R23B.TechCSECOURSESTRUCTURE&SYLLABUS

From II Year to IV Year

Vision and Mission of the University

Vision

The University is primarily promoting quality of education in the areas of Science, Technology, Engineering and Mathematics (STEM) as four academic pillars of education, to excel in teaching, learning, research, consultancy and placements through innovativepractices with global perspective.

Mission

1. DesignanIndustryrelevantcurriculumfromtimetotimewithaGlobal perspective
2. Promoting quality education by embracing ICT delivery mechanism with continuous pedagogy throughe-learning mechanism
3. Spread across for industry collaborations with a focus to pre-training and placements for technology transfer to society
4. Establishingcentersof excellencetopromoteresearchandinnovationsin multidisciplinary areas to bring in patent culture and consultancy practices
5. InternationalCollaborationsforstudentoutreach
6. Facilitating international students to study in JNTUK to infuse cross culture learning practices.

VisionandMission of theInstitute

VisionandMission of theDepartment

ProgrammeEducationObjectives(PEOs)oftheB.Tech (CSE)

PEO1:"CompetentITprofessionalwithsoundfundamentalandappliedknowledgein Computer Science and Engineering."

PEO 2: "Sustained learner to bring out creative and innovative ideas to meet the challengesof industry and society with ethics and human values and pursue higher studies."

PEO 3: "Entrepreneurs in computer science acquainted with interpersonal, managerial skills to make them successful in multidisciplinary fields."

ProgrammeOutcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and societyApply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutionsinsocietalandenvironmentalcontexts,anddemonstratetheknowledgeof,andneed for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance : Demonstrate knowledge and understanding of the engineering and management principles and applytheseto one's own work, as amember and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learningin the broadest context of technological change.

ProgrammeSpecificOutcomes (PSOs)

PSO1:"Designalgorithmsforreal-worldcomputationalproblemsandanalyzethecomplexities to optimize solutions."

PSO 2: "Apply methods and tools for data acquisition, analysis, and knowledge discovery in developing decision-making systems."

PSO 3: "Develop adaptable and self-learning models with real-world data fitting, evaluation, and performance improvement methods."

MappingofProgrammeSpecificOutcomes toPEOs

PEO\PSO	PSO1	PSO2	PSO3
PEO1	H	M	M
PEO2	M	H	H
PEO3	L	M	H

ModelLabExaminationRubrics

Criterion	*Weightage*	*Excellent(H)–8–10*	*Good(M)–5–7*	*Satisfactory(L)–2–4*	*Unsatisfactory–0–1*
1. Problem Understanding & Algorithm Design	20%	Demonstrates complete understanding; designsoptimal and structured logic/algorithm	Understands problemclearly; logic mostly correct with minor gaps	Partial understanding; logicincomplete or inefficient	Nounderstanding; illogical or irrelevantapproach
2.Program Design &Coding Standards	20%	Code is well-structured, modular, uses OOP concepts correctly; excellentnaming andformatting	Good structure; correct use of major concepts; minorformatting issues	Basic program structure; limited modularity; poor naming/formatting	Disorganized code; missing structure; no use ofOOP concepts
3. Program Execution& Debugging Skills	25%	Program runs perfectlyforall cases; independently debugs errors efficiently	Programruns with minor errors; needs minimalhelp	Program runs partially;needs moderate assistance	Programdoesnot run; unable to debug
4. Output Accuracy& Test Cases	20%	All outputs correct; handled multiple test cases;edgecases included	Outputsmostly correct; some test cases missing	Limitedaccuracy; few test cases	Incorrect/no outputs
5. Viva Voce (Conceptsand topics)	15%	Answers all questions correctly with clarityanddepth	Answersmost questions correctlywith reasonable understanding	Answers basic questions only; limitedconceptual clarity	Unabletoanswer; no conceptual understanding

B.Tech.–IIYearI Semester

S.No.	Category	Title	L	T	P	Credits
1	BS&H	DiscreteMathematics& GraphTheory	3	0	0	3
2	BS&H	Universal human values – understandingharmonyand Ethicalhumanconduct	2	1	0	3
3	EngineeringScience	DigitalLogic&Computer Organization	3	0	0	3
4	Professional Core	AdvancedDataStructures& AlgorithmAnalysis	3	0	0	3
5	Professional Core	ObjectOriented Programming ThroughJava	3	0	0	3
6	Professional Core	AdvancedDataStructuresand AlgorithmAnalysis Lab	0	0	3	1.5
7	Professional Core	ObjectOriented Programming ThroughJava Lab	0	0	3	1.5
8	Skill Enhancement Course	PythonProgramming	0	1	2	2
9	Audit Course	EnvironmentalScience	2	0	0	-
Total			**16**	**2**	**8**	**20**

B.Tech.–IIYearII Semester

S.No.	**Category**	**Title**	**L**	**T**	**P**	**Credits**
1	ManagementCourse- I	ManagerialEconomicsand FinancialAnalysis	2	0	0	2
2	EngineeringScience/ Basic Science	Probability&Statistics	3	0	0	3
3	Professional Core	OperatingSystems	3	0	0	3
4	Professional Core	DatabaseManagement Systems	3	0	0	3
5	Professional Core	SoftwareEngineering	2	1	0	3
6	Professional Core	OperatingSystems Lab	0	0	3	1.5
7	Professional Core	DatabaseManagement Systems Lab	0	0	3	1.5
8	SkillEnhancement Course	FullStackDevelopment–I	0	1	2	2
9	BS&H	DesignThinking &Innovation	1	0	2	2
Total			**14**	**2**	**10**	**21**
MandatoryCommunityServiceProjectInternshipof08weeksduration during summervacation						

IIYearI Semester

L	T	P	C
3	0	0	3

DISCRETEMATHEMATICSANDGRAPHTHEORY

Course Objectives:

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

CourseOutcomes:*At theend ofthecourse,successfulstudentwill beableto*

CO1:Applytheprinciplesofpropositionalandpredicatelogictoconstructwell-formed formulas and validate arguments using inference rules (K3)
CO2: Analyze and solve problems related to sets, relations, functions, lattices, and algebraic structures using appropriate mathematical techniques (K4)
CO3:Applycombinatorialtechniquesandgeneratingfunctionstoformulateandsolverecurrence relations in discrete structures (K3)
CO4:Examinegraphtheoreticconceptssuchaspaths,circuits,connectivity,andgraph isomorphism, and apply them to model and solve real-world problems (K4)
CO5:Applyadvanced graphalgorithms(BFS,DFS,spanningtrees,colouring,planargraphs) and evaluate their suitability in solving computational problems (K5)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	L	L	-	-	-	-	-	-	M	-	-	-
CO2	H	H	L	L	L	-	-	-	-	-	-	M	-	-	-
CO3	H	H	M	M	L	-	-	-	-	-	-	M	-	-	-
CO4	H	H	M	M	M	-	-	-	-	-	-	M	-	-	-
CO5	H	H	H	M	H	-	-	-	-	-	-	M	-	-	-

UNIT–I:MathematicalLogic:

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

UNIT-II:SetTheory:

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

UNIT-III:CombinatoricsandRecurrenceRelations:

Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems.

RecurrenceRelations:

Generating Functions, Function of Sequences, Partial Fractions, 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

UNIT-IV:Graph Theory:

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

Unit-V:MultiGraphs

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

TEXT BOOKS:

1. DiscreteMathematicalStructureswithApplicationstoComputerScience,J.P. Tremblay and P. Manohar, Tata McGraw Hill.
2. ElementsofDiscreteMathematics-AComputerOrientedApproach,C.L.LiuandD. P.Mohapatra,3rdEdition,TataMcGrawHill.
3. TheoryandProblemsofDiscreteMathematics,Schaum'sOutlineSeries,Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.

REFERENCEBOOKS:

1. DiscreteMathematicsforComputerScientistsandMathematicians,J.L.Mott,A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
2. DiscreteMathematicalStructures,BernandKolman,RobertC.BusbyandSharon Cutler Ross, PHI.
3. DiscreteMathematics,S.K.ChakraborthyandB.K.Sarkar,Oxford,2011.
4. DiscreteMathematicsanditsApplicationswithCombinatoricsandGraphTheory,K. H.Rosen,7th Edition,TataMcGraw Hill.

IIYearI Semester

L	T	P	C
2	1	0	3

UNIVERSALHUMANVALUES–UNDERSTANDINGHARMONYAND ETHICAL HUMAN CONDUCT

Course Objectives:

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

Course Outcomes:

1. Definethe termslikeNaturalAcceptance, HappinessandProsperity(L1,L2)
2. Identifyone'sself,andone'ssurroundings(family, societynature) (L1,L2)
3. Apply whatthey havelearnttotheirownselfin differentday-to-day settingsin real life (L3)
4. Relatehumanvalueswithhumanrelationshipand humansociety.(L4)
5. Justifythe need foruniversal human valuesand harmonious existence(L5)
6. Developassociallyandecologicallyresponsibleengineers(L3,L6)

Course Topics

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

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

UNIT I Introduction to Value Education (6 lectures and 3 tutorials for practicesession)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture2:UnderstandingValue Education

Tutorial 1: Practice Session PS1 Sharing about Oneself

Lecture3:self-explorationastheProcessforValueEducation

Lecture4:ContinuousHappinessandProsperity–theBasicHuman Aspirations
Tutorial2:PracticeSessionPS2ExploringHumanConsciousness Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial3:PracticeSessionPS3ExploringNaturalAcceptance

UNIT II Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture8:Distinguishingbetweenthe Needsoftheselfandthebody
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture9:ThebodyasanInstrumentoftheself Lecture 10: Understanding Harmony in the self
Tutorial5:PracticeSessionPS5ExploringSourcesofImaginationintheself Lecture 11: Harmony of the self with the body
Lecture12: Programmeto ensureself-regulation and Health
Tutorial6: PracticeSessionPS6 ExploringHarmonyofself with the body

UNIT III HarmonyintheFamilyandSociety(6lecturesand3tutorialsforpractice session)
Lecture13:HarmonyintheFamily–theBasicUnitofHumanInteraction Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial7:PracticeSessionPS7ExploringtheFeelingofTrust Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture16:OtherFeelings,JusticeinHuman-to-HumanRelationship
Lecture 17: Understanding Harmony in the Society
Lecture18: VisionfortheUniversal Human Order
Tutorial9:PracticeSession PS9ExploringSystems tofulfilHuman Goal

UNIT IV HarmonyintheNature/Existence(4lecturesand2tutorialsforpracticesession)
Lecture19:UnderstandingHarmonyinthe Nature
Lecture20:Interconnectedness,self-regulationandMutualFulfilmentamong the Four Orders of Nature
Tutorial10:PracticeSessionPS10ExploringtheFourOrdersofNature Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture22: TheHolisticPerception ofHarmonyin Existence
Tutorial11: PracticeSession PS11 ExploringCo-existencein Existence.

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture24:Definitivenessof(Ethical)HumanConduct
Tutorial12:PracticeSessionPS12 ExploringEthicalHuman Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution andUniversal Human Order
Lecture26:Competence inProfessionalEthics
Tutorial13:PracticeSessionPS13ExploringHumanisticModelsinEducation
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial14:PracticeSessionPS14ExploringStepsofTransitiontowards Universal Human Order

PracticeSessionsforUNITI–IntroductiontoValueEducation PS1
Sharing about Oneself
PS2ExploringHumanConsciousness PS3
Exploring Natural Acceptance

PracticeSessionsforUNIT II–HarmonyintheHumanBeing PS4
Exploring the difference of Needs of self and body
PS5ExploringSourcesofImaginationintheself PS6
Exploring Harmony of self with the body

PracticeSessionsforUNIT III–HarmonyintheFamilyandSociety PS7
Exploring the Feeling of Trust
PS8Exploringthe Feelingof Respect
PS9ExploringSystemstofulfilHuman Goal

PracticeSessionsforUNIT IV–HarmonyintheNature(Existence) PS10
Exploring the Four Orders of Nature
PS11ExploringCo-existenceinExistence

PracticeSessionsforUNITV–ImplicationsoftheHolisticUnderstanding–aLookat Professional Ethics
PS12ExploringEthicalHumanConduct
PS13ExploringHumanisticModelsin Education
PS14ExploringStepsofTransitiontowardsUniversalHuman Order

READINGS:
TextbookandTeachersManual

a. The Textbook

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

b. TheTeacher's Manual

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

ReferenceBooks

1. *JeevanVidya:EkParichaya,*ANagaraj,JeevanVidyaPrakashan,Amarkantak,1999.
2. *HumanValues,*A.N.Tripathi,NewAgeIntl.Publishers,NewDelhi,2004.
3. *TheStory of Stuff*(Book).
4. *TheStory of MyExperiments with Truth*-byMohandas Karamchand Gandhi
5. *Smallis Beautiful*-E. F Schumacher.
6. *Slowis Beautifu*l-CecileAndrews
7. *Economyof Permanence* -JC Kumarappa
8. *BharatMein AngrejiRaj*– PanditSunderlal
9. *RediscoveringIndia* - byDharampal
10. *HindSwaraj or Indian Home Rule* -byMohandas K.Gandhi
11. *India WinsFreedom*-MaulanaAbdulKalamAzad
12. *Vivekananda*-RomainRolland (English)
13. *Gandhi*-Romain Rolland (English)

ModeofConduct:

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

Tutorialhours areto beused forpracticesessions.

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

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

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

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life.Dependingonthenature oftopics,worksheets,homeassignmentand/oractivityareincluded. Thepracticesessions(tutorials)wouldalsoprovidesupporttoastudentinperformingactions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed beforethe student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.
Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385

https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

IIYearI Semester

L	T	P	C
3	0	0	3

DIGITALLOGIC&COMPUTER ORGANIZATION

Course Objectives:

Themain objectives ofthecourseis to

- providestudentswithacomprehensiveunderstandingofdigitallogicdesign principles and computer organization fundamentals
- Describememoryhierarchyconcepts
- Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices

CourseOutcomes(COs)*:At theendof thecourse,successfulstudent willbeable to*

CO1:*Apply*numbersystems,binarycodes,logicgates,andK-maptechniquesto*designand simplify* combinational logic circuits. **(K3)**

CO2: *Analyze* the behavior and operation of sequential circuits, flip-flops, counters, and registers,and*explain*thebasicstructureandperformancefactorsofcomputersystems. **(K4) CO3:** *Perform and evaluate* arithmetic operations including addition, subtraction, multiplication, and division using various algorithms, and *examine* processor organization and instruction execution mechanisms. **(K4)**

CO4:*Analyzeandcompare*differentmemoryorganizations,includingRAM,ROM,cache, and virtual memory, with respect to speed, size, cost, and performance. **(K4)**

CO5: *Explain and assess* I/O organization concepts such as interrupts, DMA, buses, and interfacecircuits,and*evaluate*standardI/Ointerfacesusedinmoderncomputersystems. **(K5)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	H	M	L	-	-	-	-	-	-				
CO2	H	H	M	M	L	-	-	-	-	-	-				
CO3	H	M	M	M	L	-	-	-	-	-	-				
CO4	H	H	M	H	M	-	-	-	-	-	-				
CO5	H	H	M	M	M	-	-	-	-	-	-				

UNIT– I:

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

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

UNIT– II:

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

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

UNIT– III:

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

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

UNIT– IV:

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

UNIT– V:

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

Textbooks:

1. ComputerOrganization,CarlHamacher,ZvonkoVranesic,SafwatZaky,6th edition, McGraw Hill
2. DigitalDesign,6thEdition,M.MorrisMano,PearsonEducation.
3. ComputerOrganizationandArchitecture,WilliamStallings,11thEdition,Pearson.

ReferenceBooks:

1. ComputerSystemsArchitecture,M.MorisMano,3rdEdition,Pearson
2. ComputerOrganizationandDesign, DavidA.Paterson,JohnL.Hennessy,Elsevier
3. FundamentalsofLogic Design,Roth,5thEdition,Thomson

OnlineLearningResources:

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

L	T	P	C
3	0	0	3

IIYearI Semester

ADVANCEDDATASTRUCTURES &ALGORITHMANALYSIS

Course Objectives:

Themain objectives ofthecourseis to

- provide knowledge on advance data structures frequentlyused in Computer Science domain
- Developskillsinalgorithmdesigntechniquespopularlyused
- Understandtheuseof variousdatastructures inthealgorithm design

CourseOutcomes (COs)

CO1: *Analyze* algorithm performance usingspace and time complexitymeasures, apply asymptoticnotations,and*constructandmanipulate*AVLTreesandB-Treesforvarious applications. **(K4)**

CO2: *Apply and evaluate* heap structures, graph representations, and graph traversal techniques,and*implement*divide-and-conqueralgorithmssuchasquicksort,mergesort, Strassen's multiplication, and convex hull computations. **(K4)**

CO3:*Apply*greedyanddynamicprogrammingstrategiestosolveoptimizationproblemssuch as MST, shortest paths, knapsack, OBST, TSP, and string editing, and *analyze* their computational efficiency. **(K4)**

CO4: *Develop and analyze* solutions for combinatorial problems using backtracking and branch-and-boundtechniques,including8-queens,subsetsum,graphcoloring,knapsack,and TSP. **(K4)**

CO5:*Explainandevaluate*NP-hardand NP-completeproblemclasses,includinggraphand schedulingdecisionproblems,and*assess*theircomputationalintractabilitywithreferenceto theoretical foundations. **(K4)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	M	L	-	-	-	-	-	-	-			
CO2	H	H	H	M	M	-	-	-	-	-	-	-			
CO3	H	H	H	M	M	-	-	-	-	-	-	-			
CO4	H	M	H	M	L	-	-	-	-	-	-	-			
CO5	H	M	M	M	L	-	-	-	-	-	-	-			

UNIT– I:

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations. AVL Trees – Creation, Insertion, Deletion operations and Applications; B-Trees – Creation, Insertion, Deletion operations and Applications

UNIT– II:

HeapTrees (PriorityQueues)– Minand MaxHeaps,Operations and Applications

Graphs–Terminology,Representations,BasicSearchandTraversals,Connected Components and Biconnected Components, applications

DivideandConquer:TheGeneralMethod,QuickSort,MergeSort,Strassen'smatrix multiplication, Convex Hull

UNIT– III:

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

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

UNIT– IV:

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

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

UNIT– V:

NPHardandNPCompleteProblems:BasicConcepts,Cook's theorem

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

NPHardSchedulingProblems:SchedulingIdentical Processors,JobShop Scheduling

Textbooks:

1. FundamentalsofDataStructuresinC++,Horowitz,Ellis;Sahni,Sartaj;Mehta,Dinesh, 2nd Edition Universities Press
2. Computer Algorithms in C++, Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2nd Edition University Press

ReferenceBooks:

1. DataStructuresandprogramdesigninC,RobertKruse,PearsonEducationAsia
2. AnintroductiontoDataStructureswithapplications,Trembley&Sorenson,McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. DataStructuresusingC &C++: Langsam,Augenstein&Tanenbaum,Pearson,1995
5. Algorithms+DataStructures&Programs:,N.Wirth, PHI
6. Fundamentalsof DataStructuresinC++:Horowitz Sahni&Mehta,GalgottiaPub.
7. DatastructuresinJava:,ThomasStandish,PearsonEducationAsia

OnlineLearningResources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. AbdulBari,IntroductiontoAlgorithms(youtube.com)

L	T	P	C
3	0	0	3

IIYearI Semester

OBJECTORIENTEDPROGRAMMINGTHROUGHJAVA

Course Objectives:

Thelearningobjectives of this courseareto:

- identifyJavalanguagecomponents and how theywork together inapplications
- Learn the fundamentals of object-oriented programming in Java, including definingclasses, invoking methods, using class libraries.
- learnhowtoextendJavaclasseswithinheritanceanddynamicbindingandhowto use exception handling in Java applications
- understandhow todesign applications withthreads in Java
- understandhowtouseJavaAPIsforprogram development

CourseOutcomes(COs)

CO1: *Apply* object-oriented programming principles and Java program structure to write, compile, andexecutebasicJavaprogramsusingappropriatedatatypes,operators,andcontrolstatements. **(K3) CO2:** *Develop and utilize* classes, objects, constructors, methods, access specifiers, and method overloading/overriding to implement modular and reusable Java applications. **(K3)**

CO3:*Implementandanalyze*arrays,inheritancemodels,interfaces,andabstractclassestodesign structured and extensible Java solutions for given problems. **(K4)**

CO4:*Useandevaluate*Javapackages,standardlibraries,exceptionhandlingmechanisms,andJava I/O streams to build robust and efficient applications. **(K4)**

CO5:*Developandintegrate*advancedJavafeaturesincludingstringhandling,multithreading,JDBC-based database connectivity, and JavaFX GUI components to create interactive and concurrent applications. **(K5)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M	L	L	-	-	-	-	-	-	-			
CO2	H	M	H	M	L	-	-	-	-	-	-	-			
CO3	H	H	H	M	L	-	-	-	-	-	-	-			
CO4	H	M	M	H	M	-	-	-	-	-	-	-			
CO5	H	M	H	H	M	-	-	-	-	-	-	-			

UNITI

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

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final,**Introduction to Operators**, Precedence and Associativity of Operators, AssignmentOperator(=),BasicArithmeticOperators,Increment(++)andDecrement(--)

Operators,TernaryOperator,RelationalOperators,BooleanLogicalOperators,BitwiseLogical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, TernaryOperator?:,SwitchStatement,IterationStatements,whileExpression,do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement. **UNIT II**

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded ConstructorMethods,NestedClasses,FinalClassandMethods,PassingArgumentsbyValue and by Reference, Keyword this.

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

UNITIII

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

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

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

UNITIV

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

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

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

UNITV

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

MultithreadedProgramming: Introduction,NeedforMultipleThreadsMultithreadedProgrammingforMulti-coreProcessor,ThreadClass,MainThread-CreationofNew Threads,ThreadStates,ThreadPriority-Synchronization,DeadlockandRaceSituations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

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

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

TextBooks:

1) JAVAonestepahead, AnithaSeth,B.L.Juneja, Oxford.
2) JoywithJAVA,FundamentalsofObjectOrientedProgramming,DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3) JAVA9 forProgrammers, PaulDeitel, HarveyDeitel, 4th Edition, Pearson.

ReferencesBooks:

1) ThecompleteReference Java,11thedition,Herbert Schildt,TMH
2) IntroductiontoJavaprogramming,7th Edition,YDaniel Liang,Pearson

Online Resources:

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

L	T	P	C
0	0	3	1.5

IIYearI Semester

ADVANCEDDATASTRUCTURES&ALGORITHMANALYSISLAB

Course Objectives:

Theobjectives of the courseis to

- acquirepracticalskillsinconstructingandmanagingDatastructures
- applythe popular algorithm design methods in problem-solving scenarios

ExperimentscoveringtheTopics:

- OperationsonAVLtrees,B-Trees,HeapTrees
- GraphTraversals
- Sortingtechniques
- Minimumcostspanning trees
- Shortestpathalgorithms
- 0/1KnapsackProblem
- TravellingSalesperson problem
- OptimalBinarySearch Trees
- N-QueensProblem
- JobSequencing

CO1:*Implementandmanipulate*advancedtreedatastructuressuchasAVLTrees, B-Trees, andHeapstoperformoperationsincludinginsertion,deletion,traversal,andfile/array-based storage. **(K3)**

CO2:*Developandanalyze*graphtraversalandgraph-basedalgorithmssuchasBFS,DFS, connected and biconnected components using multiple graph representations. **(K4)**

CO3:*Applyandcompare*divide-and-conquer,greedy,anddynamicprogrammingtechniques to solve problems such as sorting, shortest paths, job sequencing, and knapsack, including performance evaluation for various inputs. **(K4)**

CO4:*Designandimplement*backtrackingandbranch-and-boundsolutionsforcombinatorial optimization problems such as N-Queens, 0/1 Knapsack, and Travelling Salesperson Problem. **(K5)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M	L	M	-	-	-	L	-	-	L			
CO2	H	H	M	M	M	-	-	-	L	-	-	L			
CO3	H	H	H	M	M	-	-	-	L	-	-	M			
CO4	H	H	H	M	M	-	-	-	L	-	-	M			

SamplePrograms:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implementinsertanddeleteoperationontheconstructedtree.Writecontentsoftree into a new file using in-order.
2. ConstructB-Treeanorderof5withasetof100randomelementsstoredinarray. Implement searching, insertion and deletion operations.
3. ConstructMinandMaxHeapusingarrays,deleteanyelementanddisplaythecontent of the Heap.

4. ImplementBFTandDFTforgivengraph,when graphisrepresentedby
   a) AdjacencyMatrix b)AdjacencyLists
5. Writeaprogram for findingthebiconnectedcomponentsin agivengraph.
6. ImplementQuicksortandMergesortandobservetheexecutiontimeforvarious input sizes (Average, Worst and Best cases).
7. ComparetheperformanceofSingleSourceShortestPathsusingGreedymethodwhen the graph is represented by adjacency matrix and adjacency lists.
8. ImplementJobSequencingwith deadlinesusingGreedystrategy.
9. Writeaprogram tosolve0/1Knapsackproblem UsingDynamicProgramming.
10. ImplementN-QueensProblemUsingBacktracking.
11. UseBacktrackingstrategytosolve0/1 Knapsackproblem.
12. ImplementTravellingSalesPersonproblemusingBranchandBoundapproach.

ReferenceBooks:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2nd Edition, Universities Press
2. ComputerAlgorithms/C++EllisHorowitz,SartajSahni,SanguthevarRajasekaran,2nd Edition, University Press
3. DataStructuresandprogramdesigninC,RobertKruse,PearsonEducationAsia
4. An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill

OnlineLearningResources:

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

L	T	P	C
0	0	3	1.5

IIYearI Semester

OBJECTORIENTEDPROGRAMMINGTHROUGHJAVALAB

Course Objectives:

Theaim ofthis courseisto

- PracticeobjectorientedprogrammingintheJavaprogramming language
- Implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- Illustrateinheritance,Exceptionhandlingmechanism,JDBCconnectivity
- ConstructThreads,Event Handling,implementpackages,JavaFXGUI

Course Outcomes:

CO1: Apply object-oriented programming fundamentals—including data types, control structures,classes,methods,inheritance,andpolymorphism—todevelopstructuredJava programs (K3)

CO2: Implement and demonstrate Java features such as interfaces, packages, exception handling, and multithreading to build modular, robust, and concurrent applications (K4)

CO3:Useandmanagefiles,I/Ostreams,JDBCconnectivity,andJavaFXGUIcomponents to create interactive applications involving data input, storage, and display (K4)

CO4:DesignandevaluateJavaapplicationsbyintegratingOOPconcepts,multithreading, exceptions,GUIand databaseoperations tosolvereal-world programmingproblems (K5)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	H	L	L	-	-	-	-	-	-	-			
CO2	H	M	H	H	L	-	-	-	-	-	-	-			
CO3	H	M	M	H	M	-	-	-	-	-	-	-			
CO4	H	H	H	H	M	-	-	-	-	-	-	-			

ExperimentscoveringtheTopics:

- ObjectOrientedProgrammingfundamentals-data types,control structures
- Classes,methods,objects, Inheritance, polymorphism,
- Exceptionhandling,Threads,Packages,Interfaces
- Files, I/Ostreams,JavaFXGUI

SampleExperiments:

Exercise–1:

a) WriteaJAVA program to displaydefault valueofall primitivedata typeof JAVA

b) Writeajavaprogramthatdisplaytherootsofaquadraticequation$ax^2+bx=0$.Calculatethe discriminate D and basing on value of D, describe the nature of root.

Exercise-2

a) WriteaJAVAprogramtosearchforanelementinagivenlistofelementsusing binary search mechanism.

b) WriteaJAVAprogram tosort for anelement inagiven listof elementsusingbubble sort

c) WriteaJAVAprogram usingStringBuffer to delete,removecharacter.

Exercise-3

a) WriteaJAVAprogramtoimplement classmechanism.Createaclass,methodsandinvoke them inside main method.

b) WriteaJAVA programimplement method overloading.

c) WriteaJAVAprogram toimplement constructor.

d)WriteaJAVA programto implementconstructor overloading.

Exercise-4

a) WriteaJAVA programto implementSingleInheritance

b) WriteaJAVAprogram toimplementmultilevelInheritance

c) WriteaJAVA programforabstract classtofind areasofdifferent shapes

Exercise-5

a) WriteaJAVAprogram giveexamplefor"super" keyword.

b) WriteaJAVAprogramtoimplementInterface.Whatkindof Inheritancecanbeachieved?

c) WriteaJAVAprogramthatimplementsRuntime polymorphism

Exercise-6

a) WriteaJAVAprogramthatdescribesexceptionhandlingmechanism

b) WriteaJAVAprogramIllustratingMultiplecatchclauses

c) WriteaJAVA program forcreation ofJavaBuilt-in Exceptions

d) WriteaJAVAprogramforcreationofUserDefined Exception

Exercise-7

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

b) Writeaprogramillustrating**isAlive** and**join()**

c) WriteaProgramillustratingDaemonThreads.

d) WriteaJAVA programProducerConsumer Problem

Exercise–8

a) WriteaJAVA programthatimport andusethe userdefined packages
b) Withoutwritinganycode,buildaGUIthatdisplaytextinlabelandimageinanImage View (use JavaFX)
c) Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

Exercise–9

a) Writeajavaprogram that connectsto adatabaseusingJDBC
b) Writeajavaprogramto connectto adatabaseusingJDBCand insertvalues into it.
c) Writeajavaprogram to connect to adatabaseusingJDBC and deletevalues from it

L	T	P	C
0	1	2	2

IIYearI Semester

PYTHON PROGRAMMING (SKILLENHANCEMENTCOURSE)

Course Objectives:

Themain objectivesof thecourse areto

- IntroducecoreprogrammingconceptsofPythonprogramminglanguage.
- DemonstrateaboutPythondatastructureslike Lists,Tuples,Setsand dictionaries
- ImplementFunctions,ModulesandRegularExpressionsinPythonProgramming and to create practical and contemporary applications using these

CourseOutcomes:

CO1:ApplycorePythonprogrammingconcepts—includingdatatypes,operators,controlflowstatements, functions, and basic data structures—to solve computational problems efficiently (K3)

CO2:Implementand analyzestring operations, list manipulations,tupleanddictionary operations, and set-based concepts to handle structured data in Python programs (K4)

CO3: Use and manage file handlingtechniques, object-oriented programming principles, and modular programming constructs to develop clean, reusable, and real-world Python applications (K4)

CO4: Develop data handling and data-processing programs using JSON, XML, NumPy, and Pandas, including array operations, slicing, indexing, and tabular data exploration (K5)

CO5: Design and build Python applications integrating OOP, file processing, data structures, functional programming, and basic data science libraries to address real-world computational tasks. (K5)

UNTI-I:

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

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

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

SampleExperiments:

1. Writeaprogram to find thelargest element amongthree Numbers.
2. WriteaProgram todisplayall primenumbers within an interval
3. Writeaprogramto swaptwonumbers without usingatemporaryvariable.
4. DemonstratethefollowingOperators in Python with suitableexamples.

i) Arithmetic Operators ii) Relational Operators iii) Assignment Operatorsiv) Logical Operatorsv)BitwiseOperatorsvi)TernaryOperatorvii)Membership Operatorsviii) Identity Operators

5. Writeaprogram to addand multiplycomplexnumbers
6. Writeaprogram to printmultiplicationtableofagiven number.

UNIT-II:

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

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

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

SampleExperiments:

1. Writeaprogram todefineafunctionwith multiplereturn values.
2. Writeaprogram todefineafunctionusingdefaultarguments.
3. Writeaprogramto find the length of thestringwithout usinganylibrary functions.
4. Writeaprogram to checkif thesubstringis present in agiven stringor not.
5. Writeaprogramto perform thegiven operationson alist:
    i. Addition,ii.Insertion,iii.slicing
6. Writea program toperform any5built-infunctions bytakinganylist.

UNIT-III:

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

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

SampleExperiments:

1. Writeaprogramtocreatetuples(name,age,address,college)foratleasttwo members and concatenate the tuples and print the concatenated tuples.
2. Writeaprogram to countthenumber ofvowels in astring(No control flowallowed).
3. Writeaprogram to checkif agiven keyexists in a dictionaryor not.
4. Writeaprogramto addanewkey-value pairtoanexisting dictionary.
5. Writeaprogram tosum allthe itemsin agiven dictionary.

UNIT-IV:

Files: Types of Files, Creatingand ReadingTextData, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Pythonos and os.path Modules.

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

SampleExperiments:

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

2. Pythonprogramtoprinteachlineof afileinreverse order.
3. Pythonprogramtocomputethenumberof characters,wordsandlinesinafile.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.
5. Writeaprogram to add, transpose and multiplytwo matrices.
6. Write a Python program to create a class that represents a shape. Include methods to calculateitsareaandperimeter.Implementsubclassesfordifferentshapeslikecircle, triangle, and square.

UNIT-V:

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

SampleExperiments:

1. PythonprogramtocheckwhetheraJSONstring containscomplexobjector not.
2. PythonProgram to demonstrateNumPyarrays creationusingarray() function.
3. Pythonprogramtodemonstrateuseofndim,shape,size, dtype.
4. Pythonprogramtodemonstratebasicslicing,integerand Booleanindexing.
5. Pythonprogramtofind min,max,sum,cumulativesumofarray
6. Create a dictionarywith at least five keys and each keyrepresent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a) Applyhead ()function to thepandas dataframe
    b) PerformvariousdataselectionoperationsonData Frame
7. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

ReferenceBooks:

1. GowrishankarS,Veena A.,IntroductiontoPythonProgramming,CRCPress.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson,2024
3. IntroductiontoProgrammingUsingPython,Y.DanielLiang,Pearson.

OnlineLearningResources/Virtual Labs:

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

IIYearISemester

L	T	P	C
2	0	0	0

ENVIRONMENTALSCIENCE

Course Objectives:

- Tomakethestudentstogetawarenessonenvironment
- Tounderstandtheimportanceofprotectingnaturalresources,ecosystemsforfuture generations and pollution causes due to the day to day activities of human life
- To saveearth from the inventions bythe engineers.

Course Outcomes:

1. Demonstrateanunderstandingofthemultidisciplinarynatureofenvironmental studies and identify various renewable and non-renewable natural resources.
2. Explaintheconceptsofenergyflowinecosystems,bio-geo-chemicalcycles,and ecological pyramids.
3. Analyzethemajorcausesofenvironmentalpollution,principlesofsolidwaste management, and related preventive and control measures.
4. Describetheconceptsandsignificanceofrainwaterharvesting,watershed management, ozone layer depletion, and wasteland reclamation.
5. Discussthecausesandimpactsofpopulationexplosion,andunderstandthe importance of value education and various welfare programmes.

UNIT–I

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

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

UNIT–II

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

a. Forestecosystem.
b. Grassland ecosystem
c. Desertecosystem
d. Aquaticecosystems(ponds,streams,lakes,rivers,oceans,estuaries)

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

UNIT–III

EnvironmentalPollution:Definition,Cause,effectsandcontrolmeasuresof:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marinepollution
e. Noisepollution
f. Thermalpollution
g. Nuclearhazards

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

UNIT–IV

SocialIssuesandtheEnvironment:FromUnsustainabletoSustainabledevelopment–Urban problems related to energy – Water conservation, rain water harvesting, watershed management –Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions–Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wastel and reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act–Wild life Protection Act–Forest Conservation Act–Issues involved inenforcement of environment allegislation–Public awareness.

UNIT–V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education–HIV/AIDS–Women and Child Welfare–Role of informationTechnologyinEnvironmentandhumanhealth–Casestudies.FieldWork: Visit to a local area to document environmental assets River/ forest grassland/ hill/ mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds–river, hills lopes, etc..

Textbooks:

1. TextbookofEnvironmentalStudiesforUndergraduateCoursesErachBharuchafor University Grants Commission, Universities Press.
2. Palaniswamy,"EnvironmentalStudies",Pearson education
3. S.AzeemUnnisa,"EnvironmentalStudies"AcademicPublishingCompany
4. K.RaghavanNambiar,"TextbookofEnvironmentalStudiesforUndergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt.Ltd.

ReferenceBooks:

1. DeekshaDaveandE.SaiBabaReddy,"TextbookofEnvironmentalScience", Cengage Publications.
2. M.AnjiReddy,"TextbookofEnvironmentalSciencesandTechnology",BS Publication.
3. J.P.Sharma,ComprehensiveEnvironmentalstudies,Laxmipublications.
4. J.GlynnHenryandGaryW.Heinke,"EnvironmentalSciencesandEngineering", Prentice Hall of India Private limited
5. G.R.Chatwal,"ATextBookofEnvironmentalStudies"HimalayaPublishing House
6. GilbertM.MastersandWendellP.Ela,"IntroductiontoEnvironmentalEngineering and Science, Prentice Hall of India Private limited.

IIYearIISemester

L	T	P	C
2	0	0	2

MANAGERIALECONOMICSANDFINANCIALANALYSIS

Course Objectives:

- Toinculcatethebasicknowledgeofmicroeconomicsandfinancialaccounting
- Tomake thestudentslearn howdemandisestimatedfordifferentproducts,input-out put relationship for optimizing production and cost
- ToKnowtheVarioustypes ofmarketstructure andpricingmethodsand strategy
- Togiveanoverviewoninvestmentappraisalmethodstopromote thestudentsto learn how to plan long-term investment decisions.
- Toprovidefundamentalskillsonaccountingandtoexplaintheprocessof preparing financial statements.

Course Outcomes:

1. DefinetheconceptsrelatedtoManagerialEconomics,financialaccountingandmanagement .
2. Explainthefundamentals ofEconomics viz.,Demand,Production,cost,revenue and markets
3. Applythe Concept of Production cost and revenues foreffectiveBusinessdecision
4. Analyzehowto investtheircapital andmaximizereturns
5. Evaluatethecapitalbudgetingtechniques
6. Developtheaccounting statementsandevaluatethefinancialperformanceof business entity.

UNIT-I

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

UNIT-II

Production and Cost Analysis: Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and long runProduction Function- Isoquants and Isocosts, MRTS -Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) -Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.

UNIT-III

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

UNIT-IV

Capital Budgeting: Introduction – Nature, meaning, significance, functions and advantages. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting–Features, Proposals, Methods and Evaluation. Projects– Pay Back Method, Accounting Rate of Return(ARR) Net Present Value(NPV)Internal Rate Return(IRR)
Method(sample problems)

UNIT-V

FinancialAccountingandAnalysis: Introduction–Nature,meaning,significance,functions and advantages. Concepts and Conventions-Double-Entry Book Keeping, Journal, Ledger, Trial Balance-Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Financial Analysis-Analysis and Interpretation of LiquidityRatios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1.Varshney&Maheswari:ManagerialEconomics,Sultan Chand,2013.

ReferenceBooks:

1. ManagerialEconomics:PrinciplesAndWorldwideApplications,9E(Adaptation)by Dominick Salvatore and Siddhartha Rastogi
2. ManagerialEconomics:PrinciplesandWorldwideApplications by Dominick Salvatore

IIYearIISemester

L	T	P	C
3	0	0	3

PROBABILITYAND STATISTICS

Course Objectives:

- Tofamiliarizethestudents withthefoundationsof probabilityandstatistical methods
- Toimpartprobabilityconceptsandstatisticalmethodsinvariousapplications Engineering

CourseOutcomes: Upon successfulcompletionof thiscourse,thestudent shouldbeable to

1. Classifytheconceptsofdata scienceanditsimportance(L2)
2. Interprettheassociationofcharacteristicsandthroughcorrelationandregressiontools (L4)
3. Applydiscrete andcontinuous probabilitydistributions (L3)
4. Designthecomponentsof aclassicalhypothesis test(L6)
5. Inferthestatisticalinferentialmethodsbasedonsmallandlargesamplingtests(L4)

Unit–I:Descriptivestatistics and methodsfordata science:

Data science – Statistics Introduction – Population vs Sample –Collection of data – primary and secondary data – Type of variable: dependent and independent Categorical and Continuous variables –Data visualization – Measures of Central tendency – Measures of Variability – Skewness – Kurtosis.

UNIT–II: Correlationand Regression:

Correlation–Correlation coefficient –Rankcorrelation.
Linear Regression: Straight line – Multiple Linear Regression - Regression coefficients and properties **–** Curvilinear Regression: Parabola – Exponential – Power curves.

UNIT–III: Probabilityand Distributions:

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

UNIT–IV:SamplingTheory:

Introduction – Population and Samples – Sampling distribution of Means and Variance (definitiononly)–PointandIntervalestimations–Maximumerrorofestimate–Central limittheorem(without proof)–Estimation usingt,and F-χ^2distributions.

UNIT– V:Tests ofHypothesis:

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Levelofsignificance–Onetailandtwo-tailtests–Testofsignificanceforlargesamplesand SmallSamples:Singleanddifferencemeans–Single andtwoproportions–Student'st-test, F-test, χ^2 -test.

TextBooks:

- **MillerandFreund's**,ProbabilityandStatisticsforEngineers,7/e,Pearson, 2008.
- **S.C.GuptaandV.K.Kapoor**,FundamentalsofMathematicalStatistics,11/e, Sultan Chand & Sons Publications, 2012.

ReferenceBooks:

- **ShronL.Myers,KeyingYe,RonaldEWalpole,**ProbabilityandStatistics Engineers and the Scientists,8th Edition, Pearson 2007.
- **Jayl.Devore,**ProbabilityandStatisticsforEngineeringandtheSciences,8th Edition, Cengage.
- **SheldonM.Ross**,Introductiontoprobabilityandstatistics Engineersandthe Scientists, 4th Edition, Academic Foundation, 2011.
- **JohannesLedolterandRobertV.Hogg**,AppliedstatisticsforEngineersand Physical Scientists, 3rd Edition, Pearson, 2010.

IIYearII Semester

L	T	P	C
3	0	0	3

OPERATINGSYSTEMS

Course Objectives:

Themain objectives of thecourseis to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Makeuseofprocessschedulingalgorithmsandsynchronizationtechniquestoachieve better performance of a computer system.
- Illustratedifferentconditionsfordeadlock andtheirpossible solutions.

Course Outcomes:

CO1:Explainthefundamentalconcepts,structures,andoperationalprinciplesofoperating systems, including system calls, services, and system design (K2)

CO2:Demonstrateunderstandingofprocesses,threads,concurrency,andCPUscheduling algorithms to effectively manage execution in operating systems (K3)

CO3:Applysynchronizationmechanismsandanalyzedeadlockconditionstodesignsafeand concurrent process interactions (K4)

CO4:Analyzeandcomparememory-managementtechniques,virtualmemorystrategies,and storage management approaches used in modern operating systems (K4)

CO5:Explaintheconceptsoffilesystems,directorystructures,allocationmethods,and protection mechanisms to understand secure and efficient data management (K2)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M	L	L	-	-	-	-	-	-	-			
CO2	H	H	M	M	L	-	-	-	-	-	-	-			
CO3	H	H	H	M	M	-	-	-	-	-	-	-			
CO4	H	M	H	H	M	-	-	-	-	-	-	-			
CO5	H	M	M	M	L	-	-	-	-	-	-	-			

UNIT-I

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems

System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design andImplementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT-II

Processes:ProcessConcept,Processscheduling,Operationsonprocesses,Inter-processcommunication.

ThreadsandConcurrency: Multithreadingmodels,Threadlibraries,Threadingissues.

CPUScheduling:Basicconcepts,Schedulingcriteria,Schedulingalgorithms,Multiple processor scheduling.

UNIT– III

SynchronizationTools:TheCriticalSectionProblem,Peterson'sSolution,MutexLocks, Semaphores, Monitors, Classic problems of Synchronization.
Deadlocks:systemModel,Deadlockcharacterization,MethodsforhandlingDeadlocks,Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT-IV

Memory-ManagementStrategies:Introduction,Contiguousmemoryallocation,Paging, Structure of the Page Table, Swapping.
Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing
StorageManagement:OverviewofMassStorageStructure,HDDScheduling.

UNIT-V

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory

implementation,Allocationmethod,Freespacemanagement;File-SystemInternals:File-System Mounting, Partitions and Mounting, File Sharing.
Protection:Goalsofprotection,Principlesofprotection,ProtectionRings,Domainof protection, Access matrix.

Text Books:

1. OperatingSystemConcepts,SilberschatzA,GalvinPB,GagneG, 10th Edition, Wiley, 2018.
2. ModernOperatingSystems,Tanenbaum AS, 4th Edition, Pearson, 2016

ReferenceBooks:

1. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
2. OperatingSystems:AConceptBasedApproach,D.MDhamdhere,3rd Edition, McGraw-Hill, 2013

OnlineLearningResources:

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

L	T	P	C
3	0	0	3

IIYearII Semester

DATABASEMANAGEMENTSYSTEMS

Course Objectives:

Themain objectives ofthecourseis to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introducethe conceptsof basicSQLasauniversal Databaselanguage
- Demonstratetheprinciplesbehind systematicdatabasedesignapproaches bycovering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

CourseOutcomes(COs)

CO1:*Explain*thefundamentalconceptsofdatabasesystems,includingcharacteristics,architecture, data models, and differences between database and file systems. **(K2)**
CO2:*Constructandinterpret*Entity-Relationship(ER)diagram,includingentities,attributes, relationships, generalization, specialization, and inheritance for real-world scenarios. **(K3)**
CO3:*Apply*therelationalmodelconcepts,includingtuples,relations,domains,constraints,relational algebra, and relational calculus to model and query databases. **(K3)**
CO4:*Developandexecute*SQLqueriesfordatadefinition,datamanipulation,aggregation,joins, nested queries, views, and relational set operations on a database schema. **(K3)**
CO5: *Analyze and design* normalized database schemas using functional dependencies, various normalforms(1NF–5NF),andschemarefinementtechniquestoensureminimalredundancyanddata integrity. **(K4)**
CO6:*Explainandimplement*transactionmanagement,concurrencycontrol,recoverymechanisms, and indexing techniques (B+ Trees, Hash-based indexing) to ensure ACID properties and efficient data access. **(K4)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	L	-	-	-	-	-	-	-	-			
CO2	H	H	M	M	-	-	-	-	-	-	-	-			
CO3	H	H	H	M	-	-	-	-	-	-	-	-			
CO4	H	H	H	H	-	-	-	-	-	-	-	-			
CO5	H	H	H	H	M	-	-	-	-	-	-	-			
CO6	H	M	H	H	M	-	-	-	-	-	-	-			

UNITI:

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models;ConceptsofSchema,Instanceanddataindependence;Threetierschemaarchitecture for data independence; Database system structure, environment, Centralized and ClientServer architecture for the database.

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

UNITII:

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

UNITIII:

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

UNITIV:

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

UNITV:

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

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

TextBooks:

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

ReferenceBooks:

1) IntroductiontoDatabase Systems, 8th edition,CJDate, Pearson.
2) DatabaseManagementSystem,6th edition,RamezElmasri,ShamkantB.Navathe, Pearson
3) DatabasePrinciplesFundamentalsofDesignImplementationandManagement, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:

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

IIYearII Semester

L	T	P	C
2	1	0	3

SOFTWAREENGINEERING

Course Objectives:

Theobjectives of thiscourseareto introduce

- Softwarelifecyclemodels, SoftwarerequirementsandSRS document.
- ProjectPlanning, qualitycontrol andensuringgood qualitysoftware.
- SoftwareTestingstrategies,useofCASEtools,Implementationissues,validation &verification procedures.

CourseOutcomes (COs)

CO1:Explaintheevolutionofsoftwareengineering,softwaredevelopmentprojects,andvarious software life cycle models, including Waterfall, Spiral, Agile, and RAD. (K2)
CO2: Analyze and apply software project management principles, estimation techniques, risk management,andsoftwarerequirementsgatheringtoplanandmanagesoftwareprojectseffectively. (K4)
CO3:Designsoftwaresystemsusingstructuredanalysis,function-orienteddesign,layeredmodules, cohesion and coupling concepts, and develop effective user interfaces. (K4)
CO4:Implement,test,andevaluatesoftwarethroughcodingstandards,black-boxandwhite-box testing, debugging, integration testing, and quality management practices, ensuring software reliability. (K4)
CO5:Applyandevaluatecomputer-aidedsoftwareengineering(CASE)tools,softwaremaintenance strategies, and software reuse approaches to enhance productivity and maintainability in software development. (K4)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	L	-	-	-	-	-	-	-	-			
CO2	H	H	M	M	-	-	-	-	-	-	-	-			
CO3	H	H	H	H	M	-	-	-	-	-	-	-			
CO4	H	M	H	H	M	-	-	-	-	-	-	-			
CO5	H	M	H	H	M	-	-	-	-	-	-	-			

UNITI:

Introduction: Evolution, Software development projects, Exploratory style of software developments,Emergenceofsoftwareengineering,Notablechangesinsoftwaredevelopment practices, Computer system engineering.

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

UNITII:

Software Project Management: Software project management complexities, Responsibilitiesofasoftwareprojectmanager,Metricsforprojectsizeestimation,Project

estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.

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

UNITIII:

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

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

Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.

User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNITIV:

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

Software Reliability And Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000.SEI Capability maturity model. Few other important quality standards, and Six Sigma**.**

UNITV:

Computer-Aided Software Engineering (Case): CASE and its scope, CASE environment, CASEsupportinthesoftwarelifecycle,othercharacteristicsofCASEtools,Towardssecond generation CASE Tool, and Architecture of a CASE Environment.

Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

Software Reuse: reuse- definition, introduction, reason behind no reuse so far, Basic issuesin any reuse program, A reuse approach, and Reuse at organization level.

TextBooks:

1. FundamentalsofSoftwareEngineering, RajibMall, 5th Edition,PHI.
2. SoftwareEngineeringApractitioner'sApproach,RogerS.Pressman,9th Edition,Mc-Graw Hill International Edition.

ReferenceBooks:

1. SoftwareEngineering, IanSommerville,10th Edition,Pearson.
2. Software Engineering, PrinciplesandPractices,DeepakJain,OxfordUniversity Press.

e-Resources:

1) https://nptel.ac.in/courses/106/105/106105182/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview
3) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01338269041100390473 5_shared/overview

IIYearII Semester

L	T	P	C
0	0	3	1.5

OPERATINGSYSTEMSLAB

Course Objectives:

Themain objectivesof thecourse areto

- Provideinsightsintosystemcalls,filesystems,semaphores,
- Develop and debug CPU Scheduling algorithms, page replacement algorithms, thread implementation
- Implement BankersAlgorithmstoAvoidtheDeadLock

ExperimentscoveringtheTopics:

- UNIXfundamentals,commands&systemcalls
- CPUSchedulingalgorithms,threadprocessing
- IPC,semaphores,monitors, deadlocks
- Pagereplacementalgorithms,fileallocation strategies
- Memoryallocationstrategies

SampleExperiments:

1. Practicingof Basic UNIX Commands.
2. WriteprogramsusingthefollowingUNIXoperatingsystemcalls
   fork, exec, getpid, exit, wait, close, stat, opendir and readdir
3. SimulateUNIXcommandslikecp,ls,grep,etc.,
4. SimulatethefollowingCPUscheduling algorithms
   a) FCFSb) SJFc) Priorityd) Round Robin
5. Controlthenumberofports opened bythe operatingsystemwith
   a) Semaphoreb) Monitors.
6. Writeaprogramtoillustrateconcurrentexecutionofthreadsusingpthreadslibrary.
7. Writeaprogramto solveproducer-consumerproblem usingSemaphores.
8. Implementthe following memoryallocationmethods forfixed partition
   a) Firstfitb)Worstfitc) Bestfit
9. Simulatethefollowingpage replacement algorithms
   a) FIFOb)LRUc)LFU
10. SimulatePagingTechniqueof memorymanagement.
11. ImplementBankersAlgorithmforDead Lockavoidanceandprevention
12. Simulatethefollowingfileallocationstrategies
    a) Sequentialb) Indexedc) Linked
13. Downloadandinstallnachosoperatingsystemandexperimentwith it

ReferenceBooks:

1. OperatingSystemConcepts,SilberschatzA,GalvinPB,GagneG,10th Edition,Wiley, 2018.
2. ModernOperatingSystems, TanenbaumA S,4th Edition,Pearson, 2016
3. OperatingSystems-InternalsandDesignPrinciples,StallingsW,9th edition, Pearson, 2018
4. OperatingSystems:AConceptBasedApproach,D.MDhamdhere,3rd Edition, McGraw-Hill, 2013

OnlineLearningResources:

1. https://www.cse.iitb.ac.in/~mythili/os/
2. http://peterindia.net/OperatingSystems.html
3. www.cs.washington.edu/~tom/nachos

L	T	P	C
0	0	3	1.5

IIYearII Semester

DATABASEMANAGEMENTSYSTEMSLAB

Course Objectives:

ThisCoursewill enable students to

- Populateandquerya database usingSQLDDL/DMLCommands
- Declareandenforceintegrityconstraintsonadatabase
- WritingQueriesusingadvancedconceptsofSQL
- ProgrammingPL/SQLincludingprocedures,functions,cursorsand triggers

Experimentscoveringthetopics:

- DDL,DML,DCLcommands
- Queries,nestedqueries, built-infunctions,
- PL/SQLprogramming-control structures
- Procedures,Functions,Cursors, Triggers,
- Databaseconnectivity-ODBC/JDBC

SampleExperiments:

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

8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9. Programdevelopmentusingcreationofstoredfunctions,invokefunctionsinSQL Statements and write complex functions.
10. Developprogramsusingfeaturesparametersina CURSOR,FORUPDATECURSOR, WHERE CURRENT of clause and CURSOR variables.
11. DevelopProgramsusingBEFOREandAFTERTriggers,RowandStatement Triggers and INSTEAD OF Triggers
12. Createatableandperformthesearchoperationontableusingindexingandnon-indexing techniques.
13. WriteaJavaprogram that connectsto adatabaseusingJDBC
14. WriteaJavaprogram toconnect toadatabaseusingJDBCand insertvalues into it
15. WriteaJavaprogramto connecttoadatabaseusingJDBCanddelete valuesfrom it

TextBooks/SuggestedReading:

1. Oracle:TheCompleteReferencebyOracle Press
2. NileshShah,"DatabaseSystemsUsingOracle",PHI,2007
3. RickFVanderLans,"IntroductiontoSQL",FourthEdition,PearsonEducation,2007

L	T	P	C
0	1	2	2

IIYearII Semester

FULL STACK DEVELOPMENT – 1
(SKILLENHANCEMENTCOURSE)

Course Objectives:

Themain objectivesof thecourse areto

- Makeuse ofHTMLelementsandtheirattributesfordesigningstaticwebpages
- Buildawebpage byapplyingappropriateCSSstylestoHTML elements
- ExperimentwithJavaScripttodevelopdynamicwebpagesandvalidate forms

ExperimentscoveringtheTopics:

- Lists,LinksandImages
- HTMLTables,Forms and Frames
- HTML5andCascadingStyleSheets,TypesofCSS
- Selectorforms
- CSSwithColor,Background,Font, TextandCSS BoxModel
- ApplyingJavaScript-internalandexternal,I/O,Type Conversion
- JavaScriptConditionalStatementsand Loops,Pre-definedandUser-definedObjects
- JavaScriptFunctionsandEvents
- Node.js

SampleExperiments:

1. Lists,Links and Images

a. WriteaHTMLprogram,to explain the workingoflists.
   Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.

b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.

c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.

d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

2. HTMLTables,FormsandFrames

a. WriteaHTMLprogram,toexplaintheworkingoftables.(usetags:<table>,<tr>,<th>, <td>andattributes:border,rowspan,colspan)

b. Write a HTMLprogram, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
c. Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).
d. Write a HTMLprogram, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame→ image, second frame→ paragraph, third frame → hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

3. HTML5andCascadingStyleSheets,TypesofCSS

a. WriteaHTMLprogram,thatmakesuseof<article>,<aside>,<figure>,<figcaption>, <footer>,<header>,<main>,<nav>, <section>, ,tags.
b. WriteaHTMLprogram,to embed audio and video into HTMLweb page.
c. Writeaprogramtoapplydifferenttypes(orlevelsofstylesorstylespecificationformats) -inline,internal,externalstylestoHTMLelements.(identifyselector,propertyandvalue).

4. Selectorforms

a. Writeaprogram toapplydifferent typesof selector forms
   i. Simpleselector(element, id,class,group,universal)
   ii. Combinatorselector(descendant,child,adjacentsibling,generalsibling)
   iii.Pseudo-class selector
   iv. Pseudo-elementselector
   v. Attributeselector

5. CSSwithColor, Background,Font,Text andCSS Box Model

a. Writeaprogramto demonstratethevariouswaysyoucan referenceacolor in CSS.
b. WriteaCSSrulethatplacesabackgroundimagehalfwaydownthepage,tiltingithorizontally. The image should remain in place when the user scrolls up or down.
c. Writeaprogram usingthe followingtermsrelatedto CSSfont and text:
   i. font-size ii.font-weight iii.font-style
   iv.text-decoration v. text-transformation vi.text-alignment
d. Writeaprogram, toexplain the importanceofCSS Boxmodel using
   i. Content ii. Border iii. Margin iv. padding

6. ApplyingJavaScript-internalandexternal,I/O,TypeConversion

a. Writeaprogramto embedinternalandexternalJavaScriptinaweb page.
b. Writeaprogramtoexplain thedifferentwaysfordisplayingoutput.
c. Writeaprogramto explainthedifferent waysfortaking input.

d. Createawebpagewhichusespromptdialogueboxtoaskavoterforhisnameandage. Display the information in table format along with either the voter can vote or not

7. JavaScriptPre-definedandUser-definedObjects

a. Writeaprogram usingdocument object properties andmethods.
b. Writeaprogram usingwindow objectpropertiesand methods.
c. Writeaprogram usingarrayobject properties andmethods.
d. Writeaprogram usingmathobject properties andmethods.
e. Writeaprogram usingstringobject propertiesand methods.
f. Writeaprogramusingregexobjectpropertiesandmethods.
g. Writeaprogram usingdate object properties andmethods.
h. Write a program to explain user-defined object by using properties, methods, accessors,constructors and display.

8. JavaScriptConditionalStatementsand Loops

a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGERNUMBER"inaninformationmessagedialog. Ifthenumbersareequal,output HTML text as "EQUAL NUMBERS".
b. Writeaprogram to displayweek days usingswitch case.
c. Writeaprogram toprint1 to 10numbers usingfor,whileand do-while loops.
d. Writeaprogramtoprintdatainobjectusingfor-in,for-eachandfor-of loops
e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER'ornot.[Eg:153isanArmstrongnumber,sincesumofthecubeofthedigitsis equal to the number i.e.,13 + 53+ 33 = 153]
f. Write a program to displaythe denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's)

9. JavaScriptFunctionsand Events

a. Designaappropriatefunctionshouldbecalledtodisplay
    i. Factorialofthatnumber
    ii. Fibonacciseriesup tothat number
    iii. Primenumbers upto that number
    iv. Isitpalindromeor not
b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
    i. Factorialofthatnumber
    ii. Fibonacciseriesup tothat number
    iii. Primenumbersuptothat number
    iv. Isitpalindromeor not
c. Writeaprogramto validate thefollowingfields inaregistration page

i. Name(startwithalphabetandfollowedbyalphanumericandthelengthshouldnot be less than 6 characters)
ii. Mobile(onlynumbersandlength10 digits)
iii. E-mail(shouldcontainformatlikexxxxxxx@xxxxxx.xxx)

TextBooks:

1. ProgrammingtheWorld WideWeb,7th Edition,RobetW Sebesta,Pearson, 2013.
2. WebProgrammingwithHTML5,CSSandJavaScript,JohnDean,Jones&Bartlett Learning, 2019 (Chapters 1-11).
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.

WebLinks:

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

IIYearIISemester

L	T	P	C
1	0	2	2

DESIGNTHINKING& INNOVATION

CourseObjectives: Theobjectives of thecourseareto

- Bringawarenessoninnovativedesignandnewproduct development.
- Explainthebasicsofdesignthinking.
- Familiarizetheroleofreverseengineeringinproductdevelopment.
- Trainhow to identifytheneedsof societyand convert into demand.
- Introduceproductplanningandproductdevelopment process.

UNIT– I IntroductiontoDesignThinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamentaldesigncomponents.Principlesofdesign.Introductiontodesignthinking,history of Design Thinking, New materials in Industry.

UNIT-II Design Thinking Process

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

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

UNIT-III Innovation

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

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

UNIT-IV ProductDesign

Problem formation, introductionto product design,Product strategies,Product value,Product planning, product specifications. Innovation towards product design Case studies.

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

UNIT– V DesignThinkinginBusinessProcesses

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

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

Textbooks:

1. TimBrown,Changebydesign,1/e, Harper Bollins, 2009.
2. IdrisMootee,DesignThinkingforStrategic Innovation,1/e,AdamsMedia,2014.

ReferenceBooks:

1. DavidLee,DesignThinkingintheClassroom,Ulyssespress,2018.
2. ShrrutinNShetty,DesigntheFuture,1/e,NortonPress,2018.
3. Williamlidwell,Kritinaholden,&Jillbutter,Universalprinciplesofdesign,2/e,Rockport Publishers, 2010.
4. Chesbrough.H,Theeraofopen innovation, 2003.

OnlineLearningResources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

Course Outcomes:

COs	Statements	Level
CO1	Definethe conceptsrelatedtodesignthinking.	L1
CO2	ExplainthefundamentalsofDesignThinkingandinnovation.	L2
CO3	Applythedesignthinkingtechniquesforsolvingproblemsin varioussectors.	L3
CO4	Analyseto workin a multidisciplinaryenvironment.	L4
CO5	Evaluatethe valueof creativity.	L5

B.Tech.–III YearI Semester

S.No	Category	Title	L	T	P	C
1	Professional Core	DataWarehousing&DataMining	3	0	0	3
2	Professional Core	ComputerNetworks	3	0	0	3
3	Professional Core	FormalLanguagesandAutomata Theory	3	0	0	3
4	Professional Elective-I	1. ObjectOrientedAnalysisand Design 2. Artificial Intelligence 3. Microprocessors & Microcontrollers 4. Quantum Computing 5. 12 week MOOC Swayam/ NPTEL course recommended by the BoS	3	0	0	3
5	OpenElective-I	OR EntrepreneurshipDevelopment& Venture Creation	3	0	0	3
6	Professional Core	DataMiningLab	0	0	3	1.5
7	Professional Core	ComputerNetworks Lab	0	0	3	1.5
8	Skill Enhancement course	FullStackDevelopment-2	0	1	2	2
9	Engineering Science	UserInterfaceDesignusing Flutter / SWAYAM Plus - Android ApplicationDevelopment(with Flutter)	0	0	2	1
10	EvaluationofCommunityServiceInternship		-	-	-	2
Total			15	1	10	23
MC	MinorCourse(Studentmayselectfrom thesame specializedminorspool)		3	0	3	4.5
MC	MinorCourse through SWAYAM/NPTEL(minimum12 week,3creditcourse)		3	0	0	3
HC	Honors Course (Studentmayselectfromthesame honors pool)		3	0	0	3
HC	Honors Course (Student mayselect from thesame honors pool)		3	0	0	3

B.Tech.IIIYearII Semester

S.No	Category	Title	L	T	P	C
1	Professional Core	Compiler Design	3	0	0	3
2	Professional Core	Cloud Computing	3	0	0	3
3	Professional Core	Cryptography&Network Security	3	0	0	3
4	Professional Elective-II	1. SoftwareTestingMethodologies 2. CyberSecurity 3. DevOps 4. MachineLearning 5. 12weekMOOCSwayam/NPTEL course recommended by the BoS	3	0	0	3
5	Professional Elective-III	1. SoftwareProjectManagement 2. MobileAdhocNetworks 3. NaturalLanguageProcessing 4. BigDataAnalytics 5. DistributedOperatingSystem 6. 12weekMOOCSwayam/NPTEL course recommended by the BoS	3	0	0	3
6	OpenElective–II		3	0	0	3
7	Professional Core	Cloud Computing Lab	0	0	3	1.5
8	Professional Core	Cryptography& NetworkSecurityLab	0	0	3	1.5
9	Skill Enhancement course	Softskills//SWAYAMPlus-21st Century Employability Skills	0	1	2	2
10	Audit Course	TechnicalPaperWriting&IPR	2	0	0	-
Total			**20**	**1**	**08**	**23**
MandatoryIndustryInternship/MiniProject of08weeksdurationduringsummer vacation						
MC	Minor Course (Studentmayselectfromthesamespecializedminorspool)		3	0	3	4.5
MC	Minor Course (Studentmayselectfromthesamespecializedminorspool)		3	0	0	3
HC	Honors Course (Studentmayselectfromthesamehonors pool)		3	0	0	3
HC	Honors Course (Student mayselect from thehonors pool)		3	0	0	3

*UnderIndustryInternshipinterestedstudentscanpursueSWAYAMPluscoursesviz., Hands-on Masterclass on Data Analytics OR Artificial Intelligence for Real-World Application

OpenElectives,offeredtootherdepartmentstudents:

OpenElectiveI:PrinciplesofOperatingSystems/ComputerOrganizationand Architecture
Open Elective II: Principles ofDatabaseManagement Systems
OpenElectiveIII:ObjectOrientedProgrammingThroughJava
OpenElective IV:PrinciplesofSoftwareEngineering/Computer Networks

MinorEngineering

Note:

1. *ToobtainMinorEngineering,studentneedstoobtain18creditsbysuccessfully completing any of the following courses in the concern stream.*
2. *DuringMinor/HonorsCourseselection,thereshouldnotbeanyoverlappingwith Regular/Major/OPEN Electives*

MinorinCSE

1. PrinciplesofDatabaseManagementSystems 3-0-3-4.5(II-II)
2. PrinciplesofSoftwareEngineering 3-0-0-3(III-I)
3. Advanced DataStructures&AlgorithmAnalysis 3-0-3-4.5(III-II)
4. PrinciplesofOperatingSystems 3-0-0-3(IV-I)

Anyof thefollowing12Week3credit NPTELMOOC Courses

5. ArtificialIntelligence:KnowledgeRepresentation and Reasoning
6. ComputerNetworksandInternet Protocol
7. MachineLearningandDeepLearning-FundamentalsandApplications
8. Fundamentalsof Object OrientedProgramming
9. DiscreteMathematicsfor CS
10. SoftwareEngineering

COURSESOFFEREDFORHONORSDEGREEINCSE

Note: ***ToobtainHonor'sdegree,studentneedstoobtain18creditsbysuccessfully completing any of the following courses in the concern stream.***

1. SocialNetwork Analysis 12Week3CreditCourse,MOOCS
2. Applied LinearAlgebrain AI&ML 12Week3CreditCourse,MOOCS
3. Design &ImplementationofHuman-Computer Interfaces –NPTELMOOCS
4. Cryptographyand Network Security 12Week3CreditCourse,MOOCS
5. Privacyand SecurityinOnlineSocial Media12Week 3Credit Course, MOOCS
6. Deep LearningforNaturalLanguageProcessing -12Week3CreditCourse,MOOCS
7. ComputerVision -12Week3CreditCourse, MOOCS
8. AppliedTime-Series Analysis 12Week3CreditCourse, MOOCS
9. ParallelComputer Architecture 12Week3CreditCourse,MOOCS
10. Reinforcement Learning 12Week3CreditCourse,MOOCS
11. GPUArchitectureandProgramming 12Week3CreditCourse,MOOCS
12. Computational Complexity 12Week3CreditCourse,MOOCS
13. QuantumAlgorithmsandCryptography 12Week3CreditCourse,MOOCS
14. UnmannedArialSystems& Robotics 12Week3CreditCourse,MOOCS
15. PromptEngineeringforGenerativeAI (III-II)

IIIYearI Semester	DATAWAREHOUSING&DATA MINING	L	T	P	C
		3	0	0	3

Pre-requisites: Data Structures, Algorithms, Probability & Statistics, Data Base Management Systems

CourseObjectives: The mainobjectiveof thecourseis to

- Introducebasicconceptsand techniquesofdata warehousinganddata mining
- Examine the types of the data to be mined and apply pre-processing methods on raw data
- Discoverinterestingpatterns,analyzesupervisedandunsupervisedmodelsand estimate the accuracy of the algorithms.

CourseOutcomes (COs)

CO1: Explain the concepts of data warehousing, OLAP, data cubes, cloud data warehouses, and data visualization to support decision-making. (K2)
CO2: Apply data preprocessing techniques—including cleaning, integration, transformation, reduction, and discretization—to prepare datasets for analysis. (K3)
CO3:Analyzeclassificationproblemsusingdecisiontrees,Bayesianandrule-based classifiers, and evaluate models for accuracy and scalability. (K4)
CO4: Develop association rules from transactional data using algorithms such as Apriori and FP-Growth, and perform pruning and compact representation of frequent itemsets (K5)
CO5: Analyze clustering techniques such as K-means, hierarchical clustering, and DBSCAN to group data and interpret the resulting clusters for knowledge discovery. (K4)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	L	-	-	-	-	-	-	-	-			
CO2	H	H	M	M	-	-	-	-	-	-	-	-			
CO3	H	H	H	H	M	-	-	-	-	-	-	-			
CO4	H	H	H	H	M	-	-	-	-	-	-	-			
CO5	H	H	M	H	M	-	-	-	-	-	-	-			

UNIT–I: Data Warehousing and Online Analytical Processing: Basic concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Cloud Data Warehouse, Data Mining and Patten Mining, Technologies, Applications, Major issues, Data Objects & Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. (Text Book- 1)

UNIT II: Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. (Text Book- 1)

UNIT–III: Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Scalability andDecisionTreeInduction,VisualMiningforDecisionTreeInduction,Bayesian

Classification Methods: Bayes Theorem, Naïve Bayes Classification, Rule-Based Classification, Model Evaluation and Selection. (Text Book- 2)

UNIT–IV: Association Analysis: Problem Definition, Frequent Itemset Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP-Growth Algorithm. (Text Book- 2)

UNIT–V: Cluster Analysis: Overview, Basics and Importance of Cluster Analysis, Clustering techniques, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bi-secting K Means, Agglomerative Hierarchical Clustering:BasicAgglomerativeHierarchicalClusteringAlgorithm DBSCAN:Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Text Book- 2)

TextBooks:

1. DataMiningconceptsandTechniques,3rdedition,JiaweiHan,Michel Kamber, Elsevier, 2011.
2. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.

ReferenceBooks:

1. DataMining:VikramPudiandP.RadhaKrishna, OxfordPublisher.
2. DataMiningTechniques,ArunKPujari,3rdedition, UniversitiesPress,2013.
3. (NPTEL course by Prof.PabitraMitra)
   http://onlinecourses.nptel.ac.in/noc17_mg24/preview
4. http://www.saedsayad.com/data_mining_map.htm

IIIYearI Semester	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

- Toprovide insightaboutnetworks,topologies,andthe keyconcepts.
- To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
- To understand the principles, keyprotocols, design issues, and significance of each layers in ISO and TCP/IP.
- Toknowthe basicconcepts ofnetworkservicesand variousnetworkapplications.

CourseOutcomes:*Aftersuccessfulcompletionofthe course,studentwillbeable to*

CO1: Explain computer network types, network topologies, OSI & TCP/IP reference models, and characteristics of guided and unguided transmission media.

CO2: Analyze data link layer design issues, framing methods, error detection/correction mechanisms, and evaluate sliding-window–based flow control protocols.

CO3: Compare random, controlled, and channelization MAC techniques and examine the operation and evolution of Ethernet technologies.

CO4: Apply routing algorithms and congestion-control techniques to analyze theperformance of packet-switched networks.

CO5: Examine IPv4 and IPv6 protocols, addressing schemes, subnetting/CIDR, and internetworking mechanisms such as tunneling and fragmentation.

CO6: Describe the services of transport and application layer protocols (UDP, TCP, HTTP, DNS, Email) and analyze their operational features including flow, error, and congestion control.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	-	-	-	-	-	-	-	M	-	L			
CO2	H	H	-	M	L	-	-	-	-	M	-	L			
CO3	H	M	M	-	L	-	-	-	-	M	-	L			
CO4	H	H	-	H	L	-	-	-	-	M	-	L			
CO5	H	H	L	M	L	-	-	-	-	M	-	L			
CO6	H	M	-	M	L	-	-	-	-	H	-	L			

UNIT I: Introduction: Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSIReference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP.

Physical Layer –Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and introduction about unguided media.

UNIT II: Data link layer: Design issues, **Framing**: fixed size framing, variable sizeframing, flow control, error control, error detection and correction codes, CRC, Checksum: idea,one'scomplementinternetchecksum,services providedtoNetworkLayer,**Elementary**

Data Link Layer protocols: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel.
Sliding window protocol: Onebit, Goback N,Selectiverepeat-Stop and wait protocol, Data link layer in HDLC, Point to point protocol (PPP)

UNIT – III: Media Access Control: Random Access: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA).
Wired LANs: Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.

UNIT – IV: 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, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices, Approaches to Congestion Control-Traffic Aware Routing-Admission Control-Traffic Throttling-Load Shedding. Traffic Control Algorithm-Leaky bucket & Token bucket.
Internet Working: How networks differ- How networks can be connected- Tunnelling, internetwork routing-, Fragmentation, network layer in the internet – IP protocols-IP Version 4 protocol-IPV4 Header Format, IP addresses, Class full Addressing, CIDR, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4 to IPV6, Comparison of IPV4 &IPV6.

UNIT –V: The Transport Layer: Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services- TCP features- Segment- A TCP connection-windows in TCP- flow control-Error control, Congestion control in TCP.
Application Layer –- World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System.

TextBooks:

1. ComputerNetworksm,AndrewS Tanenbaum,FifthEdition.Pearson Education/PHI
2. DataCommunicationsandNetworks, BehrouzA.Forouzan,FifthEditionTMH.

ReferencesBooks:

1. DataCommunicationsandNetworks-AchutS Godbole, AtulKahate
2. ComputerNetworks,MayankDave, CENGAGE

IIIYearI Semester	FORMALLANGUAGESAND AUTOMATA THEORY	L	T	P	C
		3	0	0	3

Course Objectives:

- TolearnfundamentalsofRegularandContextFreeGrammarsandLanguages
- TounderstandtherelationbetweenRegularLanguageandFiniteAutomataand machines
- TolearnhowtodesignAutomata'sandmachinesasAcceptors,Verifiersand Translators
- TounderstandtherelationbetweenContextsfreeLanguages,PDA andTM
- Tolearnhow todesignPDAasacceptor and TMas Calculators

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

CO1:Explainthefoundationalconceptsofautomatatheoryand construct variousfinite automata(DFA,NFA,ε–NFA,Mealy&Mooremachines),includingminimizationand applications.

CO2:Applyregularexpressions,regulargrammars,pumpinglemma,andclosureproperties to describe and analyze regular languages.

CO3:Developandsimplifycontext-freegrammars,analyzederivationsandparsetrees,and convert grammars into normal forms while evaluating ambiguity.

CO4:Designpushdownautomataanddemonstratetheirequivalencewithcontext-free grammars for recognizing context-free languages.

CO5:ConstructTuringMachinesandanalyzedecidability,undecidability,PCP,thehalting problem, and complexity classes (P, NP, NP-hard, NP-complete).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M	-	-	-	-	-	-	L	-	L			
CO2	H	H	-	M	L	-	-	-	-	L	-	L			
CO3	H	H	M	M	L	-	-	-	-	L	-	L			
CO4	H	H	M	M	L	-	-	-	-	L	-	L			
CO5	H	H	L	H	L	-	-	-	-	L	-	L			

UNITI

Finite Automata: Need of Automata theory, Central Concepts of Automata Theory, Automation, Finite Automation, Transition Systems, Acceptance of a String, DFA, Designof DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with Є-Transitions, Minimization of Finite Automata, Finite Automata with output-Mealy and Moore Machines, Applications and Limitation of Finite Automata.

UNITII

RegularExpressions,RegularSets, IdentityRules,EquivalenceoftwoRE,Manipulationsof REs, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between FA andRE,PumpingLemmaofRegularSets,ClosurePropertiesofRegularSets,Grammars,

Classification of Grammars, Chomsky Hierarchy Theorem, Right and Left Linear Regular Grammars, Equivalence between RG and FA, Inter Conversion.

UNITIII

Formal Languages, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, Є-Productions and Unit Productions, Normal Forms-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

UNITIV

Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description, Language Acceptance of Pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars, Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.

UNITV

Turning Machine: Definition, Model, Representation of TMs-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a TM, Design of TMs, Types of TMs, Church's Thesis, Universal and Restricted TM, Decidable and Un-decidable Problems, Halting Problem of TMs, Post's Correspondence Problem, Modified PCP, Classes of P and NP, NP-Hard and NP-Complete Problems.

Text Books:

1. IntroductiontoAutomataTheory,LanguagesandComputation,J.E.Hopcroft,R.Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008

2. Theory of Computer Science-Automata, Languages and Computation, K. L. P. Mishraand N. Chandrasekharan, 3rd Edition, PHI, 2007

ReferenceBooks:

1. ElementsofTheoryofComputation,LewisH.P.&PapadimitionC.H.,Pearson /PHI
2. Theoryof Computation, V. Kulkarni, Oxford UniversityPress, 2013
3. TheoryofAutomata,LanguagesandComputation,Rajendrakumar,McGrawHill,2014

e-Resources:

1) https://nptel.ac.in/courses/106/104/106104028/

IIIYearI Semester	OBJECTORIENTEDANALYSISAND DESIGN	L	T	P	C
		3	0	0	3

CourseObjectives: Themain objectiveis thestudents to

- BecomefamiliarwithallphasesofOOAD.
- MasterthemainfeaturesoftheUML.
- Master the main concepts of Object Technologies and how to applythem at work and develop the ability to analyze and solve challenging problem in various domains.
- LearntheObjectdesignPrinciplesandunderstandhowtoapplythemtowards Implementation.

CourseOutcomes:*Aftersuccessfulcompletionofthe course,studentwillbeable to*

CO1: Explain the structure, attributes, and complexities of large software systems and apply principles for designing complex systems (K2)

CO2:ExplainUMLfundamentals,itsconceptualmodel,modelingprinciples,andapplybasic structural modeling using classes, relationships, and diagrams (K2)

CO3: Develop class and object diagrams by applying advanced structural modeling concepts such as interfaces, packages, roles, and relationships for diverse case studies (K3)

CO4: Construct behavioral models, including use case, interaction, and activity diagrams, to accurately represent system behavior for real-world applications (K3)

CO5:Designadvancedbehavioralandarchitecturalmodelsusingstatemachines,events, components, and deployment diagrams for complex software systems (K4)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	-	-	-	-	-	-	-	-	L	M	L	-
CO2	H	M	M	-	L	-	-	-	-	-	-	L	M	L	-
CO3	H	M	H	L	M	-	-	-	-	L	-	L	H	L	L
CO4	M	M	H	M	M	-	-	-	-	L	-	M	M	M	L
CO5	M	H	H	M	H	-	-	-	-	L	-	M	H	M	M

UNITI:

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

UNITII:

Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management.

UNITIII:

Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI: Cryptanalysis.

UNITIV:

Basic Behavioral Modeling-I: Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study:** Web Application: Vacation Tracking System

UNITV:

Advanced Behavioral Modeling: Events and signals, state machines, processes andThreads, time and space, state chart diagrams. **Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams. **Case Study:** Weather Forecasting

Text Books:

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

ReferenceBooks:

1. MeilirPage-Jones:FundamentalsofObjectOrientedDesigninUML,Pearson Education.
2. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech IndiaPvt. Ltd.
3. AtulKahate:ObjectOrientedAnalysis &Design,TheMcGraw-Hill Companies.
4. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

IIIYearI Semester	ARTIFICIALINTELLIGENCE	L	T	P	C
		3	0	0	3

Pre-requisite:

1. KnowledgeinComputer Programming.
2. Acourseon"MathematicalFoundationsofComputer Science".
3. Backgroundinlinear algebra,datastructuresandalgorithms,andprobability.

Course Objectives:

1. Thestudent should bemadeto studythe concepts of ArtificialIntelligence.
2. ThestudentshouldbemadetolearnthemethodsofsolvingproblemsusingArtificial Intelligence.
3. Thestudent should bemadeto introducethe concepts of Expert Systems.
4. TounderstandtheapplicationsofAI,namelygameplaying,theoremproving,and machine learning.
5. Tolearndifferentknowledgerepresentationtechniques

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

CO1:DescribeAIproblems,foundationsofAI,andagentarchitectures,andanalyzehow agents perceive, act, and make rational decisions in different environments (K2)

CO2:Applyuninformedandheuristicsearchstrategies—includingBFS,DFS,HillClimbing, A*, AO*, and game-playing algorithms—to solve well-formulated problems (K3)

CO3: Develop suitable knowledge representation schemes using predicate logic, semantic networks,frames,rules,andprobabilisticmodelstosupportreasoningunderuncertainty(K3) CO4: Perform inference using first-order logic, unification, resolution, forward/backward chaining, and applylearning approaches such as decision trees, EBL, statistical methods, and reinforcement learning (K4)

CO5:Examinethearchitecture,components,knowledgeacquisitiontechniques,andshellsof expert systems, and evaluate typical expert system applications (K4)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	-	-	-	-	-	-	-	-	L	-	-	-
CO2	H	H	H	M	L	M	-	-	-	-	-	L	-	-	-
CO3	H	M	H	M	M	M	-	-	-	L	-	L	-	-	-
CO4	H	H	H	H	M	M	-	-	-	L	-	M	-	-	-
CO5	M	M	M	M	H	L	-	-	-	L	-	M	-	-	-

UNIT-I

Introduction: AIproblems,foundationofAIand historyofAIintelligent agents:Agentsand Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

Textbooks:

1. S.RusselandP.Norvig,"ArtificialIntelligence–AModernApproach", SecondEdition, Pearson Education.

2. KevinNight andElaineRich,NairB., "Artificial Intelligence(SIE)",McGrawHill

ReferenceBooks:

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

OnlineLearningResources:

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

IIIYearI Semester	MICROPROCESSORS& MICROCONTROLLERS	L	T	P	C
		3	0	0	3

Course Objectives:

- Tointroducefundamentalarchitecturalconceptsofmicroprocessorsand microcontrollers.
- Toimpartknowledgeonaddressingmodesandinstruction setof8086and8051
- Tointroduceassemblylanguageprogramming concepts
- Toexplain memoryandI/Ointerfacingwith8086and 8051
- Tointroduce16 bit and32 bit microcontrollers.

CourseOutcomes:*Aftersuccessful completionofthecourse,student willbeable to*

CO1:Explainthearchitecture,operationalmodes,timing,andinterruptmechanismsofthe 8086 microprocessor (K2)

CO2:Applyaddressingmodes,instructionset,andassemblerdirectivestodevelopassembly-level programs for the 8086 microprocessor (K3)

CO3:Designinterfacingcircuitsformemories,I/Odevices,interrupts,serialcommunication, and peripheral controllers commonly used with 8086 (K4)

CO4:Describethearchitecture,SFRs,instructionset,andprogrammingmodelofthe8051 microcontroller and develop basic assembly programs (K3)

CO5: Develop interface routines for timers, serial communication, interrupts, sensors, ADC/DAC,andexternaldevicesusing8051,andcomparemicroprocessor/microcontroller families (K3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	-	-	-	-	-	-	L	-	-	-	-	-
CO2	H	M	H	M	M	-	-	-	-	L	-	-	-	-	-
CO3	H	H	H	H	H	-	-	-	-	L	-	-	-	-	-
CO4	H	M	M	L	M	-	-	-	-	L	-	-	-	-	-
CO5	H	H	H	M	H	-	-	-	-	M	-	-	-	-	-

UNITI:

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNITII:

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNITIII:

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNITIV:

Microcontroller, Architecture of 8051, Special Function Registers(SFRs), I/O Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming.

UNITV:

InterfacingMicrocontroller,Programming8051 Timers, Serial Port Programming,Interrupts Programming, LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation,Comparison ofMicroprocessor, Microcontroller, PIC and ARM processors

Textbooks:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall,SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition,1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition,McGraw Hill Education, 2017.
3. RajKamal,Microcontrollers:Architecture,Programming,InterfacingandSystem Design, 2nd edition, Pearson, 2012.

ReferenceBooks:

1. RameshSGaonkar,MicroprocessorArchitectureProgrammingandApplicationswith the 8085, 6thedition, Penram International Publishing, 2013.
2. KennethJ.Ayala,The8051Microcontroller,3rdedition,Cengage Learning,2004.

IIIYearI Semester	QUANTUMCOMPUTING	L	T	P	C
		3	0	0	3

Pre-requisites:
BasicknowledgeofLinearAlgebra(vectors,matrices,eigenvalues,operations)
Fundamental concepts of Probability & Statistics
BasicunderstandingofClassicalComputing(binaryoperations,logicgates,algorithmic thinking)
IntroductoryPhysicsknowledge(wave-particleconcepts,basicmechanics/electromagnetics)
Basic Foundations of Programming (ability to understand algorithms and computational models)

Course Objectives:
Tointroducethefundamentalsofquantumcomputing,theproblem-solvingapproachusing finite dimensional mathematics

Course Outcomes: *After successful completion of the course, student will be able to*
CO1:Explaintheevolutionofquantumcomputinganddistinguishbetweenclassicaland quantum computing models, including bits vs qubits and logical operations (K2)
CO2: Apply foundational mathematics, physics, and biological concepts—including linear algebra,Hilbertspaces,superposition,entanglement,andgenomics/proteomics—toanalyze quantum computational principles (K3)
CO3:Demonstratetherepresentation,physicalrealization,andmanipulationofqubits,and construct simple quantum circuits using single and multi-qubit gates (K3)
CO4: Analyze and implement foundational quantum algorithms such as Deutsch, Deutsch–Jozsa, Grover, and Shor, and compare their performance with classical algorithms (K4)CO5:Examinenoisesources,applyquantumerror-correctionandfault-tolerantmechanisms, and interpret modern applications of quantum information and cryptography (K4)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	-	-	-	-	-	-	L	-	L	-	-	-
CO2	H	H	H	M	L	M	-	-	-	L	-	L	-	-	-
CO3	H	H	H	M	M	M	-	-	-	L	-	L	-	-	-
CO4	H	H	H	H	M	M	-	-	-	M	-	M	-	-	-
CO5	M	H	M	M	L	L	-	-	-	M	-	M	-	-	-

UNIT-I
History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations

UNIT-II
Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements.

Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, densityoperators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

UNIT-III

Qubit:PhysicalimplementationsofQubit.QubitasaquantumunitofinformationTheBloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

UNIT-IV

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.

UNIT-V

Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

TextBooks:

1. QuantumComputationandQuantum Information,NielsenM.A.,Cambridge
2. ProgrammingQuantumComputers,EssentialAlgorithmsandCodeSamples,EricR Johnson, Nic Harrigan, Mercedes Ginemo, Segovia, Oreilly

ReferenceBooks:

1. QuantumComputingforComputerScientists,NosonS.Yanofsk,MircoA.Mannucci
2. PrinciplesofQuantumComputationandInformation,BenentiG.,CasatiG.andStrini G., Vol.I: Basic Concepts, Vol II
3. BasicToolsandSpecialTopics,WorldScientific.PittengerA.O.,AnIntroductionto Quantum Computing Algorithms

IIIYearI Semester	DATAMININGLAB	L	T	P	C
		0	0	3	1.5

Pre-requisites: DataBaseManagementSystems,PythonProgramming

CourseObjectives: The mainobjective of thecourseis to

- InculcateConceptual,Logical,andPhysicaldesignofDataWarehousesOLAP applications and OLAP deployment
- Design a data warehouse or data mart to present information needed by management in a form that is usable
- Emphasizehands-onexperienceworkingwithallrealdatasets.
- Testreal datasets usingpopulardataminingtoolssuch asWEKA, PythonLibraries
- Developabilityto designvarious algorithmsbasedon dataminingtools.

CourseOutcomes:*Aftersuccessful completionofthe course,student willbeable to*

CO1: Construct data warehouses, design multidimensional models (Star/Snowflake/Fact Constellation), and perform ETL and OLAP operations using industrial tools (K3)

CO2: Explore and operate WEKA tools to load, preprocess, visualize datasets, and analyze attribute characteristics for machine learning tasks (K3)

CO3: Apply data preprocessing, association rule mining (Apriori/FP-Growth), and interpretation of rules to derive meaningful insights from datasets (K4)

CO4: Implement and evaluate classification and clustering algorithms (ID3, J48, NB, k-NN, k-means) using WEKA/Python/R, and compare model performance using ROC curves, entropy, SSE, and confusion matrices (K4)

CO5: Develop machine learning programs in Python/Java/R for association mining, Naive Bayes, clustering, chi-square computation, and visualization using Matplotlib, and interpret results (K4)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	H	M	H	-	-	-	-	L	-	-	-	-	-
CO2	H	M	M	M	H	-	-	-	-	L	-	-	-	-	-
CO3	H	H	H	H	H	-	-	-	-	L	-	-	-	-	-
CO4	H	H	H	H	H	-	-	-	L	M	-	-	-	-	-
CO5	H	H	H	H	H	-	-	-	L	M	-	-	-	-	-

SoftwareRequirements:WEKATool/Python/R-Tool/RapidTool/OracleData mining

List ofExperiments:

1. CreationofaData Warehouse.
   - Build Data Warehouse/Data Mart (using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics; or other data warehouse tools like Microsoft-SSIS, Informatica, Business Objects, etc.,)

- Design multi-dimensional data models namelyStar,Snowflakeand Fact Constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, manufacturing, Automobiles, sales etc).
- WriteETLscripts and implement usingdatawarehouse tools.
- PerformVariousOLAPoperationssuchslice,dice,rollup,drillupand pivot

2. Exploremachine learningtool "WEKA"

- ExploreWEKADataMining/MachineLearning Toolkit.
- Downloadingand/orinstallationofWEKAdata mining toolkit.
- UnderstandthefeaturesofWEKAtoolkitsuchasExplorer,KnowledgeFlow interface, Experimenter, command-line interface.
- Navigate the options available in the WEKA (ex. Select attributes panel, Preprocesspanel, Classify panel, Cluster panel, Associate panel and Visualize panel)
- Study thearfffileformat Exploretheavailabledatasets in WEKA. Loadadataset (ex. Weather dataset, Iris dataset, etc.)
- Load eachdatasetandobservethefollowing:
  1. Listtheattributenamesand theytypes
  2. Numberofrecordsineachdataset
  3. Identifytheclassattribute(ifany)
  4. Plot Histogram
  5. Determinethenumberofrecordsfor eachclass.
  6. Visualizethedata invarious dimensions

3. Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets

- Explore various options available in Weka for preprocessing data and apply UnsupervisedfilterslikeDiscretization,Resamplefilter,etc.oneachdataset
- Loadweather.nominal,Iris,GlassdatasetsintoWekaandrunApriori Algorithm with different support and confidence values.
- Studythe rules generated. Applydifferent discretization filters on numerical attributes and run the Apriori association rule algorithm. Study the rules generated.
- Derive interestinginsights and observethe effect of discretization in the rulegeneration process.

4. DemonstrateperformingclassificationondatasetsWeka/R

- Loadeachdatasetandrun1d3,J48classificationalgorithm.Studytheclassifier output. Compute entropy values, Kappa statistic.
- Extractif-thenrulesfromthedecisiontreegeneratedbytheclassifier,Observethe confusion matrix.
- Load each dataset into Weka/R and perform Naïve-bayes classification and k-Nearest Neighbour classification. Interpret the results obtained.
- Plot RoC Curves

- Compare classification results of ID3, J48, Naïve-Bayes and k-NN classifiers for each dataset, and deduce which classifier is performing best and poor for each dataset and justify.

5. Demonstrateperformingclusteringofdata sets
   - LoadeachdatasetintoWeka/Randrunsimplek-meansclusteringalgorithmwith different values of k (number of desired clusters).
   - Studytheclustersformed.Observethesumofsquarederrorsandcentroids,and derive insights.
   - Exploreotherclusteringtechniques availablein Weka/R.
   - Explore visualization features of Weka/R to visualize the clusters. Derive interesting insights and explain.

6. Demonstrateknowledge flowapplicationondatasetsintoWeka/R
   - Developaknowledgeflowlayoutforfindingstrongassociationrulesbyusing Apriori, FP Growth algorithms
   - SetuptheknowledgeflowtoloadanARFF(batchmode)andperformacross validation using J48 algorithm
   - Demonstrate plotting multiple ROC curves in the same plot window by using j48 and Random forest tree
7. DemonstrateZeroRtechniqueonIrisdataset(byusingnecessarypreprocessing technique(s)) and share your observations
8. Writeajavaprogramto prepareasimulated datasetwith unique instances.
9. Write a Python program to generate frequent item sets / association rules using Apriorialgorithm
10. Writeaprogramtocalculatechi-squarevalueusingPython/R.Reportyourobservation.
11. WriteaprogramofNaiveBayesianclassificationusingPython/Rprogramming language.
12. Implement aJava/RprogramtoperformApriorialgorithm
13. WriteaRprogramtoclusteryourchoiceofdatausingsimplek-meansalgorithmusingJDK
14. Writeaprogramofclusteranalysisusingsimplek-meansalgorithmPython/Rprogramming language.
15. Writeaprogramtocompute/displaydissimilaritymatrix(foryourowndatasetcontaining at least four instances with two attributes) using Python
16. Visualize the datasets using matplotlib in python/R.(Histogram, Box plot, Bar chart, Pie chart etc.,)

IIIYearI Semester	COMPUTERNETWORKSLAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

Learn basic concepts of computer networking and acquire practical notions of protocols with theemphasisonTCP/IP. AlabprovidesapracticalapproachtoEthernet/Internetnetworking: networksareassembled, andexperimentsaremadetounderstandthelayeredarchitectureand how do some important protocols work

CourseOutcomes:*Aftersuccessfulcompletionofthe course,studentwillbeable to*

CO1:Configureandoperatebasicnetworkdevicestoestablish LocalAreaNetworksand analyze packet-level behavior using tools such as Wireshark (K4)

CO2:Implement data link layer framing,errordetection and correctiontechniques such as bit/character stuffing, checksum, Hamming code, and CRC algorithms (K3)

CO3:Developandsimulatereliabledatatransferprotocolsincluding Stop-and-Wait,Go-Back-N, and Selective Repeat using programming constructs (K3)

CO4:ImplementroutingalgorithmssuchasDijkstra'sshortestpathandDistanceVector routing to compute optimal routing paths (K4)

CO5: Simulate congestion control, packet flow behavior, and throughput using NS2/Nmapand evaluate network performance under various scenarios (K5)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	L	M	H	-	-	-	-	L	-	M	-	-	-
CO2	H	M	L	M	L	-	-	-	-	L	-	M	-	-	-
CO3	M	M	M	M	L	-	-	-	-	L	-	M	-	-	-
CO4	H	H	M	H	L	-	-	-	-	L	-	M	-	-	-
CO5	M	H	M	H	H	-	-	-	-	L	-	H	-	-	-

List ofExperiments:

1. Studyof Networkdevices in detailand connectthecomputers inLocal AreaNetwork.
2. WriteaProgramto implementthedatalink layerfarmingmethodssuchas i)Character stuffingii) bit stuffing.
3. WriteaProgramto implementdatalink layerfarmingmethod checksum.
4. Writeaprogramfor HammingCode generationforerrordetectionandcorrection.
5. WriteaProgramtoimplementonadatasetofcharactersthethreeCRCpolynomials– CRC 12, CRC 16 and CRC CCIP.
6. WriteaProgram toimplement Slidingwindowprotocol forGoback N.
7. WriteaProgramto implement Slidingwindow protocolfor Selectiverepeat.
8. WriteaProgramto implementStop andWait Protocol.
9. Writeaprogram for congestion controlusingleakybucket algorithm
10. Write a Program to implement Dijkstra's algorithm to compute the Shortest path through a graph.

11. Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).
12. WriteaProgramto implement Broadcasttreebytakingsubnet of hosts.
13. Wireshark
    i. PacketCaptureUsingWireshark
    ii. StartingWire shark
    iii. ViewingCaptured Traffic
    iv. AnalysisandStatistics&Filters.
14. Howto run Nmap scan
15. OperatingSystemDetectionusing Nmap
16. Dothe followingusingNS2Simulator
    i. NS2Simulator-Introduction
    ii. Simulateto FindtheNumberofPackets Dropped
    iii. Simulateto FindtheNumber ofPackets Dropped byTCP/UDP
    iv. Simulateto Find theNumber ofPackets Dropped dueto Congestion
    v. SimulatetoCompareDataRate& Throughput.

IIIYearI Semester	FULLSTACKDEVELOPMENT-2	L	T	P	C
		0	1	2	2

Course Objectives:

Themain objectivesof thecourse areto

- Makeuseofrouter,templateengineandauthenticationusingsessionstodevelop application in Express JS.
- Buildasinglepage applicationusingRESTfulAPIsinExpress JS
- Applyrouter and hooksin designingReact JSapplication
- MakeuseofMongoDBqueriesto performCRUD operationsondocumentdatabase

CourseOutcomes:*Aftersuccessfulcompletionofthe course,studentwillbeable to*

CO1:Buildserver-sideapplicationsusingExpressJSwithrouting,middleware,templating, sessions, authentication, and RESTful APIs (K3)

CO2:Developinteractiveclient-sideapplicationsusingReactJScomponents,props,states, JSX, routing, forms, hooks, and event handling (K4)

CO3:DesignandintegrateMERN-basedfull-stackapplicationsusingExpressJS,ReactJS, and MongoDB for end-to-end data management (K5)

CO4:PerformCRUDoperationsandmanagecollections,indexes,andaggregationsusing MongoDB and Mongoose (K3)

CO5:Implementandtestreal-worldapplications(e.g.,To-Do,QuizApp)andevaluate security, performance, and usability considerations (K5)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	M	L	H	-	-	-	-	L	-	M	-	-	-
CO2	M	H	M	M	H	-	-	-	-	M	-	M	-	-	-
CO3	H	H	H	M	H	-	-	-	-	M	-	H	-	-	-
CO4	M	M	M	M	H	-	-	-	-	L	-	M	-	-	-
CO5	M	H	H	H	H	-	-	-	-	M	-	H	-	-	-

ExperimentscoveringtheTopics:

- ExpressJS –Routing,HTTPMethods,Middleware,Templating,FormData
- ExpressJS–Cookies,Sessions,Authentication,Database,RESTfulAPIs
- React JS – Render HTML, JSX, Components – function & Class, Props and States,Styles, Respond to Events
- ReactJS–ConditionalRendering,RenderingLists,ReactForms,ReactRouter, Updating the Screen
- React JS – Hooks, Sharing data between Components, Applications – To-do list and Quiz
- MongoDB–Installation,Configuration,CRUDoperations,Databases,Collections and Records

SampleExperiments:

1. ExpressJS –Routing,HTTPMethods,Middleware.

a. Writeaprogramtodefinearoute,HandlingRoutes,RouteParameters,Query Parameters and URL building.

b. Writeaprogramtoacceptdata,retrievedataanddeleteaspecifiedresourceusinghttp methods.

c. Writeaprogram to show the workingof middleware.

2. ExpressJS–Templating,FormData

a. Writeaprogram usingtemplatingengine.

b. Writeaprogramto workwithform data.

3. ExpressJS –Cookies,Sessions, Authentication

a. Writeaprogramforsessionmanagement usingcookies and sessions.

b. Writeaprogramfor userauthentication.

4. ExpressJS –Database,RESTfulAPIs

a. Write a program to connect MongoDB database using Mangoose and perform CRUD operations.

b. Writeaprogram todevelopasinglepageapplication usingRESTful APIs.

5. ReactJS–RenderHTML,JSX,Components–function& Class

a. Writeaprogram torender HTMLtoa web page.

b. Writeaprogram for writingmarkupwith JSX.

c. Writeaprogram for creatingand nestingcomponents (function and class)

6. ReactJS– PropsandStates,Styles,RespondtoEvents

a. Writeaprogram toworkwith propsand states.

b. Writeaprogramto addstyles(CSS &Sass Styling) and displaydata.

c. Writeaprogram for respondingto events.

7. ReactJS–ConditionalRendering,RenderingLists,React Forms

a. Writeaprogramfor conditional rendering.

b. Writeaprogram for renderinglists.

c. Writeaprogramfor workingwithdifferentformfieldsusingreact forms.

8. ReactJS–ReactRouter,Updatingthe Screen

a. Writeaprogramforroutingtodifferent pagesusingreactrouter.

b. Write aprogram forupdatingthescreen.

9. ReactJS–Hooks,Sharingdatabetween Components

a. Writeaprogramto understandtheimportanceof using hooks.

b. Writeaprogram forsharingdatabetween components.

10. MongoDB–Installation,Configuration,CRUD operations

a. InstallMongoDBand configureATLAS

b. WriteMongoDBqueriestoperformCRUDoperationsondocumentusinginsert(), find(), update(), remove()

11. MongoDB–Databases,CollectionsandRecords

a. WriteMongoDBqueriestoCreateanddropdatabasesandcollections.

b. WriteMongoDBqueriestoworkwithrecordsusingfind(),limit(),sort(), createIndex(), aggregate().

12. AugmentedPrograms:(Any2mustbe completed)

a. Designato-dolistapplicationusingNodeJSandExpressJS.

b. Design aQuizappusingReactJS.

c. CompletetheMongoDB certificationfrom MongoDBUniversitywebsite.

TextBooks:

1. ProMERNStack:FullStackWebAppDevelopmentwithMongo,Express,React,and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.
2. Node.JsinAction,MikeCantelon,MarkHarter,T.J.Holowaychuk,Nathan Rajlich,Manning Publications. (Chapters 1-11)
3. ReactQuickly,AzatMardan,ManningPublications(Chapters1-8,12-14)

WebLinks:

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

IIIYearI Semester	USERINTERFACEDESIGN USING FLUTTER	L	T	P	C
		0	0	2	1

Course Objectives:

- LearnstoImplement FlutterWidgetsandLayouts
- UnderstandsResponsive UIDesignandwithNavigationinFlutter
- KnowledgeonWidgesandcustomizewidgetsfor specificUIelements, Themes
- Understandtoincludeanimationapartfromfetchingdata

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

CO1:ApplyDartprogrammingconstructsandcoreFlutterwidgetstobuildbasicuser interfaces (K3)

CO2:Developresponsiveandmulti-screenmobileapplicationsusinglayouts,navigation,and routing techniques (K4)

CO3:Implementeffectivestatemanagementand customwidgetdesignusingFlutter frameworks such as setState and Provider (K4)

CO4:Integrateanimations,formhandling,validation,andRESTAPIcommunicationtobuild interactive and data-driven mobile applications (K5)

CO5:Performdebugging,testing,andperformanceoptimizationofFlutterapplicationsusing available tools, testing frameworks, and best practices (K5)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	M	L	H	-	-	-	-	L	-	M	-	-	-
CO2	M	M	H	L	H	-	-	-	-	M	-	M	-	-	-
CO3	M	H	H	L	H	-	-	-	-	M	-	H	-	-	-
CO4	M	H	H	M	H	-	-	-	-	M	-	H	-	-	-
CO5	M	H	M	H	H	-	-	-	-	M	-	H	-	-	-

List ofExperiments:

Studentsneedtoimplementthefollowingexperiments

1. a)InstallFlutterandDartSDK.
   b)WriteasimpleDart programtounderstandthelanguagebasics.
2. a)ExplorevariousFlutterwidgets(Text, Image,Container,etc.).
   b) ImplementdifferentlayoutstructuresusingRow,Column,andStackwidgets.
3. a)DesignaresponsiveUIthat adaptstodifferentscreensizes.
   b) Implementmediaqueriesandbreakpointsfor responsiveness.
4. a)SetupnavigationbetweendifferentscreensusingNavigator.
   b) Implementnavigationwithnamedroutes.
5. a)Learnaboutstatefulandstatelesswidgets.
   b) ImplementstatemanagementusingsetState andProvider.
6. a)Createcustom widgetsforspecificUIelements.
   b) Applystylingusingthemes and custom styles.

7. a)Designa formwithvariousinput fields.
   b) Implementformvalidationanderrorhandling.
8. a)AddanimationstoUIelementsusingFlutter'sanimation framework.
   b) Experimentwithdifferenttypesofanimations(fade,slide,etc.).
9. a)Fetch data from aREST API.
   b) Displaythefetched data in ameaningful wayinthe UI.
10. a) Writeunit tests forUIcomponents.
    b) UseFlutter'sdebuggingtoolstoidentifyandfixissues.

TextBooks:

1. MarcoL.Napoli,BeginningFlutter:A Hands-onGuidetoAppDevelopment.
2. RapPayne,BeginningAppDevelopmentwithFlutter:CreateCross-PlatformMobile Apps 1st Edition, Apres
3. RichardRose,Flutter&DartCookbook,DevelopingFullstackApplicationsforthe Cloud, Oreilly.

IIIYearII Semester	COMPILERDESIGN	L	T	P	C
		3	0	0	3

Course Objectives:

Understandthebasicconceptofcompiler design,anditsdifferentphaseswhichwillbe helpful to construct new tools like LEX, YACC, etc.

CourseOutcomes:*Aftersuccessfulcompletionofthe course,studentwillbeable to*

CO1:Explainlexicalandsyntaxanalysismechanisms,tokenspecification,andgrammar properties used in compiler front-end design (K2)

CO2: Apply top-down and bottom-up parsing techniques to analyze context-free grammarsand construct predictive and LR parsing tables (K3)

CO3:Developsyntax-directeddefinitions,translationschemes,andintermediatecode representations such as TAC, syntax trees, and backpatching (K4)

CO4: Examine code optimization techniques, data-flow analysis, and loop optimizations toimprove intermediate code efficiency (K4)

CO5:Constructruntimeenvironments,activationrecords,andgenerateobjectcodebyaddressing issues in code generation and register allocation (K5)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	L	L	-	-	-	-	L	-	M	-	-	-
CO2	H	H	M	L	M	-	-	-	-	L	-	M	-	-	-
CO3	H	H	H	M	H	-	-	-	-	L	-	H	-	-	-
CO4	M	H	M	H	H	-	-	-	-	L	-	H	-	-	-
CO5	H	H	H	M	H	-	-	-	-	L	-	H	-	-	-

UNITI:

Lexical Analysis: LanguageProcessors,StructureofaCompiler,LexicalAnalysis,TheRole of the Lexical Analyzer, Bootstrapping, Input Buffering, Specification of Tokens, Recognition of Tokens, Lexical Analyzer Generator-LEX, Finite Automata, Regular Expressions and Finite Automata, Design of a Lexical Analyzer Generator.

Syntax Analysis: The Role of the Parser, Context-Free Grammars, Derivations, Parse Trees, Ambiguity, Left Recursion, Left Factoring,

UNITII:

Top Down Parsing: Pre Processing Steps of Top Down Parsing, Backtracking, Recursive Descent Parsing, LL (1) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing.

Bottom Up Parsing: Introduction, Difference between LR and LL Parsers, Types of LR Parsers, Shift Reduce Parsing, SLR Parsers, Construction of SLR Parsing Tables, More Powerful LR Parses, Construction of CLR (1) and LALR Parsing Tables, Dangling Else Ambiguity, Error Recovery in LR Parsing, Handling Ambiguity Grammar with LR Parsers.

UNITIII:

Syntax Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. **Intermediate Code Generation:** Variants of Syntax Trees,Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Backpatching, Intermediate Code for Procedures.

UNITIV:

Code Optimization: The Principle Sources of Optimization, Basic Blocks, Optimization of Basic Blocks, Structure Preserving Transformations, Flow Graphs, Loop Optimization, Data-Flow Analysis, Peephole Optimization

UNITV:

Run Time Environments: Storage Organization, Run Time Storage Allocation, Activation Records, Procedure Calls, Displays

Code Generation: Issues in the Design of a Code Generator, Object Code Forms, Code Generation Algorithm, Register Allocation and Assignment.

Text Books:

1.Compilers:Principles,TechniquesandTools,SecondEdition,AlfredV.Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, Pearson, 2007.

ReferenceBooks:

1. Compiler Construction, Principles and Practice, Kenneth C Louden, Cengage Learning, 2006
2. Modern compiler implementation in C, Andrew W Appel, Revised edition, CambridgeUniversity Press.
3. OptimizingCompilersforModernArchitectures,RandyAllen,KenKennedy, Morgan Kauffmann, 2001.
4. Levine, J.R., T. Mason and D. Brown,Lex and Yacc, edition, O'Reilly & Associates,1990

IIIYearII Semester	CLOUDCOMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

- Toexplain theevolvingutilitycomputingmodelcalled cloud computing.
- Tointroducethevariouslevels ofservicesofferedbycloud.
- Todiscussthefundamentalsofcloudenablingtechnologiessuchasdistributedcomputing, service-oriented architecture and virtualization.
- Toemphasizethesecurityand otherchallengesincloud computing.
- Tointroducetheadvancedconceptssuchascontainers,serverlesscomputingand cloud-centric Internet of Things.

CourseOutcomes:*Aftersuccessful completionofthecourse,student willbeable to*

CO1:Explaincloudcomputingconcepts,servicemodels,deploymentmodels,andassociated benefits in modern distributed systems (K2)

CO2:Applycloud-enablingtechnologiessuchasparallelcomputing,distributedsystems, SOA, and virtualization in cloud environments (K3)

CO3:Analyzevirtualizationtechniques,containertechnologies,orchestrationtools,and public cloud VM/container services (K4)

CO4:Evaluatecloudcomputingchallengesrelatedtointeroperability,scalability,energy efficiency, and cloud security architecture (K5)

CO5:Assessadvancedcloudparadigmsincludingserverlesscomputing,cloud-centricIoT, edge/fog computing, DevOps, and quantum cloud technologies (K5)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	L	L	-	L	-	-	L	-	M	-	-	-
CO2	H	H	M	M	M	-	L	-	-	L	-	M	-	-	-
CO3	H	H	H	M	H	-	L	-	-	L	-	H	-	-	-
CO4	H	H	M	H	H	-	M	L	-	L	-	H	-	-	-
CO5	H	H	M	H	H	-	M	L	-	L	-	H	-	-	-

UNIT-I:IntroductiontoCloudComputingFundamentals

Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google AppEngine).

UNIT-II:CloudEnablingTechnologies

Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributedcomputing, Inter-processcommunication,technologiesfordistributedcomputing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.

UNIT-III:VirtualizationandContainers

Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware), building blocks of containers, container platforms (LXC, Docker), containerorchestration,DockerSwarmandKubernetes,publiccloudVM(e.g.AmazonEC2) and container (e.g. Amazon Elastic Container Service) offerings.

UNIT-IV:Cloudcomputingchallenges

Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

UNIT-V:Advancedconceptsincloudcomputing

Serverless computing, Function-as-a-Service, serverless computingarchitecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS) serverless platforms, Internet ofThings (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.

TextBooks:

1. MasteringCloudComputing,2nd edition,RajkumarBuyya,ChristianVecchiola,Thamarai Selvi, Shivananda Poojara, Satish N. Srirama, Mc Graw Hill, 2024.
2. Distributed and Cloud Computing, KaiHwang,Geoffery C. Fox, Jack J. Dongarra,Elsevier, 2012.

ReferenceBooks:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. EssentialsofcloudComputing,K.Chandrasekhran,CRCpress, 2014.
3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)

IIIYearII Semester	CRYPTOGRAPHY&NETWORK SECURITY (CommontoCSE,CS&IT)	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of this course are to explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, public keyalgorithms, design issues and workingprinciples of various authentication protocols and various secure communication standards including Kerberos, IPsec, and SSL/TLS.

UNITI:

Basic Principles: Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography- integer arithmetic, modular arithmetic, matrices, linear conguence.

UNITII:

Symmetric Encryption: Mathematics of Symmetric KeyCryptography-algebraic structures, GF(2^n) Fields, Introduction to Modern Symmetric Key Ciphers-modern block ciphers, modern stream ciphers, Data Encryption Standard- DES structure, DES analysis, Security of DES, Multiple DES, Advanced Encryption Standard-transformations, key expansions, AES ciphers, Analysis of AES

UNITIII:

Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography-primes, primality testing, factorization, CRT, Asymmetric Key Cryptography- RSA crypto system, Rabin cryptosystem, Elgamal Crypto system, ECC

UNITIV:

Data Integrity, Digital Signature Schemes & Key Management: Message Integrity and Message Authentication-message integrity, Random Oracle model, Message authentication, Cryptographic Hash Functions-whirlpool, SHA-512, Digital Signature- process, services, attacks, schemes, applications, Key Management-symmetric key distribution, Kerberos.

UNITV:

Network Security-I: Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, **Network Security-II :** Security at the Network Layer:IPSec-two modes, two security protocols, security association, IKE, ISAKMP, System Security-users, trust, trusted systems, buffer overflow, malicious software, worms, viruses, IDS, Firewalls.

TextBooks:

1. CryptographyandNetworkSecurity,3rdEditionBehrouzAForouzan,Debdeep Mukhopadhyay, McGraw Hill,2015
2. Cryptographyand NetworkSecurity,4thEdition,WilliamStallings, (6e) Pearson,2006
3. EverydayCryptography,1stEdition,KeithM.Martin,Oxford, 2016

ReferenceBooks:

1. Network Security and Cryptography, 1st Edition, Bernard Meneges, Cengage Learning, 2018

IIIYearII Semester	SOFTWARETESTING METHODOLOGIES (CommontoCSE,CS,IT,CSD,CSE(AI), CSE(AI&ML),CSE(AI&DS))	L	T	P	C
		3	0	0	3

Course Objectives

- Toprovideknowledgeoftheconceptsinsoftwaretestingsuchastestingprocess, criteria, strategies, and methodologies.
- Todevelopskillsin softwaretestautomationandmanagement usingthelatest tools.

UNIT-I

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT-II

TransactionFlowTesting:transactionflows,transactionflowtestingtechniques.
Data Flow testing: Basics of data flow testing, strategies in data flow testing, application ofdata flow testing.
DomainTesting:domainsandpaths,Nice&uglydomains,domaintesting,domainsand interfaces testing, domain and interface testing, domains and testability.

UNIT-III

Paths,PathproductsandRegularexpressions:pathproducts&pathexpression,reduction procedure, applications, regular expressions & flow anomaly detection.
LogicBasedTesting:overview,decisiontables,pathexpressions,kvcharts,specifications.

UNIT-IV

State,StateGraphsandTransitiontesting:stategraphs,good&badstategraphs,statetesting, Testability tips.

UNIT-V

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

TextBooks:

1. SoftwareTestingtechniques -BarisBeizer,Dreamtech,second edition.
2. SoftwareTestingTools–Dr. K. V.K. K. Prasad, Dreamtech.

ReferenceBooks:

1. Thecraftofsoftwaretesting- Brian Marick,Pearson Education.
2. SoftwareTestingTechniques– SPD(Oreille)
3. SoftwareTestingin theReal World–EdwardKit, Pearson.
4. EffectivemethodsofSoftwareTesting,Perry,JohnWiley.
5. ArtofSoftwareTesting–Meyers, John Wiley.

IIIYearII Semester	CYBERSECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

Theaim of thecourseis to

- identifysecurityrisksandtakepreventive steps
- understandtheforensicsfundamentals
- understandtheevidence capturingprocess
- understandthepreservationofdigitalevidence

UNIT I: Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cyber criminals,Classificationsof Cybercrime, Cyberstalking, Cybercafe and Cybercrimes, Botnets. Attack Vector,ProliferationofMobile and Wireless Devices, SecurityChallenges Posed byMobile Devices, Attacks on Mobile/Cell Phones, Network and Computer Attacks.

UNIT II: Tools and Methods : Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer over flow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft (ID Theft), Foot Printing and Social Engineering, Port Scanning, Enumeration.

UNIT III: Cyber Crime Investigation: Introduction, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

UNIT IV: Computer Forensics and Investigations: Understanding Computer Forensics, Preparing for Computer Investigations. Current Computer Forensics Tools: Evaluating Computer Forensics Tools, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Graphics and Network Forensics, E-mail Investigations, Cell Phone and Mobile Device Forensics.

UNIT V: Cyber Crime Legal Perspectives: Introduction, Cybercrime and the Legal Landscape around the World, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in InformationTechnology Act,Digital SignaturesandtheIndianITAct,Amendmentsto theIndianIT Act,CybercrimeandPunishment, Cyberlaw, Technologyand Students: Indian Scenario.

TextBooks:

1. SunitBelapureNinaGodbole"CyberSecurity:UnderstandingCyberCrimes,Computer Forensics and Legal Perspectives", WILEY, 2011.
2. NelsonPhillipsandEnfingerSteuart,"ComputerForensicsandInvestigations", Cengage Learning, New Delhi, 2009.

ReferenceBooks:

1. MichaelT.Simpson,KentBackmanandJamesE.Corley,"HandsonEthical Hacking and Network Defence", Cengage, 2019.
2. Computer Forensics,Computer CrimeInvestigationby JohnR.Vacca,Firewall Media, New Delhi.
3. AlfredBasta,NadineBasta,MaryBrownandRavinderKumar"CyberSecurity and Cyber Laws" , Cengage,2018.

E-Resources:

1. CERT-InGuidelines-http://www.cert-in.org.in/
2. https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks [Online Course]
3. https://computersecurity.stanford.edu/free-online-videos[FreeOnlineVideos]
4. Nickolai Zeldovich. 6.858 Computer Systems Security. Fall 2014. Massachusetts Institute of Technology: MIT OpenCourseWare, https://ocw.mit.eduLicense: Creative CommonsBY-NC-SA.

IIIYearII Semester	DevOps (CommontoCSE,CS,IT,AI&Ml,CSE (AI), CSE AI&ML)	L	T	P	C
		3	0	0	3

Course Objectives:

Themain objectives ofthiscourseareto:

- Describetheagilerelationshipbetweendevelopmentand IToperations.
- Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
- Implement automatedsystem updateandDevOps lifecycle.

UNIT-I

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

UNIT-II

Source Code Management (GIT): The need for source code control, The history of source code management, Roles and code, source code management system and migrations. What is Version Control and GIT, GIT Installation, GIT features, GIT workflow, working withremote repository, GIT commands, GIT branching, GIT staging and collaboration. UNIT TESTING - CODE COVERAGE: Junit, nUnit & Code Coverage with Sonar Qube, SonarQube - Code Quality Analysis.

UNIT-III

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

UNIT-IV

Continuous Delivery (CD): Importance of Continuous Delivery, CONTINUOUS DEPLOYMENT CD Flow, Containerization with Docker: Introduction to Docker, Docker installation, Docker commands, Images & Containers, DockerFile, Running containers, Working with containers and publish to Docker Hub.

TestingTools: IntroductiontoSeleniumanditsfeatures,JavaScripttesting.

UNIT-V

ConfigurationManagement-ANSIBLE: IntroductiontoAnsible,Ansibletasks,Roles, Jinja templating, Vaults, Deployments using Ansible.

CONTAINERIZATION USING KUBERNETES(OPENSHIFT): Introduction to Kubernetes Namespace & Resources, CI/CD - On OCP, BC, DC & ConfigMaps, Deploying Apps on Openshift Container Pods. Introduction to Puppet master and Chef.

TextBooks:

1. Joyner,Joseph.,DevopsforBeginners:DevopsSoftwareDevelopmentMethodGuide for Software Developers and It Professionals, 1st Edition Mihails Konoplows, 2015.
2. AlissonMachadodeMenezes.,Hands-onDevOpswithLinux,1st Edition,BPBPublications, India, 2021.

ReferenceBooks:

1. LenBass,IngoWeber,LimingZhu.DevOps:ASoftwareArchitect'sPerspective. Addison Wesley; ISBN-10
2. GeneKimJeHumble,PatrickDebois,JohnWillis.TheDevOpsHandbook,1st Edition, IT Revolution Press, 2016.
3. Verona,JoakimPractical DevOps,1st Edition,PacktPublishing,2016.
4. JoakimVerona.PracticalDevops,Ingramshorttitle;2nd edition(2018).ISBN10: 1788392574
5. Deepak Gaikwad, Viral Thakkar.DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

IIIYearII Semester	MACHINE LEARNING	L	T	P	C
		3	0	0	3

Course Objectives:

Theobjectives of the courseis to

- Definemachinelearninganditsdifferenttypes(supervisedandunsupervised)and understand their applications.
- Applysupervisedlearningalgorithmsincludingdecisiontreesandk-nearest neighbours (k-NN).
- Implementunsupervisedlearningtechniques,suchasK-meansclustering.

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

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

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

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

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

TextBooks:

1."MachineLearningTheoryandPractice",MNMurthy,VSAnanthanarayana,Universities Press (India), 2024

ReferenceBooks:

1. "MachineLearning", TomM.Mitchell,McGraw-HillPublication, 2017
2. "MachineLearningin Action",PeterHarrington, DreamTech
3. "IntroductiontoDataMining",Pang-NingTan,MichelStenbach,VipinKumar,7th Edition, 2019.

IIIYearII Semester	SOFTWAREPROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:
Attheend ofthe course,the studentshall beable to:

- To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
- Tocompare anddifferentiateorganizationstructuresandprojectstructures
- To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

UNIT-I:
Conventional Software Management: The waterfall model, conventional software Management performance.
Evolution of Software Economics: Software Economics, pragmatic software costestimation.
Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.
The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

UNIT-II:
Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.
Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT-III:
Modelbasedsoftwarearchitectures:AManagementperspective andtechnicalperspective.
Work Flows of the process: Software process workflows, Iteration workflows.**Checkpointsoftheprocess:Major**milestones,MinorMilestones,Periodicstatus assessments.
IterativeProcessPlanning: Workbreakdownstructures,planningguidelines,costand schedule estimating, Iteration planning process, Pragmatic planning.

UNIT- IV:
ProjectOrganizationsandResponsibilities: Line-of-BusinessOrganizations,Project Organizations, evolution of Organizations.
ProcessAutomation: AutomationBuildingblocks,TheProjectEnvironment.

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

UNIT-V:

Agile Methodology, ADAPTing to Scrum, Patterns for Adopting Scrum, Iterating towards Agility. **Fundamentals of DevOps**: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps deliverypipeline, DevOps eco system. DevOps adoption in projects: Technologyaspects, Agiling capabilities, Tool stack implementation, People aspect, processes

Text Books:

1. SoftwareProjectManagement,WalkerRoyce,PEA,2005.
2. Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
3. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.

ReferenceBooks:

1. SoftwareProjectManagement,BobHughes,3/e, MikeCotterell,TMH
2. SoftwareProjectManagement,JoelHenry,PEA
3. SoftwareProjectManagementinpractice,PankajJalote,PEA,2005,
4. EffectiveSoftwareProjectManagement,RobertK.Wysocki,Wiley,2006.
5. ProjectManagementin IT,KathySchwalbe,Cengage

IIIYearII Semester	MOBILE ADHOC NETWORKS (CommontoCSE,CS,IT,CSE(AI), CSE (AI &ML, CSD)	L	T	P	C
		3	0	0	3

Course Objectives:

Fromthe coursethe student will learn

- Architectsensornetworksforvariousapplicationsetups.
- Deviseappropriatedata disseminationprotocolsandmodellinkscost.
- Understandingofthefundamentalconceptsofwirelesssensornetworksandhasa basic knowledge of the various protocols at various layers.
- Evaluatethe performanceof sensornetworksandidentifybottlenecks.

UNIT I: Introduction to Ad Hoc Wireless Networks- Cellular and Ad Hoc Wireless Networks, Characteristics of MANETs, Applications of MANETs, Issues and Challenges of MANETs, Ad Hoc Wireless Internet, MAC protocols for Ad hoc Wireless Networks-Issues, Design Goals and Classifications of the MAC Protocols.

UNIT II: Routing Protocols for Ad Hoc Wireless Networks- Issues in Designing aRouting Protocol, Classifications of Routing Protocols,Topology-based versus Position-based Approaches, Issues and design goals of a Transport layer protocol, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks, Solutions for TCP over Ad Hoc Wireless Networks, Other Transport layer protocols.

UNIT III: Security protocols for Ad hoc Wireless Networks- Securityin Ad hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad hoc Wireless Networks, Cooperation in MANETs, Intrusion Detection Systems.

UNIT IV: Basics of Wireless Sensors and Applications- The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications, Data Retrieval in Sensor Networks-Classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

UNIT V: Security in WSNs- Security in WSNs, Key Management in WSNs, Secure Data Aggregation in WSNs, Sensor Network Hardware-Components of Sensor Mote, Sensor Network Operating Systems–TinyOS, LA-TinyOS, SOS, RETOS, Imperative Language-nesC, **Dataflow Style Language-**TinyGALS, Node-Level Simulators, NS-2 and its sensor network extension, TOSSIM.

TextBooks:

1. Ad Hoc Wireless Networks – Architectures and Protocols, 1st edition, C. Siva Ram Murthy, B. S. Murthy, Pearson Education, 2004
2. Ad Hoc and Sensor Networks – Theory and Applications, 2nd edition *Carlos Corderio Dharma P.Aggarwal*, World Scientific Publications / Cambridge University Press, March 2006

ReferenceBooks:

1. Wireless Sensor Networks: An Information Processing Approach, 1st edition, *Feng Zhao, Leonidas Guibas*,Elsevier Science imprint, Morgan Kauffman Publishers,2005, rp2009
2. Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, 1stedition,SubirKumarSarkar,etal.,AuerbachPublications,Taylor&FrancisGroup, 2008
3. AdhocNetworking,1stedition,*CharlesE.Perkins*,PearsonEducation, 2001
4. Wireless Ad hoc Networking, 1st edition, *Shih-Lin Wu, Yu-Chee Tseng,* Auerbach Publications, Taylor & Francis Group, 2007
5. Wireless Sensor Networks – Principles and Practice, 1st edition, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010

IIIYearII Semester	NATURALLANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives:

Thiscourseintroducesthefundamentalconceptsandtechniquesofnaturallanguage processing (NLP).

- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
- Enablestudentstobecapabletodescribetheapplicationbasedonnaturallanguage processing and to show the points of syntactic, semantic and pragmatic processing.

UNITI:

INTRODUCTION: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNITII:

WORD LEVEL ANALYSIS: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part- of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNITIII:

SYNTACTIC ANALYSIS: Context-Free Grammars, Grammar rules for English,Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification offeature structures

UNITIV:

SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – WordSenses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNITV:

DISCOURSE ANALYSIS AND LEXICAL RESOURCES: Discourse segmentation, Coherence–ReferencePhenomena,AnaphoraResolutionusingHobbsandCentering

Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

TextBooks:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Daniel Jurafsky, James H. Martin - Pearson Publication,2014.
2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, OReilly Media,2009.

ReferenceBooks:

1. Language Processing with Java andLing Pipe Cookbook, 1st Edition, BreckBaldwin,Atlantic Publisher, 2015.
2. NaturalLanguageProcessingwithJava,2nd Edition,RichardMReese,OReilly Media,2015.
3. HandbookofNaturalLanguageProcessing,Second,NitinIndurkhyaandFredJ. Damerau, Chapman and Hall/CRC Press, 2010.Edition
4. NaturalLanguageProcessingandInformationRetrieval,3rd Edition,TanveerSiddiqui, U.S.Tiwary,OxfordUniversityPress,2008.

IIIYearII Semester	BIGDATA ANALYTICS	L	T	P	C
		3	0	0	3

CourseObjectives: Thiscourseisaimed atenablingthestudents to

- Toprovideanoverviewofanexciting growingfieldof bigdata analytics.
- TointroducethetoolsrequiredtomanageandanalyzebigdatalikeHadoop,NoSQL, Map Reduce, HIVE, Cassandra, Spark.
- To teach the fundamental techniques and principles in achieving big data analytics withscalability and streaming capability.
- TooptimizebusinessdecisionsandcreateCompetitiveadvantagewithBigDataanalytics

UNIT I: big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics,inter and trans firewall analytics.

UNIT II: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views,distributionmodels,sharding,master-slavereplication,peer-peerreplication,sharding andreplication,consistency,relaxingconsistency,versionstamps,WorkingwithCassandra ,Tablecreation,loadingandreadingdata.

UNIT III: Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance, with data replication, High availability, Data locality, Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization. Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

UNIT IV: Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions,Dataframes,RDDtoDataframes,Catalystoptimizer,DataFrameTransformations,Worki ng with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers-StandaloneMode, Sparkon YARN, Spark Logs, TheSparkUI-SparkUIHistory Server, Debugging and Spark First Aid

UNIT V: Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and StatefullProcessing-EventTime,StatefullProcessing,WindowsonEventTime-Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream,Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

TextBooks:

1. BigData,BigAnalytics:Emerging,MichaelMinnelli,MichelleChambers,and AmbigaDhiraj, 1st edition ,2013
2. SPARK:TheDefinitiveGuide,BillChambers&MateiZaharia,O'Reilley,2018-firstEdition.
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley,First edition-2013.
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional, 2012
5. TomWhite,"Hadoop:TheDefinitiveGuide",ThirdEdition,O'Reilley,2012

ReferenceBooks:

1. "HadoopOperations",O'Reilley,EricSammer,FirstEdition-2012.
2. "ProgrammingHive",O'Reilley,E.Capriolo,D.Wampler,andJ.Rutherglen,2012.
3. "HBase:TheDefinitiveGuide",O'Reilley,LarsGeorge,September2011:FirstEdition..
4. "Cassandra: The Definitive Guide", O'Reilley, Eben Hewitt, 2010.

"ProgrammingPig",O'Reilley,AlanGates,October2011:FirstEdition

IIIYearII Semester	DISTRIBUTEDOPERATINGSYSTEM	L	T	P	C
		3	0	0	3

Course Objectives:

The main objective of the course is to introduce design issues and different message passing techniques in DOS, distributed systems, RPC implementation and its performance in DOS, distributed shared memory and resource management, distributed file systems and evaluate the performance in terms of fault tolerance, file replication as major factors

Unit I:

Fundamentals:

What is Distributed Computing Systems? Evolution of Distributed Computing System; Distributed Computing System Models; What is Distributed Operating System? Issues in Designing a Distributed Operating System; Introduction to Distributed Computing Environment(DCE).

MessagePassing:

Introduction, Desirable features of a Good Message Passing System, Issues in PC byMessage Passing, Synchronization, Buffering, Multi-datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication, Case Study: 4.3 BSD UNIX IPC Mechanism.

UnitII:RemoteProcedure Calls:

Introduction, The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Parameter-Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client-Server Binding, Exception Handling, Security, Some Special Types of RPCs, RPC in Heterogeneous Environments, Lightweight RPC, Optimization for Better Performance, Case Studies: Sun RPC

UnitIII:DistributedSharedMemory:

Introduction, General Architecture of DSM systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM. Synchronization: Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Dead Lock, Election Algorithms

UnitIV:Resource Management:

Introduction, Desirable Features of a Good Global Scheduling Algorithm, Task Assignment Approach, Load – Balancing Approach, Load – Sharing Approach Process Management: Introduction, Process Migration, Threads.

UnitV:DistributedFile Systems:

Introduction, Desirable Features of a Good Distributed File System, File models, File– AccessingModels, File– SharingSemantics,File –CachingSchemes,FileReplication,Fault Tolerance, Atomic Transactions and Design Principles.

Textbooks

1. Pradeep.K.Sinha:DistributedOperatingSystems:ConceptsandDesign,PHI,2007.

ReferenceBooks:

1. AndrewS.Tanenbaum:DistributedOperatingSystems,PearsonEducation,2013.
2. AjayD. Kshemkalyani andMukeshSinghal,DistributedComputing:Principles,Algorithms and Systems, Cambridge University Press, 2008
3. SunitaMahajan,Seema Shan,"Distributed Computing",OxfordUniversityPress,2015

IIIYearII Semester	CLOUDCOMPUTING LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- Tointroducethevariouslevels ofservicesofferedbycloud.
- Togivepracticalknowledge aboutworkingwithvirtualizationandcontainers.
- Tointroducetheadvancedconceptssuchasserverlesscomputingandcloud simulation.

CourseOutcomes: At theendofthe course, thestudentshould beable to

- Demonstratevariousservicetypes,deliverymodelsandtechnologiesofacloudcomputing environment.
- Distinguishtheservicesbasedonvirtualmachinesandcontainersinthecloud offerings.
- Assessthechallengesassociated witha cloud-based application.
- Discussadvancedcloudconceptssuch asserverlesscomputingandcloudsimulation.
- Examine various programming paradigms suitable to solve real world and scientificproblems using cloud services.

List ofExperiments:

1. Labonwebservices
2. Labon IPC,messaging,publish/subscribe
3. InstallVirtual Box/VMwareWorkstationwithdifferentflavoursof Linux orwindowsOS on top of windows8 or above.
4. Install a C compiler in the virtual machine created using Virtual Box and execute Simple Programs.
5. Create an Amazon EC2 instance and set up a web-server on the instance and associate an IP address with the instance. In the process, create a security group allowing access toport 80 on the instance.

OR

6. Dothesamewith OpenStack
7. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
8. Start a Docker container and set up a web-server (e.g. apache2 or Python based Flask micro web framework) on the instance. Map the host directory as a data volume for the container.
9. Findaproceduretotransferthe filesfromonevirtualmachinetoanothervirtualmachine. Similarly, from one container to another container.
10. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
11. InstallHadoopsinglenodeclusterand runsimpleapplicationslikewordcount.

12. Utilize OpenFaaS – Serverless computing framework and demonstrate basic event driven function invocation.
13. SimulateacloudscenariousingCloudSimandrunaschedulingalgorithmthatisnot present in CloudSim.

TextBooks:

1. MasteringCloudComputing,2nd edition,RajkumarBuyya,ChristianVecchiola,Thamarai Selvi, Shivananda Poojara, Satish N. Srirama, McGraw Hill, 2024.
2. Distributed and Cloud Computing, KaiHwang,Geoffery C. Fox, Jack J. Dongarra,Elsevier, 2012.

ReferenceBooks:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Cloud Computing: Principles and Paradigms byRajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
3. Online documentation and tutorials from cloud service providers (e.g. AWS, Google App Engine)
4. Docker,Referencedocumentation,https://docs.docker.com/reference/
5. OpenFaaS,ServerlessFunctionsMadeSimple,https://docs.openfaas.com/

IIIYearII Semester	CRYPTOGRAPHY& NETWORK SECURITYLAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- Tolearnbasicunderstandingofcryptography,howithasevolved,andsomekey encryption techniques used today.
- TounderstandandimplementencryptionanddecryptionusingCeaserCipher, Substitution Cipher, Hill Cipher.

List ofExperiments:

1. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result
3. Write a Java program to perform encryption and decryption using the following algorithms:
   a) CeaserCipher
   b) Substitution Cipher
   c) Hill Cipher
4. WriteaJavaprogramto implementthe DESalgorithm logic
5. WriteaC/JAVAprogramtoimplementtheBlowFishalgorithm logic
6. WriteaC/JAVAprogramtoimplementtheRijndaelalgorithmlogic.
7. Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create yourown key using Java key tool.
8. WriteaJavaprogram toimplement RSA Algorithm
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Considertheend useras oneoftheparties(Alice)andtheJavaScriptapplicationasother party (bob).
10. Calculatethemessagedigestofatextusingthe SHA-1algorithm in JAVA.

IIIYearII Semester	SOFTSKILLS	L	T	P	C
		0	1	2	2

Course Objectives:

- Toequip thestudents withthe skillsto effectivelycommunicate in English
- Totrainthestudentsininterview skills,groupdiscussionsandpresentation skills
- Tomotivatethestudents todevelop confidence
- Toenhancethestudents' interpersonalskills
- Toimprovethe students'writing skills

UNIT– I

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - ATalk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT– II

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

Etiquette: SocialEtiquette,BusinessEtiquette,TelephoneEtiquette,DiningEtiquette

UNIT– III

Standard Operation Methods : Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking,Minutes Preparation, Email & Letter Writing

UNIT-IV

Job-Oriented Skills: Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews

UNIT-V

Interpersonal relationships: Introduction, Importance, Types, Uses,Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships

Textbooks:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press,2011.
2. S.P.Dhanavel,EnglishandSoftSkills,OrientBlackswan,2010.

Referencebooks:

1. R.S.Aggarwal, A Modern Approach to Verbal& Non-Verbal Reasoning,S.Chand& Company Ltd., 2018.
2. Raman,Meenakshi&Sharma,Sangeeta,TechnicalCommunicationPrinciplesand Practice, Oxford University Press, 2011.

E-resources:

1. https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01

IIIYearII Semester	TECHNICALPAPERWRITING&IPR	L	T	P	C
		2	0	0	-

Course Objective : The course will explain the basic related to writing the technical reports andunderstandingtheconceptsrelatedtoformattingandstructuringthereport.Thiswillhelp students to comprehend the concept of proofreading, proposals and practice

Unit I:

Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.

Planning and Structuring: Planningthereport,identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing.

Unit II:

Draftingreportanddesign issues: Theuseofdrafts,Illustrationsandgraphics.

Final edits: Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

Unit III:

Proofreading and summaries: Proofreading, summaries, Activities on summaries. **Presenting final reports:** Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

UnitIV: Usingword processor:

Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes , Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,

Unit V:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of **Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property

TextBooks:

1. Kompal Bansal & Parshit Bansal, "Fundamentals of IPR for Beginner's", 1st Ed., BS Publications, 2016.
2. WilliamS.PfeifferandKayeA.Adkins,"TechnicalCommunication:APractical Approach", Pearson.
3. Ramappa,T.,"IntellectualPropertyRightsUnder WTO",2ndEd.,S Chand,2015.

ReferenceBooks:

1. AdrianWallwork,EnglishforWritingResearchPapers,SpringerNewYork Dordrecht Heidelberg London, 2011.
2. DayR,HowtoWriteandPublishaScientificPaper,CambridgeUniversity Press(2006)

E-resources:

1. https://www.udemy.com/course/reportwriting/
2. https://www.udemy.com/course/professional-business-english-and-technical-report-writing/
3. https://www.udemy.com/course/betterbusinesswriting/

Syllabus

for

OpenElectives &Minors

	PRINCIPLESOFOPERATING SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

Themain objectives of thecourseis to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Makeuseofprocessschedulingalgorithmsandsynchronizationtechniquestoachieve better performance of a computer system.
- Illustratedifferentconditionsfordeadlock andtheirpossible solutions.

UNIT-I

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems

System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design andImplementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT-II

Processes:ProcessConcept,Processscheduling,Operationsonprocesses,Inter-processcommunication.

ThreadsandConcurrency: Multithreadingmodels,Threadlibraries,Threadingissues.

CPUScheduling:Basicconcepts,Schedulingcriteria,Schedulingalgorithms,Multiple processor scheduling.

UNIT– III

SynchronizationTools:TheCriticalSectionProblem,Peterson'sSolution,MutexLocks, Semaphores, Monitors, Classic problems of Synchronization.

Deadlocks:systemModel,Deadlockcharacterization,MethodsforhandlingDeadlocks.

UNIT-IV

Memory-ManagementStrategies:Introduction,Contiguousmemoryallocation,Paging, Structure of the Page Table, Swapping.

Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing

StorageManagement:OverviewofMassStorageStructure,HDDScheduling.

UNIT-V

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File-System Mounting, Partitions and Mounting, File Sharing.

TextBooks:

1. OperatingSystemConcepts,SilberschatzA,GalvinPB,GagneG, 10th Edition, Wiley, 2018.
2. ModernOperatingSystems, TanenbaumA S,4th Edition, Pearson, 2016

ReferenceBooks:

1. OperatingSystems:AConceptBasedApproach,D.MDhamdhere,3rdEdition, McGraw-Hill, 2013

OnlineLearningResources:

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

	COMPUTERORGANIZATIONAND ARCHITECTURE	L	T	P	C
		3	0	0	3

Course Objectives:

The purpose of the course is to introduce principles of computer organization and the basic architectural concepts. It provides an in depth understanding of basic organization, design, programmingof a simple digital computer, computer arithmetic, instruction set design, micro programmed control unit, pipelining and vector processing, memory organization and I/O systems

UNITI:

BasicStructureOfComputers:ComputerTypes,Functionalunit,BasicOperationalconcepts, Bus structures, Software, Performance, multiprocessors and multi computers.

Logic gates: Digital Logic gates,Two-level realizations using gates - AND-OR, OR-AND, NAND-NAND and NOR-NOR

UNITII:

Sequential circuits I: Classification of sequential circuits (synchronous and asynchronous): basic flip-flops, truth tables and excitation tables (NAND RS latch, NOR RS latch, RS flip-flop. JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals).Conversion of flip-flop to flip-flop, Race around condition, Master J-K flipflop

Register Transfer Language And Micro-operations: Register Transfer language. Register Transfer Bus and memory transfers, Arithmetic Micro-operations, Logic micro operations, shift micro operations, Arithmetic logic shift unit. Instruction codes. Computer Registers, Computer instructions, Instruction cycle.

UNITIII:

Micro Programmed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

UNITIV:

Microprocessors: Evaluation of Microprocessors, CISC and RISC, Characteristics of Microprocessors

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Cache memories performance considerations, Virtual memories Introduction to Shift registers and RAID

UNITV:

Input – Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, DMA, Input Output Processor, Serial Communication.

TextBooks:

1. Digital LogicandComputerDesign,MorissMano,11thEdition,PearsonEducation.
2. ComputerOrganization,5thed.,Hamacher,VranesicandZaky,TMH,2002
3. ComputerSystemArchitecture,3/e, MorisMano,Pearson/PHI.

ReferenceBooks:

1. ComputerSystemOrganization&Architecture,JohnD.Carpinelli, Pearson,2008
2. ComputerSystemOrganization,NareshJotwani,TMH,2009
3. ComputerOrganization&Architecture:DesigningforPerformance,7th ed.,WilliamStallings, PHI, 2006
4. StructuredComputerOrganization,Andrew S.Tanenbaum,4thEdition,PHI/Pearson.

	PRINCIPLESOFDATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

Themain objectives ofthecourseis to

- Introduce database management systems and to give a good formal foundation on the relational model of data
- Introducethe conceptsofSQL
- Demonstratetheprinciplesbehind systematicdatabasedesignapproaches bycovering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing database storage techniques

UNITI:

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models;ConceptsofSchema,Instanceanddataindependence;Threetierschemaarchitecture for data independence; Database system structure, environment, Centralized and ClientServer architecture for the database.

UNITII:

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

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance.

UNITIII:

BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

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

UNITIV:

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

UNITV:

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

TextBooks:

1) Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2) DatabaseSystemConcepts,5thedition,Silberschatz,Korth,Sudarsan,TMH(ForChapter 1 and Chapter 5)

ReferenceBooks:

1) IntroductiontoDatabase Systems, 8thedition,CJDate, Pearson.
2) DatabaseManagementSystem,6thedition,RamezElmasri,ShamkantB.Navathe, Pearson
3) Database Principles Fundamentals of Design Implementation and Management, 10th edition, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning, 2022

Web-Resources:

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

	PRINCIPLES OF DATABASE MANAGEMENTSYSTEMSLAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

ThisCoursewill enable students to

- Populateandquerya database usingSQLDDL/DMLCommands
- Declareandenforceintegrityconstraintsonadatabase
- WritingQueriesusingadvancedconceptsofSQL
- ProgrammingPL/SQLincludingprocedures,functions,cursorsandtriggers

Experimentscoveringthetopics:

- DDL,DML,DCLcommands
- Queries,nestedqueries, built-infunctions,
- PL/SQLprogramming-control structures
- Procedures,Functions,Cursors, Triggers,

SampleExperiments:

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables), examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints.
   Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), stringfunctions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr andinstr),datefunctions(Sysdate,next_day,add_months,last_day,months_between, least, greatest, trunc, round, to_char, to_date)
5. i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the tableand printed for thosewhosecured first class and an exception can be raisedifno records were found)
   ii. InsertdataintostudenttableanduseCOMMIT,ROLLBACKand SAVEPOINT in PL/SQL block.
6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.
8. Program development using creation of procedures, passing parameters IN and OUT of PROCEDURES.

9. Programdevelopmentusingcreationofstoredfunctions,invokefunctionsinSQL Statements and write complex functions.
10. DevelopprogramsusingfeaturesparametersinaCURSOR,FORUPDATECURSOR, WHERE CURRENT of clause and CURSOR variables.
11. DevelopProgramsusingBEFOREandAFTERTriggers,RowandStatement Triggers and INSTEAD OF Triggers

TextBooks/SuggestedReading:

1. Oracle:TheCompleteReferencebyOracle Press
2. NileshShah,"DatabaseSystemsUsingOracle",PHI,2007
3. RickFVanderLans,"IntroductiontoSQL",FourthEdition,PearsonEducation,2007

	OBJECTORIENTEDPROGRAMMING THROUGH JAVA	L	T	P	C
		3	0	0	3

Course Objectives:

Thelearningobjectives of this courseareto:

- identifyJavalanguagecomponents and how theywork together inapplications
- Learn the fundamentals of object-oriented programming in Java, including definingclasses, invoking methods, using class libraries.
- learnhowtoextendJavaclasseswithinheritanceanddynamicbindingandhowto use exception handling in Java applications
- understandhowto designapplicationswith threadsin Java
- understandhowtouseJavaAPIsforprogram development

UNITI:

ObjectOrientedProgramming:Basicconcepts,Principles,

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

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

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

UNITII:

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded ConstructorMethods,NestedClasses,FinalClassandMethods,PassingArgumentsbyValue and by Reference, Keyword this.

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

UNITIII:

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

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

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

UNITIV:

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

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

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

UNITV:

StringHandlinginJava:Introduction,InterfaceCharSequence,ClassString,Methodsfor Extracting Characters from Strings,Comparison, Modifying, Searching; Class String Buffer.

MultithreadedProgramming:Introduction,NeedforMultipleThreadsMultithreadedProgrammingforMulti-coreProcessor,ThreadClass,MainThread-CreationofNew Threads,ThreadStates,ThreadPriority-Synchronization,DeadlockandRaceSituations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

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

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

TextBooks:

1) JAVAonestep ahead,Anitha Seth,B.L.Juneja, Oxford.
2) JoywithJAVA,FundamentalsofObjectOrientedProgramming,DebasisSamanta,Monalisa Sarma, Cambridge, 2023.
3) JAVA9forProgrammers,PaulDeitel, HarveyDeitel,4thEdition, Pearson.

ReferencesBooks:

1) ThecompleteReferenceJava,11thedition,Herbert Schildt,TMH
2) IntroductiontoJavaprogramming,7thEdition,YDaniel Liang, Pearson

OnlineResources:

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

	ADVANCEDDATASTRUCTURES& ALGORITHM ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:

Themain objectives ofthecourseis to

- provideknowledgeonadvancedatastructuresfrequentlyusedinComputerScience domain
- Developskillsinalgorithmdesigntechniquespopularlyused
- Understandthe useof various datastructures inthealgorithm design

UNIT– I:

IntroductiontoAlgorithmAnalysis,SpaceandTimeComplexityanalysis,Asymptotic Notations. AVLTrees–Creation,Insertion,DeletionoperationsandApplications B-Trees – Creation, Insertion, Deletion operations and Applications

UNIT– II:

HeapTrees (PriorityQueues)–Min andMaxHeaps,Operations and Applications

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

DivideandConquer:TheGeneralMethod,QuickSort,MergeSort,Strassen'smatrix multiplication, Convex Hull

UNIT– III:

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

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

UNIT– IV:

Backtracking:GeneralMethod,8-QueensProblem,SumofSubsetsproblem,Graph Coloring, 0/1 Knapsack Problem

BranchandBound:TheGeneralMethod,0/1KnapsackProblem,TravellingSalesperson Problem

UNIT– V:

NPHardandNPCompleteProblems:BasicConcepts,Cook's theorem

NPHardGraphProblems:CliqueDecisionProblem(CDP),ChromaticNumberDecision Problem (CNDP), Traveling Salesperson Decision Problem (TSP)

NPHardSchedulingProblems:SchedulingIdentical Processors,JobShop Scheduling

Textbooks:

1. FundamentalsofDataStructuresinC++,Horowitz,Ellis;Sahni,Sartaj;Mehta,Dinesh, 2ndEdition Universities Press

2. ComputerAlgorithmsinC++,EllisHorowitz,SartajSahni,SanguthevarRajasekaran,2nd Edition University Press

ReferenceBooks:

1. DataStructuresandprogramdesigninC,RobertKruse,PearsonEducationAsia
2. AnintroductiontoDataStructureswithapplications,Trembley&Sorenson,McGraw Hill
3. TheArtofComputerProgramming,Vol.1:FundamentalAlgorithms,DonaldEKnuth, Addison-Wesley, 1997.
4. DataStructuresusingC&C++:Langsam,Augenstein&Tanenbaum,Pearson,1995
5. Algorithms+DataStructures &Programs:,N.Wirth,PHI
6. Fundamentalsof Data StructuresinC++:Horowitz Sahni&Mehta,GalgottiaPub.
7. DatastructuresinJava:,ThomasStandish,PearsonEducation Asia

OnlineLearningResources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. AbdulBari,IntroductiontoAlgorithms(youtube.com)

	ADVANCEDDATASTRUCTURES& ALGORITHM ANALYSIS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

Theobjectives of the courseis to

- acquirepracticalskillsinconstructingandmanagingDatastructures
- applythe popular algorithm design methods in problem-solving scenarios

ExperimentscoveringtheTopics:

- OperationsonAVLtrees,B-Trees,HeapTrees
- GraphTraversals
- Sortingtechniques
- Minimumcostspanning trees
- Shortestpathalgorithms
- 0/1KnapsackProblem
- TravellingSalesperson problem
- OptimalBinarySearch Trees
- N-QueensProblem
- JobSequencing

SamplePrograms:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
2. ConstructB-Treeanorderof5withasetof100randomelementsstoredinarray. Implement searching, insertion and deletion operations.
3. ConstructMinandMaxHeapusingarrays,deleteanyelementanddisplaythecontent of the Heap.
4. Implement BFTandDFTforgivengraph,whengraphisrepresentedby a)AdjacencyMatrixb) AdjacencyLists
5. Writeaprogram for findingthebiconnectedcomponentsin agivengraph.
6. ImplementQuicksortandMergesortandobservetheexecutiontimeforvarious input sizes (Average, Worst and Best cases).
7. ComparetheperformanceofSingleSourceShortestPathsusingGreedymethodwhen the graph is represented by adjacency matrix and adjacency lists.
8. ImplementJobSequencingwith deadlinesusingGreedystrategy.
9. Writeaprogramto solve 0/1 Knapsackproblem UsingDynamicProgramming.
10. ImplementN-QueensProblemUsingBacktracking.
11. UseBacktrackingstrategytosolve0/1 Knapsackproblem.
12. ImplementTravellingSalesPersonproblemusingBranchandBoundapproach.

ReferenceBooks:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, Sahni Sartaj, Mehta, Dinesh,2nd Edition, Universities Press
2. Computer Algorithms/C++ EllisHorowitz, SartajSahni, Sanguthevar Rajasekaran,2nd Edition, University Press
3. DataStructuresandprogramdesigninC,RobertKruse,PearsonEducationAsia
4. An introductionto Data Structureswithapplications,Trembley & Sorenson,McGraw Hill

OnlineLearningResources:

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

	PRINCIPLESOFSOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

Theobjectives of thiscourseareto introduce

- Softwarelifecyclemodels, SoftwarerequirementsandSRS document.
- ProjectPlanning, qualitycontrol andensuringgood qualitysoftware.
- Software Testing strategies, use of CASE tools, Implementation issues, validation & verification procedures.

UNITI:

Introduction: Evolution, Software development projects, Exploratory style of software developments,Emergenceofsoftwareengineering,Notablechangesinsoftwaredevelopment practices, Computer system engineering.

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

UNITII:

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

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

UNITIII:

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

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

Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.

User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNITIV:

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

Software Reliability and Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma**.**

UNITV:

Software Maintenance: Characteristicsof softwaremaintenance, Softwarereverse engineering, Software maintenance process models and Estimation of maintenance cost.

Software Reuse: reuse- definition, introduction, reason behind no reuse so far, Basic issuesin any reuse program, A reuse approach, and Reuse at organization level.

TextBooks:

1. FundamentalsofSoftwareEngineering,Rajib Mall,5th Edition,PHI.
2. SoftwareEngineering:APractitioner'sApproach,RogerS.Pressman,9th Edition, Mc-Graw Hill International Edition.

ReferenceBooks:

1. SoftwareEngineering, IanSommerville,10th Edition,Pearson.
2. Software Engineering, PrinciplesandPractices,DeepakJain,OxfordUniversity Press.

e-Resources:

1) https://nptel.ac.in/courses/106/105/106105182/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview
3) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01338269041100390473 5_shared/overview

	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

- Toprovide insightaboutnetworks,topologies,andthe key concepts.
- To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
- To understand the principles, keyprotocols, design issues, and significance of each layers in ISO and TCP/IP.
- Toknowthebasic conceptsof networkservices andvarious networkapplications.

UNIT I: Introduction: Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSIReference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP.
Physical Layer –Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and introduction about unguided media.

UNIT II: Data link layer: Design issues, **Framing**: fixed size framing, variable sizeframing, flow control, error control, error detection and correction codes, CRC, Checksum: idea,one's complementinternet checksum, servicesprovided toNetworkLayer, **Elementary Data Link Layer protocols**: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel.
Sliding window protocol: Onebit, Goback N,Selectiverepeat-Stop and wait protocol, Data link layer in HDLC, Point to point protocol (PPP)

UNIT – III: Media Access Control: Random Access: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA).
Wired LANs: Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.

UNIT – IV: 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, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices, Approaches to Congestion Control-Traffic Aware Routing-Admission Control-Traffic Throttling-Load Shedding. Traffic Control Algorithm-Leaky bucket & Token bucket.

Internet Working: How networks differ- How networks can be connected- Tunnelling, internetwork routing-, Fragmentation, network layer in the internet – IP protocols-IP Version 4 protocol-IPV4 Header Format, IP addresses, Class full Addressing, CIDR, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4 to IPV6, Comparison of IPV4 &IPV6.

UNIT –V: The Transport Layer: Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services- TCP features- Segment- A TCP connection-windows in TCP- flow control-Error control, Congestion control in TCP.
Application Layer –- World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System.

TextBooks:

3. ComputerNetworksm,AndrewS Tanenbaum,FifthEdition.Pearson Education/PHI
4. DataCommunicationsandNetworks, BehrouzA.Forouzan,FifthEditionTMH.

ReferencesBooks:

3. DataCommunicationsandNetworks-AchutS Godbole, AtulKahate
4. ComputerNetworks,MayankDave, CENGAGE

B.Tech.IVYearI Semester

S. No.	Category	Title	L	T	P	C
1	Professional Core	DeepLearning	2	1	0	3
2	Management Course-II	HumanResources&Project Management	2	0	0	2
3	Professional Elective-IV	1. SoftwareArchitecture&Design Patterns 2. BlockchainTechnology 3. AugmentedReality&Virtual Reality 4. Internetof Things 5. AgenticAI 6. 12 week MOOC Swayam/NPTEL course recommendedbytheBoS	3	0	0	3
4	Professional Elective-V	1. AgileMethodologies 2. GenerativeAI 3. ComputerVision 4. CyberPhysical Systems 5. 12 week MOOC Swayam / NPTELcourserecommended by the BoS	3	0	0	3
5	Open Elective-III		3	0	0	3
6	Open Elective-IV		3	0	0	3
7	Skill Enhancement Course	PromptEngineering/SWAYAM Plus-CertificateprograminPrompt Engineering and ChatGPT	0	1	2	2
8	Audit Course	Constitution ofIndia	2	0	0	-
9	Internship	Evaluationof Industry Internship/MiniProject	-	-	-	2
Total			**18**	**2**	**02**	**21**
MC	Minor Course (Studentmayselectfromthesamespecializedminors pool)		3	0	0	3
HC	Honors Course (Student mayselect from thesame honors pool)		3	0	0	3
HC	Honors Course (Student mayselect from thesame honors pool)		3	0	0	3

B.Tech.IVYearII Semester

S. No.	Category	Title	L	T	P	C
1	Internship&Project Work	FullsemesterInternship & Project Work	0	0	24	12

Note: *Student need to do at least ONE MOOC/NPTEL Course (of 3 credits out of 160credits) to meet the mandatory requirement (11th criteria, as per R23 Regulations); they are allowed to register one semester in advance*

OpenElectives,offeredtootherdepartmentstudents:

OpenElectiveI:PrinciplesofOperatingSystems/ComputerOrganizationand Architecture
Open Elective II: Principles ofDatabaseManagement Systems
OpenElectiveIII:ObjectOrientedProgrammingThroughJava
OpenElective IV:PrinciplesofSoftwareEngineering/Computer Networks

MinorEngineering

Note:

1. *ToobtainMinorEngineering,studentneedstoobtain18creditsbysuccessfully completing any of the following courses in the concern stream.*
2. *DuringMinor/HonorsCourseselection,thereshouldnotbeanyoverlappingwith Regular/Major/OPEN Electives*

MinorinCSE

1. PrinciplesofDatabaseManagementSystems 3-0-3-4.5(II-II)
2. PrinciplesofSoftwareEngineering 3-0-0-3(III-I)
3. Advanced DataStructures&AlgorithmAnalysis 3-0-3-4.5(III-II)
4. PrinciplesofOperatingSystems 3-0-0-3(IV-I)

Anyof thefollowing12Week3credit NPTELMOOC Courses

5. ArtificialIntelligence:KnowledgeRepresentation and Reasoning
6. ComputerNetworksandInternet Protocol
7. MachineLearningandDeepLearning-FundamentalsandApplications
8. Fundamentalsof Object Oriented Programming
9. DiscreteMathematicsfor CS

COURSESOFFEREDFORHONORSDEGREEINCSE

Note: ***To obtain Honor's degree, student needs to obtain 18 credits by successfully completinganyofthefollowingcoursesintheconcernstream.(withoutduplication)***

Suggested MOOC Courses for HONORS in CSE

Studentneedtoobtain18Creditsbysuccessfullycompletingthefollowing

MandatoryCourse(s)

1. ParallelComputer Architecture(MOOCS-SWAYAM/ NPTEL12W)
2. Quantum Algorithms and Cryptography(MOOCS-SWAYAM / NPTEL12W)

Anyofthe followingforremaining 12 Credits

3. DeepLearningfor ComputerVision (MOOCS-SWAYAM / NPTEL12W)
4. AppliedLinear AlgebrainAI&ML(MOOCS- SWAYAM / NPTEL12W)
5. AppliedTime-Series Analysis (MOOCS-SWAYAM / NPTEL12W)
6. Machine Learning for Engineering and Science Applications (MOOCS- SWAYAM / NPTEL 12W)
7. PracticalHigh-PerformanceComputing(MOOCS-SWAYAM/NPTEL12W)
8. DeepLearningforNaturalLanguageProcessing(MOOCS-SWAYAM/NPTEL 12W)
9. Privacyand SecurityinOnline SocialMedia(MOOCS-SWAYAM / NPTEL12W)
10. NaturalLanguageProcessing(MOOCS-SWAYAM /NPTEL12W)

IVYearI Semester	DEEPLEARNING	L	T	P	C
		2	1	0	3

Course Objectives:

Themain objectiveof thecourseis to make students:

- Learndeeplearningmethodsforworkingwithsequentialdata,deeprecurrent& memory networks and deep Turing machines,
- Applysuch deep learningmechanisms to variouslearningproblems.
- Identifytheopenissuesindeeplearning,andhaveagraspofthecurrentresearch directions.

UNITI:

Fundamentals of Deep Learning: Artificial Intelligence, History of Machine learning: Probabilistic Modeling, Early Neural Networks, Kernel Methods, Decision Trees, Random forests and Gradient Boosting Machines, **Fundamentals of Machine Learning:** Four Branches of Machine Learning, Evaluating Machine learning Models, Overfitting and Underfitting. **[Text Book 2]**

UNITII:

Introducing Deep Learning: Biological and Machine Vision, Human and Machine Language, Artificial Neural Networks, Training Deep Networks, Improving Deep Networks. **[Text Book3]**

UNITIII:

Neural Networks: Anatomy of Neural Network, Introduction to Keras: Keras, TensorFlow, Theano and CNTK, Setting up Deep Learning Workstation, Classifying Movie Reviews: Binary Classification, Classifying newswires: Multiclass Classification.**[Text Book 2]**

UNITIV:

Convolutional Neural Networks: Nerual Network and Representation Learing, Convolutional Layers, Multichannel Convolution Operation, **Recurrent Neural Networks:** Introduction to RNN, RNN Code, PyTorch Tensors: Deep Learning with PyTorch, CNN in PyTorch. **[Text Book 3]**

UNITV:

Interactive Applications of Deep Learning: MachineVision,Natural Languageprocessing, Generative Adversial Networks, Deep Reinforcement Learning. **[Text Book 1]**

Deep Learning Research: Autoencoders**,** Deep Generative Models: Boltzmann Machines Restricted Boltzmann Machines, Deep Belief Networks. **[Text Book 1]**

TextBooks:

1. DeepLearning, IanGoodfellow,YoshuaBengio, AaronCourvile,MITPress,2016
2. DeepLearningwithPython,FrancoisChollet,December2017,ManningPublications, ISBN: 9781617294433

3. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence, Jon Krohn, Grant Beyleveld, Aglaé Bassens, September 2019, Addison-Wesley Professional, ISBN: 9780135116821
4. Deep Learning from Scratch, Seth Weidman, September 2019, O'Reilly Media, Inc., ISBN: 9781492041412

ReferenceBooks:

1. ArtificialNeuralNetworks,Yegnanarayana, B.,PHILearningPvt. Ltd,2009.
2. Matrix Computations,Golub,G.,H.,VanLoan,C.,F,JHU Press,2013.
3. NeuralNetworks:AClassroomApproach,SatishKumar,TataMcGraw-HillEducation, 2004.

WebLink:

1. Swayam NPTEL:Deep Learning: https://onlinecourses.nptel.ac.in/noc22_cs22/preview

IVYearI Semester	HUMANRESOURCES&PROJECT MANAGEMENT	L	T	P	C
		2	0	0	2

Course Objectives:

Themain objectivesof thecourse areto

- ProvideknowledgeaboutHRplanning,recruitment,selection,andjobdesign.
- DevelopskillsinmanagingHRfunctionssuchasperformanceappraisal, compensation, and employee relations.
- EmphasizetheimportanceofethicalpracticesandHRauditsinmaintaining organizational health.
- UnderstandtheHRD frameworkanditsimpactonorganizationalsuccess.
- Improvegroupinteractionandteamdynamicsforbettercollaborationand performance.
- Understandthe FundamentalsofProjectManagementandProjectNetworks
- Implementappropriatemanagementstrategiestailoredtospecificchallengesindifferent project types.

UNIT–I:

HRM: Nature, Scope, Concept of HRM, Functions ofHRM, Role of HR manager, emerging trends in HRM, E-HRM, HR audit models, ethical aspects of HRM. HR Planning, Demand and Supply forecasting of HR,Job Design, Recruitment, Sources of recruitment, Selection-Selection Procedure.

UNIT–II:

HRD,HR accounting, Models, Concept ofTraining and Development, Methods ofTraining. PerformanceAppraisal: ImportanceMethodsofperformanceappraisal, CareerDevelopment and Counseling, group interaction.

UNIT–III:

Basicsof Project Management, Concept, resource management, Project environment,Types of Projects, project networks-DPR, Project life cycle, Project proposals, Monitoring projectprogress,Project appraisal andProjectselection,80-20rules, productiontechnology, communication matrix

UNIT-IV:

Identify various project types and their unique management challenges and applyappropriate management strategies for each. Project Implementation and Review: Forms of project organization, project planning, project control, human aspects of project management, prerequisites for successful project implementation, project review, performance evaluation, abandonment analysis

UNIT-V:

Project ImplementationandReview:Formsofprojectorganization,projectplanning,project control, human aspects of project management, prerequisites for successful project implementation, project review, performance evaluation, abandonment analysis

Text Books:

1. RobertL.Mathis,JohnH.Jackson,ManasRanjanTripathy,HumanResource Management, Cengage Learning 2016.
2. SharonPandeandSwapnalekhaBasak,HumanResourceManagement,Textand Cases, Vikas Publishing, 2e, 2016.
3. Stewart R. Clegg, Torgeir Skyttermoen, Anne Live Vaagaasar, Project Management, Sage Publications, 1e, 2021.
4. K.Nagarajan,ProjectManagement,NewAge InternationalPublishers,8e,2017.

ReferenceBooks:

1. Subba Rao P, "Personnel and Human Resource Management-Text and Cases", Himalaya Publications, Mumbai, 2013.
2. KAswathappa,"HumanResourceandPersonnelManagement",TataMcGrawHill, New Delhi, 2013.
3. Prasanna Chandra, "Projects, Planning, Analysis, Selection, Financing, Implementation and Review", Tata McGraw Hill Company Pvt. Ltd., New Delhi, 1998.
4. VasanthDesai,"ProjectManagement",4thedition,HimalayaPublications,2018.
5. LalithaBalakrishnan,Gowri,"ProjectManagement", Himalayapublishinghouse, New Delhi, 2022.

IVYearI Semester	SOFTWAREARCHITECTURE& DESIGN PATTERNS (PROFESSIONALELECTIVE-IV)	L	T	P	C
		3	0	0	3

Course Objectives:

Themain objectives of thecourse areto makestudent

- Understandthe basicconcepts to identifystatebehavior ofreal world objects
- ApplyObjectOrientedAnalysisand Designconceptsto solvecomplexproblems
- ConstructvariousUMLmodelsusingtheappropriatenotationforspecificproblem context
- DesignmodelstoShowtheimportanceofsystemsanalysisanddesigninsolving complex problems using case studies
- StudyPattern Orientedapproach forreal world problems

UNIT– I:

Introduction: design pattern, Describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern What is object oriented development? key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm

UNIT– II:

Analysis a System: Overview of the analysis phase, stage 1 gathering the requirements functionalrequirementsspecification,definingconceptualclassesandrelationships,usingthe knowledge of the domain Design and Implementation, discussions and further reading

UNIT– III:

Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.

UNIT– IV:

Interactive systems and the MVC architecture: Introduction The MVC architectural pattern, analyzing a simple drawing program designing the system, designing of the subsystems, getting into implementation, implementing undo operation drawing incomplete items, adding a new feature pattern based solutions

UNIT– V:

Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web, Web services (SOAP, Restful), Enterprise Service Bus

TextBooks:

1. ObjectOrientedAnalysis,DesignandImplementation,BrahmaDathan,SarnathRammath , Universities Press, 2013
2. DesignPatterns,ErichGamma,RichardHelan,RalphJohman,JohnVlissides, PEARSON Publication, 2013

ReferenceBooks:

1. FrankBachmann,RegineMeunier,HansRohnert“PatternOrientedSoftware Architecture”, Volume 1, 1996.
2. WilliamJBrownetal.,"AntiPatterns:RefactoringSoftware,ArchitecturesandProjects in Crisis", John Wiley, 1998

IVYearI Semester	BLOCKCHAINTECHNOLOGY (PROFESSIONALELECTIVE-IV)	L	T	P	C
		3	0	0	3

Course Objectives:

Theobjectives ofthecourseareto makestudent

1. Learn the fundamentals of Block Chain and various types of block chain and consensus mechanism.
2. Understandpublicblockchainsystem,Privateblockchainsystemandconsortium block chain.
3. Identifythe securityissues of blockchaintechnology.

UNIT– I:

FundamentalsofBlockchain: Introduction,OriginofBlockchain,BlockchainSolution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.

BlockchainTypesandConsensusMechanism: Introduction,Decentralizationand Distribution, Types of Blockchain, Consensus Protocol.

Cryptocurrency: Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT– II:

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain.

Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

UNIT– III:

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain,Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E-commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, SmartContractinPrivateEnvironment,StateMachine,DifferentAlgorithmsofPermissioned Blockchain, Byzantine Fault, Multichain.

Consortium Blockchain: Introduction,KeyCharacteristicsofConsortium Blockchain,Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda.

Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial CoinOfferings, Evolution of ICO, ICO Platforms.

UNIT– IV:

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, IdentityManagement and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT– V:

BlockchainCase Studies:
CaseStudy1 –Retail,
CaseStudy2–BankingandFinancialServices, Case
Study 3 – Healthcare,
CaseStudy4–EnergyandUtilities.
Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.
Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger FabricNetwork,ChaincodesfromDeveloper.ibm.com,BlockchainApplicationUsingFabric Java SDK.

Textbook:

1. “Blockchain Technology”, Chandramouli Subramanian, Asha A.George, Abhilasj K A, Meena Karthikeyan , Universities Press.

ReferenceBooks:

1. BlockchainBlueprintfor Economy,Melanie Swan,SPD Oreilly.
2. BlockchainforBusiness,JaiSinghArun,JerryCuomo,NitinGauar,Pearson Addition Wesley

IVYearI Semester	AUGMENTEDREALITY&VIRTUAL REALITY (PROFESSIONALELECTIVE-IV)	L	T	P	C
		3	0	0	3

Course Objectives:
Theobjectives of thecourseareto

- Provide a foundation to the fast growing field of AR and make the students aware of the various Augmented Reality concepts.
- Givehistoricalandmodernoverviews andperspectivesonvirtualreality.

UNIT– I:
IntroductiontoAugmentedReality: AugmentedReality,Definingaugmentedreality,history of augmented reality, Examples, Related fields
Displays: MultimodalDisplays,VisualPerception,RequirementsandCharacteristics,Spatial Display Model, Visual Displays
Tracking: Tracking,Calibration,andRegistration,CoordinateSystems,Characteristicsof Tracking Technology, Stationary Tracking Systems, Mobile Sensors

UNIT– II:
ComputerVisionforAugmentedReality: MarkerTracking,Multiple-CameraInfrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking.
Interaction: OutputModalities,InputModalities,TangibleInterfaces,VirtualUserInterfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction **Software Architectures:** AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs

UNIT– III:
IntroductiontoVirtualReality: DefiningVirtualReality,HistoryofVR,HumanPhysiology and Perception
TheGeometryofVirtualWorlds: GeometricModels,Axis-AngleRepresentationsofRotation, Viewing Transformations
Light and Optics: Basic Behavior of Light, Lenses, Optical Aberrations, The Human Eye,Cameras, Displays

UNIT– IV:
The Physiology of Human Vision: From the Cornea to Photoreceptors, FromPhotoreceptors to the Visual Cortex, Eye Movements, Implications for VR
Visual Perception: Visual Perception - Perception of Depth, Perception of Motion, **Perception of Color Visual Rendering:** Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos

UNIT– V:
Motion in Real and Virtual Worlds: Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection
Interaction: MotorProgramsandRemapping,Locomotion,SocialInteraction
Audio: ThePhysicsofSound,ThePhysiologyofHumanHearing,AuditoryPerception, Auditory Rendering

TextBooks:

1. “Augmented Reality: Principles & Practice” by Schmalstieg, Hollerer, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494
2. VirtualReality,Steven M.LaValle,CambridgeUniversityPress,2016

ReferenceBooks:

1. “AR Game Development”, Allan Fowler, 1st Edition, Apress Publications, 2018,ISBN 978-1484236178
2. “Understanding Virtual Reality: Interface, Application and Design”, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)”. Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. “Developing Virtual Reality Applications: Foundations of Effective Design”, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009
4. “Designing for Mixed Reality”, Kharis O'Connell, O'Reilly Media, Inc., 2016, ISBN:9781491962381
5. “Theory and applications of marker-based augmented reality”, Sanni Siltanen, Julkaisija, Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
6. “Designing Virtual Systems: The Structured Approach”, Gerard Jounghyun Kim,2005

IVYearI Semester	INTERNETOFTHINGS (PROFESSIONALELECTIVE-IV)	L	T	P	C
		3	0	0	3

Course Objectives:

Themainobjectivesofthecoursearetomakestudentlearntheapplicationareasof IOT ,the revolution of Internet in Mobile Devices, Cloud & Sensor Networksand building blocks of Internet of Things and characteristics

UNITI:

Predecessors of IoT: Introduction, Wireless Sensor Networks, Machine-to-Machine Communications, Cyber Physical Systems

EmergenceofIoT:Introduction,EvolutionofIoT,EnablingIoTandtheComplexInterdependenceofTechnologies, IoTNetworkingComponents,AddressingStrategiesinIoT

UNITII:

IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics

IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.

UNITIII:

IoT Connectivity Technologies: Introduction, IEEE 802.15.4, Zigbee, Thread, ISA100.11A, Wireless HART, RFID, NFC,DASH7, Z-Wave, Weightless, Sigfox, LoRa, NB-IT, Wi-Fi, Bluetooth

IoT Communication Technologies: Introduction, Infrastructure Protocols, Discovery Protocols,DataProtocols,IdentificationProtocols,DeviceManagement,Semantic Protocols.

UNITIV:

IoTInteroperability: Introduction,Standards,Frameworks

Fog Computing and Its Applications: Introduction, View of Fog Computing Architecture,Fog Computing in IoT, Selected Applications of Fog Computing

UNITV:

Paradigms, Challenges, and the Future: Introduction, Evolution of New IoT Paradigms, Challenges Associated with IoT, Emerging Pillars of IoT

IoTCaseStudies:Agricultural IoT,VehicularIoT

TextBooks:

1. IntroductiontoIoT,SudipMisra,AnandarupMukhaerjee,ArjitRoy,CambridgeUniversity Press, 2021
2. InternetofThings:Architecture,DesignPrinciplesandApplications,Rajkamal, McGraw Hill Higher Education

ReferenceBooks:

1. Fog and Edge Computing: Principles and Paradigms, Rajkumar Buyya (Editor),SatishNarayanaSrirama(Editor), ISBN:978-1-119-52498-4,January2019
2. GettingStartedwiththeInternetofThings,CunoPfister,Oreilly

IVYearI Semester	AGENTICAI (PROFESSIONALELECTIVE-IV)	L	T	P	C
		3	0	0	3

Course Outcomes:

CO1: Explain the fundamental concepts, characteristics, and architectures of Agentic AI systems, and differentiate them from traditional, reactive, and generative AI models.

CO2: Apply decision-making, planning, and reinforcement learning techniques to design autonomousagentscapableofgoal-directed behaviorunderdeterministicanduncertain environments.

CO3: Analyze the role of Large Language Models (LLMs) in agentic systems and implement prompt-drivenreasoning,memory,andtool-usemechanismsto enableintelligent agent behavior.

CO4: Design and develop single-agent and multi-agent systems using contemporary agentic AI frameworks, incorporating coordination, communication, and workflow orchestration.

CO5: Evaluate real-world applications of Agentic AI with respect to ethics, safety, responsibility, and societal impact, and propose value-aligned and secure agentic solutions.

UNIT- I — Foundations of Agentic Intelligence: Understand what Agentic AI is, how it differs from traditional and generative AI, and learn its core theoretical building blocks.
Wat is Agentic AI vs. Generative/Reactive AI; Autonomy, Proactivity, and Goal-Directed Behavior; Components of an intelligent agent: Perception, Reasoning, Learning, Action; Agent architectures: Reactive, Deliberative, Hybrid; Rationality and decision models; Real-world use cases and motivation for agentic systems

Unit II — Decision Making, Planning & Learning: Teach how agents make decisions,plan under uncertainty, and adapt through learning.Decision processes: utility theory, Markov Decision Processes (MDPs); Planning under uncertainty; Reinforcement learning fundamentals (MDP, policy, reward shaping); Deep RL essentials (PPO, DQN, A3C — as applicable); Meta-cognition and adaptation in agents; Ethical and value-aligned decision making

Unit III — Large Language Models & Prompt-Driven Agent Behavior: Cover how modern agentic systems leverage large language models and advanced prompt techniques.
Transformer architecture and attention basics; Role of LLMs in agentic systems; Prompt engineering fundamentals (zero-shot, chain-of-thought, ReAct); Retrieval-Augmented Generation (RAG) and memory systems; Context management and embedding techniques; Tool-usage and action invocation via prompts

UNIT- IV — Tools, Frameworks & System Design: Introduce hands-on frameworks used to build agentic AI and how to compose multiple agents into work flows.Overview of agent frameworks: LangChain, LangGraph, AutoGen, CrewAI (documentation & practice); Memory, embeddingdatabases (e.g., FAISS, Pinecone, ChromaDB); Workflow orchestration and multi-agent coordination; Agent-to-agent communication; Deployment patterns andAPIs; Monitoring, scalability, and production concerns

UNIT- V — Responsible & Applied Agentic AI: Address real-world applications, ethical considerations, safety, and career perspectives. Responsible agentic AI design and risk mitigation; Bias, fairness, and interpretability in autonomous systems; Privacy, transparency, and accountability. Safety and alignment challenges; Case studies: Healthcare, cybersecurity, business automation

Textbooks:

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach (4thEd.), Pearson.
2. MichaelWooldridge,AnIntroductiontoMultiAgentSystems(2nded.)
3. RichardS.Sutton&AndrewG. Barto —ReinforcementLearning:AnIntroduction

References:

1. DavidL.Poole&AlanK.Mackworth—ArtificialIntelligence:Foundationsof Computational Agents
2. KenHuang(Ed.)—AgenticAI:Theories andPractices(Springer,2025)

IVYearI Semester	AGILEMETHODOLOGIES (PROFESSIONALELECTIVE-V)	L	T	P	C
		3	0	0	3

Course Objectives:

Themain objectives ofthis courseareto

- IntroducetheimportantconceptsofAgilesoftwaredevelopmentProcess
- Emphasizethe roleofstand-upmeetings insoftware collaboration
- Impartheknowledgeonvaluesandprinciples inunderstandingagility

UNITI :

Learning Agile: Agile, GettingAgile into your brain, UnderstandingAgile values, No Silver Bullet, Agile to the Rescue. A fractured perspective, The Agile Manifesto, Understandingthe Elephant, Where to Start with a New Methodology.

UNITII :

The Agile Principles: The 12 Principles of Agile Software, The Customer Is Always Right, Deliveringthe Project, BetterProject Deliveryfor theEbookReader Project. Communicating andWorkingTogether,ProjectExecution—MovingtheProjectAlong,ConstantlyImproving the Project and the Team. The Agile Project: Bringing All the Principles Together

UNITIII :

SCRUM and Self-Organizing Teams: The Rules of Scrum, Act I: I Can Haz Scrum, Everyone on a Scrum Team owns the Project, Status Updates Are for Social Networks!, The Whole Team Uses the Daily Scrum, Feedback and the Visibility-Inspection-Adaptation Cycle, The Last Responsible Moment, Sprinting into a Wall, Sprints, Planning, and Retrospectives.

Scrum Planning And Collective Commitment: Not Quite Expecting the Unexpected, User Stories, Velocity, and Generally Accepted Scrum Practices, Victory Lap, Scrum Values Revisited.

UNITIV:

XP And Embracing Change: GoingintoOvertime,ThePrimaryPracticesofXP,TheGame Plan Changed, but We're Still Losing, The XP Values Help the Team Change Their Mindset, An Effective Mindset Starts with the XP Values, The Momentum Shifts, Understanding the XP Principles Helps You Embrace Change.

XP, Simplicity, and Incremental Design: Code and Design, Make Code and Design Decisions at the Last Responsible Moment, Final Score.

UNITV:

Lean, Eliminating Waste, and Seeing the whole: Lean Thinking, Creating Heroes and MagicalThinking.EliminateWaste,GainaDeeper Understandingofthe Product, DeliverAs Fast As Possible.

Kanban,Flow,andConstantlyImproving: ThePrinciplesofKanban,ImprovingYour Process with Kanban, Measure and Manage Flow, Emergent Behavior with Kanban.
TheAgileCoach: CoachesUnderstandWhyPeopleDon’tAlwaysWanttoChange.The Principles of Coaching.

Text Books :

1. AndrewStellman,JillAlisonHart,LearningAgile,O'Reilly, 2015.

ReferenceBooks:

1. AndrewStellman,JenniferGreen,HeadfirstAgile,O'Reilly, 2017.
2. Rubin K , Essential Scrum : A Practical Guide To The Most Popular Agile Process,Addison-Wesley, 2013

IVYearI Semester	GENERATIVEAI (PROFESSIONALELECTIVE-V)	L	T	P	C
		3	0	0	3

Course Objectives:
The objectives of the course are to understand the basics of Generative AI, Text Generation, the process of generating videos, GAN and its variants.

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

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

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

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

UNITV:
Open Source Models And Programming Frameworks: Training and Fine tuning ofGenerative models, GPT 4 All, Transfer learning and Pretrained models, Training vision models, Google Copilot, Programming LLM,LangChain, Open Source Models, Llama, Programming for TimeSformer,Deployment, Hugging Face.

TextBooks:
1. DenisRothman,“TransformersforNaturalLanguageProcessingandComputerVision”, Third Edition , Packt Books, 2024

ReferenceBooks:
1. DavidFoster, ”GenerativeDeep Learning”,O’ReilyBooks,2024.
2. AltafRehmani,“GenerativeAIforEveryone”,BlueRoseOne,2024.

IVYearI Semester	COMPUTER VISION (PROFESSIONALELECTIVE-V)	L	T	P	C
		3	0	0	3

Course Objectives:
The objectives of the course are to understand the Fundamental Concepts related to sources, shadows and shading, the Geometry of Multiple Views

UNIT–I:
CAMERAS: Pinhole Cameras Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT-II:
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges Texture0: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by SamplingLocal Models, Shape from Texture.

UNIT-III:
TheGeometryofMultipleViews:TwoViewsStereopsis:Reconstruction,HumanStereopsis, Binocular Fusion, Using More Cameras Segmentation byClustering: What Is Segmentation? Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

UNIT-IV:
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples

UNIT-V:
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry,
Casestudy: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Case study: Registration in Medical Imaging Systems, Curved Surfaces and Alignment.

TextBooks:

1. DavidA.Forsyth,JeanPonce,"ComputerVision–AModernApproach",PHILearning (Indian Edition), 2009.

ReferenceBooks:

1. E.R.Davies,"ComputerandMachineVision–Theory,AlgorithmsandPracticalities", Elsevier (Academic Press), 4th edition, 2013.
2. R.C.Gonzalez,R.E.Woods,"DigitalImageProcessing",AddisonWesley,2008.
3. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer, Verlag London Limited, 2011.

IVYearI Semester	CYBERPHYSICALSYSTEMS (PROFESSIONALELECTIVE-V)	L	T	P	C
		3	0	0	3

Course Objectives:
Themain objectivesof thecourse areto

- DiscussthecoreprinciplesbehindCyberPhysicalSystems
- IdentifySecuritymechanismsofCyberPhysical System
- DescribeSynchronizationinDistributedCyber-Physical Systems

UNITI:
Symbolic Synthesis for Cyber-Physical Systems: Introduction and Motivation, Basic Techniques -Preliminaries,ProblemDefinition,SolvingtheSynthesisProblem,Construction of Symbolic Models, Advanced Techniques: Construction of Symbolic Models, Continuous-Time Controllers, Software Tools

UNITII:
Security of Cyber-Physical Systems: Introduction and Motivation, Basic Techniques - Cyber Security Requirements, Attack Model, Countermeasures, Advanced Techniques: System Theoretic Approaches

UNITIII:
Synchronization in Distributed Cyber-Physical Systems: Challenges in Cyber-Physical Systems, A Complexity-Reducing Technique for Synchronization, Formal Software Engineering, Distributed Consensus Algorithms, Synchronous Lockstep Executions, Time-Triggered Architecture, Related Technology, Advanced Techniques

UNITIV:
Real-Time Scheduling for Cyber-Physical Systems: Introduction and Motivation, Basic Techniques, Scheduling with Fixed Timing Parameters, Memory Effects, Multiprocessor/ Multicore Scheduling, Accommodating Variability and Uncertainty

UNITV:
Model Integration in Cyber-Physical Systems: Introduction and Motivation, Causality, Semantic Domains for Time, Interaction Models for Computational Processes, Semantics of CPS DSMLs, Advanced Techniques, ForSpec, The Syntax of CyPhyML, Formalization of Semantics, Formalization of Language Integration.

TextBooks:
1. Raj Kumar, Dionisio De Niz, Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional, 2016
2. RajeevAlur,PrinciplesofCyber-PhysicalSystems,MIT Press

ReferenceBooks:
1. E.A.Lee,SanjitSeshia,IntroductiontoEmbeddedSystems:ACyber-Physical Systems Approach, MIT Press
2. AndrePlatzer,LogicalFoundationsofCyber-PhysicalSystems,2e,SpringerPublishing, 2018

IVYearI Semester	PROMPT ENGINEERING (SKILLENHANCEMENTCOURSE)	L	T	P	C
		0	1	2	2

Course Objectives:

Themain objectivesof thecourse areto

- Applyiterativepromptingforclarityandcontext.
- Createvariedpromptstosteermodeloutputs.
- Constructchain-of-thoughtandstructured prompts.
- Developretrieval-augmentedpipelinestoground outputs.
- EvaluateLLMagentsandmultimodalappsforethicsand robustness.

Unit I: Foundations of Prompt Engineering: Definition of prompt engineering, Distinction between prompt engineering and model fine-tuning, Motivation and benefits of prompt engineering, Core principles of effective prompt design**,** Anatomy of a prompt, Setting up the Python environment for LLM interaction, Iterative prompting lifecycle, Common prompt pitfalls and remediation

Lab Experiments:

1. Environment & Connectivity: Install required packages (e.g., transformers, openai); securely configure the API key; run a simple "Hello, world" prompt to verify model access.
2. Baseline vs. Enhanced Prompts: Execute a naïve prompt ("Write a one-paragraph bio of Ada Lovelace.") and an enhanced prompt that adds role framing, specificity, and explicit format instructions; compare both outputs for relevance, completeness, and style.
3. IterativeRefinementona SimpleTask:SummarizetheplotoftheShakespeareanplay Romeo and Juliet in two sentences through three rounds of prompt tweaking:
    a. Minimal instruction.
    b. Additionoflengthandstyleconstraints
    c. Specification of key content elements (setting and theme)
    Documenthoweachiterationchangesandimprovestheresult.
4. Diagnosing Prompt Failures & Edge Cases: Craft a vague or contradictory prompt; analyze the failure mode (ambiguity, missing context, or format errors); refine the prompt by adding examples or clarifying instructions.

Unit II: Advanced Prompt Patterns & Techniques: Enhanced prompt anatomy: contextual detail and explicit output specifications, Few-shot in-context prompting, Prompt structuring and template design, Role-based prompting to establish personas or system behavior, Negative prompting to filter or suppress undesired content, Constraint specification and instruction enforcement (e.g., length, format), Iterative prompt refinement and optimization

Lab Experiments:

1. Few-Shot vs. Zero-Shot Comparison: Design and execute a zero-shot prompt and a few-shot prompt (with 2–3 exemplar input-output pairs) for a chosen text task (e.g., sentiment classification or translation); compare outputs for accuracy, consistency,and adherence to examples.
2. Role-Based & Negative Prompting: Craft a role-based prompt to establish a specific persona (e.g., "You are a financial advisor…"); then create a negative prompt to suppress undesired content (e.g., "Do not mention any brand names"); evaluate how each influences the model's response.

3. Constraint Specification & Iterative Refinement: Select an open-ended task (e.g., summarizing a technical article); issue a basic prompt; identify failures in length or format; refine the prompt by adding explicit constraints (word count, bullet format, etc.); document improvements over two refinement cycles.

Unit III: Structured Output & Reasoning Techniques: Importance of structured outputs for real-world applications, Prompting for specific formats (lists, tables, Markdown),GeneratingvalidJSONandYAMLviaexplicitinstructions,Elicitingchain-of-thought reasoning in zero-shot prompts, Decomposing complex tasks into manageable sub-tasks

Lab Experiments:

1. Structured Format Prompting: Instruct the model to output information as bullet lists and Markdown tables (e.g., "List three benefits of dailyexercise in a Markdown table with columns 'Benefit' and 'Description.'"); verify the output matches the requested structure.
2. JSON/YAML Generation: Provide a brief dataset description (e.g., three books with title, author, publication year) and prompt the model to produce valid JSON or YAML; use a parser to validate syntax and refine the prompt if errors occur.
3. Chain-of-Thought & Task Decomposition: Present a multi-step problem (e.g., a logic puzzle) and apply zero-shot CoT prompting (e.g., "Let's think step by step. Explain your reasoning before the final answer."); separately, decompose the problem into sequential sub-questions, collect partial answers, combine them, and compare accuracy against a direct-answer baseline.

Unit IV: Retrieval-Augmented Generation & LangChain Workflows: Limitations of LLM internal knowledge, Need for external data sources, Introduction to Retrieval-Augmented Generation (RAG), Overview of RAG architecture (indexing vs. retrieval + generation), Getting started with LangChain for LLM applications, Basics of LangChain Expression Language (LCEL), Simplified indexing pipeline: document loading & text splitting, Fundamentals of embeddings and vector stores, Building a basic retrieval-generation pipeline with an LCEL chain

Lab Experiments:

1. Building a Simple LCEL Chain: Create a minimal LCEL script that accepts a fixed instruction (e.g., "Summarize this text: …"), passes it to an LLM, and prints theresult; verify end-to-end execution.
2. Basic Data Indexing for RAG: Load a small collection of documents; split into uniformchunks(e.g.,200tokens); generate embeddingsforeach chunk;storethemin an in-memory vector store; inspect for consistency.
3. Constructing&RunningaBasicRAGChain: Build apipeline that:
    a. Receivesauser query
    b. Retrievesthetop-krelevant chunks
    c. Constructsa combinedprompt withcontext + query
    d. Sendit to theLLM
    e. Returnsthe answer

Testwithsamplequeriesand comparefactualaccuracyagainstapromptwithout retrieval.

Unit V: Agents, Multimodal AI & Ethical Evaluation: IntroductiontoLLMagentsand theirbasic architecture, Overview ofmultimodal AImodels (VLMs),Promptingfor text-to-imagegenerationandimageunderstanding,Importanceofpromptevaluationbeyond

subjective judgment, Manual evaluation techniques (heuristic checks for accuracy, relevance, format), Introduction to "LLM-as-Judge" for automated evaluation, Security considerations (prompt injection, sensitive-information risks), Prompt-based mitigation strategies for safety and robustness, Ethical concerns (bias, misinformation, data privacy), Brief exploration of UI frameworks (Streamlit/Gradio) for deploying prompt-driven apps, Adapting to the evolving nature of prompt engineering through continuous learning

Lab Experiments:

1. Building a Simple LLM Agent: Register a tool (e.g., a calculator function) and craft prompts that instruct the agent to invoke it when required; implement using LangChain or a function-calling API; test on queries requiring tool execution.
2. MultimodalPromptingExploration:Generateimages fromdetailedtextprompts;feed one generated image into an image-understanding model or API with an appropriate prompt; compare the returned caption to the original prompt to evaluate alignment.
3. PromptEvaluation &Ethics Workshop:
    a. Selecttwoexistingpromptsandgeneratemultipleoutputs;applymanual heuristic checks for accuracy, relevance, and format compliance.
    b. Use an "LLM-as-Judge" prompt (e.g.,"Rate these outputs on a scale of 1–5for clarity and correctness.") to automate evaluation.
    c. Designaprompt-injectiontest(e.g.,"Ignorepreviousinstructions…"), observe the response, then refine system prompts to mitigate the vulnerability.

IVYearI Semester	CONSTITUTION OFINDIA	L	T	P	C
		2	0	0	-

Course Objectives:
Theobjectives of the courseareto

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT–I:
History of Making of the Indian Constitution: History,DraftingCommittee,(Composition & Working)
PhilosophyoftheIndianConstitution-Preamble,Salient,Features

UNIT–II:
Contours of Constitutional Rights & Duties: FundamentalRights,Right toEquality,Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT–III:
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, **Executive-** President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT–IV:
Local Administration: District'sAdministrationhead: Roleand Importance,Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT–V:
Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

TextBooks:

1. TheConstitutionof India,1st Edition,(BareAct), GovernmentPublication,1950
2. FramingofIndianConstitution,1st Edition,Dr.S.N.Busi,Dr.B.R.Ambedkar, 2015

ReferenceBooks:

1. IndianConstitutionLaw,7th Edition,M.P.Jain,LexisNexis,2014

Rubrics for Project Work:

B.Tech.–IVYearII Semester

S.No.		Category	Title	L	T	P	Credits
1		Internship& ProjectWork	Fullsemester Internship &ProjectWork	0	0	24	12