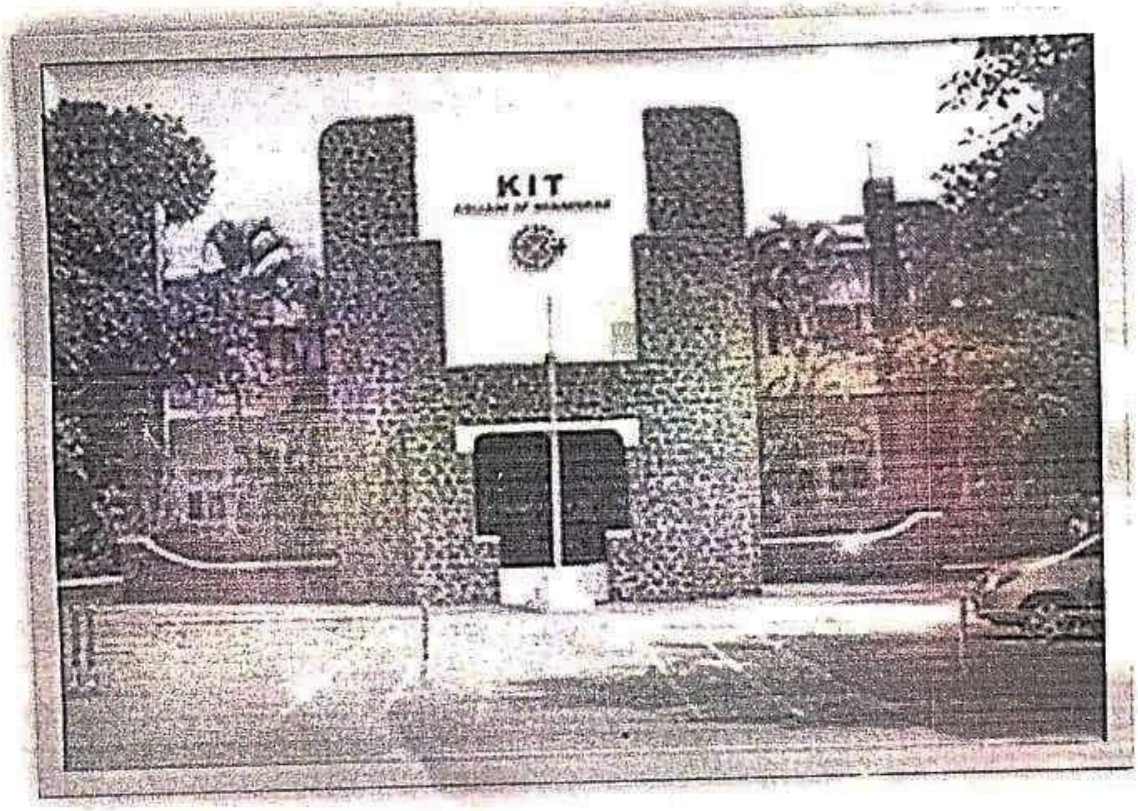
Kolhapur Institute of Technology's
College of Engineering
(Autonomous),

Kolhapur

KOLHAPUR INSTITUTE OF TECHNOLOGY'S COLLEGE OF ENGINEERING (AUTONOMOUS), KOLHAPUR



Department of Computer Science & Engineering

Curriculum and Syllabus for

S. Y. B. Tech. Computer Science & Engineering Scheme: 2024-25

(As Per NEP, 2020)

Kolhapur Institute of Technology's College of Engineering (Autonomous) Kolhapur
Computer Sci & Engg. Dept.

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Dean Academics
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Kolhapur - 416 234

ABOUT THE DEPARTMENT

The department was established in the year 1999 with an initial intake of 60. However, in 2018, due to demand from the industry and engineering aspirants the intake was increased to 180. The department has been accredited by the National Board of Accreditation (NBA) in 2008, 2018 and recently in 2023. The institution is accredited with A+ grade by National Assessment and Accreditation Council (NAAC) with CGPA 3.33 in 2023.

We have highly committed and competitive team of faculty fraternity, who experiments and adapts new innovative pedagogy methods for making all the technical concepts clear as well to keep our students abreast with the latest technologies, skills and developments emerging in this field. We have one Doctorate Faculty member and 8 Faculty members are pursuing Ph.D. from various universities. This practice has proved our students very challenging and successful in various domains of competitions at university, state and national level.

DEPARTMENT VISION

To be preferred choice of stakeholders by building core theoretical and practical skills in the students and abreast them to be globally competent with the latest technologies, skills and developments emerging in the field of Computer Science and Engineering.

DEPARTMENT MISSION	
M1:	To empower students with essential technical comprehension and skills.
M2:	To create awareness of societal and ethical needs in the field of Computer Science and Engineering.
M3:	To build competency among the students with modern tools & technologies and collaborative research.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)	
PEO1:	Graduates will possess the fundamental knowledge of computer science and engineering needed to address challenges in the real world.
PEO2:	Graduates will excel at using their theoretical knowledge in practice, which will enable them to reach professional success and corporate standards.
PEO3:	Graduates will acquire humanity skills, professionalism, ethics, entrepreneurial skills and multidisciplinary approach for wider societal and environmental context.
PEO4:	Graduates will get a platform for research and development that will assist them in recognizing and addressing the challenges of the IT sector.

PROGRAMME OUTCOMES (PO)	
PO1:	Engineering knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals, in depth technical competence in computer science and engineering discipline and an engineering specialization to develop the solution of complex engineering problems.
PO2:	Problem analysis: Identify, formulate, review various computer science research literatures and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.
PO3:	Design/Development of solutions: Design creative solutions for complex computer science and engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.
PO4:	Conduct investigations of complex problems: Conduct investigations of complex computer science and engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.
PO5:	Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex computer science and engineering problems.
PO6:	The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex computer science and engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.
PO7:	Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.
PO8:	Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9:	Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
PO10:	Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11:	Life-Long Learning: Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change in computer science and engineering discipline.

PROGRAMME SPECIFIC OUTCOMES (PSO)	
PSO1:	Learn and adapt the latest software technologies in the field of computer science and engineering.
PSO2:	Identify and analyze real life problems and provide innovative software solutions.

SEMESTER III												
Sr. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs./W**	**Credits**	**Evaluation Scheme**				**Category**
								Component				
1	UCSPC0301	Discrete Mathematical Structures	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40	PC
2	UCSPC0302	Advanced Data Structures and Algorithms	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40	PC
3	UCSPC0303	Design Thinking	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40	PC
4	UCSPC0304	Computer Networks	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40	PC
5	UCSEM0305	Software Project Management	2	-	-	2	2	ESE	50	20	20	HSSM
6	UCSVE0306	Constitution of India	2	-	-	2	2	ISE	50	20	20	VEC
7	UCSPC0331	Advanced Data Structures and Algorithms Laboratory	-	-	2	2	1	ISE ESE (POE)	25 25	10 10		PC
8	UCSPC0332	Computer Networks Laboratory	-	-	2	2	1	ISE	25	10		PC
9	UCSPC0333	Object Oriented Programming Laboratory	-	-	4	4	2	ISE ESE (POE)	25 50	10 20		PC
10	UCSIL0371	Mini Project- I	-	-	2	2	1	ISE	50	20		OJT
11	UCSMM034*	Multi-Disciplinary Minor (MDM-I)	2	-	-	2	2	ESE	100	40		MM
					Total:	27	22	Total Marks: 800 Total Credit: 23				

Semester IV												
Sr. No.	**Course Code**	Course Name	L	T	P	Hrs.	Credits	**Evaluation Scheme**				Category
								Component				
1	UCSPC0401	Computational Mathematics	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40	PC
2	UCSPC0402	Web Technologies	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40	PC
3	UCSPC0403	Automata Theory	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40	PC
4	UCSPC0404	Introduction to Artificial Intelligence	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40	PC
5	UCSPC0405	Operating Systems	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40	PC
6	UCSVE0406	Environmental Studies	2	-	-	2	2	ISE	50	20		VEC
7	UCSPC0431	Web Technologies Laboratory	-	-	2	2	1	ISE ESE (POE)	25 25	10 10		PC
8	UCSVS0432	Operating Systems Laboratory	-	-	2	2	1	ISE	25	10		PC
9	UCSIL0471	Mini-Project -II	-	-	2	2	1	ISE	25	10		OJT
10	UCSVS0433	Advanced Programming Laboratory	-	-	2	2	1	ISE ESE (POE)	25 25	10 10		VSEC
11	UCSCC0434	Co-Curricular Activities-II	-	-	2	2	1	ISE	50	20		CC
12	UCSMM044*	Multi- Disciplinary Minor	3	-	-	3	3	ESE	100	40		MM
					Total:	29	24	Total Marks: 850 Total Credit: 23				

SECOND YEAR
B.TECH. CSE SEM-III
SYLLABUS

Course Code:	UCSPC0301		L	T	P	Credit
Course Name:	Discrete Mathematical Structures		3			3

Course Prerequsites:

Fundamentals of mathematics: -Sets, Functions, Algebraic operations.

Course Description:

This Course consists of concepts of Discrete mathematical structures such as mathematical logic, sets, relations, functions, lattices and Boolean algebra, combinatorics and graph theory

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

CO1	Explain the basic concepts of discrete mathematical structures
CO2	Demonstrate the applications of discrete structures in different fields of computer science.
CO3	Make use of concepts of discrete structures to solve the problems.
CO4	Apply the mathematical proofs and techniques to prove the theorems in computer science.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3		2	1								
CO2	3	2		2	2								2
CO3	3	1	2	2	2								1
CO4	2	2		2	1								1

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation 1 (ISE1)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50	100% course contents

Course Contents:

Unit 1 Mathematical logic (Text book-1) — **8 Hours**

Statements and notations Connectives Well-formed formulas, Truth Tables, Tautology, Equivalence, implication, Normal forms, Quantifiers, Universal quantifiers. Predicates: Predicative logic, Free & Bound variables, Rules of inference, Consistency, Proof of contradiction, Automatic Theorem Proving.

Unit 2 Set theory (Text book-1) — **8 Hours**

Basic concepts of set theory, Operations on sets, Ordered pairs, Cartesian Products. Representation of discrete structures. Relation and ordering - properties of binary relations in a set, Relation matrix and the graph of a relation, Partition and Covering of set, Equivalence relations, Recurrence relations, Composition of Binary relations, Partial ordering , POSET and Hasse diagram. Functions – types, composition of functions, Inverse functions.

Unit 3 Algebraic systems (Text book-1) — **5 Hours**

Algebraic systems, properties and examples. Semigroups and Monoids, properties and examples, Homomorphism of Semigroups and Monoids. Groups: Definition and examples, Subgroups and homomorphism

Unit 4 Lattices and Boolean algebra (Text book-1) — **5 Hours**

Lattice as POSETs , definition , examples and properties. Lattice as algebraic systems, Special lattices. Boolean algebra definition and examples. Boolean functions

Unit 5	**Permutations, Combinations and Probability theory (Text book-2)**	**7 Hours**
The Basics of Counting. The Pigeonhole Principle. Permutations and Combinations. Generalized Permutations and Combinations. Discrete Probability. Conditional probability. Bayes' Theorem		
Unit 6	**Graphs (Text book-2)**	**7 Hours**
Introduction to Graphs. Graph Terminology, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Planar Graphs, Introduction to Trees		

Text Books:

1. Discrete Mathematical Structures with Application to Computer Science - J. P. Tremblay & R. Manohar (MGH International)
2. Discrete Mathematics and its Applications - Kenneth H. Rosen (AT&T Bell Labs) (mhhe.com/rosen)

Reference Books:

1. Discrete Mathematics - SemyourLipschutz, MarcLipson (MGH), Schaum's outlines.

Course Code:	UCSPC0302		L	T	P	Credit
Course Name:	Advanced Data Structures and Algorithms		3			3

Course Prerequsites:

Data Structures

Course Description:

This course introduces fundamental concepts and key techniques for designing and analyzing algorithms along with studying and applying different algorithm design methods namely, greedy method, divide and conquer, dynamic programming and backtracking. Also focuses on P and NP classes of problems.

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

CO1	Define basic concepts of algorithms and measure the efficiency of algorithm
CO2	Identify tree and graph algorithms to model real life engineering problems.
CO3	Make use of standard algorithm design techniques and identify appropriate technique for real time applications
CO4	Distinguish between P and NP Classes of problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2		2							2		
CO2	1	2	2	2							2		2
CO3	1	2	2	2							2		2
CO4	1	3	2	3							2		2

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation 1 (ISE1)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50	100% course contents

Course Contents:

Unit 1 Introduction to Algorithms and its complexity — **6 Hours**

What is algorithm, Algorithm Specification: Pseudocode Conventions, Recursive Algorithm, Performance Analysis: Space Complexity, Time Complexity, Asymptotic Notations, Practical Complexities, Performance Measurement Recurrences: The substitution method, recursion tree method.

Unit 2 Divide and Conquer — **5 Hours**

The general method, Binary search, Finding the maximum and minimum, Merge sort, Quick sort and analysis of these algorithms.

Unit 3 Tree and Graph: Basic terminology and applications — **9 Hours**

Tree: Binary tree and its representation; binary tree traversal methods; binary search tree (BST), AVL tree, Heaps;
Graph: Graph storage structures - adjacency matrix and adjacency list; Graph operations, graph traversal techniques - BFS, DFS
Minimum Spanning Trees: Kruskal and Prim, Single-Source Shortest Paths, all pair source shortest path

Unit 4 Greedy Method — **6 Hours**

The general method, Knapsack problem, Job sequencing with deadlines, Optimal storage on tapes, Optimal merge patterns, Huffman codes.

Unit 5 Dyanamic Programming and backtracking — **9 Hours**

Dynamic Programming: The general method, Multistage graphs, Optimal binary search trees, 0/1 knapsack, Reliability design, Traveling Salesperson problem.
Backtracking: The general method, 8-queen problem, Sum of subsets, Graph Coloring

Unit 6	**Complexity classes :P & NP-Complete**	**5 Hours**

Polynomial time, Polynomial-time verification, Decidability, NP completeness and reducibility, NP-complete problems, Case-studies

Text Books:

1. Fundamentals of Computer Algorithms - Ellis Horowitz, Satraj Sahani, Saguthevar Rajasejaran, Universities Press, Second Edition.
2. Thomas Cormen, Charles Leiserson, Ronald Rivest and Cliford Stein, "Introduction to Algorithms", PHI
3. Data Structures and Pseudocode approach with C, 2nd Edition by Richard F. Gilberg & Behrouz A. Forouzan

Reference Books:

1. Data Structures and Algorithms by G A V Pai (McGrawHill)

Course Code:	UCSPC0303		L	T	P	Credit
Course Name:	Design Thinking		2			2

Course pre-requisites:

Nil

Course Description:

Design Thinking is a human-centered approach to problem-solving that emphasizes understanding users' needs, rapid prototyping, and creative thinking. This course integrates principles of design thinking into the computer science curriculum to prepare students for innovative challenges in technology and software development.

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

CO1	Explain the principles and methodologies of design thinking.
CO2	Apply design thinking to computer science and software development.
CO3	Design user empathy and define user needs.
CO4	Construct innovative ideas and solutions.
CO5	Develop prototypes and test solutions iteratively.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3						3	2	2	2
CO2	3	3	3	3						2	2	3	3
CO3	3	3	3	2						3	2	2	2
CO4	3	3	3	2						3	2	2	2
CO5	3	3	3	3						3	2	3	3

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation 1 (ISE1)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50	100% course contents

Course Contents:

Unit 1 Introduction — **4 Hours**

Overview of Design Thinking, History and evolution of design thinking, Importance in computer science and technology, Case studies of successful design thinking projects

Unit 2 Empathize — **5 Hours**

Techniques for user research (interviews, surveys, observations), Building empathy maps, Persona creation, Tools for empathy: Journey maps, user stories.

Unit 3 Define — **4 Hours**

Synthesizing research findings, Defining the problem statement, Creating Point-of-View (POV) statements, Using frameworks like How Might We (HMW) questions.

Unit 4 Ideate — **4 Hours**

Brainstorming techniques (mind mapping, SCAMPER, etc.), Encouraging creativity and avoiding idea fixation, Group ideation activities, Selection criteria for ideas

Unit 5	**Prototype**	**5 Hours**
Prototyping basics and tools, Low-fidelity vs. high-fidelity prototypes, Rapid prototyping techniques, Hands-on prototyping exercises (paper prototypes, wireframes)		
Unit 6	**Test**	**4 Hours**
User testing methods and protocols, Collecting and analyzing feedback, Iterative testing and refining prototypes, Case studies on testing phases		

Text Books:

1. Tim Brown, “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation” , Harper Business, 2019
2. Don Norman, “The Design of Everyday Things”, Basic Books, 2014.

Reference Books:

1. Thomas Lockwood, “Design Thinking: Integrating Innovation, Customer Experience, and Brand Value”, Original Edition, Allworth Press, 2009.
2. Nigel Cross, “Design Thinking: Understanding How Designers Think and Work ”, Bloomsbury Publishing India Private Limited, 2011.

Course Code:	UCSPC0304		L	T	P	Credit
Course Name:	Computer Networks		3			3

Course Prerequisites:

Must have basic knowledge of computers

Course Description:

This course provides a solid understanding of OSI reference model and TCP/IP protocol suite. Also make us familiar with functionalities of different layers and gives exposure to different application layer protocol. This course will help students ready with all fundamental networking concepts

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

CO1	Define different concepts of OSI/TCP/IP network models and physical layer
CO2	Make use of framing, error control, flow control and medium access control techniques
CO3	Explain IP addresses, IP protocols, types of routing algorithm and congestion control techniques
CO4	Illustrate process to process communication, multiplexing, transport and application layer protocols

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2									2	3	
CO2	2	2			2								
CO3	1	1	2	1	3						1	3	2
CO4	2	2		1	1							3	2

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation 1 (ISE1)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50	100% course contents

Course Contents:

Unit 1 Introduction to Network — **5 Hours**

Data Communication, Networks, Internet, Protocols and Standards,Layered Task, OSI Model and Layers, TCP/IP Protocol Suite, Addressing , Physical Layer and Media

Unit 2 Data Link Control Layer — **8 Hours**

Error Detection and Correction, Block Coding, Linear Block Codes, Cyclic Codes, Checksum, Data Link Control: Framing,Flow and Error Control, Protocols: Noiseless channels, Noisy Channels

Unit 3 Medium Access Control Sub layer — **7 Hours**

Channel allocation Problem , Multiple Access Protocols: ALHOA, CSMA, Collision free protocols, Limited contention protocols, IEEE Standard 802 for LANS and MANS, Bridges, Introduction to VLANS

Unit 4 Network Layer — **8 Hours**

Network Layer Design Issues Routing Algorithms : Shortest Path, Flooding, Distance Vector, Link State, Broadcast, IP, ARP, RARP, ICMP. Congestion control algorithms: Principles, Congestion prevention policies, Traffic Shaping, congestion control in datagram subnet, Choke Packet, Load Shedding, Jitter Control, IPv4 Addresses : Introduction, Classfull and Classless addressing, Special Addresses and NAT

Unit 5	**Trans**	**4 Hours**
Transport Layer functions,UDP- datagram, services, applications, TCP - services, segment, connection, state transition diagram, Flow control, congestion control, error control, timers.		
Unit 6	**Application Layer**	**8 Hours**
DHCP: Introduction, Previous Protocols, DHCP operation, Packet Format, DHCP Configuration, DNS: Need, Name Space, Domain Name Space, Distribution of name space, and DNS in internet, Resolution, DNS massages, Types of records, Compression examples , encapsulation. Telnet and SSH, FTP and TFTP,HTTP and SMTP,SNMP: Concept and Management Component,SMI,MIB,SNMP, UDP Port and Security		

Text Books:

1. Data Communications and Networking – Behrouz A Forouzan (The McGraw Hill) (Unit 1,2,3)
2. Computer Networks – Andrew S. Tanenbaum- (Prentice Hall) 5th Edition (Unit 3, 4)
3. TCP/IP Protocol Suite- Behrouz Forouzan-(The McGraw Hill) (4,5,6)

Reference Books:

1. Computer Networking with Internet Protocols and Technology, William Stallings (Prentice Hall)

Course Code:	UCSEM0305		L	T	P	Credit
Course Name:	Software Project Management		2			2

Course Prerequisites:

Basic Engineering Knowledge and Computer Programming Skills

Course Description:

This course provides an in-depth understanding of the principles and practices involved in managing software projects. It covers project planning, scheduling, cost estimation, risk management, quality assurance, and the use of software tools for project management.

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

CO1	Explain the phases of the software development lifecycle.
CO2	Interpret the fundamentals of software project management.
CO3	Design project plans including schedules, budgets, and resource allocation.
CO4	Apply risk management strategies to identify and mitigate project risks.
CO5	Develop quality assurance processes to ensure software meets specified requirements.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	3	2	2	3	2	3	2	3	3
CO2	3	3	3	2	3	3	2	3	2	3	2	3	3
CO3	3	3	3	2	3	3	2	3	2	3	2	3	3
CO4	2	2	2	2	1	1	2	3	1	2	2	3	3
CO5	2	2	2	2	1	1	2	3	1	2	2	3	3

Assessment Scheme:

SN	Assessment	Marks	Remark
1	End Semester Examination (ESE)	50	100% course contents

Course Contents:

Unit 1	**Introduction**	**4 Hours**

Overview of software project management, Role of a project manager, Project management frameworks and methodologies

Unit 2	**Project Life Cycle and Processes**	**5 Hours**

Phases of project management, Project initiation, planning, execution, monitoring, and closure, Agile vs. Waterfall methodologies

Unit 3	**Project Planning and Scheduling**	**5 Hours**

Defining project scope, Work Breakdown Structure (WBS), Gantt charts and network diagrams, Critical Path Method (CPM) and Program Evaluation Review Technique (PERT)

Unit 4	**Cost Estimation and Budgeting**	**5 Hours**

Estimation techniques: Expert judgment, Delphi technique, Wideband Delphi, and Function Point Analysis, Cost estimation models: COCOMO and SLIM, Budget planning and management

Unit 5	**Risk Management**	**4 Hours**

Identifying project risks, Qualitative and quantitative risk analysis, Risk response planning, Risk monitoring and control

Unit 6	**Project Quality Management**	**4 Hours**

Quality assurance vs. quality control, Quality planning, assurance, and control, Software testing strategies and techniques, Quality standards (ISO, CMMI)
Text Books:
1.Bob Hughes and Mike Cotterell, “Software Project Management”, 5th Edition, Prentice Hall, 2008
Reference Books:
1. James Cadle and Donald Yeates, “Project Management for Information Systems”, 5th Edition, Allworth Press, 2009.
1. Data Structures and Algorithms by G A V Pai (McGrawHill)

Course Code:	UCSVE0306		L	T	P	Credit
Course Name:	Constitution of India		2			2

Course Prerequsites:

Basics of Indian History, Independence Movement, Fundamentals of Civics.

Course Description:

This Course is an introduction of Indian Constitution and basic concepts highlighted in this course for understanding the Constitution of India. This course is structured to give a deeper insight for making the nexus between the other law subjects.

Course Objectives

At the end of the course the student is expected to have acquired:
1. A basic understanding of Constitution of India.
2. Builds the ability to apply the knowledge gained from the course to current social legal issues.
3. Ability to understand and solve the contemporary challenges.
4. Understanding constitutional remedies.

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Explain the significance of Indian Constitution as the fundamental law of the land
CO2	Exercise his fundamental rights in proper sense at the same time Identifies his responsibilities in national building.
CO3	Analyze the Indian political system, the powers and functions of the Union, State and Local Governments in detail
CO4	Understand Electoral Process, Emergency provisions and Amendment procedure.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						3	3				3		
CO2						3	3	3	3		3		
CO3						3		3			3		
CO4						3		3			3		

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Examination (ISE)	50	100% course contents

Course Contents:

Unit 1	Constitution – Structure and Principles	3 Hours

1.1 : Meaning and importance of Constitution
1.2 : Making of Indian Constitution – Sources
1.3 : Salient features of Indian Constitution

Unit 2	Fundamental Rights and Directive Principles	10 Hours

2.1 : Fundamental Rights & Fundamental Duties
2.2 : Directive Principles of State Policy

Unit 3	Union Government & Executive	4 Hours

3.1 : President of India – Qualification, Powers and Impeachment
3.2 : Lok Sabha & Rajya Sabha Sabha- Composition, Powers & Functions, Scope to amendment in Constitution

Unit 4	State Government & Executive	3 Hours

4.1 : Governor – Qualification, Appointment, Powers & Functions
4.2 : Legislative Assembly & Legislative Council – Composition, Powers & Functions

Unit 5	**The Judiciary**	**3 Hours**

5.1 : Features of Judicial System in India
5.2 : Hierarchy of Courts, Composition and Jurisdiction

Unit 6	**Local Self Government and other constitutional Organizations**	**3 Hours**

6.1 : 73rd and 74th Constitutional Amendments
6.2 : Public Service Commission, Election Commission, CAG, National Commissions for SC, ST etc.

Text Books:

1. M.P. Jain, Indian Constitutional Law
2. M.P. Singh (ed.),V.N. Shukla, Constitutional Law of India
3. D.D. Basu, Commentary on the Constitution of India
4. S.S. Desai, Constitutional Law--I & II

Reference Books:

1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)
2. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)
3. Shripad Shridhar Desai, Constitutional Law--I, S.S. Law Publication, 2021
4. Shripad Shridhar Desai, Constitutional Law --II, S.S. Law Publication, 2021
5. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf
6. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015

Course Code:	UCSPC0331	L	T	P	Credit
Course Name:	Advanced Data Structures and Algorithms Laboratory			2	1

Course Prerequsites:

Data Structures

Course Description:

This course is to learn and implement different operations on data structures for various applications and to develop applications using Greedy, Divide and Conquer, dynamic programming.

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

CO1	Understand and apply non-linear data structure operations.
CO2	Apply Greedy, divide and conquer algorithms.
CO3	Develop dynamic programming algorithms for various real-time applications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2						1		2	1		
CO2	2	2			2		1	2					
CO3	1	1	2	1	3					1		2	

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation (ISE)	25	Experiment, Practical Performance and Oral Exam
2	End Semester Evaluation (POE)	25	Practical Performance and Oral Exam

Course Contents:

Experiment 1	Write a program to implement the following operations on Binary Search Tree: a) Insert b) Delete c) Search d) Display	**2 Hours**
Experiment 2	Write a program to create the graph and implement traversal methods.	**2 Hours**
Experiment 3	Write a program to implement Merge sort for the given list of integer values.	**2 Hours**
Experiment 4	Write a program to implement Quicksort for the given list of integer values.	**2 Hours**
Experiment 5	Write a program to find the solution for the knapsack problem using the greedy method.	**2 Hours**
Experiment 6	Write a program to find minimum cost spanning tree using Prim's algorithm	**2 Hours**
Experiment 7	Write a program to find minimum cost spanning tree using Kruskal's algorithm	**2 Hours**
Experiment 8	Write a program to find a single source shortest path for a given graph	**2 Hours**
Experiment 9	Write a program to find the solution for a 0-1 knapsack problem using dynamic programming.	**2 Hours**

Text Books:

1. Fundamentals of Computer Algorithms - Ellis Horowitz, Satraj Sahani, Saguthevar Rajasejaran, Universities Press, Second Edition.
2. Thomas Cormen, Charles Leiserson, Ronald Rivest and Cliford Stein, “Introduction to Algorithms”, PHI
3. Data Structures and Pseudocode approach with C, 2nd Edition by Richard F. Gilberg & Behrouz A. Forouzan

Reference Books:

1. Data Structures and Algorithms by G A V Pai (McGrawHill)
2. Data Structures and Algorithms in python Michael T. Goodrich (Wiley)
3. Fundamentals of Algorithmics – Gilles Brassard, Paul Bratley (Pearson Education).
4. Mastering Algorithms with C – Kyle Loudon (SPD O’Reilly).
5. Computer Algorithms- Introduction to Design and Analysis – Sara Baase, Allen Van Gelder (Pearson Education).

Course Code:	UCSPC0332	L	T	P	Credit
Course Name:	Computer Networks Laboratory			2	1

Course Prerequsites:

Basic knowledge of Computers and Computer Network

Course Description:

This course provides a solid understanding of implementation of different framing, error control, flow control and routing algorithms. Help students to design network as per the requirement. Students can develop client server application using socket API and make them understand different application layer protocol with help of simulation and demonstration.

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Build sample network and VLAN as per the organization requirements
CO2	Develop software programs for framing, error control, flow control and routing algorithms
CO3	Make use of socket API to develop client-server programs
CO4	Inspect working of different types of application layer protocols from TCP/IP protocol suite

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2							1		2	1	
CO2	2	2			2			1	2				
CO3	1	1	2	1	3						1	3	2
CO4	2	2		1	1							3	2

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation (ISE)	25	Experiment, Practical Performance and Oral Exam

Course Contents:		Hours
Experiment 1	Design and simulation of Sample Network	2
Experiment 2	Demonstration of network Testing tools	2
Experiment 3	Implementation of Framing Techniques A) Character count B) Bit stuffing	2
Experiment 4	Implementation of Error Control Mechanisms A) CRC B) Hamming Code	2
Experiment 5	Implementation of Flow Control Mechanisms A) Go Back N ARQ B) Selective repeat ARQ	2
Experiment 6	Design and simulate working of Virtual LAN	2
Experiment 7	Implementation of Routing Algorithm A) Shortest path routing B) Distance vector routing	2

Experiment 8	Implementation of Client-Server model A) Iterative client-server model B) Concurrent client-server model	2
Experiment 9	Simulation of Application Layer Protocol	2

Text Books:

1. Data Communications and Networking – Behrouz A Forouzan (The McGraw Hill)
2. Computer Networks – Andrew S. Tanenbaum- (Prentice Hall) 5th Edition
3. TCP/IP Protocol Suite- Behrouz Forouzan-(The McGraw Hill)

Reference Books:

1. Computer Networking with Internet Protocols and Technology, William Stallings (Prentice Hall)

Course Code:	UCSPC0333		L	T	P	Credit
Course Name:	Object Oriented Programming Laboratory				4	2

Course Prerequsites:

Knowledge of Computer Programming, C Programming

Course Description:

This course serves as an introduction to the fundamental principles and techniques of object-oriented programming (OOP). Object-oriented programming is a powerful paradigm for organizing and managing complex software systems. Through a combination of lectures, hands-on exercises, students will gain a solid understanding of OOP concepts and develop proficiency in applying them to real-world problem-solving.

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

CO1	Explain object oriented concepts, principles and techniques.
CO2	Select appropriate approach from procedural and object oriented to solve the given problem.
CO3	Apply various object oriented features to solve real life problems using C++ language.
CO4	Make use of exception handling and STL to solve given problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1										1		
CO2	2	2	2								1		
CO3	1	2	2		3		3	1			3	2	3
CO4	1	2	2		3		3	1	1		3	3	3

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation	25	In Semester Evaluation based on Lab assignments, Quiz, Oral, etc
2	End Semester Examination (ESE)	50	Practical Performance and Oral Exam

Course Contents:

Unit 1	Introduction and Basics of OOP	4 Hours

Introduction to procedural & object-oriented programming, Limitations of procedural programming, Need of object-oriented programming, Fundamentals of object-oriented programming: objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism.

Unit 2	Basics of C++ programming	4 Hours

Variable declarations, global scope, const variables, reference variables, function prototypes, functions with default arguments, call by value, call by reference, returning by reference, call by pointer, inline functions, constant arguments, 'cin', 'cout', formatting and I/O manipulators, Classes and Objects defining Class, data members, member functions, Access specifiers – public, private, protected, constructor, destructor, array of objects, passing objects to functions, returning object.

Unit 3	Inheritance	4 Hours

Need of Inheritance, Concept, public, private, protected inheritance, Single inheritance, Multiple and multilevel inheritance, Hybrid Inheritance, Virtual base class, overriding of member functions

Unit 4	Polymorphism	5 Hours

Pointers basics of memory management, New and delete operators, Pointer to object, Pointer to data members, this pointer. Need of Polymorphism, concept, Compile time polymorphism or early binding: function overloading and operator overloading, operator overloading using member function and friend function, overloading - unary, binary, arithmetic operators, relational operators, Overloading new and delete operators, insertion and extraction operators, Run time polymorphism or late binding using Virtual function, pure virtual function, Abstract class, Type conversion

Unit 5	**Files and Streams**	**4 Hours**

Concept of Streams, concept of File, opening and closing a file, detecting end-of-file, file modes, file pointer, reading and writing characters, strings and objects to the file, operations to move file pointers i.e. seekg, seekp, tellg, tellp.

Unit 6	**Advanced C++ features**	**5 Hours**

Introduction to Generic Programming using Templates: Function template and class template, Introduction to Standard Template Library (STL), containers, iterators and algorithms, study of container template classes for vectors and stacks and related a lgorithms Exception handling: Introduction, syntax for exception handling code: try-catch-throw, Multiple Exceptions, Exceptions with arguments

Experiments based on		
1	Classes (with constructor) and Objects.	2 Hours
2	Operator Overloading.	2 Hours
3	Inheritance	2 Hours
4	Memory Management	2 Hours
5	Polymorphism	2 Hours
6	Type Conversion	2 Hours
7	Exception Handling	2 Hours
8	Template	2 Hours
9	File Handling	2 Hours
10	STL	2 Hours

Text Books:

1. C++ programming by Robert Lafore 4th Edition (SAMS)

Reference Books:

1. C++ Programming with language - Bjarne Stroustrup, AT & T

Course Code:	UCSIL0371	L	T	P	Credit
Course Name:	Mini Project- I			2	1

Course Prerequsites:

Knowledge of Project Based Learning (PBL) concepts.

Course Description:

In this course, the students will apply Project Based Learning to a multi-course environment for solving different real-world problems. The students shall use the concepts they have learned in S.Y. B.Tech Program (SEM-III). Students will develop a solution to an identified problem.

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Identify real world problems which can be solved using computer science concepts and technologies.
CO2	Demonstrate the proposed solution.
CO3	Implement the proposed solution using Computer Science & Engineering techniques.
CO4	Build detailed project report.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	2	1		3		3					1
CO2	1				2			3	3				
CO3	2	2	3	3	3	3	2	3		3		3	2
CO4	2	3		3	3		3	3				3	

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation (ISE)	50	In Semester Evaluation based on Progress of the project

Course Contents:

Guidelines for Mini Project - I :-

1	The primary objective of the mini project-I is to achieve multi course project-based learning.	
2	Course Instructor shall form the project team of 3 to 4 students in the batch of students.	
3	Each team shall use the knowledge they learned in the SY B.Tech courses to identify the real-world problem which can be solved using technology.	
4	The solution shall be using the tools & techniques from multiple courses - e.g a solution shall be using data structures & algorithm,Computer Networks, Fundamentals of Web to develop mini project.	
5	It is recommended to develop user interface using HTML	
6	The evaluation shall be done in two phases	
	Phase1	ISE-1: In ISE 1 the students shall be graded based on the skills demonstrated to identify the problem statement, define the problem statement & designing its solution. The partial working model is expected to be completed.
	Phase2	ISE-2 In ISE 2 the students shall be graded based on the complete project implementation and its working. Followed by the detailed project report which shall cover the technical aspects of the project.

7	Its recommended to share a common project report format to all batches.
8	All course instructors shall coordinate and work towards common evaluation process.
9	Course instructors shall demonstrate and discuss sample case studies with students to help them understand the mini project deliverables.

Course Code:	UCSMM0341	L	T	P	Credit
Course Name:	Business Statistics	2			2

Course Prerequisites:

Linear algebra, Applied Statistics

Course Description:

This course introduces students to statistical methods and their applications in business decision-making. Topics covered include descriptive statistics, probability distributions, inferential statistics, hypothesis testing, regression analysis, and statistical software tools. The course aims to provide a solid foundation in statistics to enable data-driven decision-making in a business context.

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

CO1	Illustrate the role of statistics in business.
CO2	Develop skills in data collection and descriptive statistics.
CO3	Apply probability concepts to business scenarios.
CO4	Illustrate inferential statistical analysis.
CO5	Utilize statistical software for data analysis.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2			2					2	2	2	2
CO2	3	3	3	2	3			2		3	2	3	3
CO3	2	2		2	2							1	1
CO4	2	2	2	2	3					2		2	2
CO5	2	2	2	2	3			2				3	3

Assessment Scheme:

SN	Assessment	Marks	Remark
1	End Semester Examination (ESE)	100	100% course contents

Course Contents:

Unit 1 Introduction — **2 Hours**

Importance of Statistics in Business, Types of Data: Qualitative and Quantitative, Scales of Measurement

Unit 2 Data Collection and Sampling Methods — **4 Hours**

Primary and Secondary Data, Sampling Techniques: Random, Stratified, Cluster, Systematic Data Collection Methods: Surveys, Experiments, Observational Studies

Unit 3 Descriptive Statistics — **6 Hours**

Measures of Central Tendency: Mean, Median, Mode Measures of Dispersion: Range, Variance, Standard Deviation, Data Visualization: Histograms, Bar Charts, Pie Charts, Box Plots

Unit 4 Probability Concepts — **4 Hours**

Basic Probability Rules, Conditional Probability, Bayes' Theorem, Probability Distributions: Discrete and Continuous

Unit 5 Probability Distributions — **6 Hours**

Discrete: Binomial Distribution, Poisson Distribution, Hypergeometric Distribution. Continuous: Normal Distribution, Standard Normal Distribution (Z-scores), Applications of the Normal Distribution

Unit 6	Sampling Distributions	4 Hours
Central Limit Theorem, Sampling Distribution of the Sample Mean, Sampling Distribution of the Sample Proportion		

Text Books:

1. Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh., "An Introduction to Probability and Statistics" , Second Edition, Wiley, 2008.
2. J. Susan Milton, Jesse Arnold, "Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences", 4th edition, McGraw Hill Education, 2017.

Reference Books:

1. Paul Newbold, Mr William Carlson, Ms Betty Thorne, "Statistics for Business and Economics", Eigth Edition, Pearson Education, 2012.
2. David M. Levine, Kathryn A. Szabat, David F. Stephan, "Business Statistics: A First Course ", 8th edition, Pearson College Div, 2019.

Course Code:	UCSMM0342		L	T	P	Credit
Course Name:	Introduction to Internet of Things		2			2

Course Prerequisites:

Computer networks, Computer architecture

Course Description:

This course is to make students know the IoT ecosystem and to provide an understanding of the technologies and the standards relating to the Internet of Things. In this course the students will develop skills on IoT technical planning.

Illustrate After the completion of the course the student will be able to -

CO1	Interpret the technology and standards relating to IoTs.
CO2	Explain the critical ecosystem required to mainstream IoTs.
CO3	Develop skills on developing their own national and enterprise level technical strategies.
CO4	Illustrate and describe IoT real-time applications

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2		1	2		1		2	1	3	1	1
CO2	1	1		1	2				2	1	3	1	1
CO3	2	2		1	1	1			2	2	3	1	1
CO4	2	2		1	2	2			3	2	3	1	1

Assessment Scheme:

SN	Assessment	Marks	Remark
1	End Semester Examination (ESE)	100	100% course contents

Course Contents:

Unit 1 IoT & Web Technology **6 Hours**

The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Proces ses, Data Management, security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Unit 2 M2M to IoT -A Basic Perspective **6 Hours**

Introduction, Some Definitions, M2M Value Chains,IoT Value Chains, an emerging industrial structure for IoT, the internationa l driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit 3 IoT Architecture -State of the Art **6 Hours**

Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit 4 IoT Applications for Value Creations **6 Hours**

IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in yo ur Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Indus try, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Unit 5	Internet of Things Privacy, Security and Governance	5 Hours

Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smart Approach. Data Aggregation for the IoT in Smart Cities, Security

Text Books:

1. Nitesh Dhanjani, Abusing the Internet of Things, Shroff Publisher/O'Reilly Publisher.
2. Internet of Things, RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan,John Wiley and Sons.
3. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram,John Wiley & Sons.
4. Cuno Pfister, "Getting Started with the Internet of Things", Shroff Publisher/Maker Media.

Reference Books:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications.
2. Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers.

Corresponding Online Resources: 1. https://www.coursera.org/specializations/internet-of-things

Course Code:	UCSMM0343		L	T	P	Credit
Course Name:	AI in Healthcare		2			2

Course Prerequisites:

Data Structures and algorithms, Fundamentals of Programming

Course Description:

The goal of this course is to introduce the underlying concepts, methods, and the potential of intelligent systems in medicin e. This course will help in specialization in particular AI methods, clinical/healthcare applications, and relevant tools.

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Interpret what is Artificial Intelligence (AI) and Machine learning (ML)
CO2	Infer the concept of Neural Networks and its applications in healthcare
CO3	Analyze the healthcare data and process it using data analysis and statistical tools
CO4	Explore the applications of AI and ML with respect to healthcare domain

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO2
CO1	2	1	1	1							2	3	3
CO2	2	1	2	3							2	3	3
CO3	2	2	2	4							2	3	3
CO4	2	2	2	3							2	3	3

Assessment Scheme:

SN	Assessment	Marks	Remark
1	End Semester Examination (ESE)	100	100% course contents

Course Contents

Unit 1	Introduction to Artificial Intelligence (AI) and Machine learning (ML)	5 Hours

Importance and Applications of AI and ML in Healthcare, Types of Machine Learning and its classification -Decision Tree, Bayesian Classifier, Regression

Unit 2	Neural Networks, their types, and processing	7 Hours

Neural Networks – learning Models, Deep Neural Network, Convolution Neural Networks & Recurrent Neural Networks, Natural Language Processing, Commonly Used and Advanced Neural Network architectures, Computer Vision
Internet of Things (IoT) - Introduction, Process flow and Tools, Use Cases, Remote Patient Monitoring

Unit 3	Data Representation	7 Hours

Introduction to data, data frames, Data standardization, Dealing with noise and missing values, Transforming and normalizing data
Data Analytics - Overview of tools like R, Python, Statistical and Visualization tools

Unit 4	Healthcare data Analysis	5 Hours

Sources of the healthcare data, pre-processing of the healthcare data, Handling of the healthcare data, Creation of analysis-ready datasets

Unit 5	Healthcare	5 Hours

Examples and Case studies, Future trends in AI Healthcare

Text Books:	

1. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence 3
2. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press.
3. Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning, Springer
4. Adam Gibson, Josh Patterson, Deep Learning, O'Reilly Media, Inc.

Reference	

1. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again, Eric Topol, Basic Books, 1st edition 2019.
2. Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes, Arjun Panesar, Apress, 1st Edition, 2019.
3. Artificial Intelligence in Healthcare, 2020, ISBN 978-0-12-818438-7 Elsevier Inc.

SECOND YEAR
B.TECH. CSE SEM-IV
SYLLABUS

Course Code:	UCSPC0401		L	T	P	Credit
Course Name:	Computational Mathematics		3			3

Course Prerequsites:

Statistics, Probability, Vectors and Set Theory

Course Description:

This Course contains Statistics, Probability, Vectors and Fuzzy Set

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

CO1	Demonstrate the basic mathematical concepts in Computer Science Engineering related to Fuzzy Sets and Statistics
CO2	Explain Vector Space concepts in dealing with problems in Computer Science Engineering.
CO3	Apply the knowledge of Statistics to solve problems arising in Computer Science Engineering.
CO4	Make use of Fuzzy Equations to solve problems arising in Computer Science Engineering.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	1	-	-	-	-	-	-	1		
CO2	2	2	-	-	-	-	-	-	-	-	1		
CO3	2	2	-	1	-	-	-	-	-	-	1		
CO4	1	2	-	-	-	-	-	-	-	-	1		

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation 1 (ISE1)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50	100% course contents

Course Contents:

Unit 1 Advanced Linear algebra — **6 Hours**

Solutions of simultaneous linear equations using Gauss-Jordan method. Solutions of simultaneous linear equations using LU decomposition method. Determination of Eigen Value by Iteration method. Solution of non-linear simultaneous equations.

Unit 2 Vector Algebra — **8 Hours**

Vector Spaces, Subspaces, basis, span, Linear Independence, Basis and Dimension, Orthogonality - Orthogonal Vectors and Subspaces, Cosines and Projections onto Lines, Orthogonal Bases and Gram – Schmidt

Unit 3 Probability and Distributions — **7 Hours**

Random variables, Discrete distributions and Continuous distributions, Binomial Distribution, Poisson Distribution, Normal Distribution

Unit 4 Statistical Techniques — **8 Hours**

Lines of regression of bivariate data, Correlation coefficient, Fitting of Curves by method of Least-squares, Fitting of Straight lines, Fitting of Parabola, Fitting of Exponential curves.

Unit 5 Introduction to Fuzzy sets — **7 Hours**

Crisp Sets: An overview, Fuzzy sets: Basic concepts, Operations on fuzzy sets, Extension Principle

Unit 6	Fuzzy Arithmetic	6 Hours
Fuzzy numbers, Fuzzy cardinality, Operations on Fuzzy numbers, Fuzzy equations of type A + X = B and A.X = B.		
Text Books:		
1. Cyber Security, Nina Godbole, John Wiley & Sons. 2. Li Da Xu, Shancang Li, "Securing the Internet of Things", Syngress.		
Reference Books:		
1. Alasdair Gilchrist, "IoT Security Issues", De Gruyter		

Course Code:	UCSPC0402		L	T	P	Credit
Course Name:	Web Technologies		3			3

Course Prerequsites:

Advanced Programming Laboratory, HTML and CSS

Course Description:

Web Technology subject mainly deals with emerging web technology concepts and tools. It covers Server-Side Programming JSP, Servlet and Spring Boot MVC Technology.

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

CO1	Apply knowledge of Hypertext Transfer Protocol
CO2	Demonstrate use of client- s i d e technologies
CO3	Design web application using MVC architecture.
CO4	Develop RESTful web application using server-side technologies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	2		3		1				1	1	
CO2	1	2	3	1	3		1				2	2	1
CO3	1	2	3	2	3		1				2	3	2
CO4	1	2	3	2	3		1				2	3	2

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation 1 (ISE1)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50	100% course contents

Course Contents:

Unit 1 INTRODUCTION TO NODE WORLD and Node JS Modules — **7 Hours**

Introduction to Javascript event driven programming, Introduction to Node event -driven programming, Node JS Modules, Functions, Buffer, Module, Modules Types, Core Modules, Local Modules, Modules Exports

Unit 2 MAKING A WEB SERVER — **6 Hours**

Webserver basis, handling incoming request in Node JS, serving static files / pages, Content caching, Streaming and optimization, Handling filesystem

Unit 3 Rest API && HTTP OBJECT — **7 Hours**

Rest API benefits, Introduction to HTTP Object, Processing POST Data, Handling File uploads, Using Node as HTTP Client, Implementing download Throttling, Node JS way of calling another server

Unit 4 WORKING WITH DATABASES (Preferred MONGODB over MYSQL) and — **5 Hours**

Writing to a CSV File in Database, CRUD using MONGODB

Unit 5 Servlet — **8 Hours**

Introduction of servlet, servlet life cycle, Working with Apache Tomcat Server, Servlet Interface, HTTP Servlet, directory structure, deployment descriptor-web.xml, servlet in Eclipse, Servlet Request methods, reading HTML form data with servlet, database connectivity with relational DBMS

Unit 6	JSP	8 Hours
Introduction of JSP, directory structure, JSP life cycle, JSP API, JSP in eclipse, JSP Expressions, JSP Declerations, JSP Scriplets, JSP Bulit in objects, including files, reading HTML form data with JSP, Database Connectivity with RDBMS, create and deploy WAR file		

Text Books:

1. Mastering Node.js: Build robust and scalable real-time server-side web applications efficiently, Second Edition By Sandro Pasquali , Kevin Faaborg
2. Core-Servlet and JavaServer Pages Volume – 1, by Marty Hall, Larry Brown, Pearson Education 2nd Edition

Reference Books:

1. Head First Servlets and JSP: Passing the Sun Certified Web Component Developer Exam -2nd Edition-Bryan Basham, Kathy Sierra, Bert Bates- O'REILLY

Course Code:	UCSPC0403		L	T	P	Credit
Course Name:	Automata Theory		3			3

Course Prerequisites:

Basic knowledge of problem solving and Discrete mathematics

Course Description:

This course deals with the theoretical background of computer science.

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

CO1	Explain the models of computation and formal languages
CO2	Design abstract computing machines like FA, PDA and TM
CO3	Illustrate language representation techniques and tools to realize formal language.
CO4	Apply finite state machines to solve problems in computing.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2												
CO2		2	2								1		
CO3	2				1								
CO4		2	2								1		

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation 1 (ISE1)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50	100% course contents

Course Contents:

Unit 1 Introduction to Finite Automata — **5 Hours**

Introduction to Finite Automata, Structural Representation. The central concepts of Automata theory – Alphabet, Strings & Languages. Deterministic Finite Automata (DFA), Non-Deterministic and NFA with Epsilon (ε) transitions , Equivalence of NFA- ε, NFA and DFA,.

Unit 2 Regular Expressions and languages — **7 Hours**

Regular Expressions, Finite Automata and Regular Expressions, Union, intersection and complement of RLs, Pumping lemma for RLs, Minimization of Automata, Proof by mathematical induction, Kleene's Theorem, Applications of Regular Languages.

Unit 3 PDA and CFGs part I — **8 Hours**

Definition of Pushdown Automata, DPDA, Types of grammars, Context-Free Grammars, Parse Trees, Ambiguity in CFGs

Unit 4 PDA and CFG part II — **5 Hours**

Normal forms for Context Free Grammar, Intersection and complement of CFLs, Pumping lemma for CFLs LEX and YACC Tools: The Simplest Lex Program, Recognizing Words with Lex, , Parser- lexer communication, A Yacc Parser, Rules section. Running Lex and Yacc examples

Unit 5 Turing Machines — **7 Hours**

Turing Machine model: Definition of Turing Machine, Transition Function, Instantaneous Description & Moves, Languages accepted by Turing Machine, Turing Machine as function computer,

Unit 6	Variations in TMs	8 Hours
Multi-tape TMs, Nondeterministic TMs, Universal TMs Decidability: Recursive languages, recursively enumerable languages, Unsolvable problems		
Text Books:		
1. Introducing to languages & Theory of computations – John C. Marn (MGH) 2. "Introduction to Automata Theory, Languages and Computation", by John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education, 3/E, 2013.		
Reference Books:		
1. Peter Linz, "An Introduction to Formal Languages and Automata",Narosa Publishing House, 5/E, 2011.		

Course Name:	UCSPC0404		L	T	P	Credit
Course Name:	Introduction to Artificial Intelligence		2			2

Course Prerequisites:

Basics of mathematics and probability

Course Description:

This course provides an introduction to the fundamental concepts, techniques, and applications of Artificial Intelligence (AI). Students will explore various AI methodologies, including machine learning and computer vision. Through lectures, discussions students will

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

CO1	Explain the fundamental concepts in AI, including machine learning, neural networks
CO2	Illustrate the architecture and training of neural networks
CO3	Summarize various machine learning algorithms and applications
CO4	Create awareness of the ethical, societal implications of AI technologies, including issues related to bias, fairness, privacy

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2										2	1	
CO2	2										2	1	
CO3	2	2	1		1						2	2	2
CO4							2						

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation 1 (ISE1)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50	100% course contents

Course Contents:

Unit 1 Introduction to Artificial Intelligence — **4 Hours**

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

Unit 2 Machine Learning fundamentals — **6 Hours**

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

Unit 3 Regression and classification — **6 Hours**

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, Baye's probabilistic interferences and dempstershafer
theory.

Unit 4 Applications of AI — **4 Hours**

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, Decisiontrees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

Unit 5	Ethical Implications of AI and other issues	4 Hours
Expert systems:- Introduction, basic concepts, structure of expert systems, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, expert systems and the internet interacts web, knowledge engineering, scope of knowledge, difficulties in knowledge acquisition methods of knowledge acquisition.		
Unit 6	**Other Important Issues**	**4 Hours**
Machine learning, intelligent agents, selecting an appropriate knowledge acquisition method, societal impacts reasoning in artificial intelligence, inference with rules, with frames: model based reasoning, case based reasoning, explanation & meta knowledge in ference with uncertainty representing uncertainty.		
Text Books:		
1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", SecondEdition, Pearson Education 2. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press.		
Reference Books:		
1. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problemsolving", Fourth Edition, Pearson Education. 2. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.		

Course Code:	UCSPC0405		L	T	P	Credit
Course Name:	Operating Systems		3			3

Course Prerequisites:

Data Structures and Networking

Course Description:

This is one of the core courses of Computer Science & Engineering Programme. In this course you will become familiar with the core concepts of OS - how OS work, how a processes & threads are created, inter-process communication & synchronization, the various scheduling algorithms, memory management & memory allocation strategies, etc. This course will be also helpful for exams like GATE.

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

CO1	Describe the basic concepts of operating systems.
CO2	Evaluate the performance of various scheduling & page replacement algorithms.
CO3	Distinguish techniques of inter process communication and synchronization.
CO4	Identify potential deadlock situations and propose appropriate strategies to handle or avoid deadlocks.
CO5	Interpret internal representation of file and buffer cache management.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2							1		2	1	
CO2	2	2			2			1	2				
CO3	1	1	2	1	3						1		2
CO4	2	2		1	1							1	2
CO5				1						1	1	1	

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation 1 (ISE1)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50	100% course contents

Course Contents:

Unit 1 Introduction — **5 Hours**

Introduction to OS, OS Structure, Types of OS, OS Kernel, OS Services, Users Perspective of OS, System Boot Process, Architecture of UNIX OS

Unit 2 Process, Threads & Scheduling — **7 Hours**

Process: Concept, States and Transitions, Context, Creation (fork), Termination (exit), Signals (signal, kill), Awaiting Process Termination(wait, waitpid), Invoking other programs (exec), Threads (pthreads)
Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

Unit 3 Synchronization and Communication (Process & Thread) — **8 Hours**

Inter-Process Communication - Pipe, Shared Memory, Message Passing
Inter-Process Synchronization: The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization

Unit 4 Deadlocks — **5 Hours**

Deadlock: System Model; Deadlock Characterization; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery from Deadlock

Unit 5	**Buffer**	**7 Hours**

Buffer Cache: Buffer Headers, Structure of the Buffer Pool, Scenarios for Retrieval of a Buffer, Reading and Writing Disk Blocks, Advantages and Disadvantages of Cache. Internal Representation of Files: I-nodes, Structure of a Regular File, Directories, Conversion of a pathname to i-node

Unit 6	**Memory Management**	**8 Hours**

Memory background, Hierarchy, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory, Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.
2. The Design of Unix Operating System - Maurice J. Bach (PHI)

Reference Books:

1. Operating Systems –Concepts and design –Milan Milenkovic (TMGH)
2. Operating Systems: Internals and Design Principles (8th Edition)- by William Stallings (Pearson Education)
3. Modern Operating Systems by Andrew S. Tanenbaum (Pearson Education International)
4. Unix concepts and administration – 3rd Edition – Sumitabha Das (TMGH).

Course Code:	UCSVE0406		L	T	P	Credit
Course Name:	Environmental Studies		2			2

Course Prerequisites:

Students shall have knowledge of Basic Science (Physics and Chemistry)

Course Description:

The objective of the course is imparting fundamental knowledge and awareness of Environmental Studies among students and importance of conservation of environment.

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

CO1	Study scope and importance of natural resources, ecosystems, biodiversity for creating awareness and their conservation in multiple disciplines
CO2	Learn various types of pollution, their impacts and control measures for minimizing pollution and sustainable development
CO3	Understand social issues related to environment, environmental ethics and human rights towards environment.
CO4	Study various laws and regulations related to environment and its applicability in society and industries

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						2							
CO2	3											1	1
CO3							2						1
CO4						2							1

Assessment Scheme:

SN	Assessment	Marks
1	In Semester Evaluation (ISE)	50

Course Contents:

Unit 1 Nature of Environmental Studies — **4 Hours**

Definition, scope and importance, Multidisciplinary nature of environmental studies, Need for public awareness.

Unit 2 Natural Resources and Associated Problems — **5 Hours**

a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.

c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources.

d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer-pesticide problems.

e) Energy resources: Growing energy needs, renewable and nonrenewable energy resources, use of alternate energy sources. Solar

f) Land resources: Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of individuals in conservation of natural resources.

Unit 3 Ecosystems — **4 Hours**

a) Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession. Food chains, food webs and ecological pyramids.

b) Introduction, types, characteristics features, structure and function of the following ecosystem :-

1) Forest ecosystem, 2) Grassland ecosystem, 3) Desert ecosystem, 4) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit 4	**Biodiversity and its conservation**	**4 Hours**

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. India as a mega - diversity nation, Western Ghat as a biodiversity region. Hot-spot of biodiversity. Threats to biodiversity habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit 5	**Environmental Pollution**	**4 Hours**

Definition: Causes, effects and control measures of: Air pollution, Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.

Unit 6	**Social Issues and the Environment**	**4 Hours**

Disaster management: floods, earthquake, cyclone, tsunami and landslides. Urban problems related to energy Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns.Environmental ethics: Issue and possible solutions. Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products.

Unit 7	**Environmental Protection**	**5 Hours**

From Unsustainable to Sustainable development. Environmental Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Population Growth and Human Health, Human Rights.

Textbooks:

1. Environmental Studies by Dr. P.D.Raut (Shivaji University, Kolhapur)

Reference Books:

1. Miller T.G. Jr., Environmental Science. Wadsworth Publications Co.(TB).
2. Odum, E.P.1971, Fundamentals of Ecology, W.B. Saunders Co. USA,574p
3. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. I and II, Environmental Media (R)

Course Code:	UCSPC0431	L	T	P	Credit
Course Name:	Web Technologies Laboratory			2	1

Course Prerequisites:

Advanced Programming Laboratory, HTML and CSS

Course Description:

Web Technology subject mainly deals with emerging web technology concepts and tools. It covers Server Side Programming JSP, Servlet and Spring Boot MVC Technology.

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

CO1	Apply knowledge of HTTP
CO2	Demonstrate use of client side technologies
CO3	Design web application using MVC architecture.
CO4	Develop RESTful web application using server side technologies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	2		3		1				1	1	
CO2	1	2	3	1	3		1				2	2	1
CO3	1	2	3	2	3		1				2	3	2
CO4	1	2	3	2	3		1				2	3	2

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation (ISE)	25	Experiment, Practical Performance and Oral Exam
4	End Semester Examination (ESE) POE	25	Practical Performance and Oral Exam

Course Contents:

Exp.	Title	No. of Hrs.
1	Build a responsive web application for shopping cart with registration, login, catalog and cart pages using CSS3 features, flex and grid.	2
2	Use JavaScript for doing client – side validation of the pages implemented in the experiment	2
3	Explore the features of ES6 like arrow functions, callbacks, promises, async/await. Implement an application for reading the weather information from openweathermap.org and display the information in the form of a graph on the web page.	2
4	Develop a java stand alone application that connects with the database (Oracle / mySql) and perform the CRUD operation on the database tables.	2
5	Create an xml for the bookstore. Validate the same using both DTD and XSD.	2
6	Create a custom server using http module and explore the other modules of Node JS like OS, path, event.	2
7	Develop an express web application that can interact with REST API to perform CRUD operations on student data. (Use Postman)	2
8	Create a service in react that fetches the weather information from open weathermap.org and the display the current and historical weather information using graphical representation using chart.js	2
9	Create a TODO application in react with necessary components and deploy it into github.	2
10	Deployment of Simple Servlet Application	2
11	Servlet DB Connectivity- Develop servlet application to insert Student information into mysql	2

12	Servlet DB Connectivity- Develop servlet application to Retrieve Student information from mysql	**2**
13	Develop a simple application for session management using Servlet	**2**
14	Develop a simple application for Registration using JSP	**2**
15	Develop a JSP application to update information in Mysql	**2**

Text Books:

1. Mastering Node.js: Build robust and scalable real-time server-side web applications efficiently, Second Edition, By Sandro Pasquali , Kevin Faaborg.
2. Core-Servlet and JavaServer Pages Volume – 1, by Marty Hall, Larry Brown, Pearson Education 2nd Edition

Reference Books:

1. Head First Servlets and JSP: Passing the Sun Certified Web Component Developer Exam -2nd Edition-Bryan Basham, Kathy
2. Computer Networking with Internet Protocols and Technology, William Stallings (Prentice Hall)

Course Code:	UCSPC0432		L	T	P	Credit
Course Name:	Operating Systems Laboratory				2	1

Course Prerequisites:

Fundamental knowledge of programming in c/c++/java/python

Course Description:

This is one of the core course of Computer Science & Engineering Programme. In this course you will become familiar with the core concepts of OS - how OS work, how a processes & threads are created, inter-process communication & synchronization, the various scheduling algorithms, memory management & memory allocation strategies, etc. This course will be also helpful for exams like GATE.

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

CO1	Design and implement programs using system calls with process & thread management.
CO2	Implement process/thread synchronization mechanism to prevent race conditions.
CO3	Apply the concepts of inter-process communication in practical.
CO4	Write programs to evaluate the performance of various scheduling, page replacement & disk scheduling algorithms.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1		1		1		1		1		2	3	
CO2	1	3	2		2		1		1		2	3	1
CO3	1	2	1		2		1		1		2	3	1
CO4	2	2	1		1		1		2		2	3	

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation (ISE)	25	Experiment, Practical Performance and Oral Exam

Course Contents:	Hours
Assignment 1: Process Management	2
System Calls - fork(), exit(), exec(), wait(), waitpid(), getpid(), getppid()	
Assignment 2: Thread Management	2
POSIX threads. pthread_create(), pthread_join(), pthread_exit(), pthread_self()	
Assignment 3: Process Scheduling	2
Evaluate performance of scheduling algorithms-FCFS, SJF, SRTN, RR, Priority Scheduling in terms of turnaround time, response time.	
Assignment 4: Process Synchronization	2
Inter-process Synchronization using semaphores.	
Assignment 5: Classical problems of Process Synchronization	2
Classical problems of Synchronization-Bounded Buffer, Dining Philosophers Problem, and The Reader and Writer Problem.	
Assignment 6: Interprocess Communication	2
Inter-process Communication using pipes, shared memory, and message passing.	
Assignment 7: Bankers Algorithm	2
Banker's Algorithm to find a safe sequence of process execution.	

Assignment 8: Implementation of nameing algorithm	**2**
Conversion of pathname to inode	
Assignment 9: Page Replacement Algorithms	**2**
Page Replacement Algorithms-FIFO, LRU, OPR	
Assignment 10: Disk Scheduling Algorithms	**2**
Simulation of disk scheduling algorithms such as - FCFS, SSTF, SCAN, C-SCSN, LOOK, C-LOOK	

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.
2. The Design of Unix Operating System - Maurice J. Bach (PHI)

Reference Books:

1. Operating Systems –Concepts and design –Milan Milenkovic (TMGH)
2. Operating Systems: Internals and Design Principles (8th Edition)- by William Stallings (Pearson Education)
3. Modern Operating Systems by Andrew S. Tanenbaum (Pearson Education International)
4. Unix concepts and administration – 3rd Edition – Sumitabha Das (TMGH).

Course Code:	UCSIL0471		L	T	P	Credit
Course Name:	Mini Project-II				2	1

Course Prerequsites:

Knowledge of Project Based Learning (PBL) concepts.

Course Description:

In this mini project, the students will apply Project Based Learning to a multi-course environment for solving different real-world problems. The students shall use the concepts they have learned in their S.Y. B.Tech Program (SEM-III) & the courses they are learning in the current semester i.e. SEM-IV. Students will develop a solution to an identified problem.

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

CO1	Identify real world problems which can be solved using computer science concepts and technologies
CO2	Outline the proposed solution using technical documents.
CO3	Develop the proposed solution using computer science & engineering tools and techniques.
CO4	Write detailed project report.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	2	1		3		3					1
CO2	1				2	1		3	3				
CO3	2	2	3	3	3	3	2	3		3		3	2
CO4	2	3		3	3		3	3				3	

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation (ISE)	25	Assignment, Test, Quiz, Seminar, Presentation, etc.

Course Contents:

Guidelines for Mini Project:

The primary objective of the mini project-I is to achieve multi course project-based learning.

Course Instructor shall form the project team of 3 to 4 students in the batch of students.

Each team shall use the knowledge they learned in the SY B.Tech courses to identify the real-world problem which can be solved using technology.

The solution shall be using the tools & techniques from multiple courses - e.g a solution shall be using data structures, networking algorithm, Web Technology to develop mini project.

The evaluation shall be done in two phases Phase 1 ISE-1 Phase 2 ISE-2 In ISE 2 the students shall be graded based on the complete project implementation and its working. Followed by the detailed project report which shall cover the technical aspects of the project.

Its recommended to share a common project report format to all batches.

All course instructors shall coordinate and work towards common evaluation process. In ISE 1 the students shall be graded based on the skills demonstrated to identify the problem statement, define the problem statement & Designing its solution. The partial working model is expected to be completed. Comp. Sci. & Engg. B.Tech CSE

References:

SRS: https://ieeexplore.ieee.org/document/278253

Course Code:	UCSVS0433		L	T	P	Credit
Course Name:	Advanced Programming Laboratory		2		2	1

Course Prerequisites:

Basic Concepts of Programing - variable, conditional statements, loops. Basic Knowledge of

Course Description:

Course Description :In this course students will be introduced to strict oop programming environment of Java programming language. Students will learn advanced feature of Java, such as platform independent architecture, JVM, JIT components. The course will also enable students to develop GUI based computer applications which will make use of advanced computer features, for example multi threaded application, networking based applications.

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

CO1	Make use of fundamental and oop concepts for programming.
CO2	Apply knowledge of various concepts of computer science and design solutions for
CO3	Develop programming solutions to given problem.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2		1									1	1
CO2	2	1	2		3		1	1			2	2	2
CO3		1	2		3		2	1		1	3	3	3

Assessment Scheme:

SN	Assessment	Marks	Remark
1	In Semester Evaluation (ISE)	25	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	End Semester Examination (ESE) POE	25	Practical Performance and Oral Exam

Course Contents:

Unit 1 Fundamental Programming in Java — **4 Hours**

The Java Buzzwords, The Java Programming Environment- JVM, JIT Compiler, Byte Code Concept, HotSpot, A Simple Java Program, Source File Declaration Rules, Comments, Data Types, Variables, Operators, Strings, Input and Output, Control Flow, Big Numbers, ArraysJagged Array. Objects and Classes: Object-Oriented Programming Concepts, Declaring Classes, Declaring Member Variables, Defining Methods, Constructor, Passing Information to a Method or a Constructor, Creating and using objects, Controlling Access to Class Members, Static Fields and Methods, this keyword, Object Cloning, Class Design Hints.

Unit 2 Interface, Inheritance and Packaging — **4 Hours**

Interfaces: Defining an Interface, Implementing an Interface, Using an Interface as a Type, Evolving Interfaces, Default Methods. Inheritance: Definition, Superclasses, and Subclasses, Overriding and Hiding Methods, Polymorphism, Inheritance Hierarchies, Super keyword, Final Classes and Methods, Abstract Classes and Methods, casting, Design Hints for Inheritance, Nested classes & Inner Classes, finalization and garbage collection. Packages: Class importing, Creating a Package, Naming a Package, Using Package Members, Managing Source and lass Files. Developing and deploying (executable) Jar File.

Unit 3 Lambda Expressions — **4 Hours**

Lambdas in nutshell, How to use Lambdas-Functional Interfaces, Type Checking , type interfaces, Method References, Lambda Expressions

Unit 4 Files IO & Exception Handling — **6 Hours**

Exception: Definition, Dealing with Errors, The Classification of Exceptions, Declaring Checked Exceptions, Throw an Exception, Creating Exception Classes, Catching Exceptions, Catching Multiple Exceptions, Re-throwing and Chaining Exceptions, finally clause, Advantages of Exceptions, Tips for Using Exceptions. I/O Streams: Byte Stream – InputStream, OutputStream, DataInputStream, DataOutputStream, FileInputStream, FileOutputStream, Character Streams, BufferedStream, Scanner, File, RandomAccesFile.

Unit 5	Networking and Multithreading	3 Hours

Networking: Overview of Networking, Networking Basics, Working with URLs, Creating a URL, Parsing a URL, Reading Directly from a URL, Connecting to a URL, Reading from and Writing to a URL Connection, Sockets, Reading from and Writing to a Socket, Writing the server Side of a Socket, Datagrams, Writing a Datagram Client and Server. Multithreading: Processes and Threads, Runnable Interface and Thread Class , Thread Objects, Defining and Starting a Thread, Pausing Execution with Sleep, Interrupts, Thread States, Thread Properties, Joins, Synchronization

Unit 6	Collection and Parallel Data Processing & Performance	4 Hours

Collections: Collection Interfaces, Concrete Collections- List, Queue, Set, Map, the Collections Framework. Parallel Streams - turning sequential streams into parallel streams, stream performance, recursive tasks, splitting processes.

Text Books:

1. Core Java- Volume I Fundamentals: Cay Horstmann and Gary Cornell, Pearson, Eight edition
2. Core Java- Volume II Advanced Features: Cay Horstmann and Gary Cornell ,Pearson, Eight edition

Reference Books:

1]The Java Tutorials From ORACLE Java Documentation URL: http://docs.oracle.com/javase/tutorial/
2]The Java Tutorial: A Short Course on the Basics by Raymond Gallardo, Scott Hommel, Sowmya Kann
3]JAVA-The Complete Reference: Herbert Schildt, Oracle Press, Mcgraw Hill,(9th Edition).
4]JAVA™ HOW TO PROGRAM, By Deitel Paul , Deitel Harvey. Publisher: PHI Learning..(10th Edition)
5]Thinking in Java by Bruce Eckel, Prentice Hall,(4th Edition)
6]A Programmer's guide to JAVA SCJP Certification: Khaleed Mughal and Rolf W. Rasmussen

Course Code: UCSCC0434 Title of the Course: Co -Curricular Activities-II	L	T	P	Credits
	---	---	02 hours per week	01

Course pre-requisite:

None: This course is open to all second-year engineering students interested in enhancing their personal and professional development through co-curricular activities.

Course Description:

Co-Curricular activities are an integral part of curriculum which provides educational activities to the students and thereby help in broadening their experiences. Co-Curricular activities can be defined as the activities that enhance and enrich the regular curriculum during the normal college hours. All Co-Curricular activities are organized with specific purpose which may according to the nature and form of activities. This course introduces students to a variety of co-curricular activities aimed at enhancing their professional and personal development within the field of engineering and technology. Through practical projects, competitions, workshops, and community engagement, students will develop teamwork, leadership, communication, and technical skills essential for success in their careers.

Course Learning Objectives (CLOs):

1. To encourage students to showcase their intellectual and independent thinking skills.
2. To imbibe a sense of confidence and managerial capabilities among students.
3. To promote the ability to work in team, organize and analyse available resources.
4. To build responsiveness among students about the social and cultural responsibilities.

Course Outcomes (COs):

At the end of the course students will be able to:

CO1:	**Demonstrate** the ability to critically analyse information and apply independent judgment in decision-making within the context of the activity.
CO2:	**Apply** principles of management and organizational skills to plan, coordinate, and execute tasks related to the co-curricular activity.
CO3:	**Collaborate** effectively with peers to achieve common goals and objectives within the co-curricular activity.
CO4:	**Reflect** on their roles and responsibilities as members of a diverse community, fostering empathy and inclusivity.

Assessments:

Assessment	Weightage (Marks)
ISE	50

ISE: Assessment is based on the student's participation in various Co-Curricular Activities and Guidelines given in "Rules for Assigning Activity Points: Activity – Event Grade Point Scheme" Policy Document.

Course Guidelines:

1. Students are entitled to gain academic knowledge in this fast-paced environment, but it is also necessary for them to develop their personalities in both internal and external situations.
2. Co-curricular activities help students grow and develop their personalities. These activities contribute to a student's total personality development.
3. Not every student is intellectually inclined. Similarly, not all pupils are interested in co-curricular activities. Therefore, there is a need to provide a solid balance of co-curricular and extra-curricular activities in order to achieve the course learning objectives.
4. It primarily refers to intellectual, physical, emotional, and social growth that can be attained by a careful mix of academic, co-curricular, and extra-curricular activities.
5. So, keeping the course learning objectives the "Rules for Assigning Activity Points: Activity – Event Grade Point Scheme" Policy Document is proposed.

6. Student participation is assessed and reflected in the final activity performance report in order to get most students involved in extra-curricular activities (Group A) and co-curricular activities (Group B) as shown in Table 1 in the Policy Document.
7. All undergraduate students must choose at least ONE activity/event from each group i.e. (Group A and B).
8. Students shall choose one activity/ event from Group A and One from Group B that take place on-campus or off-campus.
9. Freedom shall be given to the students to take part in more than one activity under the group.
10. Students are expected to actively participate in activities, participate in contests, and earn grade points.
11. One student in each group must earn up to 50 grades in one semester so that they can achieve up to 100 grades in one year.
12. Grades for each semester are awarded based on the points achieved by the student, as shown in Table 2 in the Policy Document.

Course Structure: ***(Refer Rules for Assigning Activity Points: Activity – Event Grade Point Scheme)***

Sr. No.	Initiatives	Criteria, Activities and Assignments
1	Introduction to Co-Curricular Activities	Orientation, Induction, Course Overview
2	National Initiatives Participation	Participation, Achievement Levels and Assigned Activity Points in NCC, NSS, Unnat Bharat/ Unnat Maharashtra Abhiyan, Ek Bharat Shreshtha Bharat (EBSB)
3	Sports and Games Participation	Participation, Achievement Levels and Assigned Activity Points in Sports and Games
4	Cultural Activities Participation	Participation, Achievement Levels and Assigned Activity Points in Music, Performing Arts, Literary Arts
5	Professional Self Initiatives	Participation, Achievement Levels and Assigned Activity Points in 1. Technical Events/Quiz/Paper Contest/Project Contest / Model Making etc. 2. MOOC/ NPTEL/ SWAYAM/ Coursera etc. 3. Competitions/ Events Conducted by Professional Societies (ISTE, IEI, CSI, IEEE, IETE, SAE, ISRO-IIRS, SWE, ISHRAE, ASM, ISNT etc.) 4. Attending Full time Conference/ Seminars/ Exhibitions/ Workshop/ STTP Conducted at IITs/ NITs/ Reputed Institutes/ Universities 5. Attending Full time Conference/ Seminars/ Exhibitions/ Workshop/ STTP Conducted at KITCoEK 6. Paper Presentation in National/ International Conference of High Repute 7. Poster Presentation in National/ International Conference of High Repute 8. Paper Publication in National/ International Journal of High Repute 9. Industrial Training/ Internship (at least for 04 Weeks) 10. Participation in Institute Level Student Clubs
6	Entrepreneurship and Innovation	Participation, Achievement Levels and Assigned Activity Points in 1. Prototype Developed and Tested 2. Awards for Products Developed 3. Innovative Technologies Developed and Used by Industries 4. Got Funding from Government/ Industry for Innovative Ideas

		5. Patent-Filed/ Published/ Approved/ Licensed 6. Social Innovations
7	Leadership & Management of Clubs/ Activities	Participation, Achievement Levels and Assigned Activity Points in 1. Elected Student Representative of Student Council (University Representative, General Secretary, Cultural, Sports, NSS Secretary, Ladies Representative, Academic Toppers, Invitee Members) 2. Office Bearer of Professional Society Chapter (ISTE, IEI, CSI, IEEE, IETE, SAE, ISRO-IIRS, SWE, ISHRAE, ASM, ISNT etc.) 3. Office Bearer of Institute Level Student Club (Developer Student Club, Gaganvedhi, Walk With World, Team Mavericks, Cultural Club, Aura, Amateur Write Club, Rotaract Club of KIT Sunshine, Women Development and Gender Equality Cell, Shourya, Lead India etc.) 4. Office Bearer of Departmental Student Association 5. Office Bearer of ECell, Digital Content Lab etc. 6. Student Ambassador for Mayura AICTE IDEA Lab/ NIDHI iTBI etc. 7. Editorial Board Member of Annual Magazine 8. Editorial Board Member of E-Newsletter 9. Member of Governance Committee/ Statutory Committee
8	Culminating Event and Reflection	Final Presentations, Course Reflection, Documentation, Assessment and Evaluation

Participation Levels:

1. Level: I College Level Events
2. Level: II District/ Central/ Zonal Level Events
3. Level: III State Level Events
4. Level: IV National Level Events
5. Level: V International Level Events

Approval Documents:

1. Certificate
2. Letter from Authorities
3. Appreciation recognition letter
4. Documentary evidence
5. Legal Proof

Grading Scheme:

Grade Range	Grade	Academic Performance
90-100	O	Outstanding
71 to 90	A+	Excellent
68-71	A	Very Good
65-68	B+	Good
60-65	B	Average
55-60	C	Below Average
50-55	D	Marginal
< 50	F1	Fail due to Poor Performance

Course Code:	UCSMM0441		L	T	P	Credit
Course Name:	Optimization methods for Analytics		3			3

Course Prerequisites:

Linear algebra, Calculus, Probability and Statistics

Course Description:

This course focuses on advanced optimization methods used in Master Data Management (MDM) for analytics. It covers both theoretical foundations and practical applications of optimization techniques in the context of data management and analytics.

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

CO1	Explain the Optimization Principles.
CO2	Apply Optimization Techniques and Formulate Optimization Models.
CO3	Evaluate Optimization Performance and analyze result.
CO4	Interpret Optimization Solutions and Communicate Optimization Findings.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1							1			3		1
CO2	1	2	1		1			1	1	1	3	1	1
CO3	1	2		2				1			3		
CO4	1	2	1	2			1	1		1	3	1	1

Assessment Scheme:

SN	Assessment	Marks	Remark
1	End Semester Examination (ESE)	100	100% course contents

Course Contents:

Unit 1 Introduction to Optimization — **6 Hours**

Basics of Optimization - Definitions and scope, Importance in analytics , Types of Optimization Problems - Linear vs. Non-linear, Continuous vs. Discrete, Deterministic vs. Stochastic, Formulation of Optimization Problems - Objective functions, Constraints, Decision variables, Applications in Analytics: Case studies in various domains (e.g., finance, marketing, operations)

Unit 2 Linear Programming (LP) — **6 Hours**

Linear Programming Fundamentals - Formulation of LP problems, Graphical method, The Simplex Method - Standard form of LP, Simplex algorithm steps, Duality and Sensitivity Analysis - Dual problems, Economic interpretation of duality, Sensitivity analysis and its applications, Applications of LP : Resource allocation, Supply chain optimization, Portfolio optimization

Unit 3 Integer Programming (IP) — **8 Hours**

Introduction to Integer Programming: Formulation of integer programs, Types of integer programming problems (pure, mixed)
Solution Methods: Branch and bound method, Cutting plane method, Heuristic and metaheuristic approaches, Applications of IP: Scheduling, Capital budgeting, Network design

Unit 4 Non-Linear Programming (NLP) — **8 Hours**

Basics of Non-Linear Programming - Differences from linear programming, Formulation of NLP problems, Solution Techniques - Unconstrained optimization (e.g., gradient descent), Constrained optimization (e.g., Lagrange multipliers, KKT conditions), Convex and Non-Convex Optimization - Properties of convex functions, Local vs. global optima, Applications of NLP - Machine learning (e.g., training of models), Energy optimization, Pricing strategies

Unit 5 Dynamic Programming (DP) — **6 Hours**

Introduction to Dynamic Programming - Principle of optimality, Recursive relationships, Solution Methods - Deterministic dynamic programming, Stochastic dynamic programming, Applications of DP - Inventory management, financial planning, Markov decision processes (MDPs)

Unit 6	**Metaheuristic and Evolutionary Algorithms**	**6 Hours**

Overview of Metaheuristics - Importance in solving complex optimization problems, Characteristics and general framework, Popular Metaheuristic Algorithms - Genetic algorithms (GA), Simulated annealing (SA), Particle swarm optimization (PSO), Ant colony optimization (ACO), Applications of Metaheuristics - Large-scale optimization problems, Multi-objective optimization, Real-world case studies

Text Books:

1. G. Hadley,"Linear programming", Narosa Publishing House, New Delhi, 1990.
2. S.S. Rao,"Engineering Optimization: Theory and Practice", New Age International P)Ltd., New Delhi, 2000

Reference Books:

1. H.A. Taha,"Operations Research:An Introduction", 5th Edition, Macmillan, New York, 1992 4. Convex Optimization" by Stephen Boyd and Lieven Vandenberghe,Stephen Boyd and Lieven Vandenberghe, Cambridge University Press
2. "Dynamic Programming and Optimal Control" by Dimitri P. Bertsekas,Vol. I, 3rd edition, Athena Scientific publicaton,2005 ,ISB N 1886529086
3. Meta-heuristic and Evolutionary Algorithms for Engineering Optimization,by Omid Bozorg-Haddad, Mohammad Solgi, Hugo A. Loáiciga,Released October 2017,Publisher(s): Wiley,ISBN: 9781119386995

Course Code:	UCSMM0442		L	T	P	Credit
Course Name:	Introduction to Security of Cyber-Physical Systems		3			3

Course prerequisites:

Introduction to IoT, Computer Network basics

Course Description:

This course provides a comprehensive foundation in CPS security, equipping students with the knowledge and skills to address security challenges in this critical field.

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

CO1	Explain the basics of security and various types of security issues.
CO2	Summarize different cryptography techniques available and various security attacks.
CO3	Demonstrate network security model and how they are implemented in real world.
CO4	Outline various issues of Web security and biometric authentication.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	3		1	2	2				1	2	1
CO2	3	1	3		1	2	2				1	2	1
CO3	2		3		1	2	2				1	2	1
CO4	1	1	3		1	2	1				1	2	1

Assessment Scheme:

SN	Assessment	Marks	Remark
1	End Semester Examination (ESE)	100	100% course contents

Course Contents:

Unit 1	**Introduction**	**5 Hours**

Overview of Security in Information Systems, Security goals, Threats and vulnerabilities, Privacy in Information System.

Unit 2	**Security Fundamentals**	**8 Hours**

Applied Cryptography & Intrusion Detection, Architecture of Applied Cryptography, One Way Hash Function and Integrity, Encryption Algorithms and Confidentiality, Digital Signature and Authentication (DH, RSA, 2 class), Intrusion Detection and Information Theory.

Unit 3	**IoT Security**	**7 Hours**

Internet of Things Security, Security and Privacy for IoT Case Study: Smart Home, Smart Grid Network, Modern Vehicle, Wearable Computing & BYOD, Mobile HealthCare.

Unit 4	**Security of SDN**	**7 Hours**

Software-Defined Networks, Introduction of Software-Defined Networks, Security for Software-Defined Networks, Privacy Leakages for Software-Defined Networks, Case Studies: How to Attack Software-Defined Networks.

Unit 5	**CPS fundamentals**	**6 Hours**

Cyber-Physical Systems (CPS), CPS - Platform components, CPS implementation issues, Intelligent CPS, Secure Deployment of CPS.

Unit 6	**Security in CPS**	**7 Hours**

Network Security in CPS- Network protocols used in CPS, Securing communication channels and network infrastructure, Physical Layer Security- Security issues at the sensor and actuator levels, Techniques for protecting physical components from tampering and attacks, Control System Security- Security in industrial control systems (ICS) and SCADA, Protecting control algorithms and ensuring secure control operations

Text Books:

1. Cyber Security, Nina Godbole, John Wiley & Sons.
2. Li Da Xu, Shancang Li, "Securing the Internet of Things", Syngress.

Reference Books:

1. Alasdair Gilchrist, "IoT Security Issues", De Gruyter
2. Sean Smith, "The Internet of Risky Things" 4. Sean Smith, Shroff Publisher/O'Reilly Publisher

Course Code:	UCSMM0443		L	T	P	Credit
Course Name:	Bioimaging		3			3

Course prerequisites:

Signals and systems and linear algebra.

Course Description:

This course attempts to provide an introduction to the different commonly-used medical imaging systems. After the initial introduction and review modules, the different modalities can be taken as a stand-alone-module, and for each the physics, instrumentation, reconstruction and Image quality will be discussed.

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

CO1	Explain the fundamental concepts of biomedical imaging
CO2	Apply radiation dosimetry techniques,
CO3	Interpret image formation processes, and factors affecting image quality.
CO4	Illustrate the principles of radioactive decay and its statistical properties.
CO5	Explain the Doppler Effect in ultrasound.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2								1		2	2	
CO2	1	1			2			1	2				
CO3	2		2	1	3						1	2	2
CO4	2	2	2	2	1							2	2
CO5	1		1							1	1	3	

Assessment Scheme:

SN	Assessment	Marks	Remark
1	End Semester Examination (ESE)	100	100% course contents

Course Contents:

Unit 1 | Introduction, 2D- Signals Systems review, Image Quality metrics | 7 Hours

Introduction to Biomedical Imaging, Signals, System, Image Quality, Image Quality Metrics - contrast, resolution, noise, Signal to noise ratio, sampling, accuracy

Unit 2 | Projection Radiography | 7 Hours

Physics of Radiography - Ionization, Forms of Ionizing Radiations, Nature and properties of Ionizing Radiations, Radiation Dosimetry. Projection Radiography - Instrumentation, Image Formation, Noise and Scattering

Unit 3 | Computed Tomography | 5 Hours

CT Instrumentation, Image Formation, Image Quality in CT

Unit 4 | Nuclear Medicine- PET/SPECT | 8 Hours

Physics of Nuclear Medicine - Radioactive Decay, Modes of Decay, Statistics of Decay, Radiotracers
Planar scintigraphy - Instrumentation, Image Formation, Image Quality
Emission Computed Tomography (SPECT/PET) - Instrumentation, Image Formation, Image Quality in SPECT and PET

Unit 5 | Ultrasound Imaging | 6 Hours

Doppler Effect, Beam Pattern Formation and Focusing, UNtrasound Instrumentation, Ultrasound Imaging Modes, Steering and Focusing, 3D Ultrasound Imaging, Image Quality in Ultrasound		
Unit 6	**Magnetic Resonance Imaging**	**6 Hours**
MRI Instrumentation, MRI Data Acquisition, Image Reconstruction, Image Quality in MRI		
Text Books:		
1. Medical Imaging Signals and Systems by J. L. Prince and J. M. Links, Pearson Prentice Hall, 2006, ISBN 0130653535.		
Reference Books:		
1. Webb's Physics of Medical Imaging, 2nd Edition, CRC press		