analyze the various electrical networks.
2. Understand the operation of DC generators, 3-point starters and conduct the Swinburne's Test.
3. Analyze the performance of a transformer.
4. Analyze the operation of half wave, full wave rectifiers and OP- AMPs.
5. Explain the single stage CE amplifier and concept of feedback amplifier.

UNIT - I

DC Circuits: Electrical circuit elements (R - L and C) - Ohm's-Law, Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Mesh Analysis and Nodal Analysis. Superposition Theorem

UNIT - II

AC Circuits: Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL- RC- RLC series circuits.

UNIT - III

DC Machines: Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator – principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor

UNIT - IV

AC MACHINES: Principle and operation of Single-Phase Transformer - OC and SC test on transformer - principle and operation of Induction Motor [Elementary treatment only.

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UNIT-V

RECTIFIERS & LINEAR ICs: PN junction diodes, diode applications (Half wave and bridge rectifiers). Characteristics of operation amplifiers (OP- AMP) - application of OP-AMPs (inverting, non-inverting, integrator and differentiator).

UNIT-VI

TRANSISTORS: PNP and NPN junction transistor, transistor as an amplifier, single stage CE Amplifier, frequency response of CE amplifier, concepts of feedback amplifier.

TEXT BOOKS:

1. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI2006.
2. Electrical Technology by Surinder Pal Bali, Pearson Publications.
3. Electrical Circuit Theory and Technology by John Bird, Routledge Taylor & Francis Group

REFERENCE BOOKS:

1. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah,TMH Publications.
2. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications, 2nd edition.
3. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications, 2nd edition.
4. Industrial Electronics by G.K. Mittal,PHI.

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Year / Semester	I B. Tech / I Sem	L	T	P	C
Regulation	R19	1	0	3	2.5
Subject	Engineering Graphics & Design				

Course Objectives:

1. Engineering drawing being the principle method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales.
2. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

Course Outcomes:

Upon successful completion of this course, the student shall be able to:

1. Construct regular polygons and engineering curves using appropriate drawing methods.
2. Use different types of scales and apply orthographic projection techniques for points and lines.
3. Draw projections of straight lines inclined to one or both reference planes.
4. Represent projections of planes inclined to one or both principal planes.
5. Illustrate projections of various solids in different orientations.
6. Convert between isometric and orthographic views of 3D objects.

UNIT-I

Polygons: Construction of regular polygons by general methods, inscribing and describing polygons on circles.

Curves: Ellipse, Parabola and Hyperbola by general methods, Tangent & Normal and Ellipse by Oblong Method and Arcs of Circles Method

UNIT-II

Scales: Plain scale, Diagonal scale and Vernier scale.

Orthographic Projections: Introduction to Projections, Horizontal plane, Vertical plane, Profile plane, importance of reference lines.

Projections of points in various quadrants.

UNIT-III

Projections of straight lines inclined to one plane, inclined to both the planes, traces

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UNIT-IV

Projections of planes: inclined to one reference plane; inclined to both the reference planes.

UNIT-V

Projections of Solids – Projections of Prisms, Pyramids, Cones and Cylinders simple positions, the axis inclined to one of the reference planes.

UNIT-VI

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

Text Books:

1. Engineering Drawing by N.D. Bhatt, Charotar Publishing House Pvt. Ltd
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill
3. Engineering Drawing + AutoCAD by K. Venugopal, V. Prabhu Raja, New Age

Reference Books:

1. Engineering Drawing by K.L.Narayana& P. Kannaiah, Scitech Publications
2. Engineering Graphics for Degree by K.C. John, PHI Learning
3. Engineering Graphics by PI Varghese, McGrawHill Publishers.
4. Engineering Drawing by P.S. Gill, S.K. Kataria& Sons
5. Engineering Drawing by Venkata Reddy – B.S. Publications.

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Year / Semester	I B. Tech / I Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Applied Chemistry Lab				

Course Objectives:

1. To verify the fundamental concepts with experiments.
2. The experiments have been chosen to develop skill among the students so that they can measure, differentiate and analyze the best results.
3. This will help them to solve the engineering problems in their world of work.
4. To enhance the thinking capabilities in line with the modern trends in engineering and technology.

Course Outcomes: After completing this course, the students will be able to do the following

1. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations.
2. Exposed to a few instrumental methods of chemical analysis.
3. The student is exposed to different methods of chemical analysis and use of some commonly employed instruments.
4. Conductance phenomenon is better understood.

List Of Experiments:

1. Trial experiment - Determination of HCl using standard Na_2CO_3 solution.
2. Determination of alkalinity of a sample containing Na_2CO_3 and NaOH.
3. Determination of $KMnO_4$ using standard Oxalic acid solution.
4. Determination of Copper using standard $K_2Cr_2O_7$ solution.
5. Determination of temporary and permanent hardness of water using standard EDTA solution.
6. Determination of Vitamin – C
7. Determination of P^H of the given sample solution using P^H meter.
8. Conductometric titration between strong acid and strong base.
9. Potentiometric titration between strong acid and strong base.
10. Estimation of copper by Colorimetry
11. Estimation of KCl by Ion exchange resin method.
12. Photochemical Reduction of Ferric Salt (Blue-Printing)
13. Adsorption of acetic acid on charcoal.

14. Determination of rate of corrosion.
15. Preparation of a polymer.

Reference Books:

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.
2. Dr. Jyotsna Cherukuris (2012) Laboratory Manual of engineering chemistry-II, VGS Techno Series
3. Chemistry Practical Manual, Lorven Publications
4. Practical Engineering Chemistry, K. Mukkanti (2009) B.S. Publication

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Year / Semester	I B. Tech / I Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Problem Solving and Programming Lab				

Course Objectives:

1. Design and implement algorithms using flowcharts and Python.
2. Develop skills in recursion, iteration, and file handling.
3. Explore and analyze data processing techniques.
4. Build interactive web applications with Flask and front-end tools.
5. Solve mathematical and logical problems through hands-on tasks.

Course Outcomes: Student should be able to

1. Explain basing working of computer and program execution.
2. Develop flowcharts to solve the given problems.
3. Develop Python programs for numerical and text based problems.
4. Develop Python programs using beautiful Pythonic idiomatic practices.

Laboratory Experiments:

1. code.org fast intro to programming.
2. Construct flowcharts to
    a. Calculates the maximum, minimum and average of N numbers
    b. Develops a calculator to convert time, distance, area, volume and temperature from one unit to another.
3. Construct flowcharts with separate procedures to
    a. calculates simple and compound interest for various parameters specified by the user
    b. calculates the greatest common divisor using iteration and recursion for two numbers as specified by the user.
4. Construct flowcharts with procedures to
    a. generate first N numbers in the Fibonacci series
    b. generate N Prime numbers
5. Design a flowchart to perform Linear search on list of N unsorted numbers(Iterative and recursive)
6. Design a flowchart to perform Binary search on list of N sorted numbers(Iterative and recursive)
7. Design a flowchart to determine the number of characters and lines in a text file specified by the user

8. Design a Python script to convert a Binary number to Decimal number and verify if it is a Perfect number.
9. Design a Python script to determine if a given string is a Palindrome using recursion
10. Design a Python script to sort numbers specified in a text file using lists.
11. Design a Python script to determine the difference in date for two dates in YYYY:MM:DD format(0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.
12. Design a Python Script to determine the Square Root of a given number without using inbuilt functions in Python.
13. Design a Python Script to determine the time difference between two given times in HH:MM:SS format.(0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59)
14. Design a Python Script to find the value of (Sine, Cosine, Log, PI, *e*) of a given number using infinite series of the function.
15. Design a Python Script to convert a given number to words
16. Design a Python Script to convert a given number to a Roman number.
17. Design a Python Script to generate the frequency count of words in a text file.
18. Design a Python Script to print a spiral pattern for a 2 dimensional matrix.
19. Design a Python Script to implement Gaussian Elimination method.
20. Design a Python script to generate statistical reports(Minimum, Maximum, Count, Average, Sum etc) on public datasets.
21. Design a tic tac toe game in HTML/CSS/JavaScript with timer.
22. Project: Design a simple website with a flask backend. For example: a) student book loan/sell site for a hostel, b) Manage ToDo list, c) pizza order site, d) birthday cake site etc.

Text Book:

1. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf

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Year / Semester	I B. Tech / I Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Electrical & Electronics Engineering lab				

Section A: Electrical Engineering:

1. Verification of Kirchoffs Laws
2. Verification of Superposition Theorem.
3. Swinburne's test on D.C. Shunt machine (Predetermination of efficiency of a given D.C. Shunt machine working as motor and generator).
4. OC and SC tests on single phase transformer (Predetermination of efficiency and regulation at given power factors).
5. Speed control of D.C. Shunt motor by a) Armature Voltage control b) Field flux control method
6. Brake test on D.C. Shunt Motor.

Section B: Electronics Engineering:

1. PN junction Diode characteristics A. Forward bias, B. Reverse bias. (Cut in voltage & Resistance calculations)
2. Transistor CE Characteristics (Input and Output).
3. Full wave Rectifier with and without filters.
4. CE Amplifiers.

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Year / Semester	I B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	0
Subject	Environmental Science				

Course Objectives:

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

Course Outcomes:

Students will be able to

1. Articulate the basic structure, functions, and processes of key social systems affecting the environment.
2. Explain how Natural resources should be used.
3. Identify the threats to biodiversity.
4. Understand Causes, effects and control measures of environmental pollution.
5. Gain knowledge about watershed management and environmental ethics.
6. Gain a rigorous foundation in various scientific disciplines as they apply to environmental science, such as ecology, evolutionary biology, hydrology, and human behaviour.

UNIT –I Multidisciplinary nature of Environmental Science and Ecosystems.

Definition, Scope and Importance and sustainability – Need for public awareness- Human population and Environment.

Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem. – Types of ecosystems- Forest, Grassland, Desert and Aquatic ecosystems- Food chains, food webs and ecological pyramids.

UNIT – II Natural Resources

Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people

Water resources: Conflicts over water, dams – benefits and problems

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Energy resources: Growing energy needs- renewable and non-renewable energy sources.

Food resources – World food problems

Land resources- Wasteland reclamation.

Role of an individual in conservation of natural resources.

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UNIT – III Biodiversity and its conservation

Definition: Genetic, species and ecosystem diversity- classification - Value of biodiversity: consumptive use, productive use, social - Biodiversity at national and local levels. Hot-spots of biodiversity - Threats to biodiversity - Endangered and endemic species of India - conservation of biodiversity.

UNIT – IV Environmental Pollution

Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies.

Solid Waste Management: Sources, effects and control measures of urban and industrial solid wastes. Biomedical and e - waste management.

Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion.

UNIT – V Social Issues and the Environment

Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people. Environmental Protection Act –Air Act. –Water Act - Wildlife Protection Act -Forest Conservation Act- Public awareness.

International protocols: Stockholm and Rio Summit, Kyoto protocol and Montreal protocol.

UNIT – VI Environmental Management

Impact Assessment and its significance - various stages of EIA- Environmental audit, Ecotourism.

The student Visit of an Industry / Ecosystem.

TEXT BOOKS:

1. A Textbook of Environmental Studies, Shashi Chawla, TMH, New Delhi.
2. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
3. Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawad
2. Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
3. Text book of Environmental Science and Technology, Dr. M. Anji Reddy , BS Publications
4. Environment Studies, Anubha Kaushik, C P Kaushik, New Age International Publishers, 2014
5. Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

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I B.Tech II SEMESTER

CSE

R19 SYLLABUS

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Year / Semester	I B. Tech / II Sem	L	T	P	C
Regulation	R19	2	0	0	2
Subject	Communicative English				

Introduction:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training the students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competence of the students of Engineering.

As far as the detailed textbook is concerned, the focus should be on the skills of listening, speaking, reading and writing.

Thus the stress in the syllabus is primarily on the development of communicative skills and fostering of ideas.

Course Objectives:

1. Adopt activity based teaching-learning methods to ensure that the learners would be engaged in the use of language both in the classroom and the laboratory sessions.
2. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
3. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
4. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
5. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
6. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Course Outcomes:

At the end of the course, the learners will be able to

1. Identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English.
2. Formulate sentences using proper grammatical structures and correct word forms.
3. Speak clearly on a specific topic using suitable discourse markers in informal discussions.
4. Write summaries based on global comprehension of reading/listening texts.
5. Produce a coherent paragraph interpreting a figure/graph/chart/table.
6. Take notes while listening to a talk/lecture to answer questions.

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Methodology:

1. The class is to be learner-centered where the learners are to read the texts to get a comprehensive idea of those texts on their own with the help of the peer group and the teacher.
2. Integrated skill development methodology has to be adopted with focus on individual language skills as per the tasks/exercise.
3. The tasks/exercises at the end of each unit should be completed by the learners only and the teacher intervention is permitted as per the complexity of the task/exercise.
4. The teacher is expected to use supplementary material wherever necessary and also generate activities/tasks as per the requirement.
5. The teacher is permitted to use the lecture method when a completely new concept is introduced in the class.

Unit 1 **(10 periods)**

Reading: Skimming to get the main idea of a text

Reading for Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

Grammar and Vocabulary : Nouns and Pronouns; textual words

Learning Outcomes

At the end of the module, the learners will be able to

- ➢ employ suitable strategies for skimming to get the general idea of a text
- ➢ recognize paragraph structure with beginnings/endings
- ➢ using correct word forms of nouns and pronouns and textual words

Unit 2 **(10 periods)**

Reading: Scanning to look for specific pieces of information.

Writing: Writing sentences with proper word order - Basic Sentence Structures

Grammar and Vocabulary: Verbs - tenses; use of synonyms

Learning Outcomes

At the end of the module, the learners will be able to

- ➢ Employ suitable strategies for scanning to identify specific information from a text
- ➢ Write accurately using proper grammatical structures

Unit 3 **(10 periods)**

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

Writing: Paragraph writing using suitable cohesive devices; mechanics of writing - punctuation, capital letters.

Grammar and Vocabulary: Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions; use of synonyms

Learning Outcomes

At the end of the module, the learners will be able to

- ➢ write well structured paragraphs
- ➢ understand the use of cohesive devices

Assignment-I: Each Student is required to present a report on a problem faced by individuals or the society with an analysis and possible solutions. He/she has to make an oral presentation of it in the class before the completion of MID-I Examination. It is mandatory for all the students. It is for Internal Assessment.

Unit 4 **(10 periods)**

Reading: Note making; making notes from the text/material.

Writing: Types of Paragraph writing Grammar and Vocabulary : Subject-verb agreement, Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

Learning Outcomes

At the end of the module, the learners will be able to

- ➢ make notes of the important information of a text
- ➢ understanding types of paragraphs
- ➢ use language appropriate adjective and adverbs for descriptions

Unit 5 **(10 periods)**

Reading: Reading for comprehension.

Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.

Grammar and Vocabulary: direct and indirect speech, reporting verbs for academic purposes. Learning Outcomes

At the end of the module, the learners will be able to

- ➢ write summaries based on global comprehension of reading/listening texts
- ➢ understand a paragraph

Unit 6 **(10 periods)**

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships etc.

Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables.

Grammar and Vocabulary: Active Voice- Passive Voice; editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Learning Outcomes

At the end of the module, the learners will be able to

- ➢ interpret data from the given charts/tables/graphs
- ➢ edit short texts by correcting common errors

Assignment-II: Each Student is required to present the information regarding one novel prescribed in course. He/she has to make an oral presentation of it in the class before the completion of MID-II Examination. It is mandatory for all the students. It is for Internal Assessment.

Detailed Textbook: Prescribed by JNTUK for Reading and Writing

Non-Detailed Textbook: Wings of Fire: APJ Abdul Kalam

Reference Books

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

Web Resources

- Grammar/Listening/Writing
- 1-language.com
- http://www.5minuteenglish.com/
- https://www.englishpractice.com/
- Grammar/Vocabulary
- English Language Learning Online
- http://www.bbc.co.uk/learningenglish/
- http://www.better-english.com/
- http://www.nonstopenglish.com/
- https://www.vocabulary.com/
- BBC Vocabulary Games
- Free Rice Vocabulary Game
- Reading
- https://www.usingenglish.com/comprehension/

- https://www.englishclub.com/reading/short-stories.htm
- https://www.english-online.at/
- Listening
- https://learningenglish.voanews.com/z/3613
- http://www.englishmedialab.com/listening.html
- Speaking
- https://www.talkenglish.com/BBC Learning English – Pronunciation tips
- Merriam-Webster – Perfect pronunciation Exercises
- All Skills
- https://www.englishclub.com/
- http://www.world-english.org/
- http://learnenglish.britishcouncil.org/
- Online Dictionaries
- Cambridge dictionary online
- MacMillan dictionary
- Oxford learner's dictionaries

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Year / Semester	I B. Tech / II Sem	L	T	P	C
Regulation	R19	3	1	0	4
Subject	Mathematics-II (Probability and Statistics)				

Course Objectives: Enable the students to

1. Familiarize the foundations of probability and statistical methods
2. Impart probability concepts and statistical methods in various applications in engineering studies
3. Know the Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies
4. Make use of method of least squares to fit a best curve for the given data and apply the regression analysis to fit the curves
5. Decide the null or alternative hypotheses using the suitable test statistic
6. Draw the Control charts like X-bar, p and R-charts

Course Learning Outcomes:

Upon completing this course, the student should be able to

1. Compute descriptive statistics and interpret in data science problems
2. Compute probability and conditional probability of events for data sciences
3. Compute probability distribution and fit problems to data
4. Compute various linear and nonlinear regression models to the data
5. Compute inferential statistics to test hypothesis
6. Apply the methods of control charts like X-bar, R, p etc for quality control problems

Unit-I: Descriptive statistics and methods for data science

Data science, Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Type of variables: dependent and independent Categorical and Continuous variables, Data visualization, Measures of Central tendency, Measures of Variability (spread or variance), Skewness, Kurtosis

Unit-II: Introduction to Probability

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Bayes theorem, random variables (discrete and continuous), properties, mathematical expectation.

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Unit-III: Probability Distributions

Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution- properties, fitting of Binomial distribution, Poisson distribution.

Unit-IV: Correlation & Regression

Correlation and Regression**:** Simple Bivariate Correlation: Karl Pearson‘s coefficient of correlation, Spearman‘s Rank correlation coefficient.

Linear Regression - Regression lines, Regression coefficients, properties.

Non-Linear Regression - Quadratic, Power and Exponential models.

Unit-V: Tests of Hypothesis

Null and Alternative Hypothesis, One tail and two tailed tests, Type I and Type II errors. Tests of hypothesis using Student‘s t-distribution, F-test and χ^2test goodness of fit.

Unit-VI: Statistical Quality Control Methods

Introduction- Methods for preparing control charts – problems, using X- bar, R charts, p chart, np chart

Text Books:

1. Miller and Freunds, 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.

References:

1. T.S.R. Murthy, Probability and Statistics for engineers, 1st edition, BS Publications, 2018.
2. T.K.V.Iyengar, B. Krishna Ghandhi, S. Ranganathan and M.V.S.S.N.Prasad, Engineering Mathematics, Volume-I, 12th Ed., S. Chand Publishers, 2014
3. B. V. Ramana, Engineering Mathematics, 4th Ed., Tata McGraw Hill, New Delhi, 2009
4. S. Ross, a First Course in Probability, Pearson Education India, 2002.

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Year / Semester	I B. Tech / II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Applied Physics				

Course Objectives:

1. To highlight the importance of physics concepts in Engineering & Technology.
2. To facilitate the students with the aid of advanced insight in applied science.
3. To focus on the real time applications of physics in engineering fields.
4. To prepare the students to face the challenges in core fields with the support of physical principles.
5. To motivate the students to understand the Engineering Principles through basic ideas in Physics.

Course Outcomes:

Upon the completion of the course the students will be able to:

1. Interpret the interaction of energy with the matter.
2. Explain the concepts and applications of Dielectrics.
3. Classify the magnetic materials based on susceptibility and their temperature dependence.
4. Identify the applications of optical fibers in various fields.
5. Learn classification of semiconductors and their real time applications.
6. Understand the principle and background of superconductors

UNIT-I: WAVE OPTICS

Interference-Principle of Superposition-Interference of light-Theory of Interference fringes-Conditions for Sustained Interference -Interference in thin films (reflected light)-Newton's Rings-Determination of Wavelength. Diffraction- types of Diffraction, Fraunhofer Diffraction-Single slit, Double slit -Diffraction Grating -Determination of Wavelength. Polarization- types of polarized light, Polarization by reflection, refraction and double refraction-Nicol's prism-Half wave and Quarter wave plate- Engineering applications of Interference, Diffraction and Polarization.

UNIT-II: DIELECTRICS

Introduction to Dielectrics--Electric polarization-Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations with mathematical Derivations –Frequency dependence of polarization-Lorentz(internal) field-Clausius -Mossotti equation-Applications of Dielectrics.

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UNIT-III: MAGNETIC MATERIALS

Introduction -Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials-Weiss theory of ferromagnetism (qualitative)-Hysteresis-soft and hard magnetic materials-Ferrites-Magnetic device applications.

UNIT-IV: FIBER OPTICS

Introduction to Optical Fibers-Total Internal Reflection- Construction of optical fibers -Acceptance angle-Numerical Aperture-Classification of fibers based on Refractive index profile, modes - Propagation of electromagnetic wave through optical fiber -l Applications -Block Diagram of Fiber optic Communication.

UNIT-V: SEMICONDUCTORS

Origin of energy bands - Classification of solids based on energy bands – Intrinsic semiconductors - density of charge carriers-Fermi energy – Electrical conductivity – extrinsic semiconductors - P-type & N-type - Density of charge carriers - Dependence of Fermi energy on carrier concentration and temperature- Direct and Indirect band gap semiconductors-Hall effect- Hall coefficient - Applications of Hall effect - Drift and Diffusion currents – Einstein's equation - Applications of Semiconductors.

UNIT-VI: SUPERCONDUCTORS

Introduction to Superconductors-Properties-Critical parameters of Superconductors- Meissner's effect-BCS Theory-Josephson effect (AC & DC)-Types of Superconductors-High Tc Superconductors-SQUID-Superconductors Applications

Text books:

1. M.N. Avadhanulu, P.G.Kshirsagar "A Textbook of Engineering Physics"-S.ChandPublications,2017
2. H.K.Malik AK.Singh "Engineering Physics",- McGraw Hill Publishing Company Ltd, 2018

Reference Books:

1. David J.Griffiths, "Introduction to Electrodynamics"- 4/e, Pearson Education,2014
2. Gerd Keiser "Optical Fiber Communications"- 4/e, Tata Mcgraw Hill ,2008
3. Charles Kittel "Introduction to Solid State Physics",Wiley Publications,2011
4. S.M.Sze "Semiconductor devices-Physics and Technology"-Wiley,2008
5. T Pradeep "A Text book of NanoScience and NanoTechnology"- Tata Mcgraw Hill 2013

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Year / Semester	I B. Tech / II Sem	L	T	P	C
Regulation	R19	2	1	0	3
Subject	AI Tools, Techniques and Applications				

Course Objectives: To enable the students

1. Define AI and ML and understand their relationship with data
2. Learn importing data and exploring using Python
3. understand different data wrangling techniques and their significance
4. Understand different types of supervised learning and build various regression models
5. Understand basic math fundamentals of this domain
6. Understand performance metrics
7. Understand classification as part of supervised learning and demonstrate and evaluate different classification techniques and models in Python
8. Intuitively understand basic math fundamental behind each technique
9. Explain the mechanism of unsupervised learning and practice various clustering techniques in Python.
10. Understand Dimensionality reduction and its importance
11. Comprehend text mining and its applications
12. Understand basic working of recommender system
13. know probabilistic learning models and their applications

Course Outcomes: Students should be able to

1. Explain the importance of AI.
2. Analyze concepts of Machine Learning algorithms and their limitations.
3. Design and develop Chatbots based on the requirements.
4. Solve complex problems involving image processing, such as quality control, visual surveillance, multimodal human-machine interfaces, and image compression.
5. Apply Reinforcement Learning in real-world scenarios.
6. Develop smart solutions for various domains.

Unit I: Intro and basic tools in Python

Introduction to AI and Machine Learning. Emergence of AI. Relationship between AI, ML and Data Science. Types of Machine Learning with definitions and application areas. Data wrangling and manipulation using Numpy and Pandas in Python. Types of data. Data visualization using matplotlib and seaborn.

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Unit II: Supervised learning - Regression

Introduction, KNN, Linear Regression, Least Squares, Mean Square Error. Plotting regression line and predicting with ScikitLearn.Gradient Descent. Stochastic Gradient Descent. Learning rate. Higher Order curves. Modifying code in scipy to switch to higher order polynomial fitting. Over fitting, Underfitting. Regularization. Measures of accuracy.Train-Test-Split. k-fold Cross Validation. Hyperparameter tuning.

Unit III: Supervised Learning - Classification

Definition of classification, use cases and algorithms using Scikit Learn, KNN, Logistic Regression, Decision Tree classifier, Support Vector Machines, Performance measures

Unit IV: Unsupervised Learning

Definition, K-Means, Hierarchical clustering techniques. Dimensionality reduction using PCA. Feature Engineering – selection, factor analysis.Time series modeling (time series data types, stationarity and ARIMA modeling)

Unit V: Natural Language Processing / Text mining

Introduction Applications, Chatbots, virtual agents (Alexa, Google Assistant, Siri). Importance, Applications, NLP Subproblems. Components of Natural Language. Steps to get text data into workable format.Terms Frequency, Inverse Document Frequency, Bag of Words, ngram, One hot encoding. Notion of corpus. Intro to NLTK and use

Unit VI: Intro to other common learning methods and applications

Intro to ANN and deep learning with applications, intro to ensemble learning with bagging and boosting, random forest and ada boost, time series modelling, Intro to probabilistic methods with terminology and applications. Naïve Bayes. Recommender systems, collaborative filtering, association Rule Mining, apriori algorithm.

Text Books:

1. Stuart J. Russell and Peter Norvig,Artificial Intelligence A Modern Approach
2. Tom Markiewicz & Josh Zheng,Getting started with Artificial Intelligence,Published by O'Reilly Media,2017
3. Stuart J. Russell and Peter Norvig,Artificial Intelligence A Modern Approach

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References:

1. Build an AI Assistant with Wolfram Alpha and Wikipedia in Python. https://medium.com/@salisuwy/build-an-ai-assistant-with-wolfram-alpha-and-wikipedia-in-python-d9bc8ac838fe
2. Tom Markiewicz & Josh Zheng,Getting started with Artificial Intelligence,Published by O'Reilly Media,2017
3. Joseph Howse, Prateek Joshi, Michael Beyeler - Opencv_ Computer Vision Projects with Python-Packt Publishing (2016)
4. Tom Markiewicz & Josh Zheng,Getting started with Artificial Intelligence,Published by O'Reilly Media,2017
5. Curated Datasets on Kaggle https://www.kaggle.com/datasets
6. AurélienGéron,Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media,2017

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Year / Semester	I B. Tech / II Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	English Communication Skills Lab				

Course Objectives

1. To sensitize the nuances of English speech sounds.
2. To bring about a consistent accent and intelligibility in students‘ pronunciation of English by providing an opportunity for practice in speaking.
3. To improve the fluency in spoken English in different contexts.
4. To demonstrate the synchronization of verbal and non verbal communication.
5. To speak with clarity and confidence.
6. To enrich the persuasive skills.

Course Outcomes:

The students will be able to:

1. Comprehend the importance of phonetics and interpret phonetic symbols, vowels and consonants.
2. Describe the speech sounds – vowels and consonants, stress and intonation.
3. Enable writing situational dialogues and enact Role Play.
4. Exemplify the synchronization of verbal and non verbal communication through the JAM session.
5. Enrich presentation skills through oral presentations - prepared and extempore.
6. Develop oratory skills through Debate.

MODULE – I

Listening: Identifying the topic, the context and overall idea by listening to short audio texts and answering a series of questions.

Non Verbal Communication (2 sessions)

MODULE – II

Listening: Answering a series of questions about specific information after listening to audio texts.

Introduction to Phonetics – Sounds of English – Vowels and Consonants (3 sessions)

MODULE – III

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

Reading with proper Stress and Intonation –Speech shadowing (3 sessions)

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MODULE– IV

Listening: Listening for global comprehension and summarizing what is listened to.

Situational Dialogues/Role Plays, Just a Minute (4 sessions)

MODULE– V

Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others (2 sessions)

MODULE – VI

Formal oral presentations on topics from academic contexts - without the use of PPT slides. (3 sessions)

INFRASTRUCTURE:

1. 60 computer systems for a class of 60 students.
2. LAN facility and English Language Software for self-study by learners.
3. Audio System
4. Projector

SYSTEM REQUIREMENT: Hardware Component

1. P – IV Processor
2. Speed – 2.8 GHZ
3. RAM – 512 MB minimum
4. Hard Disk – 80 GB
5. Headphones of high quality

SUGGESTED SOFTWARE

1. Cambridge Advanced Learners‘ English Dictionary with CD.
2. Grammar Made Easy by Darling Kindersley
3. Punctuation Made Easy by Darling Kindersley
4. Clarity Pronunciation Power – Part I
5. Clarity Pronunciation Power – part II
6. Oxford Advanced Learner‘s Compass, 7th Edition
7. DELTA‘s key to the Next Generation TOEFL Test: Advanced Skill Practice.
8. MELL - K Van Solutions Software
9. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
10. English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge
11. English Pronunciation in Use, Cambridge University Press
12. Technical Communication, OUP
13. Communication Skills, OUP

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SUGGESTED READING

1. Speaking English Effectively 2 nd Edition by Krishna Mohan and N. P. Singh, 2011. Macmillan Publishers India Ltd. Delhi.
2. Sasi Kumar, V & Dhamija, P.V. How to Prepare for Group Discussion and Interviews. Tata McGraw Hill
3. Hancock, M. 2009. English Pronunciation in Use. Intermediate. Cambridge: CUP
4. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & amp; J. B. Harrison.2013 Orient Blackswan. Hyderabad.
5. Hewings, M. 2009. English Pronunciation in Use. Advanced. Cambridge: CUP
6. Marks, J. 2009. English Pronunciation in Use. Elementary. Cambridge: CUP
7. Nambiar, K.C. 2011. Speaking Accurately. A Course in International Communication. New Delhi : Foundation
8. Soundararaj, Francis. 2012. Basics of Communication in English. New Delhi: Macmillan
9. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
10. English Pronouncing Dictionary Daniel Jones Current Edition with CD.
11. A TEXT BOOKS of English Phonetics for Indian Students by T. Balasubramanian (Macmillan)

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Year / Semester	I B. Tech / II Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Applied Physics Lab				

Course Objectives:

1. To highlight the importance of physics concepts in Engineering&Technology.
2. To facilitate the students with the aid of advanced insight in applied science.
3. To focus on the real time applications of physics in engineering fields.
4. To prepare the students to face the challenges in core fields with the support of physical principles.
5. To motivate the students to understand the Engineering Principles through basic ideas in Physics.

Course Outcomes(COs):

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

1. Analyze and apply the concepts of oscillations and of wave (sonometer, melde's experiment).
2. To interpret the intensity variation of light due to polarization, interference and diffraction.
3. Compare the intensity of the magnetic field theoretically and experimentally.
4. To study simple harmonic motion and the factors that affect the period of oscillation of pendulums.
5. Explain how frequency effects the impedance and to calculate resonant frequency.
6. To Interpret various applications of zener diode.

List of Experiments:

1. Determination of wavelength of a source-Diffraction Grating-Normal incidence
2. Newton's rings –Radius of Curvature of Plano Convex Lens.
3. Determination of thickness of a thin object using parallel interference fringes.
4. Determination of Rigidity modulus of a material- Torsional Pendulum.
5. Determination of Acceleration due to Gravity and Radius of Gyration- Compound Pendulum.
6. Melde's experiment – Transverse and Longitudinal modes.
7. Verification of laws of stretched string – Sonometer.
8. Determination of velocity of sound – Volume resonator.
9. L C R Series Resonance Circuit
10. Study of I/V Characteristics of Semiconductor diode
11. I/V characteristics of Zener diode
12. Thermistor characteristics – Temperature Coefficient
13. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.

14. Energy Band gap of a Semiconductor p.n junction.
15. Hall Effect for Semiconductors.

REFERENCE:

1. Engineering Physics Lab Manual by Dr.Y. Aparna &Dr.K.Venkateswarao (V.G.S.Book links)
2. Physics Practical Manual, Lorven Publication.

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Year / Semester	I B. Tech / II Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	AI Tools, Techniques and Applications Lab				

Course Objectives:

1. To teach students how to label images using AI tools.
2. To help students create custom models for object and sentiment recognition.
3. To train students to use speech recognition and synthesis in AI apps.
4. To guide students in building and improving neural networks.
5. To help students create AI-based chatbots and virtual assistant

Course Outcomes: The students will be able to

1. Label images using object recognition in Supervision.
2. Create models for object and sentiment recognition using Lobe.ai and Teachable Machine
3. Use speech recognition and build chatbots with Liv.ai and AWS Lex.
4. Design and test a CNN for cat vs dog image classification.

Practical Experiments:

1. Supervision - Perform Data Labelling for various images using object recognition
2. Lobe.ai - Build custom models using the visual tool for Object recognition and sentiment analysis that can convert facial expressions into emoticons
3. Teachable Machine - In Browser Object Recognition through Brain.JS
4. Liv.ai - App for Speech recognition and Synthesis through APIs
5. Building a Chatbot using AWS Lex, Pandora bots
6. Configure an existing Neural Network by manipulating various parameters involved
7. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python
8. Build a Convolutional Neural Network for Cat vs Dog Image Classification

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Year / Semester	I B. Tech / II Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Computer Programming Lab				

Course Objectives:

1. Understand the basic concept of C Programming, and its different modules that include conditional and looping expressions, Arrays, Strings, Functions, Pointers, Structures and File programming.
2. Acquire knowledge about the basic concept of writing a program.
3. Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.
4. Use of conditional expressions and looping statements to solve problems associated with conditions and repetitions.
5. Role of Functions involving the idea of modularity.

Course Outcomes: The students will be able to

1. Apply logical ability to solve problems.
2. Develop programs using the C programming development environment, including compiling, debugging, linking, and executing.
3. Analyze problems, modularize them into small components, and convert them into programs.
4. Implement pointers, memory allocation techniques, and file handling to solve a variety of problems.

Programming

Exercise - 1 Basics

a) What is an OS Command, Familiarization of Editors - vi, Emacs
b) Using commands like mkdir, ls, cp, mv, cat, pwd, and man
c) C Program to Perform Adding, Subtraction, Multiplication and Division of two numbers From
d) Command line

Exercise - 2 Basic Math

a) Write a C Program to Simulate 3 Laws at Motion
b) Write a C Program to convert Celsius to Fahrenheit and vice versa

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Exercise - 3 Control Flow - I

a) Write a C Program to Find Whether the Given Year is a Leap Year or not.
b) Write a C Program to Add Digits & Multiplication of a number

Exercise – 4 Control Flow - II

a) Write a C Program to Find Whether the Given Number is
    i) Prime Number
    ii) Armstrong Number
b) Write a C program to print Floyd Triangle
c) Write a C Program to print Pascal Triangle

Exercise – 5 Functions

a) Write a C Program demonstrating of parameter passing in Functions and returning values
b) Write a C Program illustrating Fibonacci, Factorial with Recursion without Recursion

Exercise – 6 Control Flow - III

a) Write a C Program to make a simple Calculator to Add, Subtract, Multiply or Divide Using switch...case
b) Write a C Program to convert decimal to binary and hex (using switch call function the function)

Exercise – 7 Functions - Continued

a) Write a C Program to compute the values of sinx and cosx and e^x values using Series expansion. (use factorial function)

Exercise – 8 Arrays

a) Demonstration of arrays
    i) Search-Linear.
    ii) Sorting-Bubble, Selection.
    iii) Operations on Matrix.

Exercises - 9 Structures

a) Write a C Program to Store Information of a Movie Using Structure
b) Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
c) Write a C Program to Add Two Complex Numbers by Passing Structure to a Function

Exercise - 10 Arrays and Pointers

a) Write a C Program to Access Elements of an Array Using Pointer
b) Write a C Program to find the sum of numbers with arrays and pointers.

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Exercise – 11 Dynamic Memory Allocations

a) Write a C program to find the sum of n elements entered by the user. To perform this program, allocate memory dynamically using malloc () function.

b) Write a C program to find the sum of n elements entered by the user. To perform this program, allocate memory dynamically using calloc() function. Understand the difference between the above two programs

Exercise – 12 Strings

a) Implementation of string manipulation operations with library functions.

i) copy

ii) concatenate

iii) length

iv) compare

a) Implementation of string manipulation operations without library function.

i) copy

ii) concatenate

iii) length

iv) compare

Exercise -13 Files

a) Write a C programming code to open a file and to print its contents on screen.

b) Write a C program to copy files

Exercise - 14 Files Continued

a) Write a C program that merges two files and stores their contents in another file.

b) Write a C program to delete a file.

Note:

a) All the Programs must be executed in the Linux Environment. (Mandatory)

b) The Lab record must be a print of the LATEX (.tex) Format.

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Year / Semester	I B. Tech / II Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Engineering Workshop and IT Workshop				

Engineering Workshop

Course Objective:

1. To impart hands-on practice on basic engineering trades and skills. Note: At least two exercises to be done from each trade.

Trades:

Fitting

1. Vee Fit
2. Square Fit
3. Half Round Fit
4. Dovetail Fit

Carpentry

1. T-Lap Joint
2. Cross Lap Joint
3. Dovetail Joint
4. Mortise and Tenon Joint

Tin Smithy

1. Taper Tray
2. Square Box without lid
3. Open Scoop
4. Funnel

Black Smithy

1. Round rod to Square
2. S-Hook
3. Round Rod to Flat Ring
4. Round Rod to Square headed bolt

House Wiring

1. Parallel / Series Connection of three bulbs
2. Stair Case wiring
3. Fluorescent Lamp Fitting
4. Measurement of Earth Resistance

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IT Workshop

Course Objectives:

1. Understand the basic components and peripherals of a computer.
2. To become familiar in configuring a system.
3. Learn the usage of productivity tools.
4. Acquire knowledge about netiquette and cyber hygiene.
5. Get hands on experience in troubleshooting a system.

Course Outcomes: The students will be able to

1. Identify and assemble computer hardware components and peripherals.
2. Install and configure operating systems and software applications.
3. Develop and format documents, spreadsheets, presentations, and databases using productivity tools.
4. Troubleshoot hardware and software issues and configure network settings.

List of Programs:

1. System Assembling, Disassembling and identification of Parts / Peripherals
2. **Operating System Installation**-Install Operating Systems like Windows, Linux along with necessary Device Drivers.
3. **MS-Office / Open Office**
   a. **Word** - Formatting, Page Borders, Reviewing, Equations, symbols.
   b. **SpreadSheet** - organize data, usage of formula, graphs, charts.
   c. **Power point** - features of powerpoint, guidelines for preparing an effective presentation.
   d. **Access**- creation of database, validate data.
4. **Network Configuration & Software Installation**-Configuring TCP/IP, proxy and firewall settings. Installing application software, system software & tools.
5. **Internet and World Wide Web**-Search Engines, Types of search engines, netiquette, cyber hygiene.
6. TroubleShooting-Hardware troubleshooting, Software troubleshooting.
7. **MATLAB-** basic commands, subroutines, graph plotting.
8. **LATEX**-basic formatting, handling equations and images.

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Text Books:

1. Computer Hardware, Installation, Interfacing, Troubleshooting and Maintenance, K.L. James, Eastern Economy Edition.
2. Microsoft Office 2007: Introductory Concepts and Techniques, Windows XP Edition ByGary B. Shelly, Misty E. Vermaat and Thomas J. Cashman (2007, Paperback).
3. LATEX- User's Guide and Reference manual, Leslie Lamport, Pearson, LPE, 2/e.
4. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers, Rudraprathap, Oxford University Press, 2002.
5. Scott Mueller's Upgrading and Repairing PCs, 18/e, Scott. Mueller, QUE, Pearson, 2008
6. The Complete Computer upgrade and repair book, 3/e, Cheryl A Schmidt, Dreamtech.
7. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech.
8. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.

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Year / Semester	I B. Tech / II Sem	L	T	P	C
Regulation	R19	3	0	0	0
Subject	Constitution of India				

Course Objectives:

1. To train students in understanding the basic structure of Indian Constitution
2. To prepare students to live better and happily with other fellow beings through the application of Fundamental Rights in their lives.

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

1. Examine salient features of the Indian Constitution and live accordingly in society.
2. Interpret the meaning of Fundamental Rights and Directive Principles of State Policy and develop an attitude which paves the way for better living conditions.
3. Discover various aspects of Union Government legislation and live up to the expectations of the rules.
4. Critically examine State Government legislation and improve your living standards by following the rules strictly
5. Examine powers and functions of local bodies such as Municipalities and Panchayats and, take advantage of available resources for better living
6. Analyze the powers and functions of Election Commission and The Union Public Service Commission and decide upon it for safe and secure life.

UNIT-I: Introduction to Indian Constitution

Meaning of the term Indian Constitution –Preamble- Constituent Assembly- Salient Features of Indian Constitution.

UNIT-II: Fundamental Rights

Fundamental Rights -Fundamental Duties -The Directive Principles of State Policy

UNIT-III: Union Government

Union Government -Union Legislature (Parliament) -Lok Sabha and Rajya Sabha (with Powers and Functions) -Union Executive -President of India (with Powers and Functions) -Prime Minister of India (with Powers and Functions) -Union Judiciary (Supreme Court) -Jurisdiction of the Supreme Court

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UNIT-IV State Government

State Government -State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council / Vidhan Parishad) -Powers and Functions of the State Legislature -State Executive-Governor of the State (with Powers and Functions) -The Chief Minister of the State (with Powers and Functions) -State Judiciary (High Courts)

UNIT-V: Local Self Governance

Powers and functions of Municipalities, Panchayats, ZP's and Co – Operative Societies

UNIT-VI: Sovereign Bodies

Election Commission of India (with Powers and Functions) -The Union Public Service Commission (with Powers and Functions)

Text Books:

1. Introduction to constitution of India, Durga Das Basu, LexisNexis Publications
2. Constitution of India by PROFESSIONAL BOOK PUBLISHERS
3. The Constitution of India by Arun K Tiruvengadam, Bloomsbury publishers.
4. The constitution of India by PM Bakshi, Universal law publishing co
5. The Constitution of India by S.R. Bhansali, Universal law publishing co

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II B.Tech I SEMESTER

CSE

R19 SYLLABUS

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Year / Semester	II B. Tech / I Sem	L	T	P	C
Regulation	R19	2	1	0	3
Subject	Discrete Mathematical Structures				

Course Objectives:

1. Introduce the concepts of mathematical logic.
2. Introduce the concepts of sets, relations, and functions.
3. Perform the operations associated with sets, functions, and relations.
4. Introduce generating functions and recurrence relations.
5. Relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.
6. To use Graph Theory for solving problems.

Course Outcomes: The students will be able to

1. Apply propositional and predicate logic to construct truth tables, normal forms, and inference rules.
2. Solve problems using number theory concepts like divisibility, GCD, prime testing, and modular arithmetic.
3. Analyze set theory, relations, functions, and lattices to model mathematical structures.
4. Apply combinatorial techniques such as permutations, combinations, and binomial theorems in problem-solving.
5. Explore graph theory concepts, including matrix representations, Eulerian and Hamiltonian graphs, and spanning trees.
6. Solve recurrence relations using generating functions and characteristic roots.

UNIT-I:

Mathematical Logic : Propositional Calculus: Statements and Notations, Connectives, Truth Tables, Tautologies, Equivalence of Formulas, Duality law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof. Predicate calculus: Predicative Logic, Statement Functions, Variables and Quantifiers, Inference theory for predicate calculus.

UNIT-II:

Number Theory: Number Theory: Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem)

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UNIT-III:

Set Theory: Introduction, Operations on Binary Sets, Principle of Inclusion and Exclusion.

Relations: Properties of Binary Relations, Relation Matrix and Digraph, Operations on Relations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering Relations, Hasse Diagrams.

Functions: Bijective Functions, Composition of Functions, Lattices and its Properties

UNIT-IV:

Combinatorics: Basic of Counting, Permutations, Permutations with Repetitions, Circular Permutations, Restricted Permutations, Combinations, Restricted Combinations, Generating Functions of Permutations and Combinations, Binomial and Multinomial Coefficients, Binomial and Multinomial Theorems, Pigeonhole Principle and its Application.

UNIT-V:

Graph Theory: Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and
Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).

UNIT-VI:

Recurrence Relations: Generating Functions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations

TEXT BOOKS :

1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rdEdition, Tata McGraw Hill.
3. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.

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REFERENCE BOOKS:

1. Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel, T.P. Baker, 2nd Edition, Prentice Hall of India.
2. Discrete Mathematical Structures, Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, PHI.
3. Discrete Mathematics, S. K. Chakraborthy and B.K. Sarkar, Oxford, 2011.

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Year / Semester	II B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Internet of Things				

Course Objectives

1. To understand the fundamentals of the Internet of Things and to know the physical design, logical design and various IoT level models.
2. To teach a student how to design IoT applications and to know the various communication models and protocols.
3. To understand the fundamentals of 8051 Microcontroller and various IoT Platforms.
4. To build a real time IoT application and deploy using Arduino,NodeMCU8266 and Raspberry Pi.
5. To understand various Cloud Computing platforms and Big Data analytics applied in IoT.

Course Outcomes: The students will be able to

1. Explain IoT concepts, architecture, design, and applications.
2. Analyze IoT design and compare wireless protocols like Zigbee, Wi-Fi, Bluetooth, LPWANs, and 5G.
3. Explore microcontrollers, the 8051 instruction set, and IoT development boards.
4. Evaluate IoT communication protocols for efficient data exchange.
5. Develop IoT applications using Raspberry Pi, Python, NodeMCU, and Arduino.
6. Implement cloud platforms, big data analytics, and address IoT challenges.

UNIT-I :

Introduction to IoT : Introduction to IoT-Characteristics-Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs.

UNIT-II:

IoT Design and Wireless Communication Protocols : IoT Design Methodology , IoT Components, IoT Design Methodology using home automation and Weather monitoring, Wireless Communication Protocols : 6LoWPAN, Zigbee, WIFI, , Bluetooth and BLE ,LPWANs,Cellular 4G,5G,RFID, Lifi,Widi.

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UNIT-III:

8051 Microcontroller and IoT Development Boards : Introduction to Microcontrollers, the 8051 Instruction Set, AT89S8253 Microcontroller, Assembly Language, IoT Development Boards -NodeMCU, ESP8266, Arduino, Intel Galileo and Raspberry Pi.

UNIT-IV:

IoT Protocols : MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP,XMPP and gateway protocols, IEEE 802.15.4 protocols.

UNIT-V:

Building IoT Applications with Raspberry Pi : Building IoT with RASPBERRY PI- IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python, Introduction to NodeMCU, Arduino and working example.

UNIT-VI:

IoT Platforms, Cloud and Big Data in IoT : Introduction to Cloud computing : Cloud Computing, clouds types and their features, Open Source IoT Platforms, AWS cloud for IoT, ThingSpeak, Python Web Application Framework, Django, AWS web services for IoT.

Introduction to Big Data Analytics : Introduction Big Data, Apache Hadoop framework , Apache Spark and Python Web Application Framework, Django, Data Analytics.

Challenges in IoT and future directions.

Text Books:

1. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015.
2. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
3. Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model, Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, Springer

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Year / Semester	II B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Data Structures and Algorithms				

Course Objectives:

1. The fundamental design, analysis, and implementation of basic data structures.
2. Basic concepts in the specification and analysis of programs.
3. Principles for good program design, especially the uses of data abstraction.
4. Significance of algorithms in the computer field.
5. Various aspects of algorithm development.
6. To present different sorting algorithms.

Course Outcomes: The students will be able to

1. Analyze algorithm complexity and performance of sorting and searching techniques.
2. Implement linear and non-linear data structures using arrays and linked lists.
3. Develop solutions using stack and queue operations, including recursion and conversion.
4. Apply tree-based structures and heap operations for data organization.
5. Construct and optimize search trees using AVL and Red-Black trees.
6. Implement graph traversal algorithms and apply hashing techniques with collision resolution methods.

UNIT-I:

Algorithms, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big Oh, Omega and Theta notations, Complexity Analysis Examples. Searching and Sorting: Linear and binary search methods. Bubble sort, Insertion sort, Selection Sort, Quicksort, Merge sort, Heap sort, comparison of sorting methods.

UNIT-II:

Data structures-Linear and non linear data structures, Linear List, Array representation, Linked representation, Vector representation, singly linked lists -insertion, deletion, search operations, doubly linked lists-insertion, deletion operations, circular lists. Representation of single, two-dimensional arrays

UNIT-III:

Stack and Queue, array and linked list representations, infix to postfix conversion using stack, implementation of recursion, Circular queue-insertion, and deletion, Dequeue, array and linked list representations.

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UNIT-IV:

Trees- Ordinary and Binary trees terminology, Properties of Binary trees, Binary tree representations, recursive and non-recursive traversals, Inserting a Node into a Threaded Binary Tree, Heaps, Definition of a Max Heap, Insertion into a Max Heap, Deletion from a Max Heap, Priority Queues.

UNIT-V:

Search trees- Binary search tree-Binary search tree, insertion, deletion and searching operations, Balanced search trees, AVL trees-Definition, operations, Red-Black trees –Definition, operations.

UNIT-VI:

Graphs- Introduction, Definition, Graph Representation, Elementary Graph Operations – Vertex Insertion, Vertex Deletion, Edge Insertion, Edge Deletion etc, Depth First Search, Breadth-First Search

Hashing: Definition, Hash table, Hash function, Collision, Collision Evaluation Techniques-Chaining, Open Addressing.

Text Books:

1. Data Structures, Using C, Second Edition, Reema Thareja, OXFORD Higher Education.
2. Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
3. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.
4. Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
5. Data structures and Algorithm Analysis in Java, M.A.Weiss, 2nd edition, Addison- Wesley (Pearson Education).

References:

1. Introduction to Algorithms, Third Edition, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
2. Data structures and Algorithms in Java, R.Lafore, Pearson education.
3. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.
4. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI

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Year / Semester	II B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Computer Organization and Architecture				

Course Objectives:

1. To understand the structure, function, and characteristics of computer systems.
2. To understand the design of the various functional units and components of computers.
3. To identify the elements of modern instruction sets and their impact on processor design.
4. To explain the function of each element of a memory hierarchy.
5. To identify and compare different methods for computer I/O.
6. To Understand computer arithmetic formulate and solve problems, understand the performance requirements of systems
7. To understand the structure of the multiprocessor system

Course Outcomes: After completing this course, the students will be able to

1. Explain functional units and data representation.
2. Demonstrate register transfer and ALU operations.
3. Implement instructions, addressing modes, and arithmetic.
4. Analyze memory hierarchy and storage systems.
5. Design I/O interfaces, interrupts, and DMA.
6. Describe multiprocessor architectures and interconnections.

UNIT-I

Basic Structure Of Computers: Computer Types, Functional unit, Basic Operational concepts, Bus structures, Data Representation: complements, Fixed Point Representation. Floating – Point Representation, Error Detection codes.

UNIT-II

Register Transfer Language And Micro operations: Register Transfer language, Bus and memory transfers, Binary adder, Binary adder-subtractor,Arithmetic circuit, logic micro operations, shift micro operations, Arithmetic logic shift unit.

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UNIT- III

Type of instructions : Data transfer instructions, Arithmetic and Logic instructions,shift and rotate instructions,Branch instructions, Stack organization. Instruction formats. Addressing modes.

Computer Arithmetic: Addition,subtraction, Multiplication algorithm, Division algorithm.

UNIT- IV

The Memory Systems : Memory Hierarchy, Main memory, Read Only Memory: ROM,PROM,EPROM,EEPROM,Flash memory, Cache Memory: Mapping techniques, Virtual Memory.

Secondary storage: Auxiliary memory(Magnetic Hard Disks,Optical Disks)

UNIT-V

Input-Output Organization : Peripheral Devices, Input-Output Interface, Asynchronous data transfer:Source initiated data transfer,Destination initiated data transfer,Priority Interrupts : Daisy-chaining interrupt, Parallel priority Interrupt Direct memory Access(DMA).

Design of Control Unit :Hardwired control, Micro programmed control methods.

UNIT-VI

Multi Processors : Introduction, Characteristics of Multiprocessors, Interconnection Structures:(i)Time-shared common bus,(ii)Multi port memory,(iii)8 X 8 Omega switching network ,(iv)Hypercube interconnection, Inter processor Arbitration:Serial and Parallel Arbitration

TEXT BOOKS

1. Computer system architecture, M. Morris Mano, 3 rd edition, pearson/phi
2. Computer organization , carl hamacher, zvonks vranesic, safeazaky, 5 th edition, mcgraw hill.
3. Computer architecture a quantitative approach, John L. Hennessy and David. patterson, fourth edition elsevier

REFERENCES

1. Computer Organization and Architecture – William Stallings sixth edition, pearson/phi
2. Structured Computer Organization – Andrew S. Tanenbaum, 4th edition phi/pearson
3. Fundamentals of Computer Organization and Design, - Sivarama Dandamudi springer int. edition

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Year / Semester	II B. Tech / II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Object Oriented Programming through Java				

Course Objectives:

1. Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
2. Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc.
3. Understand the Object-oriented Programming principles like inheritance, polymorphism, and relate these principles to software design.
4. Implementation of Packages, Interfaces and multi-threaded programs in Java.
5. Introduce the concepts of Exception Handling and Files in Java.
6. To Introduce the concept of Collections framework.
7. Applying the above concepts for problem solving using Java.

Course Outcomes:

Upon successful completion, students will have the knowledge and skills to

1. Explain the principles of Object-Oriented Programming (OOP), Java's features, and the structure of Java programs
2. Develop Java programs using classes, objects, constructors, and nested classes.
3. Apply inheritance, abstract classes, and interfaces in Java, and implement multithreading with synchronization
4. Implement programs using exception handling constructs and perform file operations
5. Utilize the Java Collections Framework and string handling classes to manipulate data structures like lists, sets, queues, and maps.
6. Solve real-world problems using strings, arrays, collections, and functional programming techniques.

UNIT-I:

Introduction to OOP, procedural programming language and object oriented language, principles of OOP, applications of OOP, history of Java, Java features, JVM, structure of a Java program. Variables, primitive data types, identifiers, literals, operators, expressions, precedence rules and associativity, primitive type conversion and casting, flow of control, arrays, strings, functions, Introduction to lambda expressions.

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UNIT-II:

Classes and objects, class declaration, creating objects, methods, method overloading, constructors and constructor overloading, garbage collector, importance of static keyword and examples, this keyword, command line arguments, nested classes.

UNIT-III:

Inheritance, types of inheritance, method overriding, super keyword, final keyword, overriding and abstract class. Interfaces, creating packages, using packages, importance of CLASSPATH and java.lang package, access modifiers. Multithreading: Introduction, Thread life cycle, Creation of threads, Thread priorities, Thread synchronization, Communication between threads

UNIT-IV:

Exception handlings, importance of try, catch, throw, throws, and finally block, user-defined exceptions, assertions. **File I/O:** Reading data from files and writing data to files, random access in a file, accessing data from CSV and Excel files.

UNIT-V:

Arrays, Array vs ArrayList, Strings, StringBuffer, StringBuilder, StringTokenizer. Collections: Introduction to generics, Autoboxing, Overview and hierarchy of Collection framework, List interface, ArrayList, LinkedList, Stack, Queue interface, PriorityQueue, Set interface, HashSet, LinkedHashSet, TreeSet, Collection interface, Iterator interface, Iterable interface, Collections class, Comparable and Comparator interfaces.

UNIT-VI:

Problem Solving: Strings Practice, Arrays Practice, Using Collections, problems using Lists, Priority Queue, Set, Maps, functional filtering and mapping operations on lists with lambdas. Recursion problems.

TEXT BOOKS:

1. The complete Reference Java, 11th edition, Herbert Schildt, TMH.
2. Programming in JAVA, Sachin Malhotra, Saurabh Chaudhary, Oxford.

REFERENCE BOOKS:

1. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson.

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Year / Semester	II B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	0
Subject	Quantitative Aptitude-I				

Course Objectives:

1. Understand different number systems, factorization, divisibility and concept of LCM and HCF.
2. Find averages, relation between ratio and proportion, average price of mixture of different quantities and relation between fraction and percentage.
3. Know the concepts of CP,SP, MRP, profit or loss incurred in a transaction.
4. Know the concepts of principal, interest, difference between SI and CI, EMIs.
5. Understand the relation between speed, distance and time for trains and boats in a river.
6. Understand the relation between time and efficiency, combined work and wages paid for the work.

Course Outcomes:

After completing this course, the students will be able to

1. Find number of factors, LCM and HCF of numbers and fractions, least and greatest number divisible by given numbers and leaving some remainder(s).
2. Evaluate average of numbers, Proportions of given ratio, ratio or average price of two quantities of different prices when mixed to get new mix, use relation between fractions and percentages in calculation.
3. Identify the profit or loss incurred in a transaction and how cheating is possible by an unfair trader.
4. Calculate the simple and compound interests, difference between them and the EMI repayment for a loan.
5. Evaluate the time taken by a train/car for crossing a static object or a moving object and time taken by a person to row a boat in a river.
6. Calculate the time required for individual or combined work, shares of amount for their work and time taken for a tank/cistern to get filled by inlets and outlets.

UNIT-I:

Number Systems: Basic number systems –Face and Place Value, Digital sum-Applications, Factors, Multipliers, Prime, & Composite Numbers, Divisibility Rules, LCM and HCF-Remainder Rules.

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UNIT-II:

Averages, Ratio & Proportion: Average-Weighted average, Ratio-Concept and properties, Proportions-Mean ,Third and Fourth proportions, Mixtures & Allegations-Definition-Allegation Rule, Percentages-Conversion of Percentages to Fractions and Vice-Versa.

UNIT-III:

Profit & Loss: Cost Price- Selling Price- Marked Price, Discount- Successive Discounts, Profit or Loss Percentage, False Weights- Dishonest Dealer.

UNIT-IV:

Simple & Compound Interest: Principal-Interest Rate-Tenure , Simple Interest-Formula-Sum, Compound Interest-Formula-Relation Between Simple & Compound Interest, loan-EMI, Investments-Shares.

UNIT-V:

Time & Distance: Time-Distance-Speed-Relation, Conversion of Speed , Average Speed, Trains-Relative Speed- Same and Opposite –Platform, Races, Boats-Streams-Upstream and Downstream.

UNIT-VI:

Time & Work: Work-Time-Efficiency, Combined Work-Partnership-Division of Wages, Chain Rule, Pipes and Cisterns-Inlet-Outlet.

TEXT BOOKS:

1. Dr. R.S. Aggarwal , Quantitative Aptitude for Competitive Examinations, Sultan Chand Publications, 2017.

REFERENCES:

1. Arun Sharma, How to Prepare for Quantitative Aptitude for the CAT, Tata McGraw Hill Publishing Company, 2016.
2. Dinesh Khattar, The Pearson Guide to Quantitative Aptitude for Competitive Examinations, Pearson India, 2016

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Year / Semester	II B. Tech / I Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Internet of Things (IOT) Lab				

Course Objectives:

1. Introduce the fundamentals of IoT and sensor-based applications.
2. Develop hands-on skills in interfacing sensors and actuators with microcontrollers.
3. Implement real-time data acquisition and cloud-based data handling.
4. Apply IoT technologies to automate home and industrial environments.

Course Outcomes: The Students will be able

1. Perform digital and analog input/output operations and interface sensors for real-time monitoring.
2. Develop IoT applications using platforms like ThingSpeak, Adafruit, and Blynk.
3. Implement cloud-based data storage and automate data sharing.
4. Design and develop home automation and smart city solutions using IoT.

   Note: Below experiments need to be done with NodeMCU on Arduino or RaspberryPi

List of experiments:

1. Digital Input/output
2. Analog Input/output
3. Using IR Sensor to detect objects.
4. Using LDR
5. PWM application to control LED Brightness
6. Create a localhost server
7. Use NodeMCU to upload free data from Environmental Sensors to Cloud Server
8. Automatically Tweet Sensor Data on Twitter
9. Control Home devices from self-hosted webpage on Amazon AWS
10. Controlling Home Appliance using Google Assistant
11. Calculating Distance using Ultrasonic Sensor
12. Fetching Humidity and Temperature using DHT 11 Sensor
    (Using ThingSpeak, Adafruit and Blynk IoT Platforms)

Project: Home Automation Project

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Case Study:

1. Lighting as a service
2. Intelligent Traffic systems
3. Smart Parking
4. Smart water management

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Year / Semester	II B. Tech / I Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Data Structures and Algorithms Lab				

Course Objectives:

1. To present stacks, queues and their applications
2. To introduce linked lists and its operations.
3. To introduce sorting, searching algorithms.
4. To gain knowledge on trees, graphs and their applications.

Course Outcomes: After completing this course, the students will be able to

1. Develop ADT necessary for solving applications based on Stacks and Queues.
2. Implement various types of linked lists.
3. Implement various Sorting and searching algorithms.
4. Identify suitable data structures for providing solutions to real-world problems.

Lab Experiments:

1. Implementation of Searching : (a) Linear Search (b) Binary Search
2. Implementation of Sorting : (a) Bubble Sort (b) Selection Sort
   (c) Insertion Sort (d) Quick Sort (e) Merge Sort
3. Implementation of singly linked list.
4. Implementation of Doubly Linked list.
5. Implementation of Stack using arrays.
6. Implementation of Queue using arrays.
7. Implementation of Converting infix to postfix.
8. Implementation of Stack using linked list.
9. Implementation of Queue using linked list.
10. Implementation of Circular Queue.
11. Implementation of Heap.
12. Implementation of Binary Search Trees.
13. Implementation of Depth First Search technique.
14. Implementation of Breadth First Search technique.
15. Implementation of Dijkstra's Algorithm.
16. Implementation of Prims Algorithm.
17. Implementation of Kruskal's Algorithm.

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Year / Semester	II B. Tech / I Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	OOPS through Java lab				

Course Objectives:

1. To gain fundamental programming knowledge of OOP
2. To use Exception Handling mechanism in the applications
3. To apply the knowledge of generics and Collections Framework
4. To handle files

Course Outcomes: After completing this course, the students will be able to

1. Develop Java applications with concepts like Inheritance, Interfaces, packages etc.
2. Implement Exception Handling and Multithreading in Java applications.
3. Develop applications using Collections framework.
4. Perform data reading and writing using different Java I/O streams

Exercise - 1 (Basics)

a) Write a JAVA program to find the Euclidean distance between two points.

b) Write a java program that displays the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminant D and basing on the value of D, describe the nature of the root.

c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers.

Exercise - 2 (Operations, Expressions, Control-flow, Strings)

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 to sort for an element in a given list of elements using merge sort.

d) Write a JAVA program using StringBuffer to delete, remove characters.

Exercise - 3 (Arrays)

a) Find the smallest number in an array.

b) Find the largest number in an array.

c) Count even numbers in an array.

d) Count occurrence of a given number in an array.

e) Check if the given number is palindrome or not.

f) Input two arrays and merge them in a new array in ascending order.

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g) Find Addition of two 3X3 matrices.

h) Find Multiplication of two 3X3 matrices.

i) Find Transpose of a given matrix.

j) Implement Binary Search.

k) Implement Bubble Sort.

l) Implement Selection Sort.

m) Implement Insertion Sort.

Exercise - 4 (Class, Objects)

a) Write a JAVA program to implement classes – Create a class, methods and invoke them inside the main method.

b) Write a JAVA program to implement a constructor.

Exercise - 5 (Methods)

a) Create a Point class has variables int x and int y. Provide parameterized constructors. Create a class Rectangle. Point p1 is the bottom-left corner and Point p2 is the top-right corner. Write two constructors, one to take Point p1 and Point p2 as arguments and the other to take width and height (in this case (0,0) will be the bottom-left corner). It should have methods to calculate the perimeter() and the area() of the rectangle, move the rectangle by deltax and deltay, find out if a Point p is inside the rectangle or not. Method isInside(Point p). It should also have get methods for both width and height. Write a drive program to test your class.

Exercise - 6 (Inheritance)

a) Create a class Employee and the subclasses Manager and Clerk:

Employee:

Instance Variables: name, empId, salary.

Methods: set and get methods for name, empId, getSalary,setSalary Method

Manager:

Instance Variables: type

Methods: setSalary()

Clerk:

Instance Variables: int speed, int accuracy

Methods: setSalary()

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Provide proper constructors for all classes. Create a general class "MyClass". In this class create objects of Manager, Clerk and Employee class. Set the name, empId and salary attributes for each object, and accordingly display them

Write a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea () that prints the area of the given shape.

b) Definition of a hierarchy of fruits is given below

Fruit contains an abstract method getVitamin() that returns String. Fruit contains a String field color.

Apple's vitamins are "A B12".

Banana's vitamins are "C D".

Strawberry's vitamins are "B5 E".

Blackberry's vitamins are "C K".

Apples and bananas grow on trees. All tree fruits provide a void method named peel(). Define a class (or interface?) named TreeFruit that has a method peel.

Make Apple and Banana extend (or implement?) TreeFruit.

When an Apple is being peeled, it prints out "Peeling an apple."

GroundFruit.

When a Strawberry is being picked, it prints out "Picking a strawberry."

i. Implement the classes.

ii. Implement a method named prepareFruits that takes a list of fruits and invokes tree fruits peel method and ground fruits picks methods. i.e. you have to distinguish tree fruits from ground fruits.

```
Public static void prepareFruits (Fruit [] fruits){
 //Implement
}
```

Use the following main method

```
Public static void main(String [] args){
Fruit [] fruits = new Fruit[4];
fruits[0] = new Apple();
fruits [1] = new Banana();
fruits [2] = new Strawberry();
```

```
fruits [3] = new Blackberry();
prepareFruits(fruits);
}
```

c) (Shape Hierarchy) Implement the Shape (interface) hierarchy has an abstract function draw() which will be instantiated in concrete classes with what it is drawing. Each abstract class TwoDimensionalShape should contain a method getArea to calculate the area of the two-dimensional shape. Each abstract class ThreeDimensionalShape should have methods getArea and getVolume to calculate the surface area and volume, respectively, of the three dimensional shape. Create a program that uses an array of Shape references to objects of each concrete class in the hierarchy. The program should print a text description of the object to which each array element refers. Also, in the loop that processes all the shapes in the array, determine whether each shape is a Two-DimensionalShape or a ThreeDimensionalShape. If a shape is a TwoDimensionalShape, display its area. If a shape is a ThreeDimensionalShape, display its area and volume.

Shape

2D or 3D

2D – Circle, square

3D – Cube, Sphere

Hint: use instanceof to find if it is 2D or 3D.

Your output should appear as follows:

Circle: radius: 4

Circle's area is 50

Square: side: 10

Square's area is 100

Sphere: radius: 2

Sphere's area is 50

Sphere's volume is 33

Cube: side: 8

Cube's area is 384

Cube's volume is 512

Exercise - 7 (Runtime Polymorphism)

a) Write a JAVA program that implements runtime polymorphism.

b) Write a JAVA program to create three classes Shape, Circle and Rectangle. Demonstrate runtime polymorphism.

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Exercise – 8 (Packages)

a) Write a JAVA program to illustrate CLASSPATH.

b) Write a JAVA program that imports and uses the defined class in your package in the previous problem.

Exercise - 9 (Exception Handling)

a) Design Java Programs that handle the Java built-in Exception to demonstrate exception handling mechanisms.

b) Write a JAVA program to demonstrate multiple catch clauses.

Exercise – 10 (Exception Handling)

a) Write a JAVA program for illustrating throw clause.

b) Write a JAVA program for illustrating finally block.

c) Define an exception called 'NoMatchException' that is thrown when a string is not equal to "VITBhimavaram" and Design a Java program that uses this exception.

Exercise – 11 (Strings)

a) Reverse the string

b) Anagram string

c) Count duplicate character

d) Print uppercase & lowercase letters

e) Palindrome String

f) Repeated & non-repeated character

g) Find repeated word in file

h) Reverse words of string object

i) Count the number of vowels

j) Count number of words in string

k) Display vowel, digits & blank spaces

Exercise – 12 (Collections Framework)

a) Write a JAVA program to add, retrieve & remove element from ArrayList

b) Write a JAVA program to Implement LinkedList

c) Write a JAVA program to Sort & reverse the LinkedList elements

d) Write a JAVA program to Implement push() and pop() on Stack

e) Write a JAVA program to display HashTable content

f) Write a JAVA program to search key & value from HashTable

g) Write a JAVA program to remove duplicate key from hashtable

h) Write a JAVA program to copy elements from HashSet to Array

i) Write a JAVA Program to find common elements

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j) Write a JAVA Program to insert, retrieve & remove record

k) Write a JAVA Program for binary search

l) Write a JAVA Program to delete duplicate object

m) Write a JAVA Program to implement intersection & union

Exercise – 13 (Collections Framework)

a) Write a JAVA program to implement a stack using LinkedList class.

b) Write a JAVA program to implement a queue using LinkedList class.

c) Write a JAVA program to read a string and print only the unique characters.

d) Write a JAVA program to read a string and print the frequency of each character.

Exercise – 14 (File I/O)

a) Write a JAVA program to read the data from a file and print it on the console.

b) Write a JAVA program to read name, age, and email details and store them in a file.

c) Write a JAVA program to read a CSV file containing marks of students in a class and display the average marks for each subject.

d) Write a JAVA program to read an Excel file containing age of students in a class and display the median age value.

Exercise – 15 (Threads)

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 isAlive() and join()

c) Write a Program illustrating Daemon Threads.

Exercise - 16 (Threads)

a) Write a JAVA program for solving the Producer-Consumer problem.

b) Write a case study on thread Synchronization after solving the above producer consumer problem.

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II B.Tech II SEMESTER

CSE

R19 SYLLABUS

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Year / Semester	II B. Tech / II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Software Engineering				

Course Objectives:

1. To help students to develop skills that will enable them to construct software of high quality – software that is reliable, and that is reasonably easy to understand, modify and maintain.
2. This course introduces the concepts and methods required for the construction of large software intensive systems. It aims to develop a broad understanding of the discipline of software engineering.
3. Capable of team and organizational leadership in computing project settings, and have a broad understanding of ethical application of computing-based solutions to societal and organizational problems.
4. Apply their foundations in software engineering to adapt to readily changing environments using the appropriate theory, principles and processes

Course Outcomes: After completing this course, the students will be able to

1. Explain software engineering principles, process models, and software development practices.
2. Analyze software requirements, develop Software Requirement Specifications (SRS), and apply software design principles.
3. Apply function-oriented and object-oriented design methodologies, including user interface design principles.
4. Implement coding standards, perform testing techniques, and debug software systems effectively.
5. Evaluate software reliability, quality management techniques, and project planning strategies.
6. Examine software maintenance models, configuration management, and software reuse approaches.

UNIT-I:

Software and Software Engineering: The Nature of Software, The Unique Nature of WebApps ,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.

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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 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, overview 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.

Planning a software project: Effort estimation, project schedule and staffing, quality planning, risk management planning, project monitoring plan, detailed scheduling.

UNIT–VI

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.

Text Books:

1. Software Engineering A Practitioner's Approach, Roger S. Pressman, Seventh Edition McGraw-Hill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, Third Edition, PHI.
3. Software Engineering, Ian Sommerville, Ninth edition, Pearson education

Reference Books:

1. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
2. Software Engineering, A Precise Approach, PankajJalote, 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.

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Year / Semester	II B. Tech / II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	E-Commerce				

Course Objectives:

1. Identify the major categories and trends of e-commerce applications.
2. Identify the essential processes of an e-commerce system.
3. Identify several factors and web store requirements needed to succeed in ecommerce.
4. Discuss the benefits and trade-offs of various e-commerce clicks and bricks alternatives.
5. Understand the main technologies behind e-commerce systems and how these technologies interact.
6. Discuss the various marketing strategies for an online business.
7. Define various electronic payment types and associated security risks and the ways to protect against them.

Course Outcomes: After completing this course, the students will be able to

1. Explain fundamental concepts and technologies in E-Commerce.
2. Compare and contrast various electronic payment systems and analyze the working of EDI.
3. Explore the key concepts of intra-organizational commerce.
4. Apply principles of corporate digital libraries and identify effective advertising strategies.
5. Demonstrate the process of information search and retrieval.
6. Describe the basic concepts and technologies of multimedia.

UNIT – I

Electronic Commerce-Framework, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

Consumer Oriented Electronic commerce - Mercantile Process models.

UNIT – II

Electronic Payment Systems – Types of Electronic Payment Systems, Risks in Electronic Payment systems. Inter Organizational Commerce - EDI, EDI Software Implementation.

UNIT – III

Intra Organizational Commerce - WorkFlow Automation and Coordination, Customization and Internal Commerce, Supply chain Management.

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UNIT – IV

Corporate Digital Library - Document Library, Digital Document types, Corporate Data Warehouses. Advertising and Marketing - Information based marketing, Advertising on Internet, On-line marketing process, Market research.

UNIT – V

Consumer Search and Resource Discovery - Information search and Retrieval, Commerce Catalogues, Information Filtering.

UNIT – VI

Multimedia - key multimedia concepts, Digital Video and Electronic Commerce, Desktop video processing, Desktop Video Conferencing.

Text Book:

1. Frontiers of electronic commerce – Kalakota, Whinston, Pearson.

Reference Books:

1. E-Commerce fundamentals and applications Henry Chan, Raymond Lee, TharamDillon, Ellizabeth Chang, John Wiley.
2. E-Commerce, S.Jaiswal – Galgotia.
3. E-Commerce, Efrain Turban, Jae Lee, David King, H.Michael Chang.
4. Electronic Commerce – Gary P.Schneider – Thomson.
5. E-Commerce – Business, Technology, Society, Kenneth C.Taudon, Carol GuyericoTraver

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Year / Semester	II B. Tech / II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Database Management Systems				

Course Objectives:

1. Understand the basic concepts and the applications of database systems.
2. Master the basics of SQL and construct queries using SQL.
3. Understand the relational database design principles.
4. Familiar with the basic issues of transaction processing and concurrency control.
5. Familiar with database storage structures and access techniques.

Course Outcomes: After completing this course, the students will be able to

1. Explain database systems, their architecture, and fundamental concepts like data models and independence.
2. Apply E/R models, relational models, and relational calculus for effective database design and query formulation.
3. Develop complex SQL queries incorporating advanced features such as nested queries, triggers, and integrity constraints.
4. Analyze functional dependencies and apply normalization techniques to optimize database schema.
5. Implement transaction management and concurrency control mechanisms to maintain database consistency.
6. Utilize storage and indexing techniques for efficient data organization and retrieval in databases.

UNIT- I

An Overview of Database Management: Database System Applications, database System VS file System – View of Data – Data Abstraction –Instances and Schemas – Database Users and Administrator - Data Independence - data Models - Database Languages

Database system architecture, Introduction- The Three Levels of Architecture-The External Level- the Conceptual Level- the Internal Level- Mapping-The Database Management Systems- Client/Server Architecture.

UNIT-II

The E/R Models, The Relational Model, Relational Calculus: Introduction to Database Design, Database Design and Er Diagrams-Entities Attributes, and Entity Sets-Relationship and Relationship Sets-Conceptual Design With the Er Models, The Relational Model Integrity Constraints Over

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Relations- Key Constraints –Foreign Key Constraints-General Constraints, Relational Algebra and Calculus, Relational Algebra- Selection and Projection- Set Operation, Renaming – Joins- Division- More Examples of Queries, Relational Calculus, Tuple Relational Calculus- Domain Relational Calculus.

UNIT-III

Queries, Constraints, Triggers: The Form of Basic SQL Query, Union, Intersect, and Except,Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Database.

UNIT-IV

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

UNIT-V

Transaction Management and Concurrency Control: Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and savepoint. Concurrency control for lost updates, uncommitted data, inconsistent retrievals and the Scheduler. Concurrency control with locking methods : lock granularity, lock types, two phase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering : Wait/Die and Wound/Wait Schemes, Database Recovery management : Transaction recovery.

UNIT-VI

Overview of Storages and Indexing, Data on External Storage- File Organization and Indexing – Clustered Indexing – Primary and Secondary Indexes, Index Data Structures, Hash-Based Indexing – Tree-Based Indexing, Comparison of File Organization.

Text Books:

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill 3rd Edition
2. Database Systems - The Complete Book, H G Molina, J D Ullman, J Widom Pearson

References Books:

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.

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Year / Semester	II B. Tech / II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Web Technologies				

Course Objectives:

From the course the student will learn

1. Translate user requirements into the overall architecture and implementation of new systems and Manage Project and coordinate with the Client.
2. Writing optimized front end code HTML and JavaScript.
3. Monitor the performance of web applications & infrastructure and Troubleshooting web application with a fast and accurate a resolution
4. Design and implementation of Robust and Scalable Front End Applications.

Course Outcomes: After completing this course, the students will be able to

1. Design and develop static web pages using HTML and CSS, incorporating advanced layout techniques and styling.
2. Implement dynamic functionality with JavaScript, including object manipulation, user input handling, and DHTML for interactivity.
3. Utilize XML and AJAX for data interchange and create asynchronous web applications, integrating PHP for dynamic content.
4. Develop dynamic web applications with PHP, using variables, control flow, and database integration for form processing.
5. Build Single Page Applications (SPA) with AngularJS, utilizing modules, controllers, directives, and dynamic data binding.
6. Create interactive web applications with ReactJS, focusing on components, state, props, and the virtual DOM.

UNIT-I:

HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5

CSS: Levels of Style Sheets, Style Specification Formats, Selector Forms, The Box Model, Conflict Resolution

UNIT-II:

The Basic of Javascript: Objects, Primitives Operations and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions

DHTML: Positioning Moving and Changing Elements

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UNIT- III:

XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches.

AJAX: A New Approach: Introduction to AJAX, Integrating PHP and AJAX.

UNIT-IV:

PHP Programming: Introducing PHP: Creating PHP script, Running PHP script. Working with variables and constants: Using variables, Using constants, Data types, Operators. Controlling program flow: Conditional statements, Control statements, Arrays, functions. Working with forms and Databases such as MySql.

UNIT-V:

Angular JS: Introduction, Expressions, Modules, Directives, Controllers, Filters, Forms, Single Page Application development using AngularJS

UNIT-VI:

React Js: Welcome to React, Pure React, Page Setup, The Virtual DOM, React Elements, ReactDOM, Children, Constructing Elements with Data, React Components, DOM Rendering, Factories, Props, State.

Text Books:

1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. AngularJS: Up and Running, Shyam Seshadri and Brad Green, O'Reilly
3. Learning React: Functional Web Development with React and Redux, Book by Alex Banks and Eve Porcello, O'Reilly

Reference Books:

1. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning
2. Pro Mean Stack Development, ELadElrom, Apress
3. Express.JS Guide, The Comprehensive Book on Express.js, Azat Mardan, Lean Publishing.
4. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech
5. JavaScript & jQuery the missing manual, David sawyer mcfarland, O'Reilly
6. Web Hosting for Dummies, Peter Pollock, John Wiley Brand

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Year / Semester	II B. Tech / II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Digital Logical Design				

Course Objectives:

The objectives of this course are to:

1. Introduce the basic concepts of digital systems and number systems, including binary, octal, and hexadecimal.
2. Explain the principles of Boolean algebra and its application in simplifying logic functions.
3. Teach methods for logic minimization using K-maps and implementation using logic gates.
4. Provide knowledge on the design and analysis of combinational circuits like adders, decoders, and multiplexers.
5. Introduce the working principles of sequential circuits using flip-flops and state machines.
6. Explain the operation and design of registers and counters for data storage and processing.

Course Outcomes:

By completing the course, students will be able to:

1. Perform binary arithmetic and number conversions accurately.
2. Apply Boolean algebra to simplify logic functions.
3. Design optimized logic circuits using K-maps and gates.
4. Develop combinational circuits like adders and multiplexers.
5. Construct sequential circuits using state diagrams and flip-flops.
6. Implement various types of counters and registers for data processing

UNIT- I:

Digital Systems and Binary Numbers: Digital Systems, Binary Numbers, Octal and Hexadecimal Numbers, Complements of Numbers, Signed Binary Numbers, Arithmetic addition and subtraction

UNIT -II:

Concept of Boolean algebra: Basic Theorems and Properties of Boolean algebra, Boolean Functions, Canonical and Standard Forms, Minterms and Maxterms,

UNIT- III:

Gate level Minimization: Map Method, Two-Variable K-Map, Three-Variable K-Map, Four Variable K-Maps. Products of Sum Simplification, Sum of Products Simplification, Don't – Care Conditions, NAND and NOR Implementation, Exclusive-OR Function

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UNIT- IV:

Combinational Logic: Introduction, Analysis Procedure, Design Procedure, Binary Adder–Subtractor, Decimal Adder, Binary Multiplier, Decoders, Encoders, Multiplexers.

UNIT- V:

Synchronous Sequential Logic: Introduction to Sequential Circuits, Storage Elements: Latches, Storage Elements: Flip-Flops, Analysis of Clocked Sequential Circuits, Mealy and Moore Models of Finite State Machines

UNIT -VI:

Registers and Counters: Registers, Shift Registers, Ripple Counters, Synchronous Counters, Ring Counter, Johnson Counter, Ripple Counter

Text Books:

1. Digital Design, 5/e, M.Morris Mano, Michael D Ciletti, PEA.
2. Fundamentals of Logic Design, 5/e, Roth, Cengage.

Reference Books:

1. Digital Logic and Computer Design, M.Morris Mano, PEA.
2. Digital Logic Design, Leach, Malvino, Saha, TMH. 3. Modern Digital Electronics, R.P. Jain, TMH.

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Year / Semester	II B. Tech / II Sem	L	T	P	C
Regulation	R19	3	0	0	0
Subject	Logical Reasoning				

Course Objectives:

1. Be familiar with different relations in a family, concepts of clocks and calendars.
2. Find position and order of a person /object, routes between points.
3. Understand the techniques of coding and decoding.
4. Understand the validity of statements and inferences from them.
5. Draw valid conclusions from given statements.
6. Understand the concept of analogy and properties of dice.

Course Outcomes:

After completing this course, the students will be able to

1. Identify the relation between given persons, find the direction and distance from starting point, find angle between hands at given time and vice-versa, find day of given date and vice-versa.
2. Find the position and rank of a person/object in an arrangement, arranging in order using given data.
3. Decode the given code pattern and code given word in terms of alphabet, numbers, symbols and mixed, identify missing terms in the pattern/series.
4. Draw a valid conclusion from the statements, consistency of inference drawn, valid reason from given assertions.
5. Identify the cause for the assumed effect, take decisions logically from the given data.
6. Identify the odd one in the given series/group, number opposite any face of dice, figure completion from a folded figure.

UNIT-I:

Blood Relations, Directions, Clocks & Calendars.: Blood relations -family tree, types of problems on blood relations- first person narrating type-coded relation-puzzle relation, direction-distance-direction and distance problems, angle between hands -correct or incorrect time, day of a date-repeated calendars.

UNIT-II:

Ranks & Position, Puzzles: Ranks-based on positions ,counting ,comparisons , puzzles-table based, selection based, seating based, graph and network Based .

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UNIT-III:

Coding & Decoding, Series.: Coding and decoding-letter coding, number coding, symbol coding, substitution and mixed type, Symbols and notations, series-number, letter and word type , missing term.

UNIT-IV:

Critical Reasoning-I:Syllogisms, logical consistency, inference & degree of truth, assertion & reason.

UNIT-V:

Critical Reasoning-II: Statement & assumption, statement & conclusion, cause & effect, decision making.

UNIT-VI:

Non Verbal Reasoning: Series, odd-man out, analogies, mirror & water images, paper cutting & folding, figure formation, cubes & dice .

TEXT BOOKS:

1. Dr. R.S. Aggarwal ,A Modern Approach to Verbal & Non-Verbal Reasoning Sultan Chand Publications, 2018.

REFERENCES:

1. B.S.Sijwali and Indu Sijwali, A New Approach to Reasoning Verbal & Non-Verbal, Arihant Publishers, 2016.
2. M.K. Pandey, Analytical Reasoning , Bsc Publishing Co. Pvt. Ltd 2009.1

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Year / Semester	II B. Tech / II Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Business English Communication Lab				

Course Objectives:

1. To expose student to different situations for better communication
2. To inculcate the habit of learning vocabulary for effective communication
3. To enable students to acquire Business English communication

Course Outcomes:

Upon the completion of the course, the student will be able to:

1. Interpret and analyze conversations in informal and formal contexts.
2. Exhibit one's vocabulary, body language, pronunciation and intonation with proper etiquette.
3. Critique various written texts.
4. Construct appropriate Business English writing skills.
5. Develop skit exhibiting all LSRW skills.
6. Develop the skill of note making.

UNIT- I:

Listening: Listening to short conversations or monologues

Speaking: Giving information about oneself and their opinions and Giving a short talk on business related topics

Reading: Reading short and simple texts to understand the central idea/theme.

Writing: Writing a piece of internal business communication of 30-40 words (Email)

UNIT-II:

Listening : Listening to a conversation/ monologue and taking notes

Speaking : Giving short talks on business related topics.

Reading: Matching descriptions of people to short texts. Matching statements to information given in a graph or graphs.

Writing : Writing a piece of internal business communication of 30-40 words (Message)

UNIT-III :

Listening: Listening to longer conversations/interviews.

Speaking: Debates & Extempore

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Reading : Reading a longer text and deciding whether the statements about the text are right or wrong or if the information is not given.

Writing : Write a business letter 60-80 words, based on an input text and some notes.

UNIT-IV :

Listening: Listening to TV news channels and taking notes. Listening to songs and writing down the lyrics.

Speaking: Interview sessions

Reading: Read a longer text and answer questions. .

Writing: Writing a Business Report

UNIT-V:

Listening: Watching short documentaries and making notes.(General)

Speaking: Short plays, Presentations.

Reading : Read short texts and fill in a form using information from the texts.

Writing : Write a skit and enact.

UNIT-VI:

Listening: Watching documentaries and making notes.(Business specific)

Speaking: Nail your point.

Reading : Critical Reading to know the author's perspective.

Writing : Write a skit and enact.

Reference Books:

1. Cambridge English – Business English Certificate Preliminary
2. Suresh Kumar. E. & Sreehari P.A (2007), Handbook for English Language Laboratories, Cambridge University Press India Pvt. Ltd, New Delhi.
3. Mandal S. K (2006),Effective Communication & Public Speaking , Jaico Publishing House, New Delhi.
4. Grant Taylor (2004), English Conversation Practice, Tata McGraw Hill, New Delhi.
5. Balasubramanian .T (2000), A textbook of English Phonetics for Indian Students,MacMillan Publishers, India.
6. Kamalesh Sadanand, Susheela Punitha (2008), Spoken English: A foundation Course: Parts 1& 2, New Delhi, Orient Longman Pvt. Ltd

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Year / Semester	II B. Tech / II Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Design Thinking & Product Innovation Lab				

Course Objectives:

1. To provide the basic concepts and techniques of engineering and reverse engineering, process of design, analytical thinking and ideas, basics and development of engineering drawing, application of engineering drawing with computer aide.
2. To get exposure of exhibiting their creativity in terms of an innovative product development in a structured process through this course.

Course Outcomes:

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

1. Gather deep insights of design thinking and appreciate various design process procedures.
2. Develop design ideas through different techniques and Analyse innovative product design.
3. Identify the significance of reverse Engineering to understand products.
4. Draw technical drawing for design ideas.

List of Experiments

1. List specific inventions that were (or might have been) suggested to creative thinkers by the following natural phenomena:
   i. human arms
   ii. cats
   iii. seagulls
   iv. a frozen salmon
   v. spiders
   vi. earthworms
   vii. a flower
   viii. the eye of a fly
   ix. conical shells
   x. animal bone structures
   xi. dew drops on leaves
   xii. human skulls
   xiii. bamboo
   xiv. human foot
   xv. human lungs
   xvi. larynx

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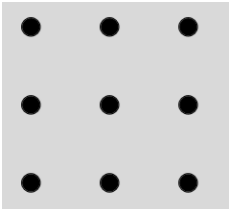
2. On a spare piece of paper draw a square of nine dots like this:



   Now see if you can connect up the dots with four consecutive straight lines, that is, without taking your pencil off the paper. You have one minute to complete the task.

3. Diagram a process for planning and cooking a family dinner. Does your process resemble the generic product development process? Is cooking dinner analogous to a market-pull, technology push, platform process-intensive, customization, high-risk, quick-build, or complex system process?
4. Sketch the organization (in some appropriate graphical representation) of a consulting firm that develops new products for clients on a project by project basis. Assume that the individuals in the firm represent all of the different functions required to develop a new product. Would this organization be most likely to be aligned with functions, be aligned by projects, or be a hybrid?
5. Create a product technology road-map illustrating the availability of technologies for a class of products you understand well, such as personal computers?
6. How can the concept selection methods be used to benchmark or evaluate existing products? Perform such an evaluation for five automobiles you might consider purchasing.
7. Perform concept screening for the four pencil holder concepts shown below. Assume the pencil holders are for a member of a product development team who is continually moving from site to site.
8. Draw the polygon using Autocad
9. Create a 2D view of the given diagram using Autocad
10. Create a 2D view of the given diagram using Autocad
11. Create a 2D view of the given diagram using Autocad
12. Create a 3D view of the given diagram using Autocad

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Year / Semester	II B. Tech / II Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Database Management Systems Lab				

Course Objectives:

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations.
3. Describe the basics of SQL and construct queries using SQL.
4. To emphasize the importance of normalization in databases.
5. To facilitate students in Database design
6. To familiarize issues of concurrency control and transaction management.

Course Outcomes: At the end of the course the students are able to:

1. Demonstrate proficiency in executing SQL queries — using SELECT, INSERT, UPDATE, DELETE commands, including advanced techniques like grouping and sorting.
2. Create, modify, and manage relational database schemas with DDL statements like CREATE, ALTER, and DROP, ensuring data integrity through constraints.
3. Create and execute complex SQL queries using subqueries, joins, set operators, and aggregate functions to analyze data.
4. Build and debug PL/SQL programs with variables, control structures, cursors, and exceptions for robust apps.

SQL-Experiments:

1. Queries to Retrieve and Change Data: Select, Insert, Delete, and Update
2. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
3. Queries using Group By, Order By, and Having Clauses.
4. Queries using operators in SQL
5. Queries on Controlling Data: Commit, Rollback, and Save point
6. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, EXCEPT, CONSTRAINTS etc.
7. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), and Creation and dropping of Views.
8. Queries on Joins and Correlated Sub-Queries.

9. Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger

PL/SQL

10. Write a PL/SQL Code using Basic Variable, Anchored Declarations, and Usage of Assignment Operation
11. Write a PL/SQL Code Bind and Substitution Variables. Printing in PL/SQL
12. Write a PL/SQL block using SQL and Control Structures in PL/SQL
13. Write a PL/SQL Code using Cursors, Exceptions and Composite Data Types
14. Write a PL/SQL Code using Procedures, Functions, and Packages FORMS

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Year / Semester	II B. Tech / II Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Web Technologies Lab				

Course Objectives:

1. To enable students to create well-structured and styled web pages using HTML and CSS.
2. To introduce JavaScript and PHP for developing interactive and dynamic web applications.
3. To teach database connectivity using MySQL and data handling through PHP.
4. To provide hands-on experience in building modern web applications using AngularJS and ReactJS.

Course Outcomes: After completing this course, the students will be able to

1. Develop and manage static and dynamic websites using HTML, CSS, PHP, and databases.
2. Create secure user authentication systems and handle data management with PHP and MySQL.
3. Implement session-based functionality for personalized user experiences on websites.
4. Build dynamic web applications using ReactJS and AngularJS with data binding and event handling.

List of Experiments

1. Design the following static web pages required for an online bookstore website.

HOME PAGE:

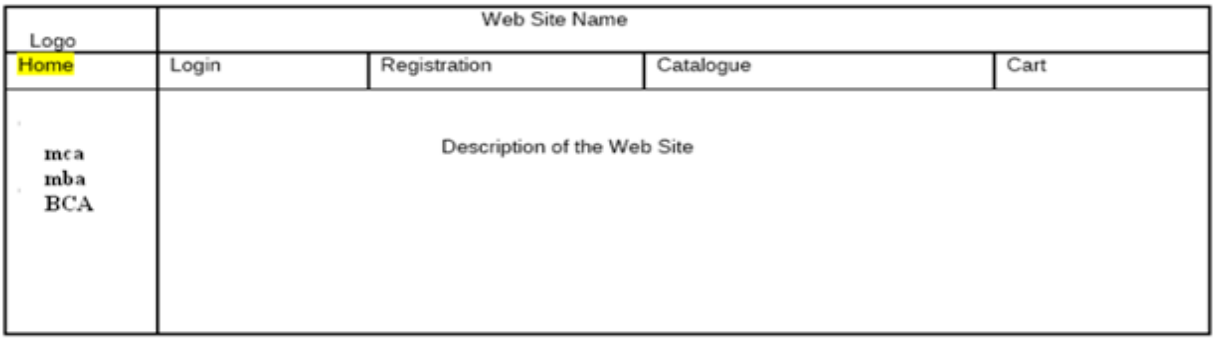
The static home page must contain three **parts**.

Header: Logo and the college name and links to Home page, Login page, Registration page, Catalogue page and Cart page (the description of these pages will be given below).

Footer: At least four links for navigation, which will display the catalogue of respective links.

For e.g.: When you click the link **"MCA"** the catalogue for MCA Books should be displayed in the Right frame.

Side Menu: The *pages to the links in the left frame must be loaded here*. Initially this page contains description of the website.



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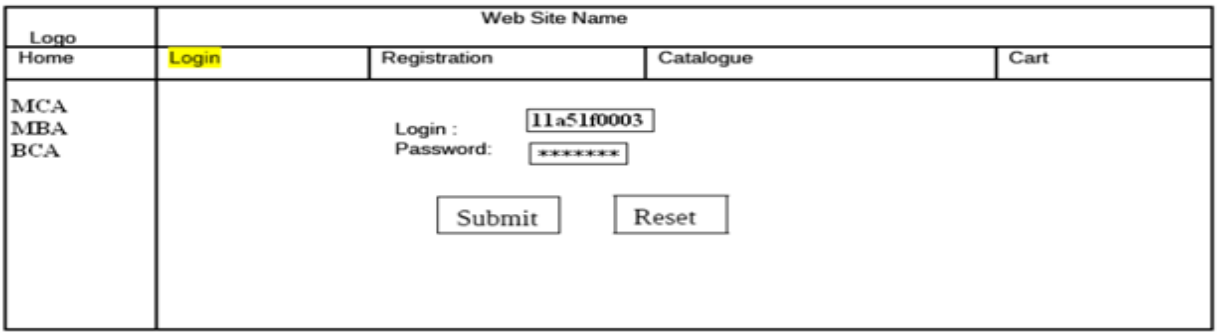
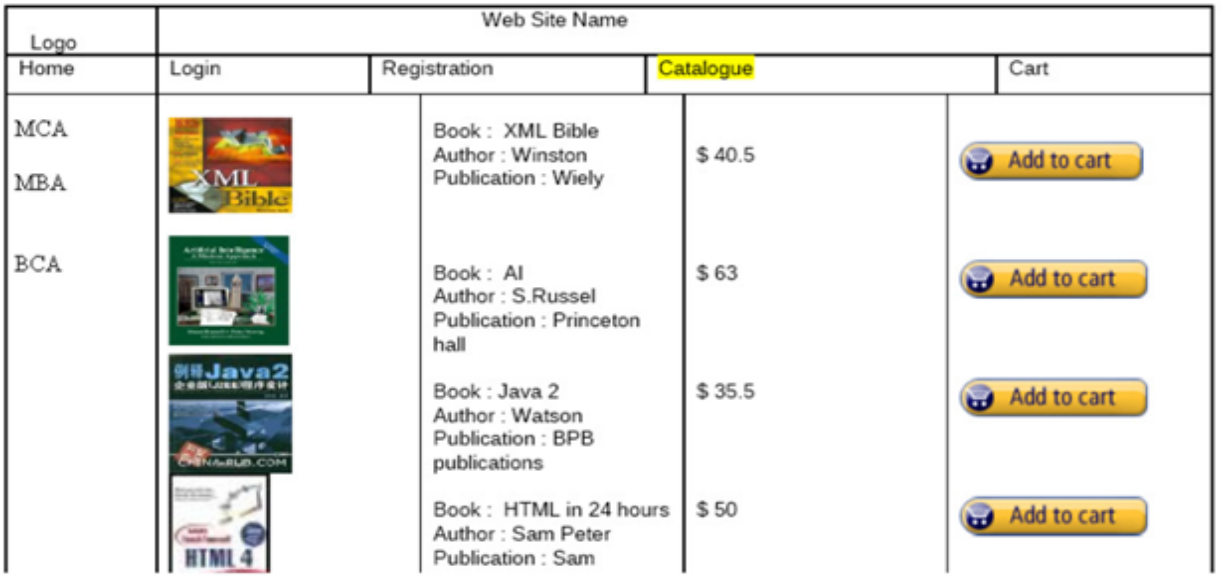
2) Login page



3) CATOLOGUE PAGE:

The catalogue page should contain the details of all the books available in the website in a table. The details should contain the following:

- Snap shot of Cover Page.
- Author Name.
- Publisher.
- Price.
- Add to cart button.



4. **REGISTRATION PAGE:**

Create a "*registration form* "with the following fields

- Name (Text field)
- Password (password field)
- E-mail id (text field)
- Phone number (text field)
- Sex (radio button)

- Date of birth (3 select boxes)
- Languages known (checkboxes – English, Telugu, Hindi, Tamil)
- Address (text area)

5. Design a web page using CSS (Cascading **S**tyle **S**heets**)** which includes the following:

- Use different font, styles:
- In the style definition you define how each selector should work (font, color etc.).
- Then, in the body of your pages, you refer to these selectors to activate the styles

6. Write an XML file which will display the Book information which includes the following:

- Title of the book
- Author Name
- ISBN number
- Publisher name
- Edition
- Price

Write a Document Type Definition (DTD) to validate the above XML file.

7. Write a PHP program for the contact us page.
8. **User Authentication**:

   Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a PHP for doing the following.

   - Create a Cookie and add these four user id's and passwords to this Cookie.
   - Read the user id and passwords entered in the Login form (Program 2) and authenticate with the values (user id and passwords) available in the cookies.
   - If he is a valid user (i.e., user-name and password match) you should welcome him by name (user-name) else you should display "You are not an authenticated user ".
   - Use init-parameters to do this.

9. Example PHP program for registering users of a website and login.
10. **Install a database (Mysql or Oracle).**

    Create a table which should contain at least the following fields: name, password, email-id, phone number (these should hold the data from the registration form).

    Write a PHP program to connect to that database and extract data from the tables and display them. Experiment with various SQL queries.

    Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page..

11. Write a PHP which does the following job:

Insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the username and password from the database.

12. Create tables in the database which contain the details of items (books in our case like Book name, Price, Quantity, Amount) of each category. Modify your catalogue page (Program 3) in such a way that you should connect to the database and extract data from the tables and display them in the catalogue page using PHP.
13. HTTP is a stateless protocol. Session is required to maintain the state.

    The user may add some items to cart from the catalog page. He can check the cart page for the selected items. He may visit the catalogue again and select some more items. Here our interest is the selected items should be added to the old cart rather than a new cart. Multiple users can do the same thing at a time(i.e., from different systems in the LAN using the ip-address instead of localhost). This can be achieved through the use of sessions. Every user will have his own session which will be created after his successful login to the website. When the user logs out his session should get invalidated (by using the method session. Invalidate (). Modify your catalogue and cart PHP pages to achieve the above mentioned functionality using sessions.
14. Implement the following in React JS
    - Using React Js creating constructs data elements.
    - Using React Js implementations DoM.
15. Implement the following in AngularJS
    - AngularJS data binding.
    - AngularJS directives and Events.
    - Using angular Js fetching data from MySQL.

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III B.Tech I SEMESTER

CSE

R19 SYLLABUS

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Formal Languages and Automata Theory				

Course Objectives:

1. This subject will introduce students to the formal languages and grammars, automata theory, various automata models and computability.
2. To introduce the concepts in automata theory and theory of computation to design grammars and recognizers for different formal languages.
3. To employ finite state machines to solve problems in computing.
4. To introduce finite state machines, context free grammars and Turing Machines and their properties as the basis for the formal expressivity of computer languages for solving linguistic decision problems.

Course Outcomes:

After the completion of the course the students will be able to

1. Gain knowledge of fundamentals of automata, finite state machines, and their real-world applications
2. Analyze formal languages, grammar hierarchy, and their relationship with automata.
3. Design and compare DFA and NFA, including ε-move transitions, and understand their equivalence.
4. Apply regular expressions to define regular languages and establish their equivalence with finite automata.
5. Differentiate Moore and Mealy machines, simplify context-free grammars, and apply normal forms.
6. Design Pushdown Automata and Turing Machines to recognize complex languages and computations.

UNIT I:

Fundamentals of Automata: Computation, Finite state machine, Components of Finite State Automata, Elements of Finite State System, Mathematical representation of Finite State Machine, Automata Classification, Automata in real world.

UNIT II:

Formal Language Theory: Symbols, Alphabets and Strings, Operations on strings, Formal Languages, Operations on Languages, Formal Language/ Grammar Hierarchy: Formal Languages, Regular Languages, Context-Free Language, Context sensitive language, Recursive language, Recursively

Enumerable Language, Other forms of formal languages, Relationship between Grammars and Languages.

UNIT III:

Finite Automata: Introduction, Deterministic Finite Automata (DFA), Design of DFA's, Non Deterministic Finite Automata (NFA), Design of NFA's, Non-Deterministic Automata with ∈ moves, Design of NFA with ∈ moves, Advantages of NFA, NFA versus DFA. Equivalent Automata:Equivalent Finite-State Automata, Equivalence of NFA/NFA-∈ and DFA, Equivalence of NFA with ∈ -moves to NFA without ∈ -moves.

UNIT IV:

Regular Expressions and Languages: Regular languages, Regular expressions, Components of Regular Expression, Properties of Regular Expression, Uses of Regular Expression.Finite Automata and Regular Expressions: Properties of regular sets and regular languages, Arden's Theorem, Equivalence of finite automata and Regular expressions, Equivalence of DFA and regular expression, Equivalence of NFA and Regular expression.

UNIT V:

Transducers: Moore machine, mealy machine, Difference between Moore and Mealy Machines, Equivalence of Moore and Mealy Machines.

Context Free Grammars and Context-Free languages: Types of Grammar, Ambiguous and Unambiguous, Noam Chomsky's classification of grammar and finite automata, Relation between regular grammar and finite automata.

Simplification of Context Free Grammar: Simplification of Context-Free Grammars- Elimination of useless symbols, epsilon productions and Unit productions, Normal Forms for Context free grammars, Chomsky Normal form, Greibach Normal Form, Chomsky Vs Greibach Normal Form, and Application of Context-Free Grammars.

UNIT VI:

Push Down Automata: Definition, Model, Graphical Notation, Instantaneous Description, Language Acceptance of pushdown Automata, Design of Pushdown Automata.

Turing Machine: Introduction, Components of Turing Machine, Description of Turing Machine, Elements of TM, Moves of a TM, Language accepted by a TM, Role of TM's , Design of TM's.

Text Books:

1. Introduction to Automata Theory, Languages and Computation, J.E.Hopcroft, R.Motwani and J.D.Ullman, 3rd Edition, Pearson, 2008.
2. A TextBook on Automata Theory, Nasir S.F.B, P.K.Srimani, Cambridge university press.
3. Theory of Computer Science-Automata, Languages and Computation, K.L.P.Mishra and N.Chandrasekaran, 3rd Edition, PHI, 2007.

4. Elements of Theory of computation, Harry R Lewis,Papdimitriou, PHI.
5. Introduction to Theory of Computation – Sipser 2nd edition CENGAGE.

Reference Books:

1. Formal languages and automata theory,C.K.Nagpal, OXFORD.
2. Theory of Computation, a problem solving approach, Kavi Mahesh, Wiley.
3. Automata, computability and complexity, Theory and applications, Elaine rich, PEARSON.
4. Theory of Computation, Vivek kulkani, OXFORD.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Design and Analysis of Algorithms				

Course Objectives:

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

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.
5. Synthesize efficient algorithms in common engineering design situations.

Course Outcomes:

Students who complete the course will have demonstrated the ability to do the following:

1. Learn what algorithms are, how to write them using pseudocode, and how to analyze their efficiency in terms of time and space.
2. Use divide and conquer techniques to solve problems like sorting and searching efficiently.
3. Solve problems like the knapsack problem and minimum spanning trees using the greedy approach.
4. Use dynamic programming to find optimal solutions for problems like the shortest path and knapsack.
5. Apply backtracking to solve problems like the 8-Queens puzzle and graph coloring.
6. Solve complex problems like the traveling salesperson problem using the branch and bound method.

UNIT-I:

Introduction: What is an Algorithm, Algorithm Specification, Pseudocode Conventions Recursive Algorithm, Performance Analysis, Space Complexity, Time Complexity, Amortized Complexity, Asymptotic Notation, Practical Complexities, Performance Measurement.

UNIT-II:

Divide and Conquer: General Method, Defective Chessboard, Binary Search, Finding the Maximum and Minimum, Merge Sort, Quick Sort, Performance Measurement, Randomized Sorting Algorithms (Quick Sort).

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UNIT-III:

The Greedy Method: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-cost Spanning Trees, Prim's Algorithm, Kruskal's Algorithms, An Optimal Randomized Algorithm, Optimal Merge Patterns, Single Source Shortest Paths.

UNIT-IV:

Dynamic Programming: All - Pairs Shortest Paths, Single – Source Shortest paths General Weights, String Editing, 0/1 Knapsack, Reliability Design.

UNIT-V:

Backtracking: The General Method, The 8-Queens Problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles.

UNIT-VI:

Branch and Bound: The Method, Least cost (LC) Search, Control Abstraction for LC-Search, Bounding, FIFO Branch-and-Bound, LC Branch and Bound, 0/1 Knapsack Problem, LC Branch-and Bound Solution, FIFO Branch-and-Bound Solution, Travelling Salesperson.

Text Books:

1. Fundamentals of computer algorithms E. Horowitz S. Sahni, University Press
2. Introduction to AlgorithmsThomas H. Cormen, PHI Learning

Reference Books:

1. The Design and Analysis of Computer Algorithms, Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman
2. Algorithm Design, Jon Kleinberg, Pearson.

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Operating Systems				

Course OBJECTIVES:

1. Study the basic concepts and functions of operating systems.
2. Understand the structure and functions of the OS.
3. Learn about Processes, Threads and Scheduling algorithms.
4. Understand the principles of concurrency and Deadlocks.
5. Learn various memory management schemes.
6. Study I/O management and File systems.

Course Outcomes: After completing this course, the students will be able to

1. Explain the fundamental concepts, types, and functions of operating systems, along with the role of system calls.
2. Analyze process management techniques, including scheduling, inter-process communication, and threading.
3. Apply synchronization techniques to solve concurrency-related problems in operating systems.
4. Demonstrate memory management techniques, including paging, segmentation, and virtual memory.
5. Evaluate and implement strategies to prevent, detect, avoid, and recover from deadlocks.
6. Explore file systems, storage management, and security mechanisms for efficient and secure system operations.

UNIT I:

Introduction to Operating System Concept: Types of operating systems, operating systems concepts, operating systems services, Introduction to System call, System call types.

UNIT-II:

Process Management – Process concept, The process, Process State Diagram, Process control block, Process Scheduling- Scheduling Queues, Schedulers, Operations on Processes, Inter-process Communication, Threading Issues, Scheduling-Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

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UNIT-III:

Concurrency: Process Synchronization, The Critical- Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization examples.

UNIT-IV:

Memory Management: Swapping, Contiguous Memory Allocation, Paging, structure of the Page Table, Segmentation

Virtual Memory Management: Virtual Memory, Demand Paging, Page-Replacement Algorithms, Thrashing.

UNIT-V:

Principles of deadlock – System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

UNIT VI:

File system Interface- the concept of a file, Access Methods, Directory structure, File system mounting, and file sharing.

File System implementation- File system structure, allocation methods, free-space management Mass-storage structure overview of Mass-storage structure, Disk scheduling.

System Protection: Goals of protection, Principles and Domain of protection.

Text Books:

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 9th Edition, John Wiley and Sons Inc., 2012.
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2011.
3. Operating Systems-S Halder, Alex A Aravind Pearson Education Second Edition 2016.

References:

1. Modern Operating Systems, Andrew S. Tanenbaum, Second Edition, Addison Wesley, 2001.
2. Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata Mc Graw Hill Education", 1996.
3. Operating Systems: A Concept-Based Approach, D M Dhamdhere, Second Edition, Tata Mc Graw-Hill Education, 2007.

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Software Testing Methodologies (Professional Elective-I)				

Course Objectives:

1. Teach fundamentals of various testing methodologies.
2. Describe the principles and procedures for designing test cases.
3. Provide support for debugging methods.
4. Acts as the reference for software testing techniques and strategies.

Course Outcomes: After completing this course, the students will be able to

1. Apply path testing using control flow graphs and predicates.
2. Implement transaction and data flow testing strategies.
3. Perform domain testing and path product analysis.
4. Design and execute syntax and logic-based testing.
5. Analyze state graphs and apply state transition testing.
6. Use automated tools like WinRunner for testing.

UNIT-I:

Introduction: Purpose of Testing, Dichotomies, Model for Testing, Consequences of Bugs, Taxonomy of Bugs.

Flow graphs and Path testing: Introduction to Path Testing, Control Flow Graphs, Path Testing-Paths, Nodes and Links, Fundamental path selection criteria, Loops, Predicates, Path Predicates, Predicate Interpretation, Path predicate Expressions, Predicate Coverage, Path Sensitizing, Path Instrumentation.

UNIT-II:

Transaction Flow Testing: Transaction Flows, Transaction Flow Testing Techniques. Data Flow testing: Basics of Data Flow Testing, Strategies in Data Flow Testing.

UNIT-III:

Domain Testing: Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interfaces Testing.

Paths, Path products and Regular expressions: Path Products & Path Expression, Reduction Procedure.

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UNIT-IV:

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

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

UNIT – V:

State, State Graphs and Transition Testing: State Graphs, Good & Bad State Graphs, Equivalent States, State Testing.

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

UNIT -VI:

Software Testing Tools: Introduction to Testing, Automated Testing, Introduction to About Winrunner, Using Win runner, Mapping the GUI, Recording Test, Working with Test, Enhancing Test, Checkpoints, Test Script Language, Putting it all together, Running and Debugging Tests, Analyzing Results, Batch Tests, Rapid Test Script Wizard.

Text Books:

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

Reference Books:

1. The Craft of software testing - Brian Marick, Pearson Education.
2. Software Testing, 3rd edition, P.C. Jorgensen, Auerbach 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.NageswaraRao, dreamtech Press
7. Win Runner in simple steps by Hakeem Shittu, 2007 Genixpress.
8. Foundations of Software Testing, D.Graham& Others, Cengage Learning.

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Natural Language Processing (Professional Elective-I)				

Course Objectives:

1. Introduces fundamental concepts and techniques of NLP
2. Provides in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information
3. Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
4. Explore Machine Learning Techniques used in NLP
5. Examine Deep Neural Architectures for Sequence Processing
6. Understands Encoder-Decoder architectures and is able to build Machine Translation Models.

Course Outcomes: After completing this course, the students will be able to

1. Describe NLP concepts, components, and apply text processing techniques like tokenization and language modeling.
2. Explain Naive Bayes for text classification and evaluate models using Precision, Recall, and F-measure.
3. Apply Logistic Regression for sentiment classification and use gradient descent and regularization.
4. Analyze vector semantics and evaluate embeddings using TF-IDF, PMI, and Word2Vec.
5. Develop neural language models and apply sequence labeling for POS tagging and NER.
6. Design RNN-based architectures and encoder-decoder models for machine translation

UNIT I

Introduction : Natural Language Processing Definition, Origins, applications, challenges, components of modern NLP – Regular Expressions, Words, Corpora, Tokenization, Text Normalization, Minimum Edit Distance.

Language Models: N -grams, Evaluating Language Models - Perplexity, Generalization and zeros, Smoothing – Laplace, Add-k, Interpolation and Backoff

UNIT II

Naive Bayes: Naive Bayes Classifier - Training the NB Classifier - an example, Optimizing for Sentiment Analysis, NB for other text classification tasks, NB as a Language Model, Evaluation: Precision, Recall, F-measure, Test sets and Cross-validation.

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UNIT III

Logistic Regression: Generative vs. Discriminative classifiers - components of machine learning classifier - Classification: the sigmoid, binary sentiment classification with sigmoid, Learning in Logistic Regression - The Cross-Entropy Loss function, Gradient Descent, SGD, Mini-batch, Regularization - Multinomial Logistic regression.

UNIT IV

Vector Semantics and Embeddings : Lexical Semantics, Vector Semantics, Words and Vectors, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector, Pointwise Mutual Information (PMI), Applications of the tf-idf or PPMI vector models, Word2vec, Visualizing Embeddings, Semantic properties of embeddings, Bias and Embeddings.

UNIT V

Neural Networks and Neural Language Models : Units, the XOR problem, Feedforward Neural Networks, Feedforward networks for NLP : classification, Feedforward Neural Language Modelling, Training Neural Nets, Training the Neural Language the model.

Sequence Labelling for Parts of Speech and Named Entities : English word classes, Part-of-speech tagging, Named Entities and Named Entity Tagging.

UNIT VI

Deep Learning Architectures for Sequence Processing : Language Models, Recurrent Neural Networks, Managing Context in RNNs: LSTMs and GRUs, Potential Harms from Language Models

Machine Translation and Encoder-Decoder Models : The Encoder-Decoder Model, Encoder-Decoder with RNNs

Text Books:

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

Reference Books:

1. Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems, Oreilly Publishers - by Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana
2. Natural Language Processing with Python: Analysing Text with the Natural Language Toolkit. Oreilly Publishers - Stevem Bord. Ewam Klein, Edward Loper

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Full Stack Web Development (Professional Elective-I)				

Course Objectives:

1. Introduce core web technologies such as JDBC, Servlets, JSP, Bootstrap, Perl, and Node.js for full-stack development.
2. Develop practical skills in building dynamic web applications with database integration and responsive designs.

Course Outcomes: After completing this course, the students will be able to

1. Build Java applications using Eclipse IDE, Git, Maven, and implement database operations with JDBC.
2. Design dynamic web applications using Servlets and JSP with MySQL integration.
3. Explain HTTP concepts, request-response mechanisms, authentication, and security measures.
4. Apply Bootstrap components for creating responsive web designs.
5. Implement scripting techniques in Perl for file handling, regular expressions, and web automation.
6. Utilize Node.js modules for server-side programming, file handling, and database access.

UNIT-I:

Eclipse IDE Overview, Git, Maven, JDBC: JDBC Introduction, JDBC Architecture, Database Overview, JDBC Basics, Driver Manager, Result Set, Connection, Statement, Prepared Statement, Callable Statement, DB Connectivity Steps, Store Image in SQL, Read Image in SQL, JDBC CRUD Application

UNIT-II:

Servlet Basics, Need of Server-Side Programming, Servlet Life Cycle, Services doGet(), doPost(), Destroy(), ServletHelloWorldApplication, Web.xmlStructure, Servlet Directives- include(), forward(), sendRedirictive(), HttpServletRequest, HttpServletResponse, Servlet and JDBC Integration, Servlet, HTML 5, MySQL-JDBC.

JSP: JSP Basics, Creating dynamic Web content with JSP, Scriplet, Declaration.

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UNIT-III:

Introduction to HTTP, Parameters, Messages, Request. Response, Methods, Status Code, Header Fields. Registration, Authentication, Caching, URL Encoding. Security

UNIT-IV:

Bootstrap: Bootstrap Introduction, Bootstrap Example, Bootstrap Container, Jumbotron, Buttons, Grid, Pagination, Images.

UNIT-V:

Introduction to PERL, Operators and if statements, Program design and control structures, Arrays, Hashes and File handling, Regular expressions, Subroutines, Retrieving documents from the web with Perl.

UNIT-VI:

Introduction to NodeJS: Modules, HTTP Module, File System, URL Module, NPM, Events, Upload Files, Send an Email, Database access with NodeJS

Text Books:

1. JDBC 4.2, Servlet 3.1, and JSP 2.3 Includes JSF 2.2 and Design Patterns, Black Book, 2ed by K.Santhosh Kumar.
2. Full Stack Java Development with Spring MVC, Hibernate, jQuery, and Bootstrap by Myur ramgir, wiley.
3. Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, Oreilly (2012)

References:

1. https://www.w3schools.com/bootstrap/default.asp
2. https://www.tutorialspoint.com/perl/index.htm
3. https://www.w3schools.com/nodejs/default.asp

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Human Computer Interaction (Professional Elective-I)				

Course Objectives:

1. The main objective is to get students to think constructively and analytically about how to design and evaluate interactive technologies.

Course Outcomes: After completing this course, the students will be able to

1. Explain the capabilities of both humans and computers from the viewpoint of human information processing.
2. Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
3. Apply an interactive design process and universal design principles to designing HCI systems.
4. Describe and use HCI design principles, standards and guidelines.
5. Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.
6. Discuss tasks and dialogs of relevant HCI systems based on task analysis and dialog design.

UNIT I:

Introduction: Usability of Interactive Systems- introduction, usability goals and measures, usability motivations, universal usability, goals for our profession Managing Design Processes: Introduction, Organizational design to support usability, Four pillars of design, development methodologies, Ethnographic observation, Participatory design, Scenario Development, Social impact statement for early design review, legal issues, Usability Testing and Laboratories

UNIT II:

Menu Selection, Form Fill-In and Dialog Boxes: Introduction, Task- Related Menu Organization, Single menus, Combinations of Multiple Menus, Content Organization, Fast Movement Through Menus, Data entry with Menus: Form Fill-in, dialog Boxes, and alternatives, Audio Menus and menus for Small Displays

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UNIT III:

Command and Natural Languages: Introduction, Command organization Functionality, Strategies and Structure, Naming and Abbreviations, Natural Language in Computing Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory Interfaces, Displays- Small and large.

UNIT IV:

Quality of Service: Introduction, Models of Response-Time impacts, Expectations and attitudes, User Productivity, Variability in Response Time, Frustrating Experiences Balancing Function and Fashion: Introduction, Error Messages, Nonanthropomorphic Design, Display Design, Web Page Design, Window Design, Color.

UNIT V:

User Documentation and Online Help: Introduction, Online Vs Paper Documentation, Reading from paper Vs from Displays, Shaping the content of the Documentation, Accessing the Documentation, Online tutorials and animated documentation, Online communities for User Assistance, The Development Process.

UNIT VI:

Information Search: Introduction, Searching in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Searching Interfaces Information Visualization: Introduction, Data Type by Task Taxonomy, Challenges for Information Visualization.

Text Books:

1. Designing the User Interface, Strategies for Effective Human Computer Interaction, 5ed, Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven M Jacobs, Pearson
2. The Essential Guide to user interface design,2/e, Wilbert O Galitz, Wiley DreamaTech.

Reference Books:

1. Human Computer, Interaction Dan R.Olsan, Cengage ,2010.
2. Designing the user interface. 4/e, Ben Shneidermann , PEA.
3. User Interface Design, Soren Lauesen , PEA.
4. Interaction Design PREECE, ROGERS, SHARPS, Wiley.

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Statistics with R Programming (Open Elective-I)				

Course Objectives:

1. Use R for statistical programming, computation, graphics, and modeling.
2. Write functions and use R in an efficient way,
3. Fit some basic types of statistical models and able to analyze data for the purpose of exploration using Descriptive and Inferential Statistics.
4. Able to understand Probability and Sampling Distributions
5. Learn the creative application of Linear Regression in multivariate context for predictive purposes.
6. Be able to expand their knowledge of R on their own in research.

Course Outcomes:

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

1. Explain the fundamental concepts of R programming, including its data types, structures, and operations.
2. Develop skills to use control structures, recursion, and functions effectively in R programming.
3. Apply mathematical functions, statistical distributions, and file handling techniques for simulations and computations.
4. Create and customize data visualizations using R's graphical capabilities.
5. Analyze probability distributions (Normal, Binomial, Poisson) and compute basic statistical measures like correlation and covariance.
6. Build and evaluate linear and generalized linear models, including regression and survival analysis.

UNIT-I

Introduction How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT-II

R Programming Structures - Control Statements, Loops, - Looping Over Non vector Sets, If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in

R, Recursion, A Quicksort Implementation-Extended Example: A Binary Search Tree.

UNIT-III

Doing Math and Simulation in R - Math Function, Extended Example Calculating Probability Cumulative Sums and Products-Minima and Maxima-Calculus, Functions for Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product-Extended, Set Operation, Input/output, Accessing the Keyboard and Monitor, Reading and writer Files.

UNIT-IV

Graphics - Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

UNIT-V

Probability Distributions - Normal Distribution- Binomial Distribution- Poisson Distributions, Basic Statistics, Correlation and Covariance.

UNIT-VI

Linear Models - Simple Linear Regression, Multiple Regression Generalized Linear Models, Logistic Regression, Poisson Regression- other Generalized Linear Models-Survival Analysis.

Text Books:

1. The Art of R Programming, A K Verma, Cengage Learning.
2. R for Everyone, Lander, Pearson
3. The Art of R Programming, Norman Matloff, No starch Press.

Reference Books:

1. R Cookbook, Paul Teetor, Oreilly.
2. R in Action, Rob Kabacoff, Manning

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Electronics Devices and Circuits (Open Elective-I)				

Course Objectives: The main objectives of this course are:

1. The basic concepts of semiconductor physics are to be reviewed.
2. Study the physical phenomena such as conduction, transport mechanism and electrical characteristics of different diodes.
3. The application of diodes as rectifiers with their operation and characteristics with and without filters are discussed.
4. The principal of working and operation of Bipolar Junction Transistor and Field Effect Transistor and their characteristics are explained.
5. The need of transistor biasing and its significance is explained. The quiescent point or operating point is explained.
6. Small signal equivalent circuit analysis of BJT and FET transistor amplifiers in different configurations is explained.

Course Outcomes: At the end of this course the student can able to:

1. Understand the basic concepts of semiconductor physics.
2. Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation.
3. Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons.
4. Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.
5. Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions.
6. Perform the analysis of small signal low frequency transistor amplifier circuits using BJT and FET in different configurations.

UNIT-I: Semiconductor Physics

Classification of solids using energy band diagrams,Generation of charge carriers in intrinsic semiconductors and extrinsic semiconductors,mobility and conductivity ,drift and diffusion, charge densities in semiconductors, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors,continuity equation Hall effect.

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UNIT- II: Junction Diode Characteristics

Open circuited p-n junction, law of junction,current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance, energy band diagram of PN junction Diode.

Special Semiconductor Diodes: Zener Diode, Breakdown mechanisms, LED, Photodiode, Tunnel Diode,UJT. Construction, operation and characteristics of all the diodes are required to be considered.

UNIT- III: Rectifiers and Filters

Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier,derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter, Capacitor filter, comparison of various filter circuits in terms of ripple factors.

UNIT- IV: Transistor Characteristics

BJT: Introduction to transistor, Operating modes of transistor, transistor current components, transistor configurations, transistor as an amplifier, and characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, punch through/ reach through, typical transistor junction voltage values.

FET: FET types, construction, operation, characteristics, parameters, MOSFET-types, construction, operation,characteristics, comparison between JFET and MOSFET.

UNIT- V: Transistor Biasing and Thermal Stabilization

Need for biasing and operating point, load line analysis,Stability factors, (S, S', S''), BJT biasing methods, fixed bias, collector to base bias, self-bias, Stabilization against variations in VBE, Ic, and β, Thermal runaway avoid condition. FET Biasing- methods and stabilization.

UNIT- VI: Small Signal Low Frequency Transistor Amplifier Models

BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters,generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.

FET: Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FETamplifiers.

Text Books:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, Second Edition.
2. Integrated Electronics- Jacob Millman, C. Halkies, C.D.Parikh, Tata Mc-Graw Hill, 2009.

References:

1. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, Second Edition
2. Electronic Devices and Circuits – A.P.Godse, U.A.Bakshi, Technical publications.

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Embedded Systems (Open Elective-I)				

Course Objectives:

Students undergoing this course are expected to:

1. The basic concepts of an embedded system are introduced.
2. The various elements of embedded hardware and their design principles are explained.
3. Different steps involved in the design and development of firmware for embedded systems are elaborated.
4. Internals of Real-Time operating systems and the fundamentals of RTOS based embedded firmware design is discussed.
5. Fundamental issues in hardware software co-design were presented and explained.

Course Outcomes:

After undergoing the course students will be able to

1. Understand the basic concepts of an embedded system and able to know an embedded system
2. Design approach to perform a specific function.
3. The hardware components required for an embedded system and the design approach of an embedded hardware.
4. The various embedded firmware design approaches on embedded environments.
5. Understand how to integrate hardware and firmware of an embedded system using a real time operating system.

UNIT –I: Introduction

Embedded system-Definition, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems,the typical embedded system-core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware

UNIT –II: Characteristics & Embedded Hardware Design

Characteristics of an embedded system, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system. Analog and digital electronic components, I/O types and examples, Serial & Parallel communication device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

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UNIT –III: Embedded Firmware Design

Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

UNIT –IV: Real Time Operating System

Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling,Task communication, Task synchronization, Device Drivers.

Hardware Software Co-Design: Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs.

UNIT –V: Embedded System Development

The integrated development environment, Types of files generated on cross-compilation, Deassembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan.

UNIT –VI: Embedded System Implementation And Testing

The main software utility tool, CAD and the hardware, Translation tools-Pre-processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools.

Text Books

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu.K.V-Tata McGraw Hill Education Private Limited, 2013.

Reference Books

1. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
2. Embedded Systems-Lyla B.Das-Pearson Publications, 2013.

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Integrated Circuits and Applications (Open Elective-I)				

Course Objectives:

Enable the students to

1. To understand the basic operation & performance parameters of differential amplifiers.
2. To understand & learn the measuring techniques of performance parameters of OP-AMP.
3. To learn the linear and non-linear applications of operational amplifiers.
4. To understand the analysis & design of different types of active filters using Op-Amps.
5. To learn the internal structure, operation and applications of different Analog ICs.
6. To acquire skills required for designing and testing integrated circuits.

Course Outcomes: After completing this course, the students will be able to

1. Design circuits using operational amplifiers for various applications.
2. Analyze and design amplifiers and active filters using Op-amp.
3. Diagnose and trouble-shoot linear electronic circuits.
4. Understand the gain-bandwidth concept and frequency response of the amplifier configurations.
5. Understand thoroughly the operational amplifiers with linear integrated circuits.

Unit –I: Integrated Circuits

Differential Amplifier-DCandAC analysis of Dual input Balanced output Configuration, Properties of other differential amplifier configuration (Dual Input Unbalanced Output, Single EndedInput–Balanced/UnbalancedOutput, Methods to improve CMRR

Unit –II: Characteristics of OP-Amps

Op-ampBlock Diagram, ideal and practical Op-amp Specifications, DC and AC characteristics,741 op-amp & its features, Op-Amp parameters & Measurement, Offset voltages & currents, slew rate, CMRR, PSRR, drift, FrequencyCompensation techniques.

Unit –III: Linear Application of Op-Amps

Open loop and closed loop configurations,Inverting and Non-inverting amplifiers, Ideal and practical Integrator, Ideal and practical differentiator,Difference amplifier,Instrumentation amplifier,V to I,I to V converters,

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Unit –IV: Non-Linear applications of op-Amps

Comparators, Schmitt trigger, Precision Rectifiers, Multivibrators, Log and Antilog Amplifiers,Sample and Hold Circuit, RC Phase shift/Wien bridge Oscillators.

Unit –V: Active Filters and IC 555

Active Filters: Design and Analysis of Butterworth active filters –1st order,2nd order Low pass, High pass, Band pass,Band reject and allpass filters.

IC 555 Timer: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger.

Unit –VI: Digital to Analog and Analog to Digital Converters

Introduction, Basic DAC techniques,weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs –parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC.DAC and ADCSpecifications.

Textbooks:

1. Linear Integrated Circuits–D.Roy Chowdhury, NewAge International(p) Ltd, 2nd Edition, 2003.
2. Op-Amps & LinearICs – Ramakanth A.Gayakwad, PHI, 1987.
3. Operational Amplifiers–C.G.Clayton,Butterworth & Company Publ. Ltd./ Elsevier,1971.

References:

1. Operational Amplifiers & Linear Integrated Circuits–SanjaySharma; SKKataria & Sons; 2nd Edition, 2010.
2. Design with Operational Amplifiers & Analog Integrated Circuits–Sergio Franco, McGrawHill,1988.
3. OPAMPS and Linear Integrated Circuits concepts and Applications, James Fiore, Cengage Learning India Ltd.
4. Operational Amplifiers & Linear Integrated Circuits–R.F.Coughlin & Frederick Driscoll, PHI, 6th Edition.
5. Operational Amplifiers & Linear ICs–David A Bell,Oxford Uni.Press, 3rd Edition.

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Robotics (Open Elective-I)				

Course Objectives:

The general objectives of the course are to enable the students to

1. Understand the components and their working principles of a robotic system.
2. Expand this knowledge into the vast area of robotics.
3. The students will be exposed to the concepts of robot kinematics, Dynamics, Trajectory planning.
4. Mathematical approach to explain how the robotic arm motion can be described.
5. The students will understand the functioning of sensors and actuators.

Course Outcomes:

Upon successful completion of this course you should be able to:

1. To learn about knowledge for the design of robotics.
2. Identify various robot configurations and components.
3. Carry out kinematic and dynamic analysis for simple serial kinematic chains
4. Calculate the Jacobian for serial and parallel robots.
5. Perform trajectory planning for a manipulator by avoiding obstacles and develop programming principles, languages for a robot control system
6. Select appropriate actuators and sensors for a robot based on specific application

UNIT –I: Robot Fundamentals

Definitions, History of robots, Laws of Robotics, Robot Specification, Anatomy of a Robot, An overview of Robotics, present and future applications, classification by coordinate system and control system.

UNIT –II: Components Of The Industrial Robotics

Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom, Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

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UNIT –III: Motion Analysis

Homogeneous transformations as applicable to rotation and translation problems.

Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics, problems.

UNIT –IV: Differential transformation and manipulators

Jacobians, problemsDynamics: Lagrange – Euler and Newton – Euler formulations, Problems.

UNIT –V: General considerations in path description and generation

Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion, straight line motion, Robot programming, languages and software packages, description of paths with a robot programming language.

UNIT –VI: Robot Actuators And Feedback Components

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.

Feedback components: position sensors, potentiometers, resolvers, encoders, Velocity sensors.

Robot Applications in Manufacturing:Material Transfer, Material handling, loading and unloading, Processing, spot and continuous arc welding & spray painting, Assembly and Inspection.

Text Books:

1. Groover M P, Industrial Robotics, Pearson Edu Special Indian Edition, 2012.
2. Mittal R K & Nagrath I J, Robotics and Control, Tata McGraw-Hill, 11th Reprint 2008.

References:

1. K S Fu,Ralph Gonzalez,C S G Lee, Robotics, McGraw Hill, 1987.
2. Richard D. Klafter, Robotic Engineering, Prentice Hall, 1st Edition, 1989.
3. John J Craig, Introduction to Robotics, Pearson, 3rd Edition, 2004.

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	2	1	0	3
Subject	Mathematics III (Differential Calculus, Number Theory & Applications)				

Course Objectives:

1. Make the students learn modeling various physical phenomena as first and higher order PDE and applications
2. Learn the Fourier series of periodic functions and expand a function in sine and cosine series
3. Understand the number theory concepts

Course Outcomes:

After undergoing this course, students will be able to:

1. Model first order linear and non-linear partial differential equations and solve analytically
2. Model higher order partial differential equations and solve analytically
3. Compute Fourier series of periodic functions
4. Physical problems of engineering like steady and unsteady heat conduction, vibration of string, etc.,
5. Find GCD, Prime factorization of Integers
6. Solve linear congruences in number theory

UNIT-I: First Order Partial Differential Equations

Formation of Partial differential equations by elimination of arbitrary constants and arbitrary functions– solutions of first order linear (Lagrange) equations and nonlinear equations-standard types

UNIT- II: Higher Order Partial Differential Equations

Solutions of Linear Partial differential equations with constant coefficients. RHS terms of the type e^{ax+by}, Sin(ax+by), Cos (ax+by), x^m y^n. Classification of second order partial differential equations-parabolic, elliptical and hyperbolic.

UNIT - III: Fourier Series

Introduction, Periodic function, Dirichlet's conditions, Fourier series of periodic function, Fourier series at the point of discontinuity, Fourier series of even and odd functions, Half-range Fourier Sine and Cosine series. Fourier series in an arbitrary interval.

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UNIT-IV: Applications of Partial Differential Equations

Method of Separation of Variables, Applications to wave equation, heat conduction equation in one dimension

UNIT-V:Basic Number Theory

The Well- ordering principle, properties of integers, division algorithm, Greatest Common Divisor(GCD), Relatively prime, Prime numbers, Euclid's Lemma, Prime Factorization, Number of Divisors, Euler's Function.

UNIT-VI: Theory of Congruences

Congruences -Properties, Residues modulo, Fermat's Theorem, Wilson's Theorem - Applications

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 42nd Ed., Khanna Publishers, New Delhi, 2012
2. Elementary Number Theory and its Applications , Kenneth H. Rosen, ADDISON-WESLEY PUBLISHING COMPANY

References:

1. T.K.V.Iyengar, B. Krishna Gandhi, S. Ranganatham and M.V.S.S.N.Prasad, Engineering Mathematics, Volume-I, 12th Ed., S. Chand Publishers, 2014
2. B. V. Ramana, Higher Engineering Mathematics, 4th Ed., Tata McGraw Hill, New Delhi, 2009
3. Elementary Number Theory , David M Burton, 7th Edition, McGraw Hill.

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	2	0	0	1
Subject	Quantitative Aptitude II				

Course Objectives:

Enable the students to

1. Know the concepts of partnership and their profit sharing at the end.
2. Understand the concept of sets and relation between sets and Venn diagrams.
3. Apply the concepts of measures of central tendency and dispersion.
4. Know the concepts of Permutations & Combinations and their application in probability.
5. Calculate ages of persons in a family using the given data.
6. Understand the given data and interpret the required values.

Course Outcomes:

After completing this course, the students will be able to

1. Calculate the profit or remuneration received at the end using the ratio of investments or workmanship.
2. Evaluate the number of persons/objects belonging to a specific category using the concept of Venn diagram.
3. Measure the range, mean, median and mode of the given data, identify the extent of dispersion and interpret the data.
4. Compute various ways of selection or arrangement of persons /objects and predict the probability of doing so.
5. Deduce the ratios/ equations corresponding to ages of persons of a family and calculate the corresponding ages.
6. Analyze the given chart / table and interpret the results from the given data.

UNIT –I: Business & Partnership

Partnership in business- Working and Sleeping Partners -Division of Shares - Partnership Involved Time and Work problems.

UNIT- II:Set Theory Venn Diagrams

Basic Concepts of Sets-Operations on Sets – Venn Diagrams- Problems.

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UNIT –III: Statistics:

Basics of Statistics -Range -Mean- Median-Mode -Standard Deviation-Problems.

UNIT –IV: Permutations & Combinations and Probability

Basic concepts of Permutations & Combinations - Selection with and without repetition- Circular Arrangements.

Concepts of Probability- Various Events of Probability- Related Problems.

UNIT –V: Ages

Ratio Based - Proportion Based - Equation Based – Average Based - Age Problems.

UNIT – VI : Data Interpretation

Line & Bar Graphs- Pie Charts/Graphs-Table –Based Problems.

Text Books:

- Dr. R.S.Aggarwal ,Quantitative Aptitude for Competitive Examinations,Sultan Chand Publications, 2017.

References:

- Arun Sharma, How to Prepare for Quantitative Aptitude for the CAT, Tata McGrawHillPublishing Company, 2016.
- Dinesh Khattar,The Pearson Guide to Quantitative Aptitude for Competitive Examinations, Pearson India, 2016.

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Full Stack Web Development Lab				

Course Objectives: By the end of this lab, students will

1. Learn database connectivity and operations using JDBC and MySQL.
2. Develop dynamic and secure web applications using Servlets, JSP, HTTP, and session management.
3. Design responsive front-end applications using Bootstrap and implement automation using Perl.
4. Build server-side applications using Node.js for backend processing and database interaction.

Course Outcomes: Upon completion of this lab, students will be able to:

1. Implement database-driven applications using JDBC, Servlets, JSP, and MySQL.
2. Develop full-stack web applications with HTTP request handling, session tracking, and security features.
3. Create responsive and interactive user interfaces using Bootstrap and automate web-based tasks using Perl.
4. Build backend services using Node.js for efficient server-side processing and data management.

List of Experiments

1. Develop a Java application to connect with MySQL using JDBC and display database metadata.
2. Implement Create, Read, Update, and Delete operations in MySQL using Java and JDBC.
3. Develop a Java application to store and retrieve images from a MySQL database.
4. Create a simple Servlet-based web application to process and display user requests.
5. Build a student registration system using Servlets and MySQL database connectivity.
6. Develop a login and authentication system using JSP, Servlets, and MySQL.
7. Implement a web application to process form data using HTTP GET and POST methods.
8. Create a web application that manages user sessions using cookies and Servlets.
9. Implement a secure authentication system where user passwords are hashed
10. Develop a responsive webpage using Bootstrap grid, forms, and navigation components.
11. Build a user registration form using Bootstrap with form validation and styling.
12. Write a Perl script to create, read, write, and append data to files.
13. Implement a Perl script to extract and display content from web pages.
14. Develop a simple web server using Node.js that serves static HTML pages.
15. Build a Node.js-based backend that interacts with a MySQL database to manage data using Create, Read, Update, and Delete operations.

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Natural Language Processing Lab				

Course Objectives:

1. To Provide hands-on experience with key NLP techniques, including regular expressions, tokenization, and text preprocessing.
2. To enable students to build and evaluate language models and apply machine learning algorithms for solving real-world NLP tasks like spam detection and sentiment analysis.

Course Outcomes: After completing this course, the students will be able to

1. Apply regular expressions and tokenization techniques for text processing.
2. Develop and evaluate N-gram models and compute perplexity for language modeling tasks.
3. Implement and evaluate Naïve Bayes and Logistic Regression models for text classification tasks.
4. Build and train sequence labeling models for Named Entity Recognition (NER) and Part-of-Speech (POS) tagging.

Experiments:

1. Solve the following by writing Regular Expressions in Python
    a. Replace all occurrences of **5** with '**five**' for the given string
    b. For the given list, filter all elements that do *not* contain '**e**'.
    c. For the given input string, display all lines not containing '**start**' irrespective of case.
    d. For the given input list, filter all elements that contains **42** surrounded by word characters.
    e. Validate the CVV number(It should have 3 or 4 digits, It should have a digit between 0-9, It should not have any alphabets and special characters)
    f. For the given input string, change whole word **mall** to **1234** only if it is at the start of a line
    g. Check whether the given email address is valid or not.
    h. Check whether the Aadhar number is valid or not (It should have 12 digits, It should not start with 0 and 1, It should not contain any alphabet and special characters, It should have white space after every 4 digits)
2. Write code snippets to
    a. Tokenize words and sentences.
    b. Perform stemming on the tokens present in the given sentence.
    c. Perform Lemmatization on the tokens present in the given sentence.

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3. Write a program to implement the Minimum Edit Distance algorithm.
4. Design a function with the name ngram_converter() that takes in a **sentence** and '**n**' as an argument and converts it into N-grams.
5. Write a program to compute unsmoothed unigrams and bigrams.
6. Build a basic N-gram language model using trigrams of Reuters corpus. Reuters corpus is a collection of 10,788 news documents totaling 1.3 million words.
7. Run N-gram program on two different small corpora of your choice (you might use email text or newsgroups). Now compare the statistics of the two corpora. What are the differences in the most common unigrams between the two? How about interesting differences in bigrams?
8. Add an option to the above program to compute the perplexity of a test set.
9. Implement and Evaluate Naïve Bayes Model for Email Spam filtering task.
10. Implement and Evaluate Naïve Bayes Model for Sentiment Analysis task.
11. Write Python functions to calculate sigmoid, softmax, cross-entropy loss.
12. Create a sample value of Z (weighted sum as in logistic regression) and create the cross-entropy loss function plot showing plots for cost function output vs hypothesis function output (probability value).
13. Train a Text Classifier for E-mail spam detection using Logistic Regression.
14. Train a Text Classifier for Sentiment Analysis using Logistic Regression
15. Design a Sequence labelling task "Part-of-Speech tagging" using Hidden Markov Model.
16. Build a custom Named-Entity-Recognition model using any library (NLTK or spacy)

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Year / Semester	III B. Tech / I Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Operating System & Language Processor Lab				

Course Objectives:

1. Understand and implement core operating system concepts such as process scheduling, memory management, and file systems.
2. Develop and apply compiler design techniques, including lexical analysis, syntax analysis, and parsing.

Course Outcomes: After completing this course, the students will be able to

1. Simulate and evaluate different CPU scheduling and memory management algorithms.
2. Develop and test solutions for synchronization and deadlock problems using semaphores and monitors.
3. Design and implement file organization and disk scheduling strategies.
4. Implement lexical analyzers and parsers using tools like Lex.

EXPERIMENTS:

PART-1

1. Simulate the following CPU Scheduling Algorithms
   (a) FCFS (b) SJF (c) Priority (d) Round-Robin
2. Simulate the following
   (a) Multiprogramming with a Fixed number of Tasks (MFT)
   (b) Multiprogramming with a Variable number of Tasks (MVT)
3. Simulate Bankers Algorithm for DeadLock Avoidance.
4. Write a program to implement the producer-consumer problem using semaphores.
5. Write a program to implement IPC using shared memory.
6. Simulate the following Page Replacement Algorithms
   (a) FIFO (b) LRU (c) LFU
7. Write a program to simulate the following contiguous memory allocation techniques
   a) Worst-fit b) Best-fit c) First-fit
8. Write a program to implement Paging technique for memory management.
9. Simulate the following File Allocation Strategies
   (a) Sequenced (b) Indexed (c) Linked
10. Simulate the following Disk Scheduling Algorithms
    (a) FCFS (b) SSTF (c) SCAN

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PART-2

1. Implementation of Symbol Table
2. Develop a lexical analyzer to recognize a few patterns in C (Ex. identifiers, constants, comments, operators etc.)
3. Implementation of Lexical Analyzer using Lex Tool
4. Construction of DAG

Additional Experiments:

1. Write a Program to implement Dining Philosophers problem using Monitors.
2. Simulate given File Organization Techniques: (a) Hierarchical (b) DAG
3. Lex Program to convert abc to ABC.
4. Implementation of Recursive Descent Parser

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III B.Tech II SEMESTER

CSE

R19 SYLLABUS

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Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Computer Networks				

Course Objectives:

1. Understand state-of-the-art in network protocols, architectures, and applications.
2. Process of networking research
3. Constraints and thought processes for networking research

Course Outcomes: After completing this course, the students will be able to

1. Explain network topologies and compare the OSI and TCP/IP reference models.
2. Describe physical layer concepts, modulation, multiplexing techniques, and data link layer design issues.
3. Apply error control techniques and data link layer protocols for reliable communication.
4. Analyze medium access protocols and Ethernet technologies for effective channel allocation and communication.
5. Evaluate routing and congestion control algorithms to address network layer design issues.
6. Illustrate transport and application layer protocols for efficient and reliable communication

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.

UNIT – II:

Physical Layer – Guided Transmission Media, Digital Modulation and Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing, Code Division Multiplexing, WaveLength Division Multiplexing.

UNIT – III:

The Data Link Layer - Services Provided to the Network Layer – Framing – Error Control –Flow Control, Error Detection and Correction – Error-Correcting Codes – Error Detecting Codes, Elementary Data Link Protocols- A Utopian Simplex Protocol-A Simplex Stop and Wait Protocol for an Error free channel-A Simplex Stop and Wait Protocol for a Noisy Channel, Sliding Window Protocols-A One Bit Sliding Window Protocol-A Protocol Using Go-Back-NA Protocol Using Selective Repeat.

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UNIT – IV:

The Medium Access Control Sublayer-The Channel Allocation Problem-Static Channel Allocation-Assumptions for Dynamic Channel Allocation, Multiple Access Protocols-Aloha- Carrier Sense Multiple Access Protocols-Collision-Free Protocols-Limited Contention Protocols- Wireless LAN Protocols, Ethernet-Classic Ethernet Physical Layer-Classic Ethernet MAC Sublayer Protocol-Ethernet Performance-Fast Ethernet Gigabit Ethernet-10-Gigabit Ethernet,

UNIT – V:

Network Layer - The Network Layer Design Issues – Store and Forward Packet Switching- Services provided to the Transport layer- Implementation of Connectionless Service- Implementation of Connection Oriented Service-Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-Shortest path Algorithm, Congestion Control Algorithms- Approaches to Congestion Control-Traffic Aware Routing-Admission Control-Traffic Throttling- Load Shedding.

UNIT – VI:

Transport Layer – The Internet Transport Protocols: Udp, the Internet Transport Protocols: Tcp Application Layer –The Domain Name System: The DNS Name Space, Resource Records, Name Servers, Electronic Mail: Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery

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, FirouzMosharraf, McGraw Hill Education

Reference Books:

1. Larry L. Peterson and Bruce S. Davie, “Computer Networks - A Systems Approach” (5th ed), Morgan Kaufmann/ Elsevier, 2011

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	3	1	0	4
Subject	Data Science & Visualization				

Course Objectives:

From the course the student will learn

1. Provide you with the knowledge and expertise to become a proficient data scientist
2. Demonstrate an understanding of statistics and machine learning concepts that are vital
3. for data science.
4. Learn to statistically analyze a dataset
5. Explain the significance of exploratory data analysis (EDA) in data science
6. Critically evaluate data visualizations based on their design and use for communicatingstories from data

Course Outcomes:

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

1. Implement Python programming concepts and basic data structures like lists, tuples, and dictionaries for data science tasks.
2. Create visualizations such as bar charts, scatter plots, and heatmaps using matplotlib.
3. Analyze data with basic statistics, including central tendency and correlation, and apply Bayes' theorem.
4. Optimize models with gradient descent and handle data using file reading and web scraping.
5. Apply machine learning algorithms like linear regression, logistic regression, k-NN, and Naive Bayes, and evaluate their performance.
6. Build recommender systems and use storytelling to present data science results effectively.

UNIT I

Introduction to Data Science, Getting Python, Whitespace Formatting, packages, Functions, Strings, Exceptions, Lists, Tuples, Dictionaries, Sets, Control Flow, Truthiness, Sorting, List Comprehensions, Object Oriented Programming, Iterators and Generators, Randomness, Regular Expressions, Functional Tools, zip and Argument Unpacking, args and kwargs,NumPy, pandas, scikit-learn packages.

UNIT II

Visualizing Data: what is data visualization, what to plot (univariate, bivariate and multivariate) matplotlib, Bar Charts, Line Charts, Scatterplots, heatmaps, distributions like histograms, bubble charts, Tree map.

EDA Process: Exploratory Vs Explanatory Analysis,handling missing values, removing duplicates, Outlier treatment, scaling, normalization, encoding categorical variables, Bivariate analysis.

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UNIT III

Introduction and Descriptive Statistics: Introduction to statistics, Describing a Single Set of Data, Central Tendencies, Dispersion, Correlation, Simpson's paradox, Other Correlational Caveats, causation,

Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem.

UNIT IV

Gradient Descent: The Idea Behind Gradient Descent, Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Stochastic Gradient Descent.

Getting Data: stdin and stdout, Reading Files, Scraping the Web, Using APIs.

UNIT V

Machine Learning: Introduction to machine learning, training versus prediction, train - test spilt, cross validation, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, Measuring performance.

Algorithms*:* Simple Linear Regression, Multiple Regression, Logistic Regression, k-Nearest Neighbors, Naive Bayes ,clustering

UNIT VI

Recommender Systems: Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Hybrid Recommendation systems, Matrix Factorization.

The art of storytelling in Data Science: The need of Storytelling, How to create stories, Types of data and suitable charts, Stories, During steps of predictive modeling, best practices.

Text Books:

1) Joel Grus, "Data Science from Scratch", OReilly.
2) Allen B.Downey, "Think Stats", OReilly.

References:

1) Doing Data Science: Straight Talk from The Frontline, 1 st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013
2) Mining of Massive Datasets, 2 nd Edition, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, v2.1, Cambridge University Press, 2014
3) "The Art of Data Science", 1 st Edition, Roger D. Peng and Elizabeth matsui, Lean Publications, 2015
4) "Algorithms for Data Science", 1 st Edition, Steele, Brian, Chandler, John, Reddy, Swarna, springers

Publications, 2016

5)https://www.analyticsvidhya.com/blog/2020/05/art-storytelling-analytics-data-science/

6) https://www.analyticsvidhya.com/blog/2020/08/exploratory-data-analysiseda-from-scratch-in-python/

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Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Compiler Design				

Course Objectives:

Understand the basic concept of compiler design, and its different phases which will be helpful to construct new tools like LEX, YACC, etc.

Course Outcomes: After completing this course, the students will be able to

1. Identify phases of a compiler and use lexical analyzers tools like LEX and YACC.
2. Explain top-down and bottom-up parsing techniques.
3. Construct LL, SLR, CLR, and LALR parse tables.
4. Apply syntax-directed translation using attributes.
5. Implement code optimization and generation techniques.
6. Analyze machine-independent optimization and data flow analysis.

UNIT - I

Introduction Language Processing, Structure of a compiler, the evaluation of Programming language, Programming Language Basics.

Lexical Analysis-: The role of lexical analyzer, specification of tokens. Recognitions of tokens the lexical analyzer generator lexical

UNIT -II

Syntax Analysis -: The Role of a parser, Context free Grammars Writing A grammar, top down parsing bottom up parsing, Introduction to LL Parser & LR Parsers.

UNIT -III

More Powerful LR parser (LR1, LALR) Using Ambiguous Grammars Equal Recovery in LR parser Syntax Directed Transactions Definition, Evolution order of SDTS Application of SDTS. Syntax Directed Translation Schemes.

UNIT - IV

Intermediated Code: Generation Variants of Syntax trees 3 Address code, Types and Deceleration, Translation of Expressions, Type Checking, Back patching.

UNIT - V

Runtime Environments, Stack allocation of space, access to Non Local data on the stack Heap Management

code generation - Issues in design of code generation the target Language Address in the target code Basic blocks and Flow graphs. A Simple Code generation.

UNIT -VI

Machine Independent Optimization. The principle sources of Optimization peep hole Optimization, Introduction to Data flow Analysis.

TEXT BOOKS:

1. Compilers, Principles Techniques and Tools. Alfred V Aho, Monical S. Lam, Ravi Sethi Jeffery D. Ullman,2nd edition,Pearson,2007
2. Compiler Design K.Muneeswaran, OXFORD
3. Principles of compiler design, 2nd edition,Nandhini Prasad,Elsebier.

REFERENCE BOOKS:

1. Compiler Construction, Principles and practice, Kenneth C Louden, CENGAGE
2. Implementations of Compiler, A New approach to Compilers including the algebraic methods, Yunlinsu, SPRINGER

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Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Software Project Management (Professional Elective-II)				

Course Objectives:

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

1. To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
2. To compare and differentiate organization structures and project structures
3. To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

Course Outcomes: After completing this course, the students will be able to

1. Explain the waterfall model, its performance, and software economics with cost estimation models.
2. Compare traditional and modern software management methods and understand the software development life cycle.
3. Analyze software architecture and process workflows.
4. Develop iterative project planning and organizational structures.
5. Implement process automation and use software metrics to monitor and improve project performance and quality.
6. Apply techniques like COCOMO, Critical Path Analysis, and PERT for estimating and managing projects.

UNIT I

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

UNIT II

The Old Way and The New: The principles of conventional software Engineering, Principles of modern software management, transitioning to an iterative process.

Life Cycle Phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

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UNIT III

Model Based Software Architectures: A Management perspective and technical perspective.

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

Checkpoints of the Process: Major mile stones, Minor Milestones, Periodic status assessments.

UNIT IV

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

UNIT V

Process Automation: Automation Building blocks, The Project Environment.

Project Control and Process Instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics.

UNIT VI

Project Estimation and Management: COCOMO model, Critical Path Analysis, PERT technique.

Text Books:

1) Software Project Management, Walker Royce, Pearson Education, 2005.
2) Software Project Management, Bob Hughes, 4th edition, Mike Cotterell, TMH.

Reference Books:

1) Software Project Management, Joel Henry, Pearson Education.
2) Software Project Management in practice, Pankaj Jalote, Pearson Education, 2005.
3) Effective Software Project Management, Robert K.Wysocki, Wiley,2006.

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Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Big Data Analytics (Professional Elective-II)				

Course Objectives:

1. To optimize business decisions and create competitive advantage with Big Data analytics
2. To learn to analyze the big data using intelligent techniques
3. To introduce programming tools PIG & HIVE in Hadoop echo system

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

1. Illustrate big data challenges in different domains including social media, transportation, finance and medicine
2. Use various techniques for mining data stream
3. Design and develop Hadoop
4. Identify the characteristics of datasets and compare the trivial data and big data for various applications
5. Explore the various search methods and visualization techniques
6. Analyze the data Analytics algorithms in Spark.

UNIT I

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.

UNIT II

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.

UNIT III

Introduction to Hadoop: Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analysing 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.

UNIT IV

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 ZooKeeper.

UNIT V

Predictive Analytics and Visualizations: Predictive Analytics, Simple linear regression, Multiple linear regression, Interpretation of regression coefficients, Visualizations, Visual data analysis techniques, interaction techniques, Systems and application.

UNIT VI

(Big Data Frame Works for Analytics) Hadoop Frame Work: Map Reduce Programming: I/O formats, Map side join-Reduce Side Join-Secondary Sorting-Pipelining MapReduce jobs Spark Frame Work: Introduction to Apache spark-How spark works, Programming with RDDs: Create RDD spark Operations-Data Frame.

Text Books:

1) Tom White, "Hadoop: The Definitive Guide", Third Edition, O'reilly Media, Fourth Edition, 2015.
2) Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.
3) Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012

Reference Books:

1) Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.
2) Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, "Harness the Power of Big Data:The IBM Big Data Platform", Tata McGraw Hill Publications, 2012.
3) Arshdeep Bahga and Vijay Madisetti, "Big Data Science & Analytics: A Hands On Approach ", VPT, 2016.
4) Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons, 2014.

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Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	NoSQL Databases (Professional Elective-II)				

Course Objectives:

1. Understand the fundamentals of NoSQL Databases
2. Understand various NoSQL databases and their uses.
3. Perform various operations on NoSQL databases.

Course Outcomes:

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

1. Discuss about Aggregate Data Models and NoSQL Databases
2. Explain about Master-Slave Replication, Peer-to-Peer replication and Key- Value Databases
3. Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.
4. Explain performance tune of Key-Value Pair NoSQL databases.
5. Apply NoSQL development tools on different types of NoSQL Databases.
6. Optimize NoSQL performance with advanced indexing, querying, and backup strategies.

UNIT-I

Introduction, Overview and History of NoSQL Databases, SQL vs NOSQL, Advantages over RDBMS, Limitations, Different Types of NoSQL Databases, Attack of the Clusters, The Emergence of NoSQL. Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation.

UNIT-II

Distribution Models: Single Server, Shading, Master-Slave Replication, Peer-to-Peer Replication, Combining Shading and Replication, the CAP Theorem. Key-Value Databases: What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Suitable Use Cases, When Not to Use.

UNIT-III

Column Oriented Databases: What Is a Column-Family Data Store, Cassandra Database: What is Cassandra, Cassandra Architecture, Cassandra Data types, Cassandra Query Language-CQL, Creating, Altering,

Dropping a KeySpace, Cassandra CRUD Operations, Suitable Use Cases, and When Not to Use.

UNIT-IV

Document Oriented Databases: What Is a Document Database, Document Database using MongoDB, MongoDB Data Types, JSON, JSON Syntax, Creating JSON Object, MongoDB Data Modelling, MongoDB CRUD Operations, MongoDB Collections: Creating CSV Files, Exploring dataset structures, Using MongoDB , Suitable Use Cases, and When Not to Use.

UNIT-V

Graph Databases: What Is a Graph Database, Graph Database using Neo4j, Advantages of Neo4j,CQL Data Types,Neo4j CQL Operators, Create Nodes, Create Relationships, Index, Constraint, Select data with match, Import data from CSV, Drop an Index, Drop a Constraint, Deleting Nodes, Deleting Relationships. Suitable Use Cases, and When Not to Use.

UNIT VI: Advanced Concepts in NoSQL Databases: Creating and managing compound indexes in MongoDB,Efficient querying techniques using indexed fields, Using `hint()` for index selection in MongoDB to optimize query performance.Data Migration and Integration: Techniques for migrating relational data to NoSQL systems,Data transformation using ETL pipelines,MongoDB backup strategiesusing mongodump and mongorestore.

Text Books:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2019.

Reference Books:

1. Dan Sullivan, "NoSQLFor Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13:978-9332557338)
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

WEB REFERENCES:

1. https://www.ibm.com/cloud/learn/nosql-databases
2. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
3. https://www.geeksforgeeks.org/introduction-to-nosql/

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Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Multimedia and Animation (Professional Elective-II)				

Course Objectives:

1. To grasp the fundamental knowledge of Multimedia elements and systems.
2. To get familiar with Multimedia file formats and standards.
3. To learn the process of Authoring multimedia presentations.
4. To learn the techniques of animation in 2D and 3D and for the mobile UI.
5. To explore different popular applications of multimedia

Course Outcomes:

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

1. Understand multimedia components, system architecture, and challenges in storage, retrieval, and security.
2. Identify and compare various multimedia file formats and color models used in digital media.
3. Use multimedia authoring tools to create interactive content and virtual learning environments.
4. Apply animation principles and techniques in 2D, 2.5D, and 3D environments including VR/AR.
5. Analyze real-world multimedia applications in big data, cloud computing, streaming, and forensics.
6. Explain compression techniques and multimedia delivery methods ensuring quality and performance.

UNIT-I INTRODUCTION TO MULTIMEDIA

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

UNIT-II MULTIMEDIA FILE FORMATS AND STANDARDS

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT-III MULTIMEDIA AUTHORING

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D

Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations.

UNIT-IV ANIMATION

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT-V MULTIMEDIA APPLICATIONS

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

UNIT-VI MULTIMEDIA COMPRESSION AND DELIVERY

Need for compression, Basics of compression algorithms: Lossless (Huffman, LZW), Lossy (DCT, Fractal, Wavelet), Image compression: JPEG, JPEG2000, Audio compression: MP3, AAC, Video compression: MPEG-1, MPEG-2, MPEG-4, H.264/AVC, H.265/HEVC. Real-time multimedia processing, Streaming techniques, Progressive downloads, Buffering, Content Delivery Networks (CDNs), Multimedia over IP, Adaptive streaming (DASH, HLS), Quality of Service (QoS): latency, jitter, packet loss.

Text Books:

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia", Third Edition, Springer Texts in Computer Science, 2021

Reference Books:

1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
2. Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018.
3. Prabhat K.Andleigh, Kiran Thakrar, "Multimedia System Design", Pearson Education, 1st Edition, 2015.
4. Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature, 1st Edition, 2021.
5. Rogers David, "Animation: Master – A Complete Guide (Graphics Series)", Charles River Media,

2006. 7. Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rd Edition, 2012.

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1. https://itsfoss.com/
2. https://www.ucl.ac.uk/slade/know/3396
3. https://handbrake.fr/
4. https://opensource.com/article/18/2/open-source-audio-visual-production-tools https://camstudio.org/
5. https://developer.android.com/training/animation/overview
6. https://developer.android.com/training/animation/overview

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Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	DIGITAL IMAGE PROCESSING (Open Elective-II)				

Course Objectives:

Students undergoing this course are expected to:

1. Understand the basic concepts of digital image processing and different image transforms.
2. Learn image processing techniques image enhancement and restoration.
3. Understand the concepts of image compression and wavelets.
4. Understand the concepts of image segmentation and morphological image processing.
5. Understand the fundamentals of color image processing and learn various color models.

Course Outcomes:

After undergoing the course students will be able to

1. Perform image manipulations and different digital image processing techniques
2. Perform basic operations like – Enhancement, Image transforms and restoration techniques on image.
3. Apply wavelets in image processing techniques.
4. Apply various morphological operators on images.
5. Analyze pseudo and fullcolor image processing techniques.

UNIT –I:Introduction

Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels.

Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVDand Radon Transform, Comparison of different image transforms

UNIT –II:Intensity Transformations and Spatial Filtering

Background, some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, combining spatial enhancement methods

Filtering in the Frequency Domain: Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters.

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UNIT –III:Image Restoration and Reconstruction

A model of the image degradation /Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering,Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter, image reconstruction from projections.

UNIT –IV:Image compression

Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding, Predictive coding

Wavelets and Multiresolution Processing: Image pyramids, subband coding, Multiresolution expansions, wavelet transforms in one dimensions & two dimensions, Wavelet coding.

UNIT –V:Image segmentation

Fundamentals, point, line, edge detection, thresholding, region –based segmentation.

Morphological Image Processing: Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology, Segmentation using morphological watersheds.

UNIT –VI:Color image processing

Color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

Text Books:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall,2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar,” Digital Image Processing”, TataMcGraw-Hill Education, 2011.

Reference Books:

1. Anil K.Jain, “Fundamentals of Digital Image Processing”, Prentice Hall of India, 9th Edition, Indian Reprint,2002.
2. B.Chanda, D.Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2009.

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Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation Year	R19	3	0	0	3
Subject	Green Building Technologies (Open Elective-II)				

Course Objectives:

The Objectives of this course is to enable students to ,

1. Learn the principles of planning and orientation of buildings.
2. Acquire knowledge on various aspects of green buildings.

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

1. Explain the principles of building planning, rainwater harvesting.
2. Understand the concepts of green buildings.

CO1: Define green buildings and explain sustainable site planning principles.

CO2: Identify eco-friendly building materials and technologies.

CO3: Apply energy and water conservation methods in buildings.

CO4: Utilize renewable energy sources in building design.

CO5: Analyze climate-responsive design for thermal comfort and energy efficiency.

CO6: Understand green building rating systems and smart building technologies.

UNIT-I

Green Buildings: Definition of Green Buildings, typical features of green buildings, benefits of Green Buildings- Sustainable site selection and planning of buildings to maximize comfort, day lighting, ventilation, planning for storm water drainage.

UNIT-II

Environmentally friendly building materials and technologies: Natural Materials like bamboo, timber, rammed earth, stabilized mud blocks, hollow blocks, lime & lime-pozzolana cements, materials from agro and industrial waste, ferro-cement and ferro-concrete, alternative roofing systems, various paints reducing the heat gain of the building, etc.

UNIT-III

Energy and resource conservation: Need for energy conservation, various forms of energy used in buildings, embodied energy of materials, energy used in transportation and construction processes- water conservation systems in buildings-water harvesting in buildings waste to energy management in residential complexes or gated communities.

UNIT-IV

Use of renewable energy resources: Wind and Solar Energy Harvesting, potential of solar energy in India and world, construction and operation of various solar appliances, success case studies of fully solar energy-based buildings in India.

UNIT-V

Climate Design: Local climatic conditions temperature, humidity, wind speed and direction -impact of climate change on built environment - comforts: the desirable conditions Principles of thermal design means of thermal light and lighting-building acoustics-energy efficient lighting, Ventilation and air quality requirement, various techniques for passive cooling, garden roofs, case studies for passive cooling and thermal comfort.

UNIT-VI

Green Building Rating Systems: Introduction to Leadership in Energy and Environment Design (LEED), Green Rating systems for Integrated Habitat Assessment Modular wastewater treatment systems for built environment Building automation and building

Text Books:

1. Alternative building materials and technologies by K.S. Jagadish, Venkatarama Reddy and K.S. Nanjunda Rao.
2. "Non-Conventional Energy Resources' by G. D. Rai, Khanna Publishers.

Reference Books:

1. Mili Majumdar, "Energy-efficient buildings in India" Tata Energy Research Institute, 2002.
2. TERI "Sustainable Building Design Manual- Volume I & II" Tata Energy Research Institute, 2009.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Information Theory and Coding (Open Elective-II)				

Course Objectives:

1. To define and apply the basic concepts of information theory (entropy, channel capacity etc.)
2. To learn the principles and applications of information theory in communication systems
3. To study various data compression methods and describe the most common such methods
4. To understand the theoretical framework upon which error-control codes are built

Course Outcomes:

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

1. Explain the concepts of information theory including entropy, information rate, and mutual information.
2. Demonstrate source coding techniques such as Shannon's theorem, Shannon-Fano coding, Huffman coding, and calculate channel capacity.
3. Explore source coding methods for different media like text, audio, speech, and image, including techniques like Huffman coding, perceptual coding, and image compression.
4. Analyze linear block codes, their matrix description, and error detection and correction capabilities.
5. Apply binary cyclic codes, including syndrome calculation, error detection, and decoding methods.
6. Implement convolution codes, including their encoding, graphical representation, and decoding using the Viterbi algorithm.

UNIT I INFORMATION THEORY:

Discrete messages, Information and its properties. Average information, Entropy and its properties. Information rate, Mutual information and its properties.

UNIT II SOURCE CODING:

Introduction, Shannon's theorem, Shannon-Fano coding, Huffman coding, efficiency calculations, channel capacity of discrete and analog Channels, Gaussian channel capacity, bandwidth –S/N trade off.

UNIT III: SOURCE CODING FOR TEXT, AUDIO, SPEECH AND IMAGE:

Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I, II, III, Dolby AC3 Speech: Channel Vocoder, Linear Predictive Coding Image: Image formats, Image compression: READ, JPEG.

UNIT IV LINEAR BLOCK CODES:

Introduction, Matrix description of Linear Block codes, Error detection and error correction capabilities of Linear block codes, Hamming codes

UNIT V BINARY CYCLIC CODES:

Polynomial Representation of Codewords, Generator Polynomial, Systematic Codes, Generator Matrix, Syndrome Calculation and Error Detection, Decoding of Cyclic Codes.

UNIT VI CONVOLUTION CODES:

Introduction, encoding of convolution codes, time domain approach, transform domain approach. Graphical approach: state, tree and trellis diagram decoding using Viterbi algorithm.

Text Books:

1. T. M. Cover, J. A. Thomas, *Elements of Information Theory*, Wiley
2. Communication Systems, 3/e, by A.B. Carlson, Mc. Graw Hill Publishers
3. R. Togneri, C.J.S deSilva, *Fundamentals of Information Theory and Coding Design*, Taylor and Francis

Reference Books:

1. R. J. McEliece, The Theory of Information and Coding, Cambridge Uinversity Press
2. R. Bose, Information Theory Coding and Cryptography, Tata McGraw Hill

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Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Principles of Signal Processing (Open Elective-II)				

Course Objectives:

To provide a comprehensive understanding of digital signal processing techniques including DFT, FFT, digital filter design (FIR & IIR), multirate signal processing, and adaptive filters, enabling students to analyze and implement DSP algorithms for real-time applications.

Course Outcomes:

1. Use the FFT algorithm for solving the DFT of a given signal
2. Design a Digital filter (FIR&IIR) from the given specifications
3. Realize the FIR and IIR structures from the designed digital filter.
4. Use the Multirate Processing concepts in various applications
5. Apply the Adaptive signal processing concepts to various signal processing applications
6. Understand real-time DSP applications and implementation techniques using suitable hardware and software platforms.

Unit I:

Discrete Signals and Systems- A Review – Introduction to DFT – Properties of DFT – Circular Convolution – Filtering methods based on DFT – FFT Algorithms –Decimation in time Algorithms, Decimation in frequency Algorithms – Use of FFT in Linear Filtering.

Unit II:

Structures of IIR filters – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation.

Unit III:

Structures of FIR filters – Linear phase FIR filter – Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques

Unit IV:

Multirate signal processing: Basic building blocks of multirate DSP, Decimation, Interpolation, Sampling rate conversion by a rational factor, Multistage Sampling Rate Converters.

Unit V:

Adaptive Filters: Introduction, LMS and RLS Adaptation Algorithms, Applications of adaptive filtering to equalization, noise cancellation.

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Unit VI:

DSP Applications and Implementation Techniques: Real-time Digital Signal Processing – Overview of DSP applications: Audio and speech processing, image processing, communication systems, biomedical signal processing.

DSP implementation considerations:
Fixed-point vs floating-point DSPs, hardware architecture of DSP processors, memory and throughput considerations, introduction to DSP programming using MATLAB or Python.

Case Studies:
Implementation of FIR/IIR filters, FFT algorithms, and adaptive filters in real-time systems.

Text Books:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G.Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI

Reference Books:

1. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris,Thomson, 2007.
2. Understanding Digital Signal Processing 2nd Edition by Richard G.Lyons

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Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	MAT Lab Programming and ML Tool Box (Open Elective-II)				

Course Objectives :

1. To provide foundational knowledge of MATLAB programming and its environment.
2. To equip learners with skills for data visualization, preprocessing, and file handling using MATLAB.
3. To introduce core machine learning techniques and their implementation using MATLAB's Machine Learning Toolbox.
4. To enable learners to apply MATLAB for solving real-world problems through hands-on projects and case studies.

Course Outcomes (COs): After completing this course, the students will be able to

1. Understand and apply MATLAB programming constructs including variables, control flow, and functions.
2. Perform data visualization using MATLAB's 2D and 3D plotting tools.
3. Read, write, and preprocess datasets for analysis using MATLAB file I/O functions.
4. Implement supervised and unsupervised machine learning algorithms using MATLAB.
5. Analyze and evaluate machine learning models using appropriate metrics and validation techniques.
6. Develop and deploy machine learning solutions to real-world problems using MATLAB.

UNIT-I

Introduction to MATLAB, Overview of MATLAB environment, Basic commands and syntax, Variables and data types, Operators and expressions

MATLAB Programming Basics: Script files and function files, Control flow: if statements, loops (for, while),Vector and matrix operations, Built-in functions and user-defined functions

UNIT-II

Data Visualization: Plotting basics: plot, scatter, bar, hist, Customizing plots: titles, labels, legends 3D plotting: mesh, surf, contour, Advanced visualization: subplot, hold on, hold off, File I/O, Reading and writing data: load, save, fopen, fclose, Importing and exporting data: CSV, Excel, text files, Data manipulation and preprocessing

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UNIT-III

Advanced MATLAB Programming: Debugging and error handling, Efficient programming techniques, Object-oriented programming in MATLAB, Toolboxes and add-ons

Machine Learning Toolbox: Introduction to Machine Learning, Overview of machine learning concepts, Types of machine learning: supervised, unsupervised, reinforcement learning, Key terminology: features, labels, training, testing.

UNIT-IV

Data Preparation: Data cleaning and preprocessing, Feature selection and extraction, Handling missing data and outliers, Data normalization and scaling, Supervised Learning, Regression: linear regression, polynomial regression, Classification: logistic regression, decision trees, SVM, k-NN, Model evaluation: cross-validation, confusion matrix, ROC curves.

UNIT-V

Unsupervised Learning: Clustering: k-means, hierarchical clustering, Dimensionality reduction: PCA, LDA, Anomaly detection, Ensemble methods: bagging, boosting, random forests.

UNIT-VI

Neural networks and deep learning basics, Time series analysis and forecasting, Model deployment and integration, Practical Applications, Case studies and real-world applications, Hands-on projects and assignments, Using MATLAB for specific machine learning tasks

Text Book:

1. RudraPratap, 2003. Getting Started with MATLAB-A Quick Introduction for Scientists and Engineers, Oxford University Press.

References:

1. William John Palm, 2005. Introduction to Matlab 7 for Engineers, McGraw-Hill Professional.New Delhi.
2. Dolores M. Etter, David C. Kuncicky, 2004.Introduction to MATLAB 7, Prentice Hall, New Delhi.
3. Kiranisingh.Y,Chaudhuri.B.B, 2007.Matlab Programming, Prentice-Hall Of India Pvt.Ltd, New Delhi.
4. Brian Hahn, 2016. Essential MATLAB for Engineers and Scientists.6thedition , Elsevier publication.

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Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Computer Networks Lab				

Course Objectives:

1. To write, execute and debug c programs which use Socket API.
2. To understand the use of client/server architecture in application development.
3. To understand how to use TCP and UDP based sockets and their differences.
4. To get acquainted with unix system internals like Socket files, IPC structures.
5. To Design reliable servers using both TCP and UDP sockets

Course Outcomes: After completing this course, the students will be able to

1. Implement data link layer framing methods and error detection using CRC polynomials.
2. Develop TCP and UDP client-server applications for text and file transfer.
3. Design concurrent server applications using multiplexing techniques like `select` and `poll`.
4. Create hybrid TCP and UDP client-server applications for handling multiple requests.

List of Experiments:

1. Implement the data link layer framing methods such as character, character stuffing and bit stuffing.
2. Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP .
3. Design TCP iterative Client and server application to reverse the given input sentence
4. Design TCP client and server application to transfer file
5. Design a TCP concurrent server to convert a given text into upper case using multiplexing system call “select”
6. Design a TCP concurrent server to echo given set of sentences using poll functions
7. Design UDP Client and server application to reverse the given input sentence
8. Design UDP Client server to transfer a file
9. Design using poll client server application to multiplex TCP and UDP requests for converting a given text into upper case.

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Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Data Science Lab				

Course Objectives:

1. To introduce data manipulation, visualization, and exploratory data analysis using Python libraries like NumPy, Pandas, and Matplotlib.
2. To develop skills in preprocessing, analyzing, and interpreting datasets through statistical methods and machine learning techniques.
3. To implement predictive modeling and classification algorithms such as Linear Regression, Logistic Regression, Naïve Bayes, and K-Means Clustering.
4. To design interactive dashboards using Plotly and Google Dashboard for effective data presentation and decision-making.

Course Outcomes:

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

1. Apply data manipulation and visualization techniques using NumPy and Pandas to preprocess, clean, and analyze datasets.
2. Perform Exploratory Data Analysis (EDA) and visualize data using various plotting techniques.
3. Build and evaluate machine learning models like Linear Regression, Logistic Regression, Naïve Bayes, and K-Means Clustering.
4. Extract and process data from online sources using Python-based web scraping techniques.

Experiments:

1. a) Visualise the correlation between the features for the Rainfall prediction data set .
   b) Find the outliers and visualise with any plot for the Housing Price dataset.
2. a) For a given dataset, find the measures of centre tendency for the chosen feature.
   b) Display the confidence interval of a chosen feature based on a sample

3. Numpy Package
   a) Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions.
   b) Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
   c) Computation on NumPy arrays using Universal Functions and Mathematical methods.
   d) Import a CSV file and perform various Statistical and Comparison operations on rows/columns.
   e) Load an image file and do crop and flip operation using NumPy Indexing.
4. Pandas package

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a) Create Pandas Series and DataFrame from various inputs.

b) Import any CSV file to Pandas DataFrame and perform the following:

i. Visualize the first and last 10 records
ii. Get the shape, index and column details
iii. Select/Delete the records(rows)/columns based on conditions.
iv. Perform ranking and sorting operations.
v. Do required statistical operations on the given columns.
vi. Find the count and uniqueness of the given categorical values.
vii. Rename single/multiple columns.

5. Import any CSV file to Pandas DataFrame and perform the following:
   (a) Handle missing data by detecting and dropping/ filling missing values.
   (b) Transform data using apply() and map() method.
   (c) Detect and filter outliers.
   (d) Perform Vectorized String operations on Pandas Series.
   (e) Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.
6. Create a database with the fields of weight, height and sex then create a plot of weight on the x-axis and height on the y-axis. Use different point characters or colors to distinguish between males and females and provide a matching legend. Label the axes and give the plot a title.

7. Create a plot for the same database consists of weight on the x-axis and height on the y-axis. Use different point characters or colors to distinguish between males and females and provide a matching legend. Label the axes and give the plot a title.

8. Write python code that will plot education on the x-axis and income on the y-axis, with both x- and y-axis limits fixed to be [0;100]. Provide appropriate axis labels. For jobs with a prestige value of less than or equal to 80, use a black * as the point character. For jobs with prestige greater than 80, use a blue @.

9. Choose any data like penguin dataset and visualize different plots like
   a) Box plot
   b) Histograms
   c) Density plot

10. Exploratory Data Analysis on
    a) Basic datasets like iris and titanic.

b) High dimensional dataset like house price prediction.

11. Creating Dashboards with
    a) Plotly
    b) Google Dashboard.

12. Create a Linear Regression model for a dataset and display the error measures
13. Choose a dataset with categorical data and apply linear regression model
14. Apply Naïve Bayes algorithm on a dataset and estimate the accuracy.
15. Classify the given text segment as ‘Positive’ or ‘Negative’ statement using the Naïve Bayes Classifier.
16. Apply Logistic Regression algorithm on a dataset and estimate the accuracy
17. Design a model to predict the housing price from Boston Dataset using Multivariate Linear Regression.
18. Implement the K-Means Clustering on any dataset like diabetic, car or buying behaviour of customers.
19. Extracting Data Using a Python Library
20. Extracting Data Using a Web Scraping

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Year/Semester	III B. Tech/II Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Advanced English Communication Skills Lab				

Course Objectives: To expose students to different contexts through right vocabulary To inculcate the habit of reading and understanding any text To enable students to acquire the ability of writing for business purposes To enable students to acquire interview skills and group discussion dynamics

Course Outcomes:

Upon the completion of the course, the student will be able to:

1. Choose vocabulary contextually.
2. Comprehend, analyze and interpret the text in a definite time frame.
3. Write resumes cohesively and coherently.
4. Construct and elaborate on a given topic.
5. Comprehend and practice the dynamics of group discussion. 1.5
6. Comprehend the concept and process of interview; answering through mock interviews

UNIT – I

Selected High GRE Words, Idioms & Phrases – Discourse Skills – using visuals – Synonyms and antonyms, word roots, one word substitutes, prefixes and suffixes, study of word origin, analogy, idioms and phrases, collocations. (2 sessions)

UNIT – II

Reading Comprehension – General Vs Local Comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning. (2 sessions)

UNIT – III

Writing Skills – Structure of Resume writing —Short Report Writing (Business/Technical) - (2 sessions)

UNIT – IV

Presentations (Technical)

UNIT – V Group Discussion – Dynamics of Group Discussion, Intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation. (2 sessions)

UNIT – VI Interview Skills – Concept and process – pre-interview planning, opening strategies, answering strategies, interview through teleconference & video-conference and mock interviews. (3 sessions)

SUGGESTED SOFTWARE:

1. K-Van solutions Software with CD
2. Oxford advanced learner's compass, 7th Edition

SUGGESTED READING:

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2. Business and Professional Communication: Keys for Workplace Excellence. Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications. 2011.
3. English Vocabulary in Use Series, Cambridge University Press 2008.
4. Communication Skills by Leena Sen, PHI Learning Pvt. Ltd., New Delhi, 2009.
5. A Course Book of Advanced Communication Skills Lab published by University Press,Hyderabad.

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IV B.Tech I SEMESTER

CSE

R19 SYLLABUS

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Network Security and Cryptography				

Course Objectives:

1. The concepts of classical encryption techniques and concepts of finite fields and number theory
2. Working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms
3. Design issues and working principles of various authentication protocols and PKIstandards
4. Various secure communication standards including Kerberos, IPsec, SSL/TLS, S/MIME and PGP

Course Outcomes:

Upon completion of the course, it is expected that student will be able to:

1. Identify information security goals and acquire fundamental knowledge on the concepts of finite fields and number theory
2. Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication
3. Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
4. Apply different digital signature algorithms to achieve authentication and create secure applications
5. Apply network security basics, analyze different attacks on networks and evaluate the performance of security protocols like SSL, IPSec, and PGP

UNIT I:

Introduction to Security: Security Attacks, Security Services, Security Mechanisms, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, a Model for Network Security Mathematics of Cryptography: Algebraic Structures (Groups, Rings, Fields and Galois Fields), Divisibility and the Division

Algorithm, The Euclidean Algorithm, Modular Arithmetic, Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms

UNIT II:

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography

Block Ciphers: Traditional Block Cipher Structure, The Data Encryption Standard, The Strength of DES, Block Cipher Design Principles, Advanced Encryption Standard, AES Structure, AES Transformation Functions, AES Key Expansion, Multiple Encryption and Triple DES, Block Cipher Modes of Operation

UNIT III:

Public-Key Cryptography: Principles of Public-Key Cryptosystems, The RSA Algorithm, DiffieHellman Key Exchange, Elgamal Cryptographic System, Elliptic Curve Cryptography **Cryptographic Hash Functions**: Applications of Cryptographic Hash Functions, Requirements and Security, Secure Hash Algorithm (SHA)

UNIT IV:

Message Authentication Codes: Requirements for Message Authentication Codes, HMAC, CMAC

Digital Signatures: Digital Signatures, Elgamal Digital Signature Scheme, Schnorr Digital Signature Scheme, NIST Digital Signature Algorithm, Elliptic Curve Digital Signature Algorithm

UNIT V:

Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure

User Authentication: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos, Remote User-Authentication Using Asymmetric Encryption

UNIT VI:

Transport-Level Security: Web Security Considerations, Transport Layer Security, Secure Shell (SSH)

Electronic Mail Security: S/MIME, Pretty Good Privacy

IP Security: IP Security Overview, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange

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Text Book:

1. Cryptography and Network Security, William Stallings, 8th Edition, Pearson Education

Reference Book:

1. Cryptography, Network Security and Cyber Laws, Bernard L. Menezes, Ravinder Kumar, Cengage Learning.
2. Cryptography and Network Security, Behrouz A Forouzan, Debdeep Mukhopadhyay, 3rd Edition, Mc-GrawHill.
3. Network Security Illustrated, Jason Albanese, Wes Sonnenreich, McGrawHill

E-RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105031/ lecture by Dr.DebdeepMukhopadhyayIIT Kharagpur [VideoLecture]
2. https://nptel.ac.in/courses/106/105/106105162/lecture by Dr. Sourav Mukhopadhyay IIT Kharagpur [VideoLecture]
3. https://www.mitel.com/articles/web-communication-cryptography-and-network-securityweb articles by Mitel PowerConnections

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Software Architectures (Professional Elective III)				

Course Objective: To understand the importance of Software Architecture in large scale software and apply different Architecture Styles to software design along with a practical approach.

Course Outcomes:

After completion of this course, student will be able to

1. Describe Software architecture for various software systems.
2. Recognize and derive Quality attributes for software architectures.
3. Demonstrate the use of different architectural styles and frameworks.
4. Depict systems requirements with the help of different UML diagrams.
5. Demonstrate documentation for architectural patterns.
6. Apply Zachman's Framework and assess the role of architecture in future software engineering.

UNIT I:

Introduction: Software architecture and requirements, Architecture diagrams,UML Component Diagram, UML Package Diagram,UML Deployment Diagram,UML Activity Diagram, Architecture structure, ABC(Architecture Business Cycle)

UNIT II:

Understanding Quality Attributes And Achieving Quality : Introduction to Quality Attributes, Need of quality attributes, Understanding quality attributes,architecture and quality attributes, achieving quality attributes.

Case study of quality attributes in software architecture templates, Deriving Quality Attributes for software architectures.

UNIT III:

Architecture in the life cycle / Architectural Views: Introduction – Definitions,Structures and views, Representing views, available notations, Standard views, 4+1 view of Rational Unified Process, Siemens 4 views,SEI's perspectives and views, Case studies Architecture in the agile projects, Architecture and requirements, Implementation and testing,Architecture reconstruction and conformance

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UNIT-IV:

Architectural Styles: Introduction– Data flow styles, Call-return styles,Shared Information styles,Event styles, Case studies for each style. Architectural styles, Pipes and filters,Data abstraction and object-oriented organization,Eventbased, implicit invocation,Layered systems, Repositories, Other familiar architectures, Heterogeneous Architectures.

UNIT V:

Documenting the architecture: Guidelines and practices,Documenting the Views using UML, Pros and cons of using visual languages,Need for formal languages, Architectural Description Languages, ACME, Designing and documentation,Case studies.

UNIT VI:

Advanced Topics: Software Architecture in the future, The Architecture Business Cycle Revisited ,Role of architecture in Software Engineering Enterprise Architectures,Zachman's Framework, Opportunities and Advances in Software Architectures.

Text Books:

1. Software Architecture in Practice, second edition, Len Bass, Paul Clements & Rick Kazman, Pearson Education, 2003.
2. Design Patterns, Erich Gamma, Pearson Education, 1995.

Reference Books:

1. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", SecondEdition, Pearson,ISBN 978-81-775-8996-2. Erich Gamma, Design Patterns
2. Ramesh Gopalaswamy, “Managing and global Software Projects”,Tata Mc GrawHill. Tenth Reprint2011.(Revised)
3. Roger S.Pressman, “Software Engineering - A Practitioner’s Approach”, 7th Edition McGraw Hill, 2010.(Revised).
4. Humphery Watts, “Managing the Software Process”,Addision Wesley,1989.(Revised). Syllabus for Bachelor of Technology Computer Engineering
5. Wheelwright and Clark: “Revolutionizing product development”, The Free Press, 1993

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Deep Learning (Professional Elective III)				

Course Objectives:

The objective of the course is to provide exposure to these advances and facilitate in depth discussions on deep learning.

Course Outcomes:

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

1. Demonstrate the basics of Machine Learning.
2. Analyze the importance of deep feedforward networks.
3. Summarize the significance of regularization for Deep Learning.
4. Implement optimization in DL.
5. Perceive the importance of Convolutional Networks and its significance.
6. Illustrate the knowledge on Sequence Modeling

UNIT I:

Machine Learning Basics:

Learning Algorithms, Capacity, Overfitting and Underfitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Estimation Bayesian Statistics. Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent, Building a Machine Learning Algorithm, Challenges Motivating Deep Learning.

UNIT II:

Deep Feedforward Networks

Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms.

UNIT III:

Regularization for Deep Learning

Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multitask Learning

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UNIT IV

Optimization for Training Deep Models:

How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

UNIT V:

Convolutional Networks:

The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks.

UNIT VI:

Sequence Modeling:

Recurrent and Recursive Nets Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Optimization for Long-Term Dependencies, Explicit Memory.

Text Books:

1. Goodfellow, I., Bengio, Y., Courville, A., & Bengio, Y. Deep learning,Vol. 1. Cambridge: MIT press.
2. François Duval , Deep Learning: Deep Learning for Beginners. Practical Guide with Python and Tensorflow, Data Sciences Publishing.

Reference Books:

1. Sebastian Raschka, Vahid Mirjalili,Python Machine Learning: Machine. Learning and Deep Learning with Python, scikit-learn, and TensorFlow, 2nd Edition, Packt Publishing

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Dev Ops (Professional Elective III)				

Course Objectives:

To get an expertise on the culture of DevOps in Software Development Methodologies for finding ways to adapt and innovate social structure, culture and technology together in order to work more effectively in the Enterprises.

Course Outcomes:

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

1. Explain key DevOps concepts, history, terminology, and cultural foundations.
2. Demonstrate effective collaboration, communication, and conflict resolution in DevOps teams.
3. Analyze team dynamics and organizational structures to strengthen team affinity.
4. Evaluate and select suitable DevOps tools for automation, monitoring, and standardization.
5. Apply scaling strategies to extend DevOps practices across teams and enterprises.
6. Implement DevOps best practices including CI/CD, IaC, DevSecOps, and agile project management.

UNIT I:

Introduction to DevOps: What is DevOps, A History of DevOps, Fundamental Terminology and Concepts – Software Development Methodologies, Operations Methodologies, Systems Methodologies, Development Release and Deployment Concepts, Infrastructure Concepts, Cultural Concepts. DevOps Misconceptions and Anti-Patterns, the Four Pillars of Effective DevOps.

UNITII:

Collaboration: Defining Collaboration, Individual Differences and Backgrounds, Opportunities for Competitive Advantage, Mentorship, Introducing Mindsets, Mindsets and Learning Organizations, The Role of Feedback, Reviews and Rankings, Communication and Conflict Resolution Styles, Empathy and Trust, Humane Staffing and Resources, Misconceptions and Troubleshooting of Collaboration.

UNIT III:

Affinity: What Makes a Team, Teams and Organizational Structure, Finding Common Ground Between Teams, Benefits of Improved Affinity, Requirements for Affinity, Measuring Affinity, Misconceptions and Troubleshooting of Affinity.

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UNIT IV: **Tools:** Software Development, Automation, Monitoring, Evolution of the Ecosystem,The Value of Tools to People, What Are Tools?, The Right Tools for Real Problems, Embracing Open Source, Standardization of Tools, Consistent Processes for Tool Analysis, Exceptions to Standardization, Irrelevance of Tools, The Impacts of Tools on Culture, Selection of Tools, Auditing Your Tool Ecosystem, Elimination of Tools, Misconceptions and Troubleshooting of Tools.

UNIT V:

Scaling: Understanding Scaling, Considering Enterprise DevOps, Organizational Structure, Team Flexibility, Organizational Life cycle, Complexity and Change, Scaling for Teams, Team Scaling and Growth Strategies, Scaling for Organizations, Misconceptions and Troubleshooting of Scaling.

UNIT VI:

DevOps Practices: Implementing CI/CD and continuous deployment, Understanding IaC practices, DevOps Best Practices: Automating everything, Choosing the right tool,Writing all your configuration in code, Designing the system architecture, Building a good CI/CD pipeline, Integrating tests, Applying security with DevSecOps, Monitoring your system, Evolving project management.

Text Books:

1. Jennifer Davis, Ryan Daniels, Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale, O'Reilly.
2. Mikael Krief, Learning DevOps, Packt Publications.

Reference Books:

1. Verona, Joakim. Practical DevOps. Packt Publishing Ltd.
2. By Jez Humble and David Farley, Continuous Delivery: Reliable Software Releases through Build, Test and Deployment Automation, Addison-Wesley Professional
3. Mandi Walls,Building a DevOps Culture, O'Reilly publications.
4. Sanjeev Sharma, "The DevOps Adoption Playbook – A Guide to Adopting DevOps in a Multi-Speed IT Enterprise", Wiley Publications.

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Augmented Reality and Virtual Reality (Professional Elective III)				

Course Objectives:

To introduce the basic concepts of Augmented Reality and Virtual Reality and to gain knowledge on various devices required for interaction and applications.

Course Outcomes:After completing this course, the students will be able to

1. Gain knowledge on AR & VR and various components involved in manifesting the same.
2. Evaluate and compare different AR and VR hardware platforms and their capabilities.
3. Plan content creation and identify necessary software required in implementing AR & VR..
4. Analyze the portability issues and understand the best practices.
5. Implement best practices for locomotion, audio, and interaction in AR and VR environments.
6. Develop AR and VR applications for various domains and evaluate future trends.

UNIT I:

Introduction: Virtual Reality, Augmented Reality, Mixed Reality, Augmented Virtuality, Extended Reality, History, VR Features, VR Controllers, Current issues with VR, AR Mobile devices, AR headsets, AR glasses, AR Controllers, Current issues with AR.

UNIT II:

Consuming Content in VR : High-end devices, Mid-tier devices, Low-end devices, Near-Future Hardware. Consuming Content in AR: Microsoft HoloLens, Meta 2, Magic Leap, Mira Prism, Apple ARKit, Google ARCore, Near-Future Hardware.

UNIT III:

Creating Content in VR and AR: Evaluating Your Project, Planning Your Virtual Reality Project, Planning Your Augmented Reality Project, Assessing Design Software, Capturing Real Life, Assessing Development Software, Distributing Your Content.

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UNIT IV:

Cross-Platform Theory: Role of Game Engines, Understanding 3D Graphics, The Virtual Camera, Degrees of Freedom, Portability Lessons from Video Game Design, Simplifying the Controller Input. Virtual Reality Toolkit: History of VRTK, SteamVR Unity Toolkit, VRTK v4, Future of VRTK, Success of VRTK, Getting Started with VRTK 4.

UNIT V:

Best Practices: Handling Locomotion in VR & AR, Effective Use of Audio in VR & AR, Common Interactions Paradigms, Inventory for VR, Augmented Reality Raycasts.

UNIT VI:

Applications: Travel, Museums, Aerospace, Retail, Military, Education, Entertainment, Real Estate, Advertising and Marketing, Mobile Apps for Experiencing Augmented Reality, Future of Virtual Reality and Augmented Reality.

Text BOOKS:

1. Paul Mealy, Virtual & Augmented Reality For Dummies, John Wiley & Sons, Inc
2. Erin Pangilinan, Steve Lukas and Vasanth Mohan, Creating Augmented and Virtual Realities, O'Reilly Media Inc.

Reference Books:

1. Kelly S. Hale, Kay M. Stanney, Handbook of Virtual Environments: Design, Implementation, and Applications, Second Edition, CRC Press.
2. Gregory C. Burdea & Philippe Coiffet, John, Virtual Reality Technology, Second Edition, Wiley & Sons, Inc.
3. William R.Sherman, AlanCraig, Understanding Virtual Reality, Interface, Application and Design, Elsevier (Morgan Kaufmann).
4. John Vince, Virtual Reality Systems, Pearson Education.
5. Andrew Davison, Killer Game Programming in Java, O'reilly-SPD.
6. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann.
7. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann
8. Steve Aukstakalnis, "Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR", Addison Wesley.

9. Brett S. Martin, "Virtual Reality", Norwood House Press.
10. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi
11. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill.

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	UNIFIED MODELING LANGUAGE & DESIGN PATTERNS (Professional Elective IV)				

Course Objectives:

1. Introducing the Unified Process and showing how UML can be used within the process.
2. Presenting a comparison of the major UML tools for industrial-strength development
3. Demonstration of patterns related to object-oriented design.
4. Describe the design patterns that are common in software applications.
5. Analyze a software development problem and express it.

Course Objectives: After completing this course, the students will be able to

1. Introducing the Unified Process and showing how UML can be used within the process.
2. Presenting a comparison of the major UML tools for industrial-strength development.
3. Demonstration of patterns related to object-oriented design.
4. Describe the design patterns that are common in software applications.
5. Analyze a software development problem and express it.
6. Apply behavioral design patterns to solve software design problems.

UNIT I:

Introduction to UML:

Why we Model, Importance of modeling, Principles of modeling, Object oriented modeling, Conceptual model of the UML, Architecture, Software Development Life Cycle. Structural Modeling: Classes, Relationships, Common Mechanisms, and Diagrams, Advanced classes, advanced relationships, Object diagrams: Common modeling techniques

UNIT II:

Basic Behavioral Modeling:

Interactions, Interaction diagrams, Use cases, Use caseDiagrams, Activity Diagrams, Common modeling techniques for Interaction diagrams, Use case diagrams and Activity diagrams. **Advanced BehavioralModeling:**

Events and Signals, State machines, Processes and Threads, Time and Space, State chart diagrams with Common modeling techniques.

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UNIT III:

Architectural Modeling:

Component, Deployment, Component diagrams and Deployment diagrams. Common modeling techniques for Component and Deployment diagrams.

Case Study: The Unified Library application

UNIT-IV:

Introduction:

What is a Design Pattern? Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

UNIT-V:

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton.

Structural Pattern: Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy.

UNIT-VI:

Behavioral Patterns:

Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, Strategy, Template Method, What to expect from Design Patterns.

Text books:

1. "The Unified Modeling Language User Guide", Grady Booch, James Rumbaugh,
2. Ivar Jacobson, 12th Impression, 2012, PEARSON.
3. Design Patterns by Erich Gamma, PearsonEducation.
4. "Object- Oriented Analysis AndDesign with Applications", Grady BOOCH, RobertA. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, KelliaHouston, 3rd edition, 2013, PEARSON.

References:

1. "The Unified modeling language Reference manual", James Rumbaugh, Ivar Jacobson, Grady Booch,Addison-Wesley.
2. "Object-oriented analysis and design with the Unified process", John W. Satzinger,Robert B. Jackson, Stephen D. Burd, Cengage Learning.

3. Patterns in JAVA Vol-I (or) Vol-II By Mark Grand, Wiley DreamTech.
4. Java Enterprise Design Patterns Vol-III By Mark Grand Wiley DreamTech.
5. "Head first object-oriented analysis and design", Brett D. McLaughlin, Gary Pollice, Dave West,O"Reilly.
6. "Object-oriented analysis and design using UML", Mahesh P. Matha,PHI.

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Data Mining (Professional Elective IV)				

Course Objectives:

The objective of this course is to teach the basic data mining concepts with particular emphasis on the association, classification, prediction and clustering techniques. Students will be enabled to understand and implement classical models and algorithms in data mining. They will learn how to analyze the data, identify the problems and choose the relevant algorithms for different kinds of data.

Course Outcomes: After completing this course, the students will be able to

1. Explain the basic concepts, functionalities, and challenges of data mining and the KDD process.
2. Apply data pre-processing techniques such as data cleaning, transformation, and dimensionality reduction.
3. Analyze concept description, mining frequent patterns, association rules, and correlation techniques.
4. Develop and evaluate classification and prediction models using various algorithms.
5. Implement clustering algorithms and evaluate clustering performance.
6. Apply web mining, spatial, temporal, and multimedia mining techniques in real-world scenarios.

UNIT I:

Introduction to data mining (DM)

Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM – KDD Process

UNIT II:

Data Pre-processing

Data summarization, data cleaning, data integration and transformation, data reduction, data discretization and concept hierarchy generation, feature extraction , feature transformation, feature selection, introduction to Dimensionality Reduction, CUR decomposition

UNIT III:

Concept Description, Mining Frequent Patterns, Associations and Correlations

What is the concept description? - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons, Basic concept, efficient and scalable frequent item-set mining methods,

mining various kinds of association rules, from association mining to correlation analysis, Advanced Association Rule Techniques, Measuring the Quality of Rules.

UNIT IV:

Classification and Prediction

Classification vs. prediction, Issues regarding classification and prediction, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms, Neural Network-Based Algorithms, Rule-Based Algorithms, Combining Techniques, accuracy and error measures, evaluation of the accuracy of a classifier or predictor. Neural Network Prediction methods: Linear and nonlinear regression, Logistic Regression Introduction of tools such as DB Miner / WEKA / DTREG DM Tools

UNIT V:

Cluster Analysis

Clustering: Problem Definition, Clustering Overview, Evaluation of Clustering Algorithms, Partitioning Clustering -K-Means Algorithm, K-Means Additional issues, PAM Algorithm; Hierarchical Clustering – Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering, Strengths and Weakness; Outlier Detection, Clustering high dimensional data, clustering Graph and Network data.

UNIT VI:

Web mining and other data mining

Web Mining: Introduction to Web Mining, Web content mining, Web usage mining, Web Structure mining, Web log structure and issues regarding web logs, Spatial Data Mining, Temporal Mining, And Multimedia Mining. Applications of Distributed and parallel Data Mining.

Text Books:

1. Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier,2011.
2. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson,2012.

Reference Books:

1. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
2. Data Mining: VikramPudi and P. Radha Krishna, Oxford Publisher.
3. Data Mining and Analysis - Fundamental Concepts and Algorithms; Mohammed J. Zaki, Wagner Meira, Jr, Oxford
4. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH. http://onlinecourses.nptel.ac.in/noc18_cs14/preview
5. (NPTEL course by Prof.Pabitra Mitra) http://onlinecourses.nptel.ac.in/noc17_mg24/preview
6. (NPTEL course by Dr. Nandan Sudarshanam& Dr. Balaraman Ravindran) http://www.saedsayad.com/data_mining_map.htm

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Micro Services (Professional Elective IV)				

Course Objectives:

1. Understand cloud computing fundamentals, service models, and deployment types.
2. Learn microservices architecture and its advantages over monolithic systems.
3. Gain hands-on experience with Docker, Kubernetes, and CI tools.
4. Assess cost and scalability benefits of microservices in cloud platforms.
5. Explore cloud security, monitoring, and future trends like edge and AI.

Course Outcomes: After completing this course, the students will be able to

1. Learn the main concepts of cloud, its characteristics, advantages, key technologies and its various delivery and deployment models
2. Explore how microservices differ from monolithic architectures
3. Describe the role of containers and orchestration in deploying microservices
4. Assess the economic impact of adopting microservices on cloud infrastructure and operational costs.
5. Build a simple microservice using a cloud-native approach
6. Analyze the issue of cloud such as security, energy efficiency and interoperability, and provide an insight into future prospects of computing in the cloud monitoring

Unit I

Cloud Computing Fundamentals- : Cloud Fundamentals, Cloud Service Components, Cloud Service, Deployment Models, Guiding principle with respect to utilization, SOA, Design and Implementation of Public and Private Cloud Environments OpenStack and AWS., Applications of Cloud Computing

Unit II

Evolution of Cloud Microservices : Application Architectures-Monolithic & Distributed, Microservice Fundamentals, Microservices Architecture, Domain-driven design (DDD) principles, Service boundaries and API gateway.

Unit III

Deploying Microservices : Containerization with Docker, Docker file and container image creation, Container orchestration, Overview of Kubernetes and its architecture, Deploying microservices, Continuous Integration (CI) principles

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Unit IV

Economic Benefits of Microservices : Scalability advantages and cost implications, pricing models of major cloud providers (AWS, Azure, Google Cloud), compute, storage, network, and data transfer costs, cost monitoring and optimization tools.

Unit V

Cloud-Native Development : cloud-native architecture, loosely coupled services, Service Discovery, Load Balancing,Autoscaling,Data Management, the twelve-factor app methodology, serverless architectures, Case studies on Netflix, Amazon, Uber, etc.

Unit VI

Cloud Security : Security Issues in Cloud Computing, Shared Responsibility Architecture, Security by Design Principles Identity and Access Management, Cloud Security Layers Illustration, Cloud Network, Host and Data Security Concepts, Security Operations and Major Cloud Service Provider Tools, Security Compliance and Regulations, Interoperability Challenges, Monitoring and Performance Management, Future Trends and Innovations - Edge computing and AI

Text Books:

1. MASTERING CLOUD-NATIVE MICROSERVICES by CHETAN WALIA, BPB PUBLICATIONS

References:

1. BUILDING MICROSERVICES by SAM NEWMAN, O'REILLY

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Game Development (Professional Elective IV)				

Course Objectives:

Understanding the processes, mechanics and issues in game design and development. At the end, the student will be in a position to create interactive games.

Course Outcomes:

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

1. Create a basic game world and understand the game engine basics.
2. Develop mobile games and real-time strategies for games.
3. Add entities to the game world and apply movements.
4. Create RTS game elements and interfaces.
5. Add and manage interactive game entities.
6. Implement intelligent unit movement and pathfinding.

UNIT I:

Creating a Basic Game World

A Basic HTML Page, Canvas Element, Audio Element, Image Element, Animation: Timer and Game Loops. Basic HTML Layout, Creating the Splash Screen and Main Menu, Level Selection, Loading Images, Loading Levels, Animating the Game, Handling Mouse Input, Defining Our Game States.

UNIT II:

Game Engine Basics

Box2D Fundamentals, Adding More Box2D Elements, Tracking Collisions and Damage, Drawing Our Own Characters, Defining Entities, Adding Box2D, Creating Entities, Adding Entities to Levels, Setting Up Box2D Debug Drawing, Drawing the Entities, Animating the Box2D World, Adding Sound.

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UNIT III:

Creating a Mobile Game

Challenges in Developing for Mobile Devices, Making the Game Responsive, Fixing Mouse and Touch Event Handling, Loading the Game on a Mobile Device, Fixing Audio Problems on Mobile Browsers, Adding Some Finishing Touches.

UNIT IV:

Creating the Real-time strategy(RTS) Game World

Basic HTML Layout, Creating the Splash Screen and Main Menu, Creating Our First Level, Loading the Mission Briefing Screen, Implementing the Game Interface, Implementing Map Panning.

UNIT V:

Adding Entities to Our World

Defining Entities, Adding Entities to the Level, Drawing the Entities, Adding the required features, Selecting Game Entities, Highlighting Selected Entities.

UNIT VI: Intelligent Unit Movement

Commanding Units, Sending and Receiving Commands, Processing Orders, Implementing Aircraft Movement, Pathfinding, Defining Our Pathfinding Grid, Implementing Vehicle Movement, Collision Detection and Steering, Deploying the Harvester, Smoother Unit Movement, Customizing Your Code Editor, Writing Modular Code, Automating Development Workflow.

Textbooks:

1. James Floyd Kelly – Game Development with Construct 2: From Design to Realization, 1st Edition, Que Publishing, 2013.
2. Patrick Felicia – Beginning Game Programming: For Teens and Beginners, 2nd Edition, CreateSpace Independent Publishing, 2015.
3. Steve Rabin (Editor) – Introduction to Game Development, 2nd Edition, Cengage Learning, 2010.
4. Anders Hejlsberg et al. – Programming HTML5 Applications, 1st Edition, O'Reilly Media, 2012.

Reference Books:

1. David Brackeen – Developing Games in Java, 1st Edition, New Riders Publishing, 2003.
2. Rex van der Spuy – Foundation Game Design with HTML5 and JavaScript, 1st Edition, Apress, 2013.

3. Brian Schwab – AI Game Engine Programming, 1st Edition, Course Technology PTR, 2009.
4. Jesse Freeman – Building HTML5 Games with ImpactJS, 1st Edition, O'Reilly Media, 2012.
5. Joseph Hocking – Unity in Action: Multiplatform Game Development in C#, 2nd Edition, Manning Publications, 2018.

Online Resources

1. **Mozilla Developer Network (MDN)** – HTML5 Canvas, Game Loops, and Web APIs
   https://developer.mozilla.org/en-US/docs/Games

2. **Unity Learn – Game Development Tutorials** https://learn.unity.com
3. **GameDev.net – Community and Tutorials** https://www.gamedev.net

4. **GeeksforGeeks – Game Development with HTML5/JavaScript**
   https://www.geeksforgeeks.org

5. **Khan Academy – Intro to JS: Drawing & Animation**
   https://www.khanacademy.org/computing/computer-programming/programming

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Rapid Manufacturing Processes (Open Elective III)				

Course Objectives:

1. To understand the need of Rapid Manufacturing processes in various industries.
2. To acquire knowledge on various additive manufacturing processes.
3. To be able to apply the concept of Additive Manufacturing for various applications through Rapid tooling.
4. To understand the softwares and data formats required in the AM generic process.
5. To apply the concept of Reverse Engineering in product development using Additive manufacturing and its applications.

Course Outcomes: After completing this course, the students will be able to

1. Differentiate Additive Manufacturing with other manufacturing processes.
2. Understand different solid, liquid and powder-based RP systems and their applications.
3. Select a suitable AM technique to produce multiple material and colored objects.
4. Use various Softwares and data formats in Additive Manufacturing by 147n corporating Rapid tooling concept for a given application.
5. Apply the concept of Reverse Engineering for complex geometries to develop products using AM.
6. Apply reverse engineering and DfAM to develop complex and customized products.

UNIT-I

INTRODUCTION TO RAPID MANUFACTURING: Traditional Prototyping vs Rapid Prototyping (RP), fundamentals of rapid prototyping, historical development, advantages and limitations of rapid prototyping, classification of RP process. Materials for AM**.**

SOLID-BASED RAPID PROTOTYPING SYSTEMS: Fused deposition modelling (FDM) models and applications, advantages and disadvantages, case studies.

Laminated object manufacturing (LOM) -models and applications, advantages and disadvantages, case studies.

UNIT-II

LIQUID-BASED RAPID MANUFACTURING PROCESSES:

Stereolithography Apparatus (SLA): models and specifications, working polymerization, applications, advantages and disadvantages, case studies.

Material Jetting (MJ): models and specifications, working process, applications, Merits and demerits, case studies.

Solid Ground Curing (SGC): models and specifications, process physics, applications, advantages and disadvantages, case studies.

UNIT-III

POWDER BASED RAPID MANUFACTURING PROCESSES: Selective laser sintering (SLS) & Electron Beam Melting (EBM): models and specifications, process physics, applications, advantages and disadvantages, case studies.

Three-dimensional printing (3DP): models and specifications, working process, applications, advantages and disadvantages, case studies.

UNIT-IV

RAPID PROTOTYPING DATA FORMATS: STL Format, STL File Problmes and STL File Repairs: Newly Proposed Formats.

RAPID PROTOTYPING SOFTWARE'S: Features of various RP software's like Magics.

Mimics.

RAPID TOOLING: Need for Rapid tooling, Conventional tooling vs Rapid tooling. classification of rapid tooling, direct and indirect tooling methods, spray metal deposition, RTV epoxy tools, investment casting, 3D Keltool process, direct AIM, DTM Rapid Tool Process, and Direct Metal Tooling using 3DP.

UNIT-V

RAPID PROTOTYPING APPLICATIONS: Applications in engineering , aerospace industry, automotive industry, jewelry industry, architecture.

Medical and bioengineering Applications: planning and simulation of complex surgery, customized implants & prosthesis, design and production of medical devices.

REVERSE ENGINEERING (RE): Concept of RE in view of Rapid Manufacturing, selection of RE systems, RE in product development.

UNIT-VI

REVERSE ENGINEERING AND DESIGN FOR ADDITIVE MANUFACTURING

Basics of Reverse Engineering (RE) – need, steps, and importance in product development. 3D scanning techniques – contact and non-contact methods, data acquisition and processing. Model reconstruction – point cloud, mesh generation, and conversion to CAD.

Software tools – Geomagic, MeshLab, Rapidform. Design for Additive Manufacturing (DfAM) – topology optimization, lattice structures, part consolidation. Integration of RE with AM – workflow, benefits, challenges. Applications – aerospace parts, medical implants, spare parts, and customized products.

Text Books:

1. Chua Chee Kai, Leong Kah Fai. 3D Printing and Additive Manufacturing: Principles & Applications, World Scientific, 4th Edition, 2015.
2. Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 1st Edition, 2006.

Reference Books:

1. Ian Gibson, David W Rosen, Brent Stucker, Additive Manufacturing Technologies, Rapid Prototyping to Direct Digital Manufacturing, Springer, 2nd Edition, 2014.
2. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer, Rev. Edition, 2001.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Bio-Medical Engineering (Open Elective III)				

Course Objectives:

1. To introduce the principles and components of biomedical instrumentation systems and physiological signal measurement.
2. To explain the function and application of electrodes, transducers, and sensors in medical devices.
3. To outline techniques and equipment used for monitoring, diagnosis, and therapy in clinical settings.
4. To emphasize safety standards, shock hazards, and the use of diagnostic imaging and biotelemetry systems.

Course Outcomes: After completing this course, the students will be able to

1. Describe the fundamentals of biomedical instrumentation and physiological systems.
2. Identify and apply various biomedical electrodes and transducers used in healthcare.
3. Measure and interpret key parameters of cardiovascular and respiratory systems.
4. Explain the operation and purpose of patient monitoring and therapeutic devices.
5. Analyze the functions of diagnostic tools such as ultrasound, CT, MRI, and biotelemetry systems.
6. Apply safety standards in biomedical environments and evaluate the role of amplifiers and recorders.

Unit - I

INTRODUCTION TO BIOMEDICAL INSTRUMENTATION: Age of Biomedical Engineering, Development of Biomedical Instrumentation, Man Instrumentation System, Components of the Man-Instrument System, Physiological System of the Body, Problems Encountered in Measuring a Living System, Sources of Bioelectric Potentials, Muscle, Bioelectric Potentials, Sources of Bioelectric Potentials, Resting and Action Potentials, Propagation of Action Potential, Bioelectric Potentials-ECG, EEG and EMG, Envoked Responses.

Unit - II

ELECTRODES AND TRANSDUCERS: Introduction, Electrode Theory, Biopotential Electrodes, Examples of Electrodes, Basic Transducer Principles, Biochemical Transducers, The Transducer and

Transduction Principles, Active Transducers, Passive Transducers, Transducers for Biomedical Applications, Pulse Sensors, Respiration Sensor, Transducers with Digital Output.

Unit - III

CARDIOVASCULAR SYSTEM AND MEASUREMENTS: The Heart and Cardiovascular System, Electro Cardiography, Blood Pressure Measurement, Measurement of Blood Flow and Cardiac Output, Measurement of Heart Sound, Plethysmography.

MEASUREMENTS IN THE RESPIRATORY SYSTEM: The Physiology of The Respiratory System, Tests and Instrumentation for The Mechanics of Breathing, Respiratory Therapy Equipment.

Unit - IV

PATIENT CARE AND MONITORING: Elements of Intensive-Care Monitoring, Patient Monitoring Displays, Diagnosis, Calibration and Repair ability of Patient-Monitoring Equipment, Other Instrumentation for Monitoring Patients, Organization of the Hospital for Patient-Care Monitoring, Pacemakers, Defibrillators, Radio Frequency Applications of Therapeutic use.

THERAPEUTIC AND PROSTHETIC DEVICES: Audiometers and Hearing Aids. Myoelectric Arm, Laparoscope, Ophthalmology Instruments, Anatomy of Vision,. Electrophysiological Tests, Ophthalmoscope, Tonometer for Eye Pressure Measurement. Diathermy, Clinical Laboratory Instruments, Biomaterials, Stimulators.

Unit - V

DIAGNOSTIC TECHNIQUES AND BIO-TELEMETRY: Principles of Ultrasonic Measurement, Ultrasonic Imaging, Ultrasonic Applications of Therapeutic Uses, Ultrasonic Diagnosis, X-Ray and Radio-Isotope Instrumentations, CAT Scan, Emission Computerized Tomography, MRI, Introduction to Biotelemetry, Physiological Parameters Adaptable to Biotelemetry, The Components of Biotelemetry System, Implantable Units, Telemetry for ECG Measurements during Exercise, Telemetry for Emergency Patient Monitoring.

Unit - VI

MONITORS, RECORDERS AND SHOCK HAZARDS: Biopotential Amplifiers, Monitors, Recorders, Shock Hazards and Prevention, Physiological Effects and Electrical Current, Shock Hazards from Electrical Equipment, Methods of Accident Prevention, Isolated Power Distribution System.

Text Books

1. "Bio-Medical Electronics and Instrumentation", Onkar N. Pandey, Rakesh Kumar, Katson Books.
2. "Bio-Medical Instrumentation", Cromewell , Wiebell, Pfeiffer

Reference Books

1. "Introduction to Bio-Medical Equipment Technology", 4th Edition, Joseph J. Carr, John M. Brown, Pearson Publications.
2. "Hand Book of Bio-Medical Instrumentation", Khandapur. McGrawHill

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Remote Sensing and GIS (Open Elective III)				

Course Objectives:

The course is designed to

1. Introduce the basic principles of Remote Sensing and GIS techniques.
2. Learn various types of sensors and platforms
3. Learn concepts of visual and digital image analyses
4. Understand the principles of spatial analysis
5. Appreciate application of RS and GIS to Civil Engineering

Course outcomes:

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

1. Be familiar with ground, air and satellite-based sensor platforms.
2. Interpret the aerial photographs and satellite imageries
3. Create and input spatial data for GIS application
4. Apply RS and GIS concepts for application in Civil Engineering
5. Analyze RS and GIS applications in land use, agriculture, forestry, and urban planning.
6. Apply RS and GIS techniques for flood mapping, groundwater, and watershed management.

UNIT I

Introduction to Remote sensing:

Basic concepts of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces, characteristics of remote sensing systems, types of resolutions - advantages & limitations

UNIT II

Sensors and platforms:

Introduction, types of sensors, airborne remote sensing, space borne remote sensing, image data characteristics, digital image data formats-band interleaved by pixel, band interleaved by line, band sequential.

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UNIT III

Image analysis:

Introduction, elements of visual interpretations, digital image processing- image pre-processing, image enhancement, image classification, supervised classification, unsupervised Classification.

UNIT IV

Geographic Information System:

Basic Principles, components, application areas of GIS, map projections.

Data entry and preparation: spatial data structures, raster and vector data formats, data inputs, data manipulation, data retrieval, data analysis and data display.

UNIT V

RS and GIS applications General: Land cover and land use, agriculture, forestry, geology, urban & transportation applications.

UNIT VI

Application to Hydrology and Water Resources:

Flood zoning and mapping, groundwater prospects, groundwater quality monitoring and potential recharge zones, watershed management.

TEXT BOOKS:

1. Bhatta B (2008), 'Remote sensing and GIS', Oxford University Press
2. Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2013) 'Remote Sensing and Image
3. Interpretation', Wiley India Pvt. Ltd., New Delhi
4. Schowenger, R. A (2006) 'Remote Sensing' Elsevier publishers.
5. 'Fundamentals of Remote Sensing' by George Joseph, Universities Press, 2013.
6. "Fundamentals of Geographic Information Systems' by Demers, M.N,Wiley India Pvt.Ltd, 2013.

REFERENCES:

1. 'Remote Sensing and its Applications' by Narayan LRA, Universities Press, 2012.
2. 'Concepts and Techniques of Geographical Information System' by Chor Pang Lo and AKW Yeung, Prentice Hall (India), 2006

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	TV Engineering (Open Elective III)				

Course Objectives:

The objectives of the course are:

1. To familiarize the students with Television transmitters and receive, and TV signal transmission.
2. To make them understand different signal processing step monochrome television,
3. To introduce color television transmitters and receivers.

Course Outcomes: After completing this course, the students will be able to

1. Explain the fundamentals of TV transmission, reception, scanning methods, and composite video signals.
2. Illustrate the working principles of monochrome TV camera tubes and transmitter systems.
3. Describe the components and operation of a monochrome TV receiver, including tuning and deflection circuits.
4. Analyze the principles of color TV systems, color signal generation, and display technologies.
5. Compare various color TV standards (PAL, NTSC, SECAM) and explain color signal transmission techniques.
6. Outline the functionality of advanced television systems including remote control, MATV, CATV, CCTV, HDTV, and satellite TV.

UNIT I:

Brief Introduction to TV transmission and reception , Interlaced scanning ,TV picture : resolution , brightness , Video Bandwidth , Line and frame wave frequency , blanking synchronizing and equalizing pulses ,complete composite video signal , VSB transmission and Reception.

UNIT II:

Monochrome TV camera tubes: image Orthicon, Vidicon and Plumbicon tubes, Monochrome TV transmitter block diagram, TV transmitting antennaTV receiving antenna.

UNIT III:

Monochrome TV Receiver block diagram, Balun, RF tuner, Video IF amplifier, Video detector, Intercarrier sound system, Sound take off circuit, Sound IF and FM detector, Transistorized Keyed AGC circuit, Horizontal and Vertical deflection circuits, EHT generator.

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UNIT IV:

Essentials of color TV, Compatibility, Three – colors theory, chromaticity diagram, color TV camera, production of luminance and color – difference signals color TV picture tubes: Delta gun, P.I.L. and Trinitron tubes.

UNIT V:

Color signal transmission and reception, frequency interleaving, modulation of color – difference signals. PAL color TV system, choice of sub – carrier frequency, PAL color receiver, comparison of PAL with NTSCa and SECAM system.

UNIT VI:

Remote control circuits, MATV, CATV CCTV system, HDTV TV via satellite

Text Books:

1. Television and Video Engineering- A.M.Dhake, 2nd Edition.
2. Modern Television Practice Principles, Technology and ServiceR .R.Gallatin, New Age International Publication, 2002.
3. Monochrome and Colour TV- R.R. Gulati, New Age International Publication, 2002.

Reference Books:

1. Colour Television Theory and Practice-S.P.BaI, TMH, 1994.
2. Basic Television and Video Systems-B.Grob and C.E.Herndon, McGraw Hill, 1999.

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Control Systems (Open Elective III)				

Course Objectives:

The course is deals with

1. To introduce different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form to interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.
2. To employ the basic concepts of block diagram reduction methods and time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions to ascertain the required dynamic response from the system.
3. Formulate different types of analysis in frequency domain to explain the nature of stability of the system.

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

1. Develop the transfer functions for open loop and closed loop control systems.
2. Model the time response of control systems.
3. Apply root locus technique to analyze & design control systems.
4. Examine the stability of control systems using frequency domain techniques.
5. Model the control systems using state space representation.
6. Model and solve continuous-time systems using state-space representation and state transition matrix.

UNIT I

INTRODUCTION:

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems-Classification of control systems, Feed-back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems, Analogous Systems.

UNIT II

TRANSFER FUNCTION REPRESENTATION:

Block diagram representation of systems considering electrical systems as examples - Block Diagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula.

UNIT III

TIME RESPONSE ANALYSIS:

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems -Time domain specifications – Steady state response - Steady state errors and error constants

UNIT IV

STABILITY ANALYSIS IN S-DOMAIN:

The concept of stability – Routh's stability Criterion – qualitative stability and conditional stability – limitations of Routh's stability ROOT LOCUS TECHNIQUE: The root locus concept -construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT V

STABILITY ANALYSIS IN FREQUENCY DOMAIN:

Introduction, Frequency domain specifications Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots. Polar Plots and its stability Analysis.

UNIT VI

STATE SPACE REPRESENTATION:

State Space Analysis of Continuous Systems Concepts of state, state variables and state model, Derivation of state models from block diagrams, Diagonalization- Solving the Time invariant State Equations- State Transition Matrix and its Properties.

Text Books:

1. Benjamin C. Kuo, "Automatic Control Systems" 8th edition John wiley and sons, 2003.
2. Katsuhiko Ogata, "Modern Control Engineering" PHl, 5th edition, 1998.

Reference Books:

1. I. J. Nagrath and M. Gopal, "Control Systems Engineering",2nd edition, New Age International (P) Limited.
2. Rao V Dukkipati, "Matlab for Control System Engineers", 2nd edition, New Academic ScienceLimited, 2014.

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Management Science (Humanities Elective I)				

Course Objectives:

1. To create awareness about different Managerial concepts like Management, Production, Marketing, Human Resource and Strategic Management.
2. To make the students equip with knowledge on techniques of PERT and CPM in project management.

Course Outcomes:

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

1. Understand the Fundamentals of Management with specific insight as its function and role.
2. Learn the Concepts of production, Management of human Resources and Management of Marketing activities along with business environment.
3. Apply the problem solving skills to demonstrate logical solutions to real life problems.
4. Explain the business strategies to deal with the dynamic business environment.
5. Apply PERT and CPM techniques for project scheduling, critical path identification, and project crashing.
6. Formulate business strategies using SWOT analysis and corporate planning principles.

UNIT I:

Introduction to Management :

Concept and importance of Management, Functions of management, Evaluation of Management thought, Fayol's principles of Management, Maslow's need hierarchy & Herzberg's two factor theory of Motivation, Decision making process, Designing organizational structure, Principles of Organization, Types of organization structures.

UNIT II:

Operations management:

Principles and types of plant Layout , Work study, Statistical Quality control. Charts – R Chart, c chart, p chart, Simple problems on R, c and p charts, Materials Management: Objectives - Need for inventory control- Inventory control techniques EOQ , ABC , HML, SDE, VED and FSN analysis.

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UNIT III:

Human Resources management (HRM):

Concepts of HRM,HRD & Personnel management and industrial relations, Basic functions of HR manager ,Wage payment plans (simple problems), Job Evaluation and Merit Rating.

UNIT IV:

Marketing Management:

Functions of marketing , Marketing Mix, Marketing strategies based on Product life cycle, Channels of distribution.

UNIT V:

Project Management(PERT/CPM):

Network analysis, Programme Evaluation and Review Technique (PERT), Critical path method(CPM) - Identifying critical path, Difference between PERT & CPM, Project Crashing (simple problems).

UNIT VI:

Strategic Management:

Mission, Goals, objectives, policy, strategy, Elements of corporate planning process, Environmental scanning, SWOT analysis Steps in strategy formulation and implementation Generic strategy alternatives.

Text BOOKS:

1. Dr. Arya Sri, “Management Science”, TMH 2011.
2. L.M.Prasad, “Principles & Practices of Management”, Sultan chand & Sons, 2007.

Reference Books:

1. K.Aswathappa and K.Sridhara Bhat, “Production and Operations Management”, Himalaya Publishing House, 2010.
2. Philip Kotler, Kevin Keller, Mairead Brady, Malcolm Goodman,Torben Hansen, “Marketing Management” Pearson Education Limited, 05-May-2016.

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Life Sciences For Engineering (Humanities Elective I)				

Course Objectives:

1. To introduce fundamental concepts of biology relevant to computer science.
2. To bridge the gap between life sciences and computational applications.
3. To develop skills in bioinformatics, biomedical data analysis, and bio-inspired algorithm design.
4. To highlight the ethical and privacy considerations in computational biology.

Course Outcomes: After completing this course, the students will be able to

1. Understand cell structure and biomolecules related to computational biology.
2. Analyze genetic mechanisms and gene expression with computational relevance.
3. Apply sequence alignment tools and interpret genomics data.
4. Model biological systems using systems biology concepts.
5. Evaluate AI/ML applications in life sciences and healthcare.
6. Apply computational techniques in diagnostics and biotechnology.

Unit I

Fundamentals of Biology for Engineers:Introduction to life sciences and biological hierarchy, Prokaryotic and eukaryotic cells, Cell organelles and their digital analogs, Overview of DNA, RNA, and proteins, Central dogma of molecular biology

Unit II

Biomolecules and Biochemical Processes: Carbohydrates, proteins, lipids, nucleic acids, Enzymes: function, kinetics, and inhibition, Cellular respiration and energy systems (ATP production), Photosynthesis – biological energy conversion

Unit III

Genetics, Genomics, and Data Representation: Mendelian genetics and gene expression, DNA replication, transcription, and translation, Introduction to genomics and proteomics, DNA sequencing technologies, Biological file formats: FASTA, FASTQ, GFF

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Unit IV

Bioinformatics and Sequence Analysis: Basic tools: BLAST, Clustal Omega, Sequence alignment algorithms: global, local, Scoring matrices: PAM, BLOSUM, Genome browsers and database querying (e.g., NCBI, Ensembl)

Unit V

AI and Machine Learning in Life Sciences: Biomedical datasets: types and characteristics, Classification and clustering in medical diagnosis, ML models for gene expression and disease prediction, Case studies: cancer classification, drug discovery using AI, Introduction to deep learning for medical imaging

Unit VI

Bio-Inspired Computing and Ethics: Genetic algorithms and evolutionary computing, Artificial neural networks inspired by brain architecture, Swarm intelligence, ant colony optimization, Bioethics, data privacy, and regulation in biomedical informatics (HIPAA, GDPR), Future directions: synthetic biology, quantum biology

Text Books:

1. Biology for Engineers, Author(s): Arthur T. Johnson Edition: 2nd Edition (2011) Publisher: CRC Press ISBN: 9781439894209
2. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids Author(s): Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison Edition: 1st Edition (1998) Publisher: Cambridge University Press ISBN: 9780521629713
3. Bioinformatics: Sequence and Genome Analysis, Author: David W. Mount Edition: 2nd Edition (2004), Publisher: Cold Spring Harbor Laboratory Press, ISBN: 9780879697129
4. Principles of Biochemistry, Author(s): David L. Nelson, Michael M. Cox Edition: 7th Edition (2017), Publisher: W.H. Freeman and Company ISBN: 9781464187964,

References:

1. Introduction to Systems Biology: Design Principles of Biological Circuit, Author: Uri Alon, Edition: 2nd Edition (2020), Publisher: CRC Press ISBN: 9780367332107.
2. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Author(s): Andreas D. Baxevanis, B. F. Francis Ouellette, Edition: 3rd Edition (2005), Publisher: Wiley-Blackwell, ISBN: 9780471478782.
3. Essential Bioinformatic, Author: Jin Xiong, Edition: 1st Edition (2006) Publisher: Cambridge University Press ISBN: 9780521600828

4. Artificial Intelligence in Healthcare, Author(s): Adam Bohr, Kaveh Memarzadeh, Edition: 1st Edition (2020), Publisher: Academic Press (Elsevier), ISBN: 9780128184387
5. Computational Biology: A Practical Introduction to BioData Processing and Analysis with Linux, MySQL, and R, Author: Röbbe Wünschiers, Edition: 1st Edition (2013), Publisher: Springer, ISBN: 9783642347498.

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Foreign Language(German A1 Course Based on NetzwerkNeu) (Humanities Elective I)				

Course Objectives:

1. Build basic German Communication Skills.
2. Understand German grammar and vocabulary.
3. Engage in everyday conversations.
4. Learn cultural aspects of German-speaking countries.
5. Read, Write, and Listen at A1 level.
6. Use German in academic and basic work settings.

Course Outcomes: Students will be able to

1. Greet, introduce, and ask basic personal questions in German.
2. Talk about hobbies, friends, and daily routines using simple grammar.
3. Handle everyday situations like directions, food, and shopping.
4. Use verbs and grammar in health, work, and leisure contexts.
5. Describe home, studies, and career plans in German.
6. Communicate while traveling and express preferences in real-life contexts.

UNIT- I

Module 1: GUTEN TAG! : Greetings and introductions, Alphabet and pronunciation, Countries and languages , Numbers 1-20 and basic questions (Wie heißt du? Woher kommst du?), Verb conjugation: sein (to be) and haben (to have), Personal pronouns, E Mail Adresse schreiben und sagen, Cultural insights: German-speaking countries

Module 2: Freunde Kollegen und ich: Describing friends and colleagues, Talking about hobbies and shared interests, Using "gern" and "lieber" to express preferences, Simple past tense of "sein" and "haben", Adjectives for personality traits, Cultural insights: Social life and work culture in Germany

UNIT- II

Module 3: In Hamburg (In the City): Asking for directions, Places in the city (Bank,, Supermarkt, Bahnhof, etc.), Prepositions of place (in, auf, neben, etc.), Giving and understanding simple directions, Cultural insights: Public transport in Germany

Module 4: GutenAppetit! Essen und Trinken (Food and Drink): Ordering in a restaurant or café, Common food and drinks vocabulary, The verb "möchten" (would like), Accusative case introduction, Cultural insights: German cuisine and eating habits

UNIT- III

Module 5: Alltag und Familie (Everyday Life and family): Talking about daily routines, Reflexive verbs (sich waschen, sich anziehen), Separable verbs (aufstehen, einkaufen), Telling the time, Days of the week and months, Family members ,relativs, relationships etc, Cultural insights: Hobbies and leisure activities in Germany

Module 6:ZeitmitFreunden: Planning and organizing meetings with friends, Talking about leisure activities, Expressing preferences and making suggestions, Using "möchten" and "würdegern" for polite requests, Making appointments and discussing availability, Birthday invitation , ordinal numbers , trennbareverben, Cultural insights: Social gatherings and traditions in Germany

UNIT- IV

Module 7 Arbeitsalltag (Workday routine): Talking about daily work routines, Common professions and workplace vocabulary, Using "müssen" and "dürfen" (must and may), Making polite requests at work, Understanding and writing simple emails, Cultural insights: Work culture and office etiquette in Germany

Module 8 Fit und Gesund: Body parts vocabulary, Talking about illness and visiting a doctor, Imperative form (commands), Using modal verbs in context, Cultural insights: Healthcare system in Germany.

UNIT- V

Module 9 MeineWohnung: Describing your home, Furniture and household vocabulary, Prepositions with dative case, Talking about renting an apartment, Cultural insights: Housing in Germany

Module 10 Studium und Beruf: Talking about studies and educational background, Describing professions and career plans, University and vocational training vocabulary, Asking about job opportunities, Verb Perfekt form, Cultural insights: Education and job market in Germany

UNIT- VI

Module-11 DieJackegefälltmir! (clothing and Shopping): Talking about clothes and fashion, Shopping dialogues: Asking for sizes and prices, Colors and adjectives agreement, Expressing preferences and opinions (gefallen, mögen, passen), Making comparisons with "besser" and "schöner", Cultural insights: Shopping culture and fashion trends in Germany

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Module-12 Ab in den Urlaub: Planning a vacation, Booking flights, hotels, and activities, Talking about holiday destinations, Packing and travel essentials vocabulary, Expressing excitement and expectations, About site seeing places, Way describing

Text Books:

1. "Studio d A1: Deutsch als Fremdsprache", Authors: Hermann Funk, Christina Kuhn, Michael Koenig, Edition: 1st Edition, Publisher: Cornelsen Verlag.
2. "Netzwerk A1: Deutsch als Fremdsprache", Authors: Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, Edition: Latest Edition (commonly used in Goethe-Institut), Publisher: Klett Sprachen.
3. "Menschen A1 – Deutsch als Fremdsprache", Authors: Stefanie Dengler, Tanja Mayr-Sieber, Paul Rusch, Helene Schmitz, Edition: 1st Edition,Publisher: Hueber Verlag
4. "The Everything Learning German Book", Author: Edward Swick, Edition: 2nd Edition, Publisher: Adams Media
5. "Practice Makes Perfect: Basic German", Author: Jolene Wochenske, Edition: 2nd Edition, Publisher: McGraw-Hill Education

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	Network Security Lab				

Course Objectives:

1. To learn different cipher techniques
2. To implement the algorithms DES, RSA,MD5,SHA-1
3. To use network security tools and vulnerability assessment tools

Course Outcomes:

Upon Completion of the course, the students will be able to:

1. Develop code for classical Encryption Techniques to solve the problems.
2. Build cryptosystems by applying symmetric and public key encryption algorithms.
3. Construct code for authentication algorithms.
4. Develop a signature scheme using Digital signature standard.
5. Demonstrate the network security system using open source tools

LIST OF EXPERIMENTS

1. Perform encryption, decryption using the following substitution techniques
   (i) Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
   i) Rail fence ii) row & Column Transformation
3. Apply the DES algorithm for practical applications.
4. Apply the AES algorithm for practical applications.
5. Implement RSA Algorithm using HTML and JavaScript
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Implement the SIGNATURE SCHEME – Digital Signature Standard.
9. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
10. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool
11. Defeating Malware
    I) Building Trojans Ii) Rootkit Hunter

References:

1. Build Your Own Security Lab, Michael Gregg, Wiley India

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Year / Semester	IV B. Tech / I Sem	L	T	P	C
Regulation	R19	0	0	3	1.5
Subject	UML Lab PE-LAB				

Course Objectives:

1. Understand the fundamental concepts of UML and its importance in software design and development.
2. Develop various UML diagrams, including structural and behavioral models, to represent real-world systems.
3. Apply design patterns to solve recurring software design problems and enhance system reusability.
4. Implement UML-based case studies using modeling tools and analyze system architectures effectively.

Course Outcomes(CO's):

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

1. Use UML tools to model structural aspects of a system through class, object, and use case diagrams.
2. Develop behavioral models using sequence, state chart, and activity diagrams for real-world applications.
3. Apply design patterns to enhance software modularity, scalability, and maintainability.
4. Design and analyze complete system architectures using component and deployment diagrams in a case study.

Laboratory Experiments

Week 1: Familiarization with UML Tools

- Introduction to **Rational Rose**, **Umbrello**, or **Visual Paradigm** for UML modeling.

Week 2-4: Structural Modeling

1. Develop **Class Diagrams** for a given system.
2. Create **Object Diagrams** to represent real-world instances.
3. Design **Use Case Diagrams** for various case studies.
4. Develop **Component and Deployment Diagrams** for system architecture.

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Week 5-7: Behavioral Modeling

5. Model **Sequence Diagrams** for system interactions.
6. Develop **State Chart Diagrams** for various system states.
7. Create **Activity Diagrams** to represent workflow and processes.

Week 8-9: Advanced UML Diagrams

8. Design **Collaboration Diagrams** for system behavior.
9. Develop **CRUD Matrix** for use cases and problem domain classes.

Week 10-12: Design Patterns Implementation

10. Implement **Creational Design Patterns** (Factory, Singleton, Builder).
11. Apply **Structural Design Patterns** (Adapter, Composite, Façade).
12. Implement **Behavioral Design Patterns** (Observer, Strategy, Command).

Week 13-14: Case Studies

13. Develop UML diagrams for **Library Management System**.
14. Develop UML diagrams for **Point of Sale (POS) System**.

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IV B.Tech II SEMESTER

CSE

R19 SYLLABUS

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Year/Semester	IV B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Real-Time Systems (Professional Elective V)				

Course Objectives:

The objective of this course is to

1. develop an understanding of various Real Time systems Application
2. obtain a broad understanding of the technologies and applications for the emerging and exciting domain of real-time systems
3. get in-depth hands-on experience in designing and developing a real operational system.

Course Outcomes:

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

1. understand concepts of Real-Time systems and modeling
2. recognize the characteristics of a real-time system
3. understand and develop document on an architectural design of a real-time system
4. develop and document Task scheduling, resource management, real-time operating systems and fault tolerant applications of Real-Time Systems.
5. Explain real-time communication and network protocols.
6. Describe RTOS features and real-time databases.

Unit I: Introduction

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

Unit II: Real Time Scheduling

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic

Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

Unit III: Resources Sharing

Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.

Unit IV: Real Time Communication

Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication,

UNIT V: Real Time Protocols

Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.

Unit VI: Real Time Operating Systems and Databases

Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristics of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases.

Text Books:

1. Real Time Systems – Jane W. S. Liu, Pearson Education Publication

Reference Books

1. Real Time Systems – Mall Rajib, Pearson Education
2. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

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Year/Semester	IV B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Smart Agents and Applications (Professional Elective V)				

Course Objectives: This course aims to

1. Introduce the fundamental concepts of intelligent agents and their architectures.
2. Explore agent-based modeling and simulation.
3. Understand multi-agent systems and their coordination mechanisms.
4. Study smart agent applications in various domains such as IoT, robotics, and cloud computing.
5. Examine agent communication languages, protocols, and frameworks.
6. Equip students with the knowledge to build real-world smart agent-based solutions.

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

1. Explain the principles, types, and architecture of intelligent agents.
2. Design and model agents using standard methodologies for real-world environments.
3. Apply concepts of multi-agent systems and communication for distributed problem solving.
4. Implement smart agent-based solutions for IoT, smart city, and robotic applications.
5. Integrate agent systems with cloud and edge environments for scalable operations.
6. Analyze trends and advanced techniques in intelligent agent systems.

UNIT I

Introduction to Smart Agents: Definition and classification of agents, Agent characteristics and properties, Rationality and autonomy, Intelligent agents vs. traditional systems, Agent architectures: Reactive, Deliberative, Hybrid, and Layered architectures, Case studies: Simple agent applications

UNIT II

Agent-Based Modeling and Design:Agent design methodology: GAIA, MaSE,Agent environments and types, Perception, sensors, and effectors, Decision-making strategies, Modeling dynamic environments, Agent simulation tools (e.g., NetLogo, AnyLogic)

UNIT III

Multi-Agent Systems (MAS): Communication in MAS: ACL, KQML,Inter-agent cooperation and coordination, Distributed problem solving, Conflict resolution and negotiation, Agent organization: roles and hierarchies, MAS platforms: JADE, ZEUS, Cougaar

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UNIT IV

Agents in Smart Applications: Agents in IoT, Agents in robotics and autonomous vehicles, Smart homes and smart cities, Intelligent agents in e-commerce and healthcare, Case studies of deployed agent-based systems.

UNIT V

Agents in Cloud and Edge Environments: Resource management using agents, Agent-based cloud orchestration, Edge computing and agent mobility, Security and privacy concerns in agent-based systems, Integration of agents with ML/DL models.

UNIT VI

Advanced Topics and Future Trends: Semantic web agents, Cognitive agents and BDI model, Learning agents and reinforcement learning basics, Ethical aspects and responsible AI agents, Trends: Conversational agents, digital twins, GPT-based agents, Agent deployment strategies and evaluation

Textbooks

1. **Michael Wooldridge**, *An Introduction to MultiAgent Systems*, 2nd Edition, Wiley, 2009.
2. **Gerhard Weiss**, *Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence*, MIT Press, 2000.
3. **Stuart Russell and Peter Norvig**, *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson, 2020.

Reference Books

1. **Yoav Shoham and Kevin Leyton-Brown**, *Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations*, Cambridge University Press, 2009.
2. **Ramon Lopez de Mantaras & Lorenza Saitta**, *Agents and Artificial Intelligence*, Springer, 2013.
3. **Stephen Cranefield and Michael Purvis**, *Agent-Oriented Methodologies*, IGI Global, 2005.
4. **Nikola Kasabov**, *Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering*, MIT Press, 1996.

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Year/Semester	IV B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Mobile Application Development (Professional Elective V)				

Course Objectives:

The objective of this course is to understand how android applications work, their life cycle, manifest, intents, and using external resources. To design and develop useful android applications with compelling user interfaces by using, extending and creating your own layouts and views and using menus. To explain the differences between android and other mobile development environments to build android apps.

Course Outcomes:

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

1. Demonstrate knowledge of different voice and data communication standards.
2. Outline the android architecture.
3. Identify the various features and the processes to develop the android application.
4. Design and develop the android applications by considering the legal and Security issues.
5. Design Android apps using menus, dialogs, lists, and SQLite with app priority handling

UNIT I:

Mobile Communications - Overview: Wireless transmission, voice and data communication standards – 1G/2G/3G/4G, WPAN, WLAN, applications, limitations, mobile computing architecture, overview on mobile devices and systems. GSM: services, system architecture, radio interface, localization, call handling, handover, security, GPRS, EDGE.

UNIT II:

Introduction to Android- Overview of Android, Android Architecture, Exploring the designer,Adding Components, Applying behaviors, Android- SDK, Emulators – What is an Emulator/Android AVD, Android Emulation – Creation and set up, First Android Application.

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UNIT III:

Android Activities and GUI Design Concepts – Enabling buttons, Reading Text Input, Inserting images, painting canvas, picking list items, checking boxes, storing data, Intent, Activity, Activity Lifecycle and Manifest, Creating Application and new Activities, Activity and implicit intents. Controlling Progress- Composing Programs, Defining variables, performing operations, branching flow, providing alternatives, Notifying messages, Looping Concepts.

UNIT IV:

Advanced UI Programming- Input Controls, Alerts and Pickers, using an option with Menu and Radio buttons, using the App bar and Tabs for Navigation, Drawables, Styles and themes, Material Design: Lists, Cards and Colors.

UNIT V:

Working in the background- Background tasks- create an AsyncTask, connect to the AsyncTask and AsyncTaskLoader, Broadcast receivers, Triggering, Scheduling and Optimizing Background Tasks.

UNIT VI:

Toast, Menu, Dialog, List and Adapter- Menu: Basics, Custom v/s System Menus, Create and Use Handset menu Button (Hardware), Dialog : Creating and Altering Dialogs, Basic operation of SQLite Database, Android Application Priorities.

Text Books:

1. Raj Kamal, Mobile Computing, Second Edition, Oxford press.
2. Mike Mcgrath, Building Android Apps in easy steps, McGraw-Hill Education.

Reference Books:

1. Reto Meier, Professional Android 2 Application Development, Wiley India Pvt Ltd.
2. Mark L Murphy, Beginning Android, Wiley India Pvt Ltd.
3. Android Developer Fundamental Course, Practical Workbook, developed by Google Developer Training Team.
4. https://developer.android.com/guide/platform/index.html.

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Year/Semester	**IV B. Tech/II Sem**	**L**	**T**	**P**	**C**
Regulation	**R19**	**3**	**0**	**0**	**3**
Subject	**BlockChain Technologies (Professional Elective V)**				

Course Objectives:

This course introduces the fundamentals and implementation issues of Blockchain Technologies.

Course Outcomes:

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

1. Infer and summarize the fundamentals of Blockchain.
2. Analyze the working of Blockchain.
3. Explain how business can be easily made with Blockchain.
4. Interpret how Blockchain can be integrated with various current technologies.
5. Examine and test the Blockchain strength in providing solutions.
6. Investigate and understand the Problems with Blockchain.

UNIT I:

Grasping Blockchain Fundamentals Tracing Blockchain's Origin, The shortcomings of current transaction systems,The emergence of bitcoin,The birth of blockchain,Revolutionizing the Traditional Business Network,Exploring a blockchain application, Recognizing the key business benefits, Building trust with blockchain.

UNIT II:

Taking a Look at How Blockchain Works Why It's Called "Blockchain", What Makes a Blockchain Suitable for Business?, Shared ledger, Permissions, Consensus, Smart contracts ,Identifying Participants and Their Roles.

UNIT III:

Propelling Business with Blockchains Recognizing Types of Market Friction, Information frictions, Interaction frictions, Innovation frictions, Moving Closer to Friction-Free Business Networks, Reducing information friction, Easing interaction friction, Easing innovation friction, Transforming Ecosystems through Increased Visibility.

UNIT IV: Blockchain in Action: Use Cases Financial Services,Commercial financing,Trade finance,Cross-border transactions, Insurance, Government, Supply Chain Management, Healthcare, Electronic medical records Healthcare payments pre-authorization, Internet of Things(IoT).

UNIT V:

Hyperledger, a Linux Foundation Project Hyperledger Vision, Hyperledger Fabric, How Can IBM Help Developers Innovate With Blockchain? Offering an easily accessible cloud and development platform, Individualized attention and industry expertise.

UNIT VI:

Problems with Block chain Security and Safeguards, Protection from attackers, Hacks on exchanges, What is stopping adoption?, Scalability problems, Network attacks to destroy bitcoin, Case Study: Failed currencies & blockchain.

Text Books:

1. Manav Gupta, Blockchain for Dummies, IBM Limited Edition, John Wiley & Sons.

Reference Books:

1. Swan, Melanie. Blockchain: Blueprint for a new economy. O'Reilly Media, Inc.

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Year/Semester	IV B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Entrepreneurship (Open Elective IV)				

Course Objective: The objective of the course is to make students understand the fundamentals of entrepreneurship and make students take their career in entrepreneurship.

Course Outcomes: After completing this course, the students will be able to

1. Understand the concept and importance of entrepreneurship.
2. Know the various means of generating business ideas.
3. Know the various legal aspects involved in forming the business.
4. Able to write a business plan.
5. Know the role of Government and Various Agencies in promoting entrepreneurship.
6. Identify startup types, avoid common mistakes, and manage downturn challenges effectively.

UNIT I

Fundamentals of Entrepreneurship: Entrepreneurship; Entrepreneurial Traits, Types of Entrepreneurs; Evolution of Entrepreneurship; Myths of Entrepreneurship; Difference between Inventors & Entrepreneurs; Role of Entrepreneurship; Entrepreneurial Ethics & Social Responsibilities.

UNIT II

Creativity & Innovation: Introduction; Creativity & Entrepreneurship; Components of Creativity; Characteristics of Creative People; Sources of New Ideas; Techniques for Generating Ideas. Innovation & the Entrepreneur: The innovation Process; Types of Innovation; Major Misconceptions of Innovation; Principles of Innovation.

UNIT III

Legal Aspects of Business: Procedures for setting up a Business in India; Legal Aspects governing businesses in India; Intellectual Property Rights and their Importance; Protection of IPRs in India.

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UNIT IV

Business Plan: Business plan; Drivers of Business plan; Basics of Business plan; Reasons for Failure of Business plans; Growth strategies for Ventures: Franchising, Licensing, Joint Ventures, Mergers & Acquisitions.

UNIT V

Institutions that facilitate Entrepreneurship & Entrepreneurship Development: National Institute for MSME, NIESBUD; Ministry of MSME; EDI; National Entrepreneurship Network (NEN); National science & Technology Entrepreneurship Development Board (NSTEDB); ISB: Wadhwani Centre for Entrepreneurship Development (WCED).

UNIT VI

Start-Ups: Start-Ups; Types of Start-Ups; Start-Ups in India; Mistakes start-Ups Make; Managing start-Ups during down turn.

References:

1. Arya Kumar: “Entrepreneurship”, Pearson, Publishing House, New Delhi, 2012.
2. VSP Rao, Kuratko: “Entrepreneurship”, Cengage Learning, New Delhi.
3. Rajeev Roy: “entrepreneurship”, Oxford University Press, New Delhi, 2012.
4. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya House 2015.

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Year/Semester	IV B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Nano Technology (Open Elective IV)				

Course Objectives:

1. The objective here is to impart the basic knowledge in Nano Science and Technology.
2. To the various methods used for synthesis and characterization of nano materials
3. To study the properties of nanomaterials.
4. To study the application of nano materials

Course Outcomes: Students will be able to

1. Describe the unique mechanical, thermal, magnetic, electrical, and optical properties of nanomaterials.
2. Outline various top-down and bottom-up synthesis techniques and consolidation methods for nanomaterials.
3. Identify and explain the tools and techniques used for the characterization of nanomaterials.
4. Illustrate the diverse applications of nanomaterials in industries such as medicine, electronics, environment, and energy.
5. Discuss recent advancements, ethical issues, and regulatory challenges associated with nanotechnology.

Unit I

Introduction: History and Scope, Can Small Things Make a Big Difference? Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges and Future Prospects.

Unit II

Unique Properties of Nanomaterials: Microstructure and Defects in Nano crystalline Materials:Dislocations, Twins,stacking faults and voids, Grain Boundaries, triple and disclinations. Effect of Nano-dimensions on Materials Behavior: Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, Enhanced solid solubility.

Magnetic Properties: Soft magnetic nanocrystalline alloy, Permanent magnetic nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties and Mechanical Properties.

Unit III

Synthesis Routes: Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method ,Self assembly,
Top down approaches: Mechanical alloying, Nano-lithography.
Consolidation of Nano powders: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

Unit IV

Tools to Characterize nanomaterials: X-Ray Diffraction (XRD), Small Angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nanoindentation.

Unit V

Applications of Nanomaterials: Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nano sensors, Nano catalysts, Food and Agricultural Industry, Cosmetic and Consumer Goods, Structure and Engineering, Automotive Industry, Water- Treatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Defence and Space Applications, Concerns and challenges of Nanotechnology.

UNIT VI

Recent Advances and Ethical Aspects in Nanotechnology: Green Nanotechnology – Sustainable Nanomaterials – Nanotechnology in Drug Delivery Systems – Nanorobotics – Ethical, Health, and Environmental Concerns – Regulatory Aspects – Social and Economic Impacts of Nanotechnology – Future Research Directions.

Text Books:

1. Text Book of Nano Science and Nano Technology – B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, University Press-IIM, 2012
2. Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wley India Edition, 2012.

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References:

1. Nano: The Essentials by T.Pradeep, Mc Graw- Hill Education, 2007
2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira and Daniel L.Schodek
3. Transport in Nano structures- David Ferry, Cambridge University press 2000
4. Nanofabrication towards biomedical application: Techniques, tools, Application and impact– Ed. Challa S.,S. R. Kumar, J. H. Carola.
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
6. Electron Transport in Mesoscopic systems - S. Dutta, Cambridge University press.

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Year/Semester	IV B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Electronic Measurements and Instrumentation (Open Elective IV)				

Course Objective:

1. To understand the measuring methods and instruments of electrical quantities.
2. To understand, design aspects and performance criterion of measuring instruments.
3. To understand the working principle of various transducers.
4. To aware the students about the different types of bridges
5. To understand transducers.

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

1. Understand operation of different instruments
2. Identify the industrial and laboratory applications of instruments
3. Distinguish between the analog and digital meters
4. Perform experiments to determine various types of errors in measurements
5. Practice for design of testing and measuring set up for electronic systems
6. Explain the working of active and passive transducers and their role in data acquisition systems.

UNIT I

Performance characteristics of instruments:

Static characteristics, accuracy, resolution, precision, expected value, error and sensitivity. Errors in measurement and dynamic characteristics: speed of response, fidelity, lag and dynamic error. Voltmeters:Multirange, range extension, solid state and differential voltmeters.

UNIT II

Ammeters:

Shunt and thermocouple type ammeter. Ohmmeters: Series type, shunt type, multimeter for voltage, current and resistance measurements. Digital multimeters: Block diagram and specifications.

UNIT III

Signal Generators:

Fixed and variable, AF oscillators, standard and AF sine and square wave signal generators, function Generators, square pulse, random noise and sweep. Wave Analyzers: Harmonic distortion analyzers, spectrum analyzers and digital Fourier analyzers.

UNIT- IV

Cathode Ray Oscilloscopes:

CRT features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, simple CRO, triggered sweep CRO, dual beam CRO, measurement of amplitude and frequency. Dual trace oscilloscope, sampling oscilloscope, storage oscilloscope, digital storage oscilloscope, Lissajous method of frequency measurement, standard specifications of CRO, probes for CRO (active and passive), attenuator type .

UNIT V

AC Bridges:

Measurement of inductance: Maxwell‘s bridge, Anderson bridge.Measurement of capacitance: Schering bridge. Kelvin‘s bridge, Wheatstone bridge and Wien Bridge. Errors and precautions and related problems. Q – Meter. Bridges: Wheatstone Bridge, Kelvin Bridge and Maxwell Bridge

UNIT VI

Active and passive transducers:

Resistance, capacitance, inductance, strain gauges, LVDT, piezoelectric transducers, resistance thermometers, thermocouples, thermistors and sensistors. Basic Hall Effect sensors.Calibration and standards and data acquisition systems.

Text Books:

1. Electronic instrumentation – H.S.Kalsi, Tata McGraw Hill, 2004, 2/e.
2. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrick and W.D. Cooper, PHI, 2002, 5/e.

Reference Books:

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, 2003, 2/e.
2. Electronic Test Instruments, Analog and Digital Measurements - Robert A.Witte, Pearson Education, 2004, 2/e.

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Year/Semester	IV B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Principles of Communication Systems (Open Elective IV)				

Course Objective:

1. Understand amplitude and angle modulation techniques.
2. Learn analog and digital pulse communication methods.
3. Analyze noise effects in analog modulation systems.
4. Understand digital data transmission and error control method**s.**

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

1. Analyze the performance of analog modulation schemes in time and frequency domains.
2. Analyze the performance of angle modulated signals.
3. Characterize analog signals in time domain as random processes and noise
4. Characterize the influence of channel on analog modulated signals
5. Determine the performance of analog communication systems in terms of SNR
6. Analyze pulse amplitude modulation, pulse position modulation, pulse code modulation and TDM systems.

UNIT-1

Amplitude modulation: Introduction, Amplitude Modulation: Time & Frequency – Domain description, switching modulator, Envelop detector. Double side band-suppressed carrier modulation: Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. Single side–band and vestigial sideband methods of modulation: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television

UNIT-II

Angle modulation: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing,

UNITIII

Signal Sampling and Analog Pulse Communication: Ideal Sampling, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position Modulation. Digital Communication Techniques: Quantization, Digital

Transmission of Data, Parallel and Serial Transmission, Data Conversion, Pulse Code Modulation, Delta Modulation.

UNIT-IV

Noise in analog modulation: Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasise in FM.

UNIT-V

Transmission of Binary Data in Communication Systems: Digital Codes, Principles of Digital Transmission, Transmission Efficiency, Modem Concepts and Methods – FSK, BPSK, Error Detection and Correction

UNIT-VI

Spread Spectrum and Multiple Access Techniques: Spread Spectrum Techniques: Introduction, Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS), Advantages of Spread Spectrum.

Code Division Multiple Access (CDMA): Principle, Spreading codes, Applications.

Multiple Access Techniques: FDMA, TDMA, CDMA comparison.Applications in Wireless and Mobile Communication Systems.

Text Books:

1. Principles of Communication Systems – H Taub& D. Schilling, GautamSahe, TMH, 2007, 3rdEdition.
2. Communication Systems – B.P. Lathi, BS Publication,2006.

References:

1. Principles of Communication Systems - Simon Haykin, John Wiley,2ndEdition.
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004.
3. Communication Systems– R.P. Singh, SP Sapre, Second Edition TMH,2007.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Year/Semester	IV B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Digital Control Systems (Open Elective IV)				

Course Objective:

The purpose of the proposed course is to present control theory that is relevant to the analysis and design of computer-controlled systems, with an emphasis on basic concepts and ideas.

Course Outcomes:

At the end of this course students will be able to

1. Explain the concepts of digital control systems and recall the fundamentals of signal processing
2. Recall the concepts of Z-Transformation
3. Interpret linear discrete–time systems in state model
4. Examine the stability of linear discrete-time systems by the use of Bilinear Transformation and Routh Stability criterion.
5. Identify an appropriate controller for the given specifications and apply conventional and modern design methods for their parameter selection

UNIT I:

Introduction and Signal Processing

Introduction to analog and digital control systems,Advantages of digital systems, Typical examples, Signals and processing, Sample and hold devices,Sampling theorem and data reconstruction, Digital to Analog conversion and Analog to Digital conversion Frequency domain characteristics of zero order hold.

UNIT II: Review of Z-Transforms

Z-Transform and theorems, finding inverse and method for solving difference equations; Pulse transforms function, block diagram analysis of sampled,data systems

Unit III:

State Space Analysis

State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and it’s Properties, Methods for Computation of

State Transition Matrix, Discretization of continuous time state – space equations- Concepts of controllability and observability – Tests (without proof). ''

UNIT IV:

Stability Analysis

Mapping between the S-Plane and the Z-Plane – Primary strips and Complementary Strips – Constant frequency loci, Constant damping ratio loci, Stability Analysis of closed loop systems in the Z-Plane. Jury stability test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.

UNIT V:

Design of Discrete Time Control System by Conventional Methods. Transient and steady – State response Analysis – Design based on the frequency response method –Bilinear Transformation and Design using frequency response in the w–plane for lag and lead compensators and digital PID controllers

UNIT VI:

State Feedback Controllers and Observers

Design of state feedback controller through pole placement – Ackerman's formula, Introduction to state observers-full order observer design.

Text Books:

1. "Discrete–Time Control systems", K. Ogata, Pearson Education/PHI, 2ndEdition, 2015.

Reference Books:

1. "Digital Control Systems", Kuo, Oxford, 2nd Edition, 2012.
2. "Digital Control and State Variable Methods", M. Gopal, McGraw Higher Ed, 4th Edition, 2012.
3. "Digital Control Systems", V. I. George, P. C. Kurian, Cengage Learning, 1st Edition, 2012.

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Year/Semester	IV B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Managerial Economics and Financial Analysis (Humanities Elective II)				

Course Objectives:

The objective of the course is to create awareness about different economic business and accounting issues.

Course Outcomes: After completing this course, the students will be able

1. Gain knowledge in basic economic tools in managerial economics and demand analysis.
2. Understand and estimate the demand elasticity and its relationship to pricing and revenue and markets.
3. Analyze the production, cost concepts and organization forms.
4. To understand the maintenance of books of accounts and financial statement analysis
5. Understand the expenditure and capital budgeting in big industries

UNIT I

Introduction to Managerial Economics and Demand Analysis: Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement-Demand forecasting and Methods of forecasting.

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UNIT II

Production and Cost Analysis: Concept of Production function- Cobb-Douglas Production function - Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs- Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(simple problems)Managerial significance and limitations of Breakeven point.

UNIT III

Introduction to Markets & Pricing Policies: Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination - Methods of

Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing.

UNIT IV

Types of Business Organization and Business Cycles: Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms – Business Cycles : Meaning and Features – Phases of a Business Cycle.

UNIT V

Introduction to Accounting; Double Entry Systems – Personal account, Real account, Nominal account GAAP-Preparation of final accounts –Trading account, Profit and Loss account, Balance sheet simple problems -Ratio Analysis .

UNIT VI

Capital and Capital Budgeting : Meaning of Capital- Capital Budgeting- Traditional Methods (pay back period, accounting rate of return) and modern methods(Discounted cash flow method, NetPresent Value method,Internal Rate of Return Method and Profitability Index)

REFERENCES:

1.Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya PublishingHouse, 2014.

2. V. Maheswari: Managerial Economics, Sultan Chand.2014

3. Suma Damodaran: Managerial Economics, Oxford 2011.

4. Vanitha Agarwal: Managerial Economics, Pearson Publications 2011.

5. Sanjay Dhameja: Financial Accounting for Managers, Pearson.

6. Maheswari: Financial Accounting, Vikas Publications.

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Year/Semester	IV B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	IPR & PE (Humanities Elective II)				

Course Objectives:

1.This course seeks to equip students with a broad understanding of the intellectual property rights system.

2.To analyze intellectual property issues in the context of environmental, economic and social development.

3.This includes an introduction to the conceptual foundations for intellectual property protection and the basic relevant treaties in the field.

Course Outcomes: Students will be able to

1. Explain the fundamentals of intellectual property laws and identify various types and misuse of IPR.
2. Summarize copyright principles, rights, ownership, registration, and infringement issues.
3. Illustrate patent laws, requirements, application process, and international considerations.
4. Describe trademark registration, maintenance, infringement, and related legal procedures.
5. Discuss the protection, maintenance, and legal implications of trade secrets.
6. Examine cyber law, IT Act provisions, cybercrime issues, and data security concerns.

UNIT I

Introduction to Intellectual Property Law – Intellectual Property Law Basics - Types of Intellectual Property – Agencies Responsible for Intellectual Property Registration – Infringement – Over use or Misuse of Intellectual Property Rights.

UNIT II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Right to prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration– Infringement of Copyright .

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UNIT III

Introduction to Patent Law – Rights and Limitations – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation –International Patent Law – New developments in Patent Law.

UNIT IV

Introduction to Trade Mark – Trade Mark Registration Process – Trade Mark maintenance – Transfer of rights – Infringement – Dilution of Ownership of Trade Mark – Trade Mark claims and Litigation –International Trade Mark Law.

UNIT V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security– Employee Access Limitation – Employee Confidentiality Agreement –Trade Secret Law – Trade Secret Litigation – Breach of Contract.

UNIT VI

Introduction to Cyber Law – Information Technology Act - Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.

Reference Books:

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning, New Delhi
2. Kompal Bansal & Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections
4. Prabhuddha Ganguli: ‘ Intellectual Property Rights” Tata Mc-Graw –Hill, New Delhi
5. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
6. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.

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Year/Semester	IV B. Tech/II Sem	L	T	P	C
Regulation	R19	3	0	0	3
Subject	Education, Technology and Society (Humanities Elective II)				

Course Description : This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society. They will also learn about the long lasting impact of good education in a technologically advanced society.

Course Objectives: The course aims

1. To help learners understand the basics of different types of technology utilised in the field of education
2. To make them realize the impact of education in society
3. To make them evolve as responsible citizens in a technologically advanced society

Course Outcomes : By the end of the course, learners will be able to

1. Appreciate the historical evolution and socio-cultural context of the Indian education system.
2. Interpret major learning theories and apply them to personal and societal growth.
3. Utilize educational technologies to enhance self-expression and knowledge sharing.
4. Demonstrate ethical responsibility in the use of digital resources and media.
5. Critically evaluate the influence of technology on human learning and relationships.
6. Explore future educational trends and their role in promoting inclusive and holistic development.

UNIT I

INDIAN EDUCATION SYSTEM Gurukul to ICT education – Teacher as facilitator – Macaulay's Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

UNIT II

LEARNING THEORIES Learning Theories – Behaviorism – Cognitivism – Social Constuctivism – Humanism Learning Styles – Multiple Intelligences – Emotional Intelligence – Blooms Taxonomy

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UNIT III

TECHNOLOGICAL ADVANCEMENTS Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

UNIT IV

EDUCATIONAL TECHNOLOGY Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

UNIT V

ETHICAL IMPLICATIONS Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individuals and society.

UNIT VI

EMERGING TRENDS IN EDUCATION AND HUMAN DEVELOPMENT

Impact of Artificial Intelligence, Virtual Reality and Augmented Reality in learning – Gamification and interactive learning – Lifelong learning and self-paced education – Role of education in fostering critical thinking and social responsibility – Vision of NEP 2020 in shaping future education.

Internal (100 % Weightage)

1. Written Test (40 marks)
2. Assignment: Write a real time report of the technology use in any school / college (15 marks)
3. Presentation: Students choose any one of the technological tools and present its relevance to education and society (15 marks)
4. Group discussion: Students discuss in groups on case studies relating to various challenges in education and technology use in society (20 marks)
5. Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others" posts. (10 marks)

References:

1. Education and Social order by Bertrand Russel
2. Theories of learning by Bower and Hilgard
3. Technology and Society by Jan L Harrington

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