

Government College of Engineering, Karad

Third Year (Sem - V) B. Tech. Information Technology

IT3501: Computer Networks

Teaching Scheme			
Lectures	03 Hrs/week	MSE	20
Tutorials	00 Hrs/week	ISE	20
Total Credits	03	ESE	60
Prerequisite: Computer Workshop		Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO): Students will be able to

- | | |
|------------|---|
| CO1 | Understand fundamentals of Computer Network and data communication system. |
| CO2 | Design and analyze different routing algorithms. |
| CO3 | Explore and various protocols and network technologies. |
| CO4 | Analyze working principle of client/server applications concern to application layer protocols. |

Course Contents

Unit 1	
CO1	Components of data communication, Data Flow, Definition and applications of computer networks, Network hardware: LAN, WAN, MAN, PAN, Topologies, Network software: Protocol hierarchy, design issues, services, OSI and TCP/IP reference models, Transmission Media, Networking components
CO2	Design issues for Data link Layer, Error control: detection and correction, Elementary Data Link protocols, Sliding window protocols, Go back n, Selective repeat Medium Access Control sublayer: Channel allocation problem, Multiple Access protocols ALOHA, CSMA, Collision Free Protocols, IEEE 802.X standards.

Unit 2	
CO2	Network Layer: Principles, Congestion prevention policies, congestion control in virtual circuit subnet, flooding, distance vector, link state, Broadcast routing, Congestion control algorithms: Network Layer Design issues, Routing Algorithms: Optimality principles, shortest path, choke packets, Load Shedding, Jitter control
CO3	Internet Layer Addresses and Protocols: Supernetting, Classless addressing, special addresses, IP Datagram format, Fragmentation and comparison between IPv4 and IPv6

Unit 3	
CO3	Transport Layer: Transport layer services and Principles, Transport layer Protocols: UDP-transport layer protocols, congestion control, The Internet Transport protocols: UDP-Introduction, RPC TCP: Introduction, Service Model, TCP Segment, TCP Connection Establishment, TCP Release connection, TCP Timers, (Self Study: Congestion Control and Sliding Window Protocols)
CO4	Application Layer: WWW, DNS, DHCP, FTP, SMTP, Telnet, SNMP. (Self Study: Emerging trends in Networking)

Unit 4	
CO3	Transport Layer: Transport layer services and Principles, Transport layer Protocols: UDP-transport layer protocols, congestion control, The Internet Transport protocols: UDP-Introduction, RPC TCP: Introduction, Service Model, TCP Segment, TCP Connection Establishment, TCP Release connection, TCP Timers, (Self Study: Congestion Control and Sliding Window Protocols)
CO4	Application Layer: WWW, DNS, DHCP, FTP, SMTP, Telnet, SNMP. (Self Study: Emerging trends in Networking)

Unit 5	
CO3	Transport Layer: Transport layer services and Principles, Transport layer Protocols: UDP-transport layer protocols, congestion control, The Internet Transport protocols: UDP-Introduction, RPC TCP: Introduction, Service Model, TCP Segment, TCP Connection Establishment, TCP Release connection, TCP Timers, (Self Study: Congestion Control and Sliding Window Protocols)
CO4	Application Layer: WWW, DNS, DHCP, FTP, SMTP, Telnet, SNMP. (Self Study: Emerging trends in Networking)

Unit 6	
CO3	Transport Layer: Transport layer services and Principles, Transport layer Protocols: UDP-transport layer protocols, congestion control, The Internet Transport protocols: UDP-Introduction, RPC TCP: Introduction, Service Model, TCP Segment, TCP Connection Establishment, TCP Release connection, TCP Timers, (Self Study: Congestion Control and Sliding Window Protocols)
CO4	Application Layer: WWW, DNS, DHCP, FTP, SMTP, Telnet, SNMP. (Self Study: Emerging trends in Networking)

Text Books	
1.	Behrouz A Forouzan, "TCP/IP Protocol Suite", TMH, 5 th Edition (Unit-1,2,3,4,5,6)
2.	James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", Pearson Publication, 6 th Edition, 2013.
3	Andrew S. Tannenbaum, "Computer Networks", PHI, 5 th Edition, 2010 (Unit-1,2,3,4,5,6)

Reference Books	
1.	W. Richard Stevens, Bill Fenner, Andrew M. Rodoff, "Unix Network Programming", Pearson, 3 rd Edition, 2009.
2.	Douglas E. Comer, Davis L. Stevens, "Internetworking with TCP/IP Vol-III Client server programming & application", Prentice-Hall of India Pvt. Ltd., 2 nd Edition, 2000.

Useful Links



Chairman, BOS IT

Rayphlem

HEAD



Govt. College of Engineering, KARAD
Department of Information Technology

Chairman, BOS IT
HEAD
Rajeshwar

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

1: Slight(Low)											
PO →	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
CO 1	1	-	3	-	2	-	-	-	-	-	1
CO 2	-	-	2	1	3	-	-	-	-	-	2
CO 3	-	-	1	-	3	1	-	-	-	-	2
CO 4	-	-	3	-	2	-	-	-	-	-	-
2: Moderate(Medium)											
PO →	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
CO 1	1	-	3	-	2	-	-	-	-	-	1
CO 2	-	-	2	1	3	-	-	-	-	-	2
CO 3	-	-	1	-	3	1	-	-	-	-	2
CO 4	-	-	3	-	2	-	-	-	-	-	-
3: Substantial(High)											
PO →	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
CO 1	1	-	3	-	2	-	-	-	-	-	1
CO 2	-	-	2	1	3	-	-	-	-	-	2
CO 3	-	-	1	-	3	1	-	-	-	-	2
CO 4	-	-	3	-	2	-	-	-	-	-	-

Mapping of COs and POs

1.	https://nptel.ac.in/courses/106/105/106105183/	Prof. S. K. Ghosh, IIT Kharagpur
2.	https://nptel.ac.in/courses/106/105/106105082/	Prof. A. Pal IIT Kharagpur.
3.	https://nptel.ac.in/courses/106/101/106101209/	Prof. S. Iyer, IIT Bombay.

Government College of Engineering, Karad

Third Year (Sem - V) B. Tech. Information Technology

IT3502: Software Engineering

Examination Scheme

Teaching Scheme			
Lectures	03 Hrs/week	MSE	20
Tutorials	00 Hrs/week	ISE	20
Total Credits	03	ESE	60
Prerequisite : Programming for Problem Solving		Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO): Students will be able to

CO1	Summarize different software process models.
CO2	Understand planning and managing software projects.
CO3	Prepare software requirement specification during analysis.
CO4	Apply the design fundamentals and industry practices.

Course Contents

Unit 1	CO1 (07)
Fundamentals of Software Engineering: Software engineering, Product: Evolving role of software, Software Characteristics, Components, Applications, Software crisis and Myths, Software Engineering Process, Model, Water fall, Incremental Model, Spiral Model, 4 GT Model, Agile process model and Rational Unified Process, CASE tools.	
Unit 2	CO2 (07)
Planning and Managing Software projects: People, Product, Process and Project, Measures, Metrics and Indicators, Metrics for software quality, Scope, Software Project Estimation, make by decision, Software risks - Identification, Projection, Assessment, Monitoring Project Scheduling and tracking tasks/Work break down structures, Time line charts, Project plan. (Self-Study: Empirical estimation model)	
Unit 3	CO2 (07)
Requirement Analysis: Communication Techniques, FAST, Quality deployment, Analysis Principles: Modeling, partitioning, Prototyping, Specification, SRS and SRS review analysis models: Data modeling, Functional modeling Information flow, Data flow Diagrams, Extension to real time systems.	
Unit 4	CO3 (07)
Design Fundamentals: Software Design and software design process, principals and concepts, Abstractions, Refinement and modularity, Software architecture, Control hierarchy, Partitioning, Data structure, Information hiding, Effective modular design, Cohesion, coupling, Design Model, Design documents.	
Unit 5	CO1, CO3 (05)
Design Methods: Architectural design and design process, transform and transaction flow, design steps, interface design, procedural design, graphical and tabular design notations.	
Unit 6	CO4 (07)
Software Testing Techniques and Strategies: Software testing fundamentals, Test case design, White box testing, Black box testing, Control structure testing, Strategic approach to testing, Strategic issues, Unit testing, Integration testing, Validation testing, System testing (Self-Study: Case Study on Software Project Management Tools)	

Text Books

1.	Roger S. Pressman "Software Engineering- A Practitioner's Approach" TMH, 6 th Edition, 2001 (Unit 1,2,3,4,5,6)
----	---

Reference Books

1.	Rajib Mall, "Fundamentals of Software Engineering" PHI, 4 th Edition, 2014.
2.	Ian Sommerville, "Software Engineering" Pearson Publication, 9 th Edition, 2017
3.	Pankaj Jalote, "Software Engineering : A Precise Approach" Wiley India, 3 rd Edition, 2010
4.	Kogent "Software Engineering" Wiley India, 2 nd Edition, 2010
Useful Links	
1.	http://nptel.ac.in/courses/106105087 Prof. Rajib Mall, IIT Kharagpur



Chairman, BOS IT
Bejinder
HEAD

HEAD

Chairman, BOS IT



Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	10
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

1: Slight(Low)												
2: Moderate(Medium)												
3: Substantial(High)												
PO →	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO 1	-	2	2	-	-	2	1	1	3	3	1	3
CO 2	-	2	2	-	-	1	2	1	3	3	1	3
CO 3	-	2	2	-	-	1	2	1	3	3	1	3
CO 4	-	2	2	-	-	2	1	1	3	3	1	3

Mapping of COs and POs

2.	https://nptel.ac.in/courses/106/101/106101061/	Prof. N. L. Sarda, IIT Bombay
3.	https://nptel.ac.in/courses/106/105/106105182/	Prof. R. Mall IIT Kharagpur

Government College of Engineering, Karad
Third Year (Sem - V) B. Tech. Information Technology
IT3503: Artificial Intelligence

Teaching Scheme			
Lectures	03 Hrs/week	MSE	20
Tutorials	00 Hrs/week	ISE	20
Total Credits	03	ESE	60
Prerequisite : Data Structures, Design and Analysis of Algorithms		Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO): Students will be able to			
CO1	Understand the fundamental concepts of Artificial Intelligence (AI)	CO2	Apply Problem-Solving and Reasoning Techniques
CO3	Develop Expertise in Planning, Decision-Making, and Optimization	CO4	Explore Applications and Ethical Implications of AI

Course Contents			
Unit 1	CO1 (07)	CO2 (07)	CO3 (06)
Introduction to Artificial Intelligence: Definition and Scope of AI, History and Evolution of AI, Agents and Environments: Solving Agents, Uniform Cost Search, Informed Search Strategies: Breadth-First Search (BFS), Depth-First Search (DFS), Uniform Cost Search, Informed Search Strategies: Greedy Best-First Search, A* Search, Adversarial Search: Minimax Algorithm, Alpha-Beta Pruning			
Unit 2	CO2 (07)	CO2 (07)	CO3 (06)
Knowledge Representation and Reasoning: Order Logic, Reasoning Systems: Forward and Backward Chaining, Probabilistic Reasoning: Bayesian Networks			
Unit 3	CO2 (06)	CO2 (06)	CO3 (06)
Planning and Decision-Making: Planning in AI: Classical Planning Problems, STRIPS Representation, Partial-Order Planning, Planning Graphs, Decision-Making Under Uncertainty: Utility Theory and Decision Networks, Markov Decision Processes (MDPs). (Self Study: Reinforcement Learning)			
Unit 4	CO3 (06)	CO3 (06)	CO3 (06)
Search and Optimization Techniques: Local Search Algorithms: Hill-Climbing, Simulated Annealing, Genetic Algorithms and Evolutionary Computation, Constraint Satisfaction Problems (CSPs): Backtracking Search, Forward Checking and Constraint Propagation, Multi-Agent Systems and Game Theory: Nash Equilibrium, Cooperative vs. Competitive Systems			
Unit 5	CO3 (07)	CO3 (07)	CO3 (07)
Reasoning Under Uncertainty: Probabilistic Reasoning: Bayesian Inference, Hidden Markov Models (HMMs), Fuzzy Logic: Membership Functions and Operations, Applications in AI, Temporal Reasoning: Time and Event Calculus, (Self Study: Dynamic Bayesian Networks)			
Unit 6	CO4 (07)	CO4 (07)	CO4 (07)
AI Applications: Overview of AI Applications in Various Fields: Healthcare (Diagnostics, Personalized Medicine), Finance (Fraud Detection, Trading Systems), Education (Intelligent Tutoring Systems), Gaming and Entertainment, Robotics and Automation: Path Planning and Navigation, Robot Perception and Control, Ethical and Responsible AI, Explainable AI and Strong AI: Ethical Challenges, Bias and Fairness in AI Systems, Regulatory Considerations			

Text Books	
1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" 3 rd Edition, 2021 (Unit: 1,2,3,4,5,6)	
Reference Books	
1. E. Rich, K. Knight, and S. B. Nair, "Artificial Intelligence", 3 rd Edition, New York, NY, USA: McGraw Hill, 2009.	



Chairman, BOS IT

 HEAD



Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

1: Slight (Low)												2: Moderate (Medium)						3: Substantial (High)					
PO ←	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO		
CO ↑	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10		
CO 1	3	2	-	-	-	1	-	-	-	-	-	1	2	3	4	5	6	7	8	9	10		
CO 2	2	3	2	-	-	1	-	-	-	-	-	1	2	3	4	5	6	7	8	9	10		
CO 3	-	-	-	3	2	1	-	-	-	-	-	1	2	3	4	5	6	7	8	9	10		
CO 4	-	-	-	-	3	2	1	-	-	-	-	1	2	3	4	5	6	7	8	9	10		

2.	D. W. Patterson, Introduction to Artificial Intelligence and Expert Systems. Englewood Cliffs, NJ, USA: Prentice Hall, 1990.
3.	I. Bratko, Prolog "Programming for Artificial Intelligence", 3rd ed. Harlow, UK: Addison-Wesley, 2001.
4.	I. Goodfellow, Y. Bengio, and A. Courville, "Deep Learning", Cambridge, MA, USA: MIT Press, 2016.
Useful Links	
1.	https://nptel.ac.in/courses/106102220 Prof. Mausam, IIT Delhi
2.	https://onlinecourses.nptel.ac.in/noc24_ge47/preview Prof. Shyamanta M. Hazarika, IIT Guwahati

Government College of Engineering, Karad			
Third Year (Sem – V) B. Tech. Information Technology			
IT3505: Multi-disciplinary Minor-03 Database Management Systems			
Teaching Scheme		Examination Scheme	
Lectures	03 Hrs/week	MSE	20
Tutorials	00 Hrs/week	ISE	20
Total Credits	03	ESE	60
		Duration of ESE	02 Hrs 30 Min
Prerequisite : Fundamentals of data Structure, Discrete Mathematics			
Course Outcomes (CO): Students will be able to			
CO1 Understand the basic concepts of database management systems.			
CO2 Analyze a database application scenario and apply the ER model to conceptually design the database.			
CO3 Formulate relational algebra expressions, SQL queries for a given specification			
CO4 Apply normalization techniques using indexing and concurrency control to improve database design			
Course Contents			
Unit 1	Introduction to DBMS:	CO1	(05)
Unit 2	Data Models and E-R Model	CO2	(06)
Unit 3	Integrity Constraints and Design:	CO2, CO4	(08)
Unit 4	SQL and PL SQL:	CO3	(08)
Unit 5	Indexing and Hashing:	CO4	(06)
Unit 6	Applications of Database Management Systems:	CO1, CO4	(07)
Text Books			
1.	Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", McGraw-Hill, 6 th edition, S2013 (Unit: 1,2,3,4,5,6)		
2.	Elmasri and Navathe, "Fundamentals of Database System", Addison Wesley Publication, 5 th edition, 2005.		
Reference Books			
1.	J. D. Ullman, "Principles of Database and Knowledge – Base Systems", Vol 1, Computer Science Press, 1988		
2.	Serge Abiteboul and Richard Hull, Victor Vianu, "Foundations of Databases", Reprint, Addison-Wesley, 1994		
3.	Ram Krishnan and Gehrke, "Database Management System", 3 rd Edition, McGraw Hill Inc, 2022		
Useful Links			
1.	http://nptel.ac.in/courses/106106093/ Prof. D. Janakirram, IIT Madras.		
2.	http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall2010/lecture-notes.		





Chairman, BOS IT
HEAD

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	20
Analyse	5	5	20
Evaluate	5	5	10
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

1: Slight (Low) 2: Moderate(Medium) 3: Substantial(High)

PO →	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3	2	1	-	1	-	-	-	-	-	2
CO 2	-	1	2	3	-	1	-	-	-	-	-	-
CO 3	-	1	2	3	-	1	-	-	-	1	-	-
CO 4	-	-	2	3	-	1	1	-	-	-	-	-

Mapping of COs and POs

3.	https://www.cse.iitb.ac.in/~sudarsaha/db-book/slide-dir
4.	http://www.tutorialspoint.com/dbms

Government College of Engineering, Karad
Third Year (Sem - V) B. Tech. Information Technology
IT3516: Open Elective-03 Augmented Reality and Virtual Reality

Teaching Scheme			
Lectures	02 Hrs/week		
Tutorials	00 Hrs/week		
Total Credits	02		
Prerequisite : Computer Graphics, Java Programming			
Course Outcomes (CO): Students will be able to			

CO1	Gain foundational knowledge of virtual reality concepts, including the principles of interface design and interaction within virtual environments.
CO2	Analyze the role of visual perception in VR and apply rendering techniques to create realistic and immersive experiences.
CO3	Develop proficiency in using state-of-the-art tools and frameworks for creating virtual reality applications, including AR/VR-specific development environments.
CO4	Design and implement augmented and virtual reality applications across diverse domains such as education, healthcare, and entertainment.

Course Contents			
Unit	CO	Hours	
Unit 1	CO1	(04)	Introduction to Virtual Reality: Defining Virtual Reality, Four Key Elements of Virtual Reality, Artificial Reality, Virtual World Cyberspace, Augmented Reality Tele presence, Virtual Reality, Tele presence, Augmented Reality and Cyberspace, A History of VR.
Unit 2	CO1	(04)	Interface to the Virtual World-Input: User Monitoring (User Input to the Virtual World) Position, Tracking Body, Tracking Other Physical Input Devices, World Monitoring (Dynamic Input to the Virtual World), Persistent Virtual Worlds, Interface to the Virtual World-Output.
Unit 3	CO2	(05)	Visual Perception & Rendering: Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering-Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates.
Unit 4	CO3	(05)	Augmented Reality: Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, enhancing interactivity in AR environments (Self Study: Evaluating AR systems)
Unit 5	CO3	(04)	Development Tools and Frameworks: Human factors: Introduction, the eye, the ear, the somatic senses, Hardware: Introduction, sensor hardware, Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML. (Self Study: Integrated VR Systems)
Unit 6	CO4	(04)	AR/VR Applications: Introduction, Engineering, Entertainment, Science, Training. Case studies: NICE, An Educational Experience B Crumbs, A Tool for Scientific Visualization C Boeing Wire Bundles, An Augmented Reality System D Placeholder, (Self Study: An Artistic Exploration)

Text Books			
1.	William R Sherman and Alan B Craig, "Understanding Virtual Reality - Interface, Application and Design", Morgan Kaufmann Publishers, San Francisco, 3 rd Edition, 2002. (Unit: 1,2,3)		
2.	Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications", Morgan Kaufmann, 2 nd Edition, 2013. (Unit: 4,5,6)		
Reference Books			
1.	Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2016.		
2.	Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Applications, Foundations of Effective Design", Morgan Kaufmann, 2009.		
3.	John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007.		



HEAD
Chairman, BOS IT

Useful Links	1.	https://stanford.edu/class/ee267/syllabus.html	Prof. Ivan Sutherland, Stanford University.
	2.	https://nptel.ac.in/courses/106/106/106106138/	Prof. Steve Lavalle, IIT Madras.
	3.	https://nptel.ac.in/courses/121/106/121106013/	Prof. Dr. M. Maniyanman, IIT Madras.

Mapping of COs and POs

	PO →	CO ↓	CO 1	CO 2	CO 3	CO 4	1: Slight(Low)	2: Moderate(Medium)	3: Substantial(High)
PO →	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	-	-	-	-	-	-
	1	2	3	-	-	-	-	-	-
	1	2	3	-	-	-	-	-	-
	1	2	3	-	-	-	-	-	-
	1	2	3	-	-	-	-	-	-
	1	2	3	-	-	-	-	-	-
	1	2	3	-	-	-	-	-	-
	1	2	3	-	-	-	-	-	-
	1	2	3	-	-	-	-	-	-

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60



Chairman, BOS IT

HEAD

Department of Information Technology
Govt. College of Engineering, KARAO



Chairman, BOS IT
HEAD

Government College of Engineering, Karad			
Third Year (Sem – V) B. Tech. Information Technology			
IT3507: Computer Networks Lab			
Laboratory Scheme:		Examination Scheme:	
Practical		02 Hrs/week	
Total Credits		01	
Prerequisite : Computer Network, Knowledge of Programming			
Course Outcomes (CO): Students will be able to			
CO1	Understand and apply networking hardware and software to design network.		
CO2	Implement various Networking protocols.		
CO3	Configure/Implement various client/server environments to use application layer protocols.		
CO4	Demonstrate and use of various networking tools and technologies.		
Course Contents			
CO		Implementation of following concepts	
Experiment 1		Survey of Campus wide Networking and components in the working organization and suggest any one improvement	
Experiment 2		Demonstration of Network Connectivity Testing Tools/Utilities/commands	
Experiment 3		Framing Methods (Bit Stuffing and Character Stuffing)	
Experiment 4		Error detection methods (Hamming Code) and Error correction methods (CRC)	
Experiment 5		Simulate Go Back N and Selective Repeat Modes of Sliding window protocol.	
Experiment 6		Identify MAC address, IP address, subnet mask, first and last Address using given IP Address	
Experiment 7		Shortest Path routing algorithm.	
Experiment 8		Socket programming (TCP and UDP)	
Experiment 9		Demonstration of Network packet capturing and analysis Tool(Wireshark)	
Experiment 10		Understand measures of network performance: Throughput and Delay	
Experiment 11		Understand the events involved in NetSim DES(Discrete Event Simulator) in simulating flow of one packet from a wired node to wireless node (Level 2)	
Experiment 12		Study the working and routing table formation of interior routing protocols, like Routing Information Protocol (RIP) and Open Shortest Path First (OSPF) using NetSim (Mandatory)	
Experiment 13		Implement a mini project based on given case study. (Mandatory)	
CO1, CO2, CO3, CO4			
List of Submission: Course coordinator should give new problem statement based on above list of experiments.			
Minimum number of Experiments : 10			

Chairman, BOS IT

Skill Level (as per CAS Sheet)	Task I	Task II	Task III	ISE
Exp	1	05	05	25
Exp	2	15	05	25
Exp	3	15	05	25
Exp	4	15	05	25
Exp	5	15	05	25
Exp	6	15	05	25
Exp	7	15	05	25
Exp	8	15	05	25
Exp	9	15	05	25
Exp	10	15	05	25
Exp	11	15	05	25
Exp	12	15	05	25
Avg				

Guideline for Assessment Pattern:

Mapping of COs and POs																
PO →	CO 1	CO 2	CO 3	CO 4	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1: Slight (Low)	2	-	-	2	2	3	1	1	1	1	1	1	1	2	-	2
2: Moderate (Medium)	2	-	-	1	2	1	1	1	1	1	1	1	1	1	-	2
3: Substantial (High)	2	-	-	1	1	1	1	1	1	1	1	1	1	1	-	2
PO 1	2	-	-	3	1	1	1	1	1	1	1	1	1	-	-	2
PO 2	2	-	-	2	1	1	1	1	1	1	1	1	1	-	-	2
PO 3	2	-	-	1	2	1	1	1	1	1	1	1	1	-	-	2
PO 4	2	-	-	1	1	1	1	1	1	1	1	1	1	-	-	2
PO 5	2	-	-	1	1	1	1	1	1	1	1	1	1	-	-	2
PO 6	2	-	-	1	1	1	1	1	1	1	1	1	1	-	-	2
PO 7	2	-	-	1	1	1	1	1	1	1	1	1	1	-	-	2
PO 8	2	-	-	1	1	1	1	1	1	1	1	1	1	-	-	2
PO 9	2	-	-	1	1	1	1	1	1	1	1	1	1	-	-	2
PO 10	2	-	-	1	1	1	1	1	1	1	1	1	1	-	-	2
PO 11	2	-	-	1	1	1	1	1	1	1	1	1	1	-	-	2
PO 12	2	-	-	1	1	1	1	1	1	1	1	1	1	-	-	2

Laboratory Scheme:	
Practical	02 Hrs/week
Total Credits	01
Prerequisite : Data Structure, Mathematics	
Course Outcomes (CO): Students will be able to	
CO1	Understand and Apply Spring Framework Concepts.
CO2	Implement form handling, validation (email & date), and authentication mechanisms using the Struts Framework for robust web applications.
CO3	Design and develop database-integrated web applications using Spring Boot, Hibernate ORM, and Hibernate Query Language (HQL) for data persistence.
CO4	Apply Hibernate mapping collections and query optimization techniques to enhance data retrieval and storage in enterprise applications.

Course Contents	
CO	
Implementation of following concepts	
Experiment 1	Spring Framework Annotations
Experiment 2	Spring Boot with REST API
Experiment 3	Spring Boot with Database and Data JPA.
Experiment 4	Application to handle form data in spring MVC.
Experiment 5	Email Validation using Struts Framework
Experiment 6	Date Validation using Struts Framework
Experiment 7	Build a Web Application Using the Struts Framework with Database Integration.
Experiment 8	Create a Login and Logout System Using the Struts Validation Framework.
Experiment 9	Develop a Web application using Hibernate Framework.
Experiment 10	Application using Hibernate Mapping Collections.
Experiment 11	Hibernate – Query Language
Experiment 12	Mini Project: Design and implement a dynamic web application for any business functionality (Mandatory)
CO1, CO2, CO3, CO4	

List of Submission: Course coordinator should give new problem statement based on above list of experiments.	
Minimum number of Experiments : 10	

Mapping of COs and POs	
PO →	CO ↓
PO 1	CO 1
PO 2	CO 2
PO 3	CO 3
PO 4	CO 4
PO 5	CO 1
PO 6	CO 2
PO 7	CO 3
PO 8	CO 4
PO 9	CO 1
PO 10	CO 2
PO 11	CO 3
PSO 1	CO 4
PSO 2	CO 1





HEAD
Chairman, BOS IT

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

Guideline for Assessment Pattern:



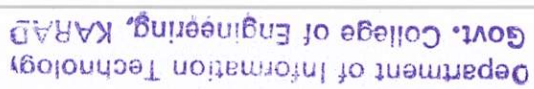
Chairman, BOS IT
HEAD

Mapping of COs and POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	3	2	-	2	-	-	3	-	-	2	-	2	1
CO 2	2	3	2	-	-	-	2	-	-	2	-	2	1
CO 3	-	-	3	-	-	-	3	-	-	2	-	2	1
CO 4	-	-	-	3	-	-	2	-	-	2	-	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Government College of Engineering, Karad	
Third Year (Sem - V) B. Tech. Information Technology	
IT3509: Artificial Intelligence Lab	
Laboratory Scheme:	Examination Scheme:
Practical	02 Hrs/week
Total Credits	01
Prerequisite : Data Structure, Mathematics	ESE
Course Outcomes (CO): Students will be able to	ISE
CO1	Implement AI search algorithms to solve real-world problems.
CO2	Develop knowledge-based reasoning systems using propositional and first-order logic.
CO3	Apply learning models for decision-making and optimization.
CO4	Explore AI applications in fields such as healthcare, finance, and robotics.
Course Contents	
Implementation of following concepts	
Experiment 1	Develop a reflex-based agent in a grid world.
Experiment 2	Implement Greedy Best-First Search and A Search* on a graph-based problem.
Experiment 3	Solve a pathfinding problem using Uniform Cost Search.
Experiment 4	Implement the Minimax Algorithm for a simple game (e.g., Tic-Tac-Toe).
Experiment 5	Solve an 8-puzzle problem using heuristic functions.
Experiment 6	Develop a Bayesian Network for medical diagnosis and perform inference.
Experiment 7	Develop a Partial-Order Planning solution for a real-world scenario.
Experiment 8	Markov Decision Process (MDP) for a simple decision-making problem.
Experiment 9	Develop a Genetic Algorithm for solving a scheduling problem.
Experiment 10	Solve the N-Queens Problem using Backtracking Search and Forward Checking.
Experiment 11	Implement a Hidden Markov Model (HMM) for weather prediction.
Experiment 12	Develop a Fuzzy Inference System for an intelligent decision-making application.
List of Submission: Course coordinator should give new problem statement based on above list of experiments.	
Software and Tools Required	
• Programming Language: Python • Libraries: NumPy, Pandas, SciPy, Scikit-learn, TensorFlow/PyTorch, OpenAI Gym, NetworkX • Tools: Jupyter Notebook, Google Colab	
Minimum number of Experiments : 10	



for

Chairman, BOS IT

[illegible]

Guideline for Assessment Pattern:

Laboratory Scheme:		Examination Scheme:	
Practical	02 Hrs./week	ISE	50
Total Credits	01	ESE	--

Prerequisite: Fundamentals of data Structure, Discrete Mathematics

Course Outcomes (CO): Students will be able to

CO1	Design ER diagrams for the case studies.
CO2	Apply DDL, DML, TCL and DCL statements on various databases.
CO3	Analyze and implement concepts in PL-SQL like Procedures, Triggers and Cursors.
CO4	Design Database and apply CRUD operations on the database.

Course Contents

Implementation of following concepts

Experiment 1	Study and design of ER diagram for given case study.	CO1
Experiment 2	Implementation of DDL for given case study. (Create table with all constraints, Alter table, Drop table).	CO2
Experiment 3	Implementation of DML for given case study. (Basic SQL structure-select, from, where clause, Other DML clauses like insert, update, delete, between, etc.)	CO2
Experiment 4	Implementation of joins for given case study- (Natural Join, outer joins)	CO2
Experiment 5	Study and use of string, set operations, order by clause, Queries based on above commands. Aggregate functions, Group by, Having clauses for given case study.	CO2
Experiment 6	Study of DCL queries (SavePoint, RollBack, and Commit) for given case study.	CO2
Experiment 7	Implement a View and its operation on the given case study.	CO3
Experiment 8	Study of TCL queries (Grant, Revoke) for given case study.	CO2
Experiment 9	Implement Procedures and functions in PL-SQL.	CO3
Experiment 10	NoSQL database operations using MongoDB.	CO3
Experiment 11	Execute Aggregation operations : \$avg, \$min, \$max, \$push, \$addToSet etc	CO4
Experiment 12	Implement a mini project based on given case study. (Mandatory)	CO4
List of Submission: Course coordinator should give new problem statement based on above list of experiments.		
Minimum number of Experiments : 10		

Mapping of COs and POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	1	-	3	2	1	1	1	1	-	-	-	2	1
CO 2	2	1	3	2	1	1	1	1	-	-	-	2	-
CO 3	1	-	1	2	1	1	1	1	-	1	-	3	-
CO 4	1	2	2	2	3	1	1	1	-	1	1	3	-
1: Slight (Low)													
2: Moderate (Medium)													
3: Substantial (High)													



Chairman, BoS IT

HEAD



Govt. College of Engineering, KARAP
Department of Information Technology

HEAD

[Signature]

Chairman, Bos IT

Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Task I	Task II	Task III	ISE
Exp 1	15	05	05	25
Exp 2	15	05	05	25
Exp 3	15	05	05	25
Exp 4	15	05	05	25
Exp 5	15	05	05	25
Exp 6	15	05	05	25
Exp 7	15	05	05	25
Exp 8	15	05	05	25
Exp 9	15	05	05	25
Exp 10	15	05	05	25
Avg	15	05	05	25

Government College of Engineering, Karad

Third Year (Sem – V) B. Tech. Information Technology

IT3514: Program Elective-01: Web Technology

Teaching Scheme			
Lectures	03 Hrs/week		
Tutorials	00 Hrs/week		
Total Credits	03		
Prerequisite : Data Structure			
Course Outcomes (CO): Students will be able to			
CO1 Apply the client side technologies for web development.			
CO2 Analyse the concepts of Servlet and JSP.			
CO3 Create the effective web applications for business functionalities using latest web development platforms.			
CO4 Analyse the Web services and frameworks.			
Examination Scheme			
MSE	20		
ISE	20		
ESE	60		
Duration of ESE	02 Hrs 30 Min		

Course Contents

Unit 1	CO1	(08)
Web Essentials and Mark-up language- HTML		
The Internet, basic internet protocols, the world wide web, HTTP Request message, HTTP response message, web clients, web servers. HTML: Introduction, history and versions. HTML elements, CSS: Introduction to Style Sheet, CSS features, CSS core syntax, Style sheets and HTML, Bootstrap.		

Unit 2	CO2	(05)
Client Side Technologies: JavaScript and DOM		
JavaScript: Introduction to JavaScript, basic syntax, variables and data types, statements, operators, literals, functions, objects, arrays, built in objects, JavaScript debuggers. DOM: Introduction to Document Object Model, jQuery, Overview of Angular JS.		

Unit 3	CO2	(04)
Java Servlets and XML		
Servlet: Servlet architecture overview, Servlets generating dynamic content, Servlet life cycle, parameter data, sessions, cookies, URL rewriting, databases (MySQL) and Java Servlets. XML: XML documents and vocabularies, XML declaration, XML Namespaces DTD, AJAX: Introduction, Working of AJAX.		

Unit 4	CO3	(04)
JSP and Web Services		
JSP: Introduction to Java Server Pages, JSP and Servlets, running JSP applications, Basic JSP, JavaBeans classes and JSP, Support for the Model-view-controller paradigm, JSP related technologies. Web Services: Web Service concepts, WSDL. (Self Study: Communicating Object data: SOAP, Struts)		

Unit 5	CO3	(05)
Server Side Scripting Languages		
PHP: Introduction to PHP, uses of PHP, general syntactic characteristics, Primitives, operations and expressions, output, control statements, arrays, functions, pattern matching, form handling, files, cookies, session tracking, using MySQL with PHP, WAP and WML. Introduction to ASP.NET, Node JS, MERN and MEAN Technology.		

Unit 6	CO4	(05)
Ruby and Rails		
Introduction to Ruby: Origins & uses of Ruby, scalar types and their operations, simple input and output, control statements, fundamentals of arrays, hashes, methods, classes, code blocks and iterators, pattern matching. Introduction to Rails, Rails with Ajax. (Self Study: Introduction to EJB)		

Text Books		
1.	Jeffrey C.Jackson, "Web Technologies: A Computer Science Perspective", 2 nd Edition, Pearson Education, 2007, ISBN 978-0131856035. (Unit 1,2,3,4,5,6)	
2.	Robert W. Sebesta, "Programming the World Wide Web", 4 th Edition, Pearson education, 2008.	
Reference Books		
1.	Marty Hall, Larry Brown, "Core Web Programming", 2 nd Edition, Pearson Education, 2001, ISBN 978-	



Chairman, BOS IT
[Signature]
HEAD

HEAD
Chairman, BOS IT



Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

1: Slight (Low)													2: Moderate (Medium)													3: Substantial (High)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
PO →	CO 1	CO 2	CO 3	CO 4	PO →	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PO 16	PO 17	PO 18	PO 19	PO 20	PO 21	PO 22	PO 23	PO 24	PO 25	PO 26	PO 27	PO 28	PO 29	PO 30	PO 31	PO 32	PO 33	PO 34	PO 35	PO 36	PO 37	PO 38	PO 39	PO 40	PO 41	PO 42	PO 43	PO 44	PO 45	PO 46	PO 47	PO 48	PO 49	PO 50	PO 51	PO 52	PO 53	PO 54	PO 55	PO 56	PO 57	PO 58	PO 59	PO 60	PO 61	PO 62	PO 63	PO 64	PO 65	PO 66	PO 67	PO 68	PO 69	PO 70	PO 71	PO 72	PO 73	PO 74	PO 75	PO 76	PO 77	PO 78	PO 79	PO 80	PO 81	PO 82	PO 83	PO 84	PO 85	PO 86	PO 87	PO 88	PO 89	PO 90	PO 91	PO 92	PO 93	PO 94	PO 95	PO 96	PO 97	PO 98	PO 99	PO 100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
	3	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Mapping of COs and POs

0130897930.	2.	H.M. Deitel, P.J. Deitel and A.B. Goldberg, "Internet & World Wide Web How To Program", 3 rd Edition, Pearson Education, 2006, ISBN 978-0131752429.	3.	Chris Bates, "Web Programming Building Internet Applications", 3 rd Edition, Wiley India, 2006.	4.	Xue Bai et al, "The web Warrior Guide to Web Programming", Thomson, 2003.	Useful Links		1.	https://archive.nptel.ac.in/courses/106/105/106105084/ Prof. I. Sengupta, IITKharagpur	2.	https://freevideolectures.com/course/2308/internet-technology/25 video lecture by Prof. Indranil Sengupta, IIT, Kharagpur	3.	https://www.digitat.in/nptel/courses/video/106105191/L01.html	4.	http://www.nptelvideos.com/php/php_video_tutorials.php
-------------	----	--	----	--	----	---	--------------	--	----	--	----	---	----	---	----	--

Government College of Engineering, Karad
Third Year (Sem – V) B. Tech. Information Technology
IT3524: Program Elective-01: Machine Learning

Teaching Scheme			
Lectures	03 Hrs./week		
Tutorials	00 Hrs./week		
Total Credits	03		
Prerequisite: Basics of Linear Algebra, Calculus, Probability			
Course Outcomes (CO): Students will be able to			

CO1	Identify the needs and challenges of machine learning for real time applications.
CO2	Analyse various data pre-processing techniques to simplify and speed up machine learning algorithms.
CO3	Understand various regression & classification techniques and evaluate their performance.
CO4	Discuss unsupervised machine learning algorithms and basic concept of ANN.

Course Contents

Unit	Topic	CO	Hours
Unit 1	Introduction to Machine Learning model, Probabilistic Models, Logical Models, etc.	CO1	(06)
Unit 2	Feature Engineering Data Acquisition and EDA, Concept of Feature, Pre-processing of data, Introduction to Dimensionality Reduction, Principal Component Analysis (PCA), Feature Extraction, Statistical feature engineering: count-based, Length, Mean, Median, Mode etc.	CO2	(06)
Unit 3	Supervised Learning : Regression (Self-study : Linear Discriminant Analysis) Bias, Variance, Generalization, Under fitting, Over fitting, Linear regression, Ridge regression, Lasso regression, Gradient descent algorithm, Evaluation Metrics.	CO3	(07)
Unit 4	Supervised Learning : Classification Metrics and Score. (Self-study : Random Forest) Classification: K-nearest neighbour, Support vector machine, Decision Trees, Evaluation	CO3	(07)
Unit 5	Unsupervised Learning: K-Means, and different types of Clustering algorithms, Outlier analysis: introduction of isolation factor, local outlier factor. Evaluation metrics and score: elbow method, extrinsic and intrinsic methods.	CO4	(07)
Unit 6	Introduction To Neural Networks: Artificial Neural Networks: Single Layer Neural Network, Multilayer Perceptron, Back Propagation Learning, Functional Link, and Radial Basis Function Network, Activation functions, Overview of Deep Learning. (Self-Study: Business Applications of CNN)	CO4	(07)

Text Books	
1.	Tom Mitchell, "Machine learning", McGraw-Hill series in Computer Science, 2020 (Unit 1,2,3,4,5,6)
2.	Sanjeev J. Wagh, Manisha S. Bhende and Anuradha D. Thakare "Fundamentals of Data Science", A Chapman & Hall Book, CRC Press, 1 st Edition 2021, (Unit 3,4,5)
3.	Ethem Alpaydm, "Introduction to Machine Learning", PHI, 2 nd Edition-2013

Reference Books	
1.	Bishop, Christopher M., and Nasser M. Nasrabadi, "Pattern recognition and machine learning", Vol. 4, No.4, New York: Springer, 2006
2.	Shalev-Shwartz, Shai, and Shai Ben-David, "Understanding machine learning: From theory to algorithms", Cambridge university press, 2014
3.	Jiawei Han, Micheline Kamber, and Jian Pei, "Data Mining: Concepts and Techniques", Elsevier Publishers Third Edition, ISBN: 9780123814791, 9780123814807
4.	Parag Kulkarni: Reinforcement and Systematic Machine Learning for Decision Making, Wiley IEEE Press, July 2012.
5.	Shalev-Shwartz S., Ben-David S., "Understanding Machine Learning: From Theory to Algorithms", CUP, 2014

Useful Links



Chairman, BOS IT

 HEAD



HEAD

[Signature]

Chairman, BOS IT

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

1: Slight (Low)												2: Moderate (Medium)												3: Substantial(High)											
PO →	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO			
CO 1	3	2	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
CO 2	2	2	1	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
CO 3	2	2	2	-	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
CO 4	3	-	-	1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			

Mapping of COs and POs

1.	https://nptel.ac.in/courses/106/106/106106139/	Introduction to Machine Learning, Dr. Balaraman Ravindran,
2.	https://nptel.ac.in/courses/106/106/106106202/	Machine Learning, Prof. Carl Gustaf Jansson
3.	https://nptel.ac.in/courses/106/105/106105152/	Introduction to Machine Learning, Prof. S. Sarkar

Government College of Engineering, Karad

Third Year (Sem – V) B. Tech. Information Technology

IT3534: Program Elective-01 : Advanced Database Management Systems

Teaching Scheme

Lectures 03 Hrs/week

Tutorials 00 Hrs/week

Total Credits 03

Prerequisite : Database Management Systems

Course Outcomes (CO): Students will be able to

CO1 Understand fundamental concepts involved in advanced databases.

CO2 Design database schemas using object oriented and object relational database.

CO3 Analyze architectures and performance of parallel and distributed databases using modern tools.

CO4 Explore the optimal database-based solution to solve real world problem.

Course Contents

Unit 1	Extended ER:	CO1 (06)	Hours
--------	--------------	----------	-------

Specialization and Generalization, Subclass super class, Constraints and characteristics of specialization and Generalization, Relationship types of degree higher than two, Aggregation, Union and Categories.

Unit 2	Object Oriented Databases:	CO2 (07)
--------	----------------------------	----------

Overview of object oriented concepts, Object identity, Object structure and type constructors, Encapsulation of operations, Methods and persistence, Type hierarchies and inheritance, Type extends and queries, Complex objects, OQL basics

Unit 3	Object Relational Database:	CO2 (06)
--------	-----------------------------	----------

Nested relations and collections, Inheritance, Reference types, Functions and procedures, Storage and access methods, Query processing and optimization, Comparison of relational and cloud databases, Comparison of RDBMS, OODBMS and ORDBMS.

Unit 4	Parallel Database and Distributed Database:	CO3 (08)
--------	---	----------

Architectures for parallel databases, Parallel query evaluation, Sorting, Joins, Distributed database concepts, Data fragmentation, Replication and allocation techniques for distributed database design, Query processing in distributed databases, Concurrency control and recovery in distributed database.

Unit 5	NOSQL Databases:	CO3 (06)
--------	------------------	----------

Searching: Features of NoSQL, Types of NoSQL databases: Document-oriented (MongoDB, CouchDB), Column-family (Cassandra, HBase), Key-value stores (Redis, DynamoDB), Graph databases (Neo4j) (Self-Study: Design and Implementation of Cloud Native/MongoDB)

Unit 6	Recent Applications:	CO4 (08)
--------	----------------------	----------

SpatialDB: Spatial Query Processing, Access Methods, Handling High-Dimensional Data, a Data-based and User-centric Approach to Spatial Information, Database Security: Threats to databases-SQL injection, Database access control: Discretionary and mandatory access control (RBAC), Data encryption techniques for database security, Auditing and intrusion detection in databases.

Text Books

1.	R. Elmasri and S. Navathe, "Fundamentals of Database Systems", Pearson Education, 5 th Edition, 2013. (Unit: 1, 2, 3)
----	--

2.	Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw Hill Higher Education, 6 th Edition, 2010. (Unit: 4, 5, 6)
----	--

3.	Albert K. W. Yeung, G. Brent Hall, "Spatial Database Systems: Design, Implementation and Project Management", Springer Volume 87, 2007 (Unit:6)
----	---

Reference Books

1.	J. D. Ullman, "Principles of Database and Knowledge – Base Systems", Vol. 1, Computer Science Press, 1988
----	---



HEAD

[Signature]

Chairman, BOS IT

2.	Serge Abiteboul, Richard Hull, Victor Vianu, "Foundations of Databases", Prentice Hall of India, 4 th Edition 1991. ISBN: 81 – 203 – 1553 – 7.
Useful Links	
1.	http://www.nptelvideos.in/2012/11/database-management-system.html Prof. D. Janakiram, IIT Madras
2.	https://nptel.ac.in/courses/106/106/106106220/ Prof. S. Kumar IIT Madras
3.	http://nptel.ac.in/courses/106106130/ Prof. D. Janakiram, IIT Madras
4.	https://www.youtube.com/watch?v=ukx7Hd4FSEw Prof. S. K. Ghosh, IIT Roorkee

Mapping of COs and POs

	1: Slight(Low)	2: Moderate(Medium)	3: Substantial(High)
PO →	PO	PO	PO
CO 1	1	3	2
CO 2	3	1	1
CO 3	-	3	2
CO 4	-	1	-

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	10
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60



HEAD

[Signature]

Chairman, Bos IT

Teaching Scheme			
Lectures	03 Hrs/week		
Tutorials	00 Hrs/week		
Total Credits	03		
Prerequisite : Data Structure and Algorithms, Operating Systems			
Course Outcomes (CO): Students will be able to			
CO1 Understand the Fundamental Concepts of Distributed Systems			
CO2 Apply Synchronization and Coordination Techniques			
CO3 Analyze and Implement Fault Tolerance Mechanisms			
CO4 Explore Distributed Computing Paradigms and Modern Frameworks			
Duration of ESE			
ESE	60		
ISE	20		
MSE	20		

Examination Scheme			
Course Contents			
CO	Hours		

Unit 1	Introduction to Distributed System: Main Problems, Models of Distributed System, Design Goals, Distributed System, Advantages and Disadvantages of Distributed System, Design Goals, Introduction to Distributed System, Examples of Distributed System, Characteristics of Grid, Cluster and Cloud System.	CO1	(06)
Unit 2	Distributed Objects and File System: Introduction to Distributed Object, Distributed Objects Communication, Remote Procedure Call, Events and Notifications, JAVA RMI Case Study, Introduction to DFS, File Service Architecture, SUN Network File System, Name Services, DNS, Comparison of Different Distributed File Systems (Self-Study: Google FS, HADOOP)	CO1	(07)
Unit 3	Time and State in Distributed System Time in DS, Physical Clock, Logical Clock, Vector Clock, Global State and State Recording, Distributed Debugging, Coordination and Agreement: Mutual Exclusion in DS, Mutual Exclusion Algorithms, Distributed Election, Multicast Communication, Consensus.	CO1, CO2	(07)
Unit 4	Replication: Replication and its Reasons, Object Replication, Replication as Scaling Technique, Fault Tolerant and Highly Available Services, Transaction and Concurrency Control: Transactions and Nested Transactions, Locks, Optimistic Concurrency Control, Timestamp Ordering, Comparison of Concurrency Control Methods, Introduction to Distributed Transaction, Flat and Nested Distributed Transaction, Atomic Commit Protocol, Distributed Deadlock, Transaction Recovery.	CO1, CO3	(08)
Unit 5	Fault Tolerance Introduction to Fault Tolerance, Process Resilience, Reliable Client Server Communication, Distributed Commit, Distributed Recovery (Self Study: Case Study - Distributed System CORBA, Mach, JINI, TIB/Rendezvous)	CO1, CO2, CO3	(06)
Unit 6	Operating System Support and Distributed Heterogeneous Applications OS Layer, Protection, Process and Thread, Communication and Invocation, OS Architecture, Distributed Heterogeneous Applications and CORBA: Heterogeneity in DS, Middleware, CORBA Approach.	CO4	(06)

Text Books	
1.	George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems – Concept and Design", Pearson Publication, 5 th Edition, 2017 (Unit:1,2,3,4,5,6)
Reference Books	
1.	Andrew S. Tanenbaum and Maarten Van Steen, "Distributed Systems Principles and Paradigms", Pearson Publication, 2 nd Edition, 2006.
2.	Mukesh Singhal, "Advanced Concepts in Operating Systems", McGraw-Hill Series in Computer Science.
Useful Links	



HEAD

Chairman, BOS IT



Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

1: Slight(Low)											
PO →	CO 1	CO 2	CO 3	CO 4							
PO	1	2	3	2	2	2	2	2	2	2	2
PO	2	2	2	2	2	2	2	2	2	2	2
PO	3	2	2	2	2	2	2	2	2	2	2
PO	4	2	2	2	2	2	2	2	2	2	2
PO	5	2	2	2	2	2	2	2	2	2	2
PO	6	2	2	2	2	2	2	2	2	2	2
PO	7	2	2	2	2	2	2	2	2	2	2
PO	8	2	2	2	2	2	2	2	2	2	2
PO	9	2	2	2	2	2	2	2	2	2	2
PO	10	2	2	2	2	2	2	2	2	2	2
PO	11	2	2	2	2	2	2	2	2	2	2
PO	12	2	2	2	2	2	2	2	2	2	2
PO	13	2	2	2	2	2	2	2	2	2	2
PO	14	2	2	2	2	2	2	2	2	2	2
PO	15	2	2	2	2	2	2	2	2	2	2
PO	16	2	2	2	2	2	2	2	2	2	2
PO	17	2	2	2	2	2	2	2	2	2	2
PO	18	2	2	2	2	2	2	2	2	2	2
PO	19	2	2	2	2	2	2	2	2	2	2
PO	20	2	2	2	2	2	2	2	2	2	2
PO	21	2	2	2	2	2	2	2	2	2	2
PO	22	2	2	2	2	2	2	2	2	2	2
PO	23	2	2	2	2	2	2	2	2	2	2
PO	24	2	2	2	2	2	2	2	2	2	2
PO	25	2	2	2	2	2	2	2	2	2	2
PO	26	2	2	2	2	2	2	2	2	2	2
PO	27	2	2	2	2	2	2	2	2	2	2
PO	28	2	2	2	2	2	2	2	2	2	2
PO	29	2	2	2	2	2	2	2	2	2	2
PO	30	2	2	2	2	2	2	2	2	2	2
PO	31	2	2	2	2	2	2	2	2	2	2
PO	32	2	2	2	2	2	2	2	2	2	2
PO	33	2	2	2	2	2	2	2	2	2	2
PO	34	2	2	2	2	2	2	2	2	2	2
PO	35	2	2	2	2	2	2	2	2	2	2
PO	36	2	2	2	2	2	2	2	2	2	2
PO	37	2	2	2	2	2	2	2	2	2	2
PO	38	2	2	2	2	2	2	2	2	2	2
PO	39	2	2	2	2	2	2	2	2	2	2
PO	40	2	2	2	2	2	2	2	2	2	2
PO	41	2	2	2	2	2	2	2	2	2	2
PO	42	2	2	2	2	2	2	2	2	2	2
PO	43	2	2	2	2	2	2	2	2	2	2
PO	44	2	2	2	2	2	2	2	2	2	2
PO	45	2	2	2	2	2	2	2	2	2	2
PO	46	2	2	2	2	2	2	2	2	2	2
PO	47	2	2	2	2	2	2	2	2	2	2
PO	48	2	2	2	2	2	2	2	2	2	2
PO	49	2	2	2	2	2	2	2	2	2	2
PO	50	2	2	2	2	2	2	2	2	2	2
PO	51	2	2	2	2	2	2	2	2	2	2
PO	52	2	2	2	2	2	2	2	2	2	2
PO	53	2	2	2	2	2	2	2	2	2	2
PO	54	2	2	2	2	2	2	2	2	2	2
PO	55	2	2	2	2	2	2	2	2	2	2
PO	56	2	2	2	2	2	2	2	2	2	2
PO	57	2	2	2	2	2	2	2	2	2	2
PO	58	2	2	2	2	2	2	2	2	2	2
PO	59	2	2	2	2	2	2	2	2	2	2
PO	60	2	2	2	2	2	2	2	2	2	2
PO	61	2	2	2	2	2	2	2	2	2	2
PO	62	2	2	2	2	2	2	2	2	2	2
PO	63	2	2	2	2	2	2	2	2	2	2
PO	64	2	2	2	2	2	2	2	2	2	2
PO	65	2	2	2	2	2	2	2	2	2	2
PO	66	2	2	2	2	2	2	2	2	2	2
PO	67	2	2	2	2	2	2	2	2	2	2
PO	68	2	2	2	2	2	2	2	2	2	2
PO	69	2	2	2	2	2	2	2	2	2	2
PO	70	2	2	2	2	2	2	2	2	2	2
PO	71	2	2	2	2	2	2	2	2	2	2
PO	72	2	2	2	2	2	2	2	2	2	2
PO	73	2	2	2	2	2	2	2	2	2	2
PO	74	2	2	2	2	2	2	2	2	2	2
PO	75	2	2	2	2	2	2	2	2	2	2
PO	76	2	2	2	2	2	2	2	2	2	2
PO	77	2	2	2	2	2	2	2	2	2	2
PO	78	2	2	2	2	2	2	2	2	2	2
PO	79	2	2	2	2	2	2	2	2	2	2
PO	80	2	2	2	2	2	2	2	2	2	2
PO	81	2	2	2	2	2	2	2	2	2	2
PO	82	2	2	2	2	2	2	2	2	2	2
PO	83	2	2	2	2	2	2	2	2	2	2
PO	84	2	2	2	2	2	2	2	2	2	2
PO	85	2	2	2	2	2	2	2	2	2	2
PO	86	2	2	2	2	2	2	2	2	2	2
PO	87	2	2	2	2	2	2	2	2	2	2
PO	88	2	2	2	2	2	2	2	2	2	2
PO	89	2	2	2	2	2	2	2	2	2	2
PO	90	2	2	2	2	2	2	2	2	2	2
PO	91	2	2	2	2	2	2	2	2	2	2
PO	92	2	2	2	2	2	2	2	2	2	2
PO	93	2	2	2	2	2	2	2	2	2	2
PO	94	2	2	2	2	2	2	2	2	2	2
PO	95	2	2	2	2	2	2	2	2	2	2
PO	96	2	2	2	2	2	2	2	2	2	2
PO	97	2	2	2	2	2	2	2	2	2	2
PO	98	2	2	2	2	2	2	2	2	2	2
PO	99	2	2	2	2	2	2	2	2	2	2
PO	100	2	2	2	2	2	2	2	2	2	2

Mapping of COs and POs

1.	https://nptel.ac.in/courses/106/106/106106168/ Prof. Rajiv Mishra IIT Patna.
2.	https://nptel.ac.in/courses/106/104/106104182/ Prof. Rajiv Mishra IIT Patna.
3.	https://nptel.ac.in/courses/106/106/106106107/# Prof. V.S. Anantnarayana NITK Surathkal.



HEAD
Chairman, BOS IT

Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Information Technology				
IT3510: Program Elective-01 Lab: Web Technology Lab				
Laboratory Scheme:			Examination Scheme:	
Practical	02 Hrs/week	ISE	25	
Total Credits	01	ESE	-	
Prerequisite : Data Structure				
Course Outcomes (CO): Students will be able to				
CO1	Understand the importance of website planning and website design issues			
CO2	Apply the client side and server side technologies for web application development			
CO3	Analyze the web technology languages, frameworks and services			
CO4	Develop web based applications			
Course Contents				
CO				
Implementation of following concepts				
Experiment 1	Create a simple webpage using basic HTML elements (headings, paragraphs, images, links, lists, forms, etc.).			
Experiment 2	Apply basic CSS properties (e.g., font-size, color, background, margins) to a webpage and create an external stylesheet.			
Experiment 3	Create a responsive webpage layout using Bootstrap's grid system and predefined classes.			
Experiment 4	Create a user registration form with text inputs, radio buttons, checkboxes, and dropdown menus. Apply basic validation using HTML5 attributes.			
Experiment 5	JavaScript program to perform basic arithmetic operations and display the results.			
Experiment 6	Create a JavaScript program that uses functions to calculate the area and perimeter of various shapes (circle, rectangle, square).			
Experiment 7	JavaScript code to dynamically add, remove, and modify elements on a webpage based on user input.			
Experiment 8	JavaScript code to handle events like button clicks, mouse hover, and form submissions.			
Experiment 9	Create a servlet that handles sessions using cookies and URL rewriting to track user data.			
Experiment 10	Create a JSP page that interacts with a JavaBean class to display dynamic content.			
Experiment 11	Create a simple Ruby on Rails application with basic CRUD operations (Create, Read, Update, Delete) using a database.			
Experiment 12	Mini Project: Design and implement a dynamic web application for any business functionality by using web development technologies that you have learnt in the above given assignments. (Mandatory)			
List of Submission: Course coordinator should give new problem statement based on above list of experiments.				
Minimum number of Experiments : 10				
Mapping of COs and POs				
PO →	CO 1	CO 2	CO 3	CO 4
PO 1	2	3	3	2
PO 2	3	3	3	3
PO 3	2	2	2	3
PO 4	1	1	1	1
PO 5	1	1	1	1
PO 6	1	1	1	1
PO 7	1	1	1	1
PO 8	1	1	1	1
PO 9	1	1	1	1
PO 10	1	1	1	1
PO 11	2	2	2	2
PSO 1	2	2	2	2
PSO 2	1	1	1	1



Govt. College of Engineering, KARAPALAY
Department of Information Technology

HEAD

Chairman, BOS IT

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

Guideline for Assessment Pattern:



Chairman, BOS IT
HEAD

Mapping of COs and POs

PO →	CO 1	CO 2	CO 3	CO 4
PO 1	2	2	1	2
PO 2	1	2	2	2
PO 3	-	-	3	3
PO 4	-	-	2	2
PO 5	3	3	1	1
PO 6	1	1	1	1
PO 7	1	1	1	1
PO 8	1	1	1	1
PO 9	-	-	-	-
PO 10	1	1	1	1
PO 11	2	2	1	1
PSO 1	2	2	1	1
PSO 2	1	1	1	1

1: Slight (Low)
2: Moderate (Medium)
3: Substantial (High)

Government College of Engineering, Karad	
Third Year (Sem – V) B. Tech. Information Technology	
IT3520: Program Elective-01 Lab: Machine Learning Lab	
Laboratory Scheme:	Examination Scheme:
Practical	02 Hrs./week
Total Credits	01
Prerequisite : Python programming, Database management system(DBMS)	
Course Outcomes (CO): Students will be able to	
CO1	Understand and apply data pre-processing techniques, including handling missing values, normalization, and standardization, for effective data preparation.
CO2	Implement and evaluate regression to model and predict data trends.
CO3	Apply classification techniques such as Support Vector Machine (SVM), Naïve Bayes, and Random Forest to solve real-world problems with appropriate datasets.
CO4	Design, build, and evaluate Artificial Neural Network (ANN) models with multiple layers and activation functions for classification tasks.
Course Contents	
Implementation of following concepts	
Experiment 1	Data pre-processing on a raw dataset (e.g., handling missing values, normalization, and standardization).
Experiment 2	Exploratory Data Analysis and Visualization
Experiment 3	Principal Component Analysis (PCA) on a multivariate dataset to reduce its dimensionality, visualize the data in lower dimensions, and evaluate the amount of variance retained after transformation
Experiment 4	Linear Regression Algorithm and Logistic Regression algorithm
Experiment 5	Support vector machine for classification
Experiment 6	Decision Tree and K-nearest neighbour
Experiment 7	Compare different regression algorithms (considering suitable data and problem statements).
Experiment 8	Compare different classification algorithms (considering suitable data and problem statements) using precision, recall and accuracy.
Experiment 9	k-means clustering algorithm to cluster data into multiple groups based on similarity of features.
Experiment 10	Build a single-layer artificial neural network for a simple classification problem.
Experiment 11	A neural network algorithm to classify data into multiple classes based on predictor variables.
Experiment 12	Mini Project (Mandatory)
List of Submission: Course coordinator should give new problem statement based on above list of experiments.	
Minimum number of Experiments : 10	



HEAD

[Signature]

Chairman, BOS IT

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

Guideline for Assessment Pattern:



Chairman, BOS IT
HEAD

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

Guideline for Assessment Pattern:

PO →	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	3	2	2	1	1	1	1	-	1	-	3
CO 2	-	3	1	2	-	1	1	1	-	-	-	1
CO 3	-	-	3	2	-	1	1	1	-	-	-	1
CO 4	-	1	2	3	-	1	1	1	2	-	-	1

Mapping of COs and POs

Minimum number of Experiments : 10	
List of Submission: Course coordinator should give new problem statement based on above list of experiments.	
Experiment 12	Implement a mini project based on given case study. (Mandatory)
Experiment 11	Design Data Model using NoSQL Databases such as Hive/Hbase/Cassandra/DynamoDB
Experiment 10	Study of NoSQL Databases such as Hive/Hbase/Cassandra/DynamoDB
Experiment 9	Design and implement an application to demonstrate distributed databases
Experiment 8	Design and implement an application to demonstrate parallel databases
Experiment 7	Implement Client-Server Architecture.
Experiment 6	Demonstrate relational operation sort-merge join algorithm
Experiment 5	Write a program to demonstrate fragmentation and replication of databases
Experiment 4	Implement nested queries of given case study.
Experiment 3	Implement CRUD operation using Python.
Experiment 2	Design Conceptual model using Star and Snowflake schema
Experiment 1	Design and implement a database schema using EER modeling to demonstrate specialization and generalization.
Implementation of following concepts	
Course Contents	
CO	
CO1	Analyze the performance of different databases using modern tools.
CO2	Illustrate the optimal database-based solution to solve real world problem.
CO3	Select the advanced/modern databases for modelling complex data.
CO4	Apply acquired knowledge in databases to design and build the different applications.
Prerequisite : Database Management System Lab	
Course Outcomes (CO): Students will be able to	
Total Credits	01
Practical	02 Hrs/week
Laboratory Scheme:	
IT3530: Program Elective-01 Lab: Advanced Database Management System Lab	
Third Year (Sem - V) B. Tech. Information Technology	
Government College of Engineering, Karad	

[illegible]

Guideline for Assessment Pattern:

	1: Slight (Low)	2: Moderate (Medium)	3: Substantial (High)
CO 4	2	1	2
CO 3	1	3	-
CO 2	2	1	2
CO 1	1	2	1
CO ↑	2	2	2
PO →	PO 1	PO 3	PO 9
	PO 2	PO 4	PO 10
		PO 5	PO 11
		PO 6	PSO 1
		PO 7	PSO 2
		PO 8	
		PO 9	
		PO 10	
		PO 11	
		PSO 1	
		PSO 2	

Mapping of COs and POs

Government College of Engineering, Karad			
Third Year (Sem – V) B. Tech. Information Technology			
IT3540: Program Elective-01 Lab: Principles of Distributed Systems Lab			
Laboratory Scheme:		Examination Scheme:	
Practical	02 Hrs/week	ISE	25
Total Credits	01	ESE	-
Prerequisite : Data Structure and Algorithms, Operating Systems , C/C++ Programming			
Course Outcomes (CO): Students will be able to			
CO1	Implement Interprocess Communication & Synchronization		
CO2	Develop and Analyze Distributed Coordination Mechanisms		
CO3	Apply Fault Tolerance and Recovery Techniques		
CO4	Work with Distributed Storage & Computing Frameworks		
Course Contents			
CO			
Implementation of following concepts			
Experiment 1	Concurrent echo client-server application.	CO1	
Experiment 2	Chat Server.	CO1	
Experiment 3	Remote Procedure Call.	CO1	
Experiment 4	Berkeley's algorithm for clock synchronization.	CO2	
Experiment 5	Cristian's algorithm for clock synchronization	CO2	
Experiment 6	Lamport's algorithm for clock synchronization.	CO2	
Experiment 7	Centralized algorithm for mutual exclusion	CO3	
Experiment 8	Non token based algorithm for Mutual Exclusion.	CO3	
Experiment 9	Ring election algorithm	CO4	
Experiment 10	Bully election algorithm.	CO4	
Experiment 11	Distributed algorithm for mutual exclusion.	CO4	
Experiment 12	Termination detection.	CO4	
List of Submission: Course coordinator should give new problem statement based on above list of experiments.			
Minimum number of Experiments : 10			



HEAD

Chairman, BOS IT

Department of Information Technology
Govt. College of Engineering, KARAD

Government College of Engineering, Karad			
Third Year (Sem – VI) B. Tech. Information Technology			
IT3601: Advanced Operating Systems			
Teaching Scheme		Examination Scheme	
Lectures	03 Hrs/week	MSE	20
Tutorials	00 Hrs/week	ISE	20
Total Credits	03	ESE	60
Prerequisite : Operating System Fundamentals		Duration of ESE	
Course Outcomes (CO): Students will be able to		02 Hrs 30 Min	
CO1	Illustrate the fundamentals of Operating Systems with Threads.		
CO2	Analyze the key features of Embedded Operating Systems.		
CO3	Emphasize the concepts of Distributed Operating Systems.		
CO4	Design the principles of Multimedia System with security Threads.		
Course Contents			
Unit 1	Operating Systems Overview: The Operating System as a User/Computer Interface, The Operating System as Resource Manager, Developments Leading to Modern Operating Systems, Virtual Machines, OS Design Considerations for Multiprocessor and Multicore.	CO1	(07)
Unit 2	Threads: Thread Functionality, Types of Threads, Windows 7 Thread And SMP Management, Process and Thread Objects, Windows Thread States, Solaris Thread and SMP Management, Solaris Thread States, Linux Process and Thread Management, Linux Tasks and Linux Threads.	CO1	(07)
Unit 3	Embedded Operating Systems: Introduction, Characteristics Of Embedded Operating Systems, Embedded Configurable Operating System (eCos), TinyOS, TinyOS goals and Components.	CO2	(07)
Unit 4	Distributed Operating Systems: Types of Distributed Operating Systems, Distributed File Systems- Naming and Transparency, Remote File Access, Stateful Versus Stateless Service, File Replication, Distributed Coordination-Event Ordering, Atomicity, Concurrency Control.	CO3	(06)
Unit 5	Multimedia Systems: (Self-Study- Beowulf And Linux Clusters) Disk Scheduling in Multimedia Systems, Requirements of Multimedia Kernels, CPU Scheduling and Multimedia, Compression, Requirement of Multimedia Systems, Network Management (Self-Study: CineBlitz)	CO3	(06)
Unit 6	Computer Security Threats: Viruses, Worms, Bots, Rootkits.	CO4	(07)
Text Books			
1.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", John Wiley & Sons Publication, 9 th edition, 2012. (Unit:1, 4, 5)		
2	William Stallings, "Operating Systems: Internals and Design Principles" Pearson Education India, 7 th edition, 2013. (Unit:2, 3, 6)		
Reference Books			
1.	Andrew S. Tanenbaum and Herbert Bos, "Modern Operating Systems", Pearson Education, 4 th edition 2015.		
2.	D M Dhamdhere, "Operating Systems" Tata McGraw-Hill, 2 nd edition, 2011.		
3.	Achyt S. Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 3 rd Edition, 2017.		
Useful Links			
1.	https://archive.nptel.ac.in/courses/106/105/106105214/ Prof. Shantanu Chatopadhyay IIT, Kharagpur		
2.	https://nptel.ac.in/courses/106106144/ Prof. Chester Rebeiro IIT Madras		
3.	https://nptel.ac.in/courses/106106144/ Prof. Chester Rebeiro IIT Madras		



Govt. College of Engineering, A
Department of Information Technology

HEAD

[Signature]

Chairman, BOS IT

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	10
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

1: Slight(Low)												
CO 4	-	-	-	1	3	2	-	-	-	-	-	2
CO 3	-	-	-	3	2	1	-	-	-	1	-	2
CO 2	-	-	-	2	2	2	1	-	-	-	3	2
CO 1	-	-	-	1	3	2	-	-	-	-	2	1
CO 1	1	2	3	4	5	6	7	8	9	10	11	2
PO →	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO

Mapping of COs and POs

2: Moderate(Medium)

3: Substantial(High)

Teaching Scheme		Prerequisite : Design and Analysis of Algorithms	
Lectures	03 Hrs/week	Course Outcomes (CO): Students will be able to	
Tutorials	00 Hrs/week	CO1 Understand and apply advanced data structures	
Total Credits	03	CO2 Design and implement advanced string algorithms	
		CO3 Solve optimization problems using advanced algorithms	
		CO4 Develop and evaluate approximation algorithms for NP-hard problems	
		Duration of ESE	
		ESE	02 Hrs 30 Min
		ISE	60
		MSE	20

Course Contents	
Unit 1	Advanced String Algorithms : Introduction to Strings and String Matching, Naive String Matching Algorithm, Knuth-Morris-Pratt (KMP) Algorithm, Boyer-Moore Algorithm, String Matching, Real-world applications of string matching (e.g., plagiarism detection, bioinformatics, text search engines)(Case studies and examples)
Unit 2	Advanced Graph Algorithms: Introduction to Graph Theory, Graph Traversal Techniques: BFS & DFS, Single-Source Shortest Paths, All-Pairs Shortest Paths, Maximum Flows: Flow networks, Ford-Fulkerson method, Bipartite Matching: stable-marriage problem, Hungarian algorithm
Unit 3	Approximation Algorithms : Introduction to NP-Hard Problems, Greedy Algorithms and Local Search Problem : Vertex cover, TSP, set-covering problem, Techniques for Approximation Algorithms: Primal-Dual Method, Linear, Programming Relaxation, Rounding Techniques, Dynamic Programming for Approximation, Randomized Algorithms and their role in approximation
Unit 4	Randomized and Online Algorithms : Introduction to Randomized Algorithms, Types of Randomized Algorithms: Las Vegas and Monte Carlo algorithms, Applications of Randomized Algorithms in Real-World Problems, Randomization Techniques, Random Sampling and Random Choices, Randomized Pivoting in Algorithms (QuickSort, Median Selection), Online Algorithms: Ski rental, paging, k-server problem, (Self Study: Competitive Analysis: Performance measures and examples)
Unit 5	Parallel Algorithms & Linear Programming Introduction to Parallel Algorithm, The basics of fork-join parallelism, Parallel matrix multiplication, Parallel Sorting Algorithms: Parallel Merge Sort & Parallel Quick Sort, Introduction to Linear Programming, Types of Linear Programming Problems: Maximization and minimization problems. (Self Study: Simplex Method for solving LP problems)
Unit 6	Optimization Techniques Role of Optimization in Algorithm Design, Linear Programming Applications: Scheduling and Resource Allocation, Advanced Topics: Integer Programming, Convex Optimization, Optimization in AI, ML, and Operations Research Case Study: Real-World Use of LP in Decision Making.

Text Books	
1.	T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to Algorithms", 4 th Edition, Cambridge, MA: MIT Press, 2022. (Unit 1,2,3,6)
2.	J. Kleinberg and E. Tardos, "Algorithm Design", Boston, MA: Pearson, 2005. (Unit 4)
3.	M. Ghaffari, "Advanced Algorithms", Lecture Notes, 2020. (Unit 5)



HEAD

Chairman, BOS IT

Chairman, BOS IT
lad

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

1: Slight(Low)													2: Moderate(Medium)						3: Substantial(High)			
PO ←	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
CO ↑	1	2	3	4	5	6	7	8	9	10	11	1	1	1	1	1	1	1	1	1	1	1
CO 1	-	3	2	1	-	-	-	-	-	1	-	1	-	1	-	1	-	1	-	1	-	2
CO 2	-	1	3	2	-	1	-	-	-	-	-	-	-	1	-	1	-	1	-	1	-	2
CO 3	-	1	2	3	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	1	-	2
CO 4	-	2	3	2	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	1	-	2

Mapping of COs and POS

Reference Books	
1.	S. Dasgupta, C. Papadimitriou, and U. Vazirani, "Algorithms. New York", NY, USA: McGraw-Hill, 2006.
2.	A. Gupta, "Advanced Algorithms", Cambridge, UK: Cambridge University Press, 2020.
3.	P. Brass, "Advanced Data Structures", Cambridge, UK: Cambridge University Press, 2008.
4.	R. Motwani and P. Raghavan, "Randomized Algorithms", Cambridge, UK: Cambridge University Press, 1995.
5.	V. V. Vazirani, "Approximation Algorithms", Berlin, Germany: Springer, 2001.
Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc23_cs63/preview Prof. Palash Dey, IIT Kharagpur
2.	https://nptel.ac.in/courses/106104019 Prof. Shashank K. Mehta, IIT Kanpur

Government College of Engineering, Karad

Third Year (Sem – VI) B. Tech. Information Technology

IT3603: Mobile Application Development

Teaching Scheme			
Lectures	02 Hrs/week		
Tutorials	00 Hrs/week		
Total Credits	02		
Prerequisite: Web Technology			
Course Outcomes (CO): Students will be able to			
Understand the key features of various Mobile Operating System.			
Summarize essential Android and ios programming concepts.			
Demonstrate and implement Data Base Connectivity Applications.			
Design and develop Android and ios platform.			

Course Contents			
CO	CO1	CO2	CO3
Hours	(05)	(05)	(05)

Unit 1	Introduction to Android:	CO1	(05)
	Introduction to Android Platform, Android Versions, Features of Android, Android Architecture, Building block of Android, SDK, Android Development Tools and android virtual devices.		
	User Interface: UI Layout basic, Understanding the Components of a Screen.		
	Designing Your User Interface with Views: Using Basic Views, Using Picker Views, Using List Views to Display Long List.		
Unit 2	Displaying Picture and Menus with Views:	CO2	(05)
	Using Image View to Display Pictures: Using Menus with Views. Data Persistence: Creating and Using Databases.		
	Content Providers: Using a Content Provider.		
	Handling and Persisting Data: Relational Database Overview, SQLite, SQL and the Database-Centric Data Model for Android Applications, the Android Database Classes, Database Design for Android Applications.		
Unit 3	Messaging:	CO2	(05)
	SMS Messaging – Sending Email.		
	Location-Base Services: Displaying Maps, Getting Location Data: Monitoring a Location.		
	Displaying Maps: Creating the Project, Obtaining the Maps API Key, Displaying the Map, Displaying the Zoom Control, Changing Views, Navigating to a specific Location, Monitoring a Location.		
Unit 4	Networking and Deployment:	CO2	(04)
	Consuming Web Service Using HTTP.		
	Publishing Android Applications: Preparing for Publishing, Deploying APK Files.		
Unit 5	Fundamentals of iOS:	CO2	(04)
	Overview of MAC OS and X-CODE, Introduction to iOS Architecture, Essential COCOA Touch Classes, Interface Builder, Nib File, COCOA and MVC Framework, Overview of features of latest iOS.		
	Swift Basics: Basics of objective c, Need of transformation from objective c to swift, Data types, variables, constants, operators, Decision making statements, looping, arrays, dictionaries, functions.		
Unit 6	iOS application development:	CO2	(04)
	Auto Layout, Views, Outlets and Actions, Different View Controller, Managing Application Memory, Application delegate, Handling Keyboard Input, UI Controllers, Location service, 3D touch, attribute tracking. (Self Study- Making the app live, overview of WatchOS)		

1. Wei-Meng Lee, "Beginning Android 4 Application Development", Wiley India Pvt. Ltd., 1st Edition, New Delhi, 2012.(Unit: 1,2,3,4)


 Government College of Engineering, Karad
 Department of Information Technology
 Govt. College of Engineering, Karad
 HEAD
 Chairman, BOS IT

HEAD

[Signature]

Chairman, BOS IT



Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	20
Analyse	5	5	20
Evaluate	5	5	10
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

	1: Slight(Low)	2: Moderate(Medium)	3: Substantial(High)	
PO →	PO	PO	PO	PSO
CO 1	1	2	1	1
CO 2	2	2	1	2
CO 3	2	3	1	2
CO 4	1	2	1	2

Mapping of COs and POs

2.	Matt Neuburg, "iOS 10 Programming Fundamentals with Swift", O'Reilly Media Publications (Unit: 5,6)
Reference Books	
1.	John Horton, "Android Programming for Beginners", Packt Publishing, 1 st Edition, Mumbai, 2015
2.	Rick Rogers, "Android Application Development (programming with Google SDK)", Jhon Lombarado, Zigurd M
3.	Jeff McWhorter, "Professional Mobile Application Development", Scott Gowell
4.	Grant Allen, "Beginning Android 4", A press publications, 2012.
Useful Links	
1.	https://www.edx.org/course/android-app-development-beginners-galileo-caad002x-21 .
2.	https://www.simplilearn.com/mobile-and-software-development/android-app-development-training



HEAD

Chairman, BOS IT

Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Information Technology				
IT3604: Multi-disciplinary Minor-04: Basics of AI and ML				
Teaching Scheme				
Lectures		02 Hrs/week	MSE	
Tutorials		00 Hrs/week	ISE	
Total Credits		02	ESE	
			Duration of ESE	
			02 Hrs 30 Min	
Prerequisite : Linear Algebra, Python Programming				
Course Outcomes (CO): Students will be able to				
CO1 Recall AI fundamentals, history, characteristics, and applications in engineering domains.				
CO2 Explain AI techniques, including search algorithms, rule-based systems, and ethical considerations.				
CO3 Apply machine learning workflows and feature engineering techniques to solve engineering problems.				
CO4 Analyze and evaluate supervised and unsupervised learning algorithms for engineering applications				
Course Contents				
CO	Hours	CO1 (04)		
Unit 1		Fundamentals of Artificial Intelligence: Introduction to AI, Definition of Artificial Intelligence, History and Evolution of AI, Key Characteristics of AI Systems, Applications of AI in Engineering Domains (Mechanical Engineering: Predictive maintenance, Automation, Civil Engineering: Smart cities, Structural health monitoring, Electrical and Electronics Engineering: Smart grids, Fault detection etc.)		
Unit 2		AI Techniques : Search Algorithms: Breadth-First Search (BFS) and Depth-First Search (DFS), Rule-based Systems and Expert Systems, Challenges and Ethics in AI, Ethical issues: Bias, Privacy, Job Displacement, Explain ability and Transparency in AI.		
Unit 3		Basics of Machine Learning Introduction to Machine Learning, Definition and Importance of Machine Learning, Difference between AI and ML, Types of Machine Learning, Machine Learning Workflow		
Unit 4		Feature Engineering Data Collection: Types of engineering data (e.g., sensors, IoT data), Data Pre-processing: Cleaning and feature scaling, Feature Selection: Importance of relevant features in engineering problems, Feature Extraction: Simplifying complex data into meaningful information, Model Training and Testing: Importance of splitting datasets.		
Unit 5		Supervised Learning Algorithms: Regression Techniques, Simple Linear Regression, Applications: Predicting stress-strain, load analysis, Polynomial Regression, Classification Techniques, Decision Trees, Evaluation Metrics, (Self Study: Applications of Supervised Learning)		
Unit 6		Unsupervised Learning Algorithms: Clustering Techniques, K-Means Clustering: Explanation with engineering applications (e.g., grouping materials), Hierarchical Clustering: Basics and use cases, Dimensionality Reduction Principal Component Analysis (PCA): Simplified concept and benefits Importance of reducing high-dimensional engineering data, (Self Study: Applications of Unsupervised Learning)		
Text Books				
1.	Tom Mitchell, "Machine learning", McGraw-Hill series in Computer Science, (Unit 3,4,5,6)			
2.	Peter Norvig and Stuart J. Russell "Artificial Intelligence: A Modern Approach", 4 th Edition, 2022, PHI Publisher (Unit 1,2)			
Reference Books				
1.	Shalev-Shwartz, Shai, and Shai Ben-David, "Understanding machine learning: From theory to algorithms", Cambridge university press, 2014			
2.	Jawei Han, Micheline Kamber, and Jian Pei, "Data Mining: Concepts and Techniques", Elsevier Publishers Third Edition, ISBN: 9780123814791, 9780123814807			
3.	Bishop, Christopher M., and Nasser M. Nasrabadi, "Pattern recognition and machine learning", Vol. 4, No. 4, New York: Springer, 2006			
Useful Links				



Chairman, BOS IT
HEAD
[Signature]

Department of Information Technology
Govt. College of Engineering, KARAT

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	5	5	10
Apply	5	5	20
Analyse	5	5	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

	1: Slight(Low)			2: Moderate(Medium)			3: Substantial(High)		
PO → CO	1	2	3	4	5	6	7	8	9
PO	1	2	3	4	5	6	7	8	9
CO 1	3	2	-	-	-	-	-	-	2
CO 2	2	3	2	-	2	-	2	-	2
CO 3	3	2	3	3	3	-	2	2	3
CO 4	3	3	2	3	3	-	2	2	3

Mapping of COs and POs

1.	https://www.dkriesel.com/media/science/neuronaleNetz-en-zeta2-1col-dkrieselcom.pdf
2.	https://onlinecourses.nptel.ac.in/noc22_cs56/preview Prof. Mausam IIT Delhi.

Government College of Engineering, Karad
Third Year (Sem – VI) B. Tech. Information Technology
IT3605 : IoT and Cloud Analytics

Teaching Scheme			
Lectures	03 Hrs/week		
Tutorials	00 Hrs/week		
Total Credits	03		
Prerequisite : Computer Networks, Web Technology			
Course Outcomes (CO): Students will be able to			
CO1	Elaborate leading commercial IoT cloud platforms and IOT hardware		
CO2	Provide a comprehensive understanding of IoT technology and its real-world applications		
CO3	Understand device authentication & secure communication protocols with best practices for securing IoT cloud systems		
CO4	Analyze and develop IoT applications for diverse industries		
Course Contents			
CO		Duration of ESE	02 Hrs 30 Min
Examination Scheme			
MSE	20		
ISE	20		
ESE	60		

Unit 1	
Introduction to IoT and IoT Cloud Platforms:	Overview of IoT technology and its applications, Role of cloud computing in IoT, Types of IoT platforms: Connectivity, Device Management, Application Enablement and Analytics. Introduction to AWS IoT, Google Cloud IoT, Microsoft Azure, IBM Watson IoT, Comparison of free and paid IoT cloud platforms (Blynk, ThingsBoard, Thingier.io, Node-RED, etc.)
Unit 2	IoT Hardware, Sensors, and Connectivity: Introduction to IoT hardware: Arduino, ESP32, Raspberry Pi., Understanding IoT sensors: Temperature, Humidity, Motion, Light, Pressure, Gas sensors, etc. Context sensing and awareness. Communication protocols in IoT: Wi-Fi, Bluetooth, Zigbee, LoRaWAN, MQTT, and CoAP, HTTP. Introduction to Edge Computing and FreeRTOS.
Unit 3	Cloud Connectivity & Data Transmission: Introduction to IoT Cloud Architecture. Setting up AWS IoT Core, Google Cloud IoT, and IBM Watson IoT. Data transmission using MQTT, HTTP, and WebSockets. Time-series databases for IoT: InfluxDB and Timespeak. Storing and retrieving sensor data from AWS IoT Core and Google Cloud IoT
Unit 4	IoT Device Management & Security: Onboarding & managing IoT devices on AWS IoT Device Management. Understanding device authentication & secure communication protocols (TLS, X.509 Certificates). Implementing AWS IoT Device Defender for security audits. Security challenges in IoT and best practices for securing IoT cloud systems.
Unit 5	IoT Cloud Analytics & Real-Time Processing: Introduction to IoT data analytics. Streaming and analyzing data with AWS IoT Events, Google Cloud IoT, and IBM Watson IoT. Using InfluxDB for time-series data analysis. (Self Study - Developing IoT dashboards with Grafana and Node-RED)
Unit 6	IoT and Cloud Applications: Edge computing with AWS IoT Greengrass. Developing end-to-end IoT cloud applications. Case studies: Smart Home, Smart Agriculture, Wearables. (Self Study- Industrial IoT)

Text Books	
1.	AWS IoT Cloud for Developers & Architects: Build highly secure and scalable IoT solutions with AWS IoT platform by Rabi Prasad Padhy (Unit:1)
2.	IoT and Edge Computing for Architects 2 nd Edition by Perry Lea (Author) (Unit:2)
3.	Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3 (Unit:3)
4.	Demystifying Internet of Things Security: Successful IoT Device/Edge and Platform Security Deployment 1st ed. Edition by Sunil Chervu (Author), Anil Kumar (Author), Ned Smith (Author), David M. Wheeler (Author) (Unit:4)



HEAD

Chairman, BOS IT

HEAD

[Signature]

Chairman, BOS IT



Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

PO →	CO 1	CO 2	CO 3	CO 4	1: Slight(Low)	2: Moderate(Medium)	3: Substantial(High)
PO →	1	1	1	1	1	1	1
PO	2	2	2	2	2	2	2
PO	3	3	3	3	3	3	3
PO	4	4	4	4	4	4	4
PO	5	5	5	5	5	5	5
PO	6	6	6	6	6	6	6
PO	7	7	7	7	7	7	7
PO	8	8	8	8	8	8	8
PO	9	9	9	9	9	9	9
PO	10	10	10	10	10	10	10
PO	11	11	11	11	11	11	11
PSO	1	1	1	1	1	1	1
PSO	2	2	2	2	2	2	2

Mapping of COs and POs

5.	An Introduction to IoT Analytics(Chapman & Hall/CRC Data Science Series) 1st Edition by Harry G. Perros (Author) (Unit:5,6)
Reference Books	
1.	Karen Rose, Scott Eldridge, Lyman Chapin, "The Internet of Things: An Overview", Internet Society, 2015.
2.	Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014, ISBN 978-1-118-43062-0
3.	Designing Connected Products: UX for the Consumer Internet of Things", By Claire Rowland, Elizabeth Goodman, Martin Chartier, Ann Light, and Alfred Lui
Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc22_cs53/preview
2.	https://nptel.ac.in/courses/108108179
	Prof. T V Prabhakar IISC Bangalore
	Prof. Sudip Mishra IIT Kharagpur

Teaching Scheme			
Lectures	01 Hrs/week	ISE	25
Practical	02 Hrs/week	ESE	25
Total Credits	02		

Prerequisite : Web Technology, Advance Java

Course Outcomes (CO): Students will be able to

CO1	Develop scalable, optimized, and secure full-stack applications.
CO2	Use modern Angular techniques for form handling, state management and routing
CO3	Design and secure RESTful APIs with authentication and authorization.
CO4	Deploy and maintain high-performance full-stack applications in production.

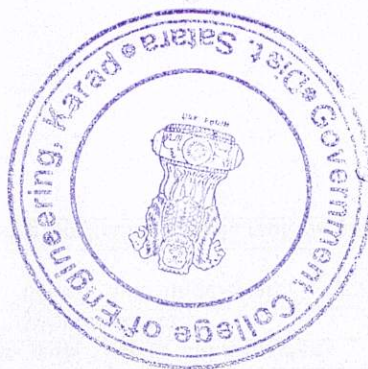
Course Contents			
Unit 1	Dynamic Forms with Validation and RxJS Observables in Angular: Building a dynamic Angular form, implementing custom validators for form validation. Using RxJS Observables to fetch data & manipulate streams with operators like map, filter.	CO1	(02)
Unit 2	State Management with NgRx and Lazy Loading in Angular: Implement NgRx state with a To-Do List application, Using Actions, Reducers, Selectors, and Effects in NgRx. Modularize a large Angular application, Optimizing routing	CO2	(02)
Unit 3	Setting Up a Backend Server with Database Integration: Node.js using Express.js. Handle HTTP GET & POST requests, Connect database (MongoDB) using Mongoose. Design validation, Perform basic CRUD operations (Create, Read, Update, Delete).	CO2	(02)
Unit 4	Authentication, Authorization, and RESTful API Development: Implement authentication using JWT (JSON Web Token). Protect routes using middleware. Build RESTful APIs for managing resources. Errors and response formatting effectively.	CO3	(03)
Unit 5	Deploying and Optimizing Full-Stack Web Applications: Deploy a full-stack to Heroku, AWS, Configure environment variables & CI/CD pipelines. Optimize Angular applications using lazy loading. Optimize API responses.	CO1, CO3	(03)
Unit 6	Testing, Debugging, and Security Considerations in Web Applications: Unit and integration tests for frontend & backend. Implement end-to-end (E2E) testing with Cypress. Debugging and logging errors in production. Security techniques.	CO4	(02)

Implementation of following concepts			
Frontend Development- Angular Fundamentals			
Experiment 1	Create a dynamic Angular form with validation & use custom validators and error messages.	CO1	
Experiment 2	Data fetching with observables Use operators like map, filter.	CO1	
Experiment 3	Build a mini application using NgRx for state management (e.g., a to-do list or e-commerce cart). Demonstrate actions, reducers, and effects.	CO2	
Experiment 4	Convert a large Angular application into feature modules with lazy loading.	CO2	
Experiment 5	Create a Node.js or Python Flask/Django-based server.	CO2	
Experiment 6	Design a schema with validation, hooks, and middleware. (e.g., MySQL, MongoDB).	CO2	
Experiment 7	Create a real-time chat application using Socket.IO. Enable multiple users to join	CO3	

Chairman, BOS IT

HEAD





Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

		1: Slight(Low)						2: Moderate(Medium)						3: Substantial(High)								
PO ←	PO	PO	PO	PO	PO	PO	PSO	CO ↑	1	2	3	4	5	6	7	8	9	10	11	1	PO	PSO
CO 1	1	-	3	-	3	-	2	1	1	1	1	1	1	1	1	1	2	-	-	2	2	2
CO 2	-	3	1	-	-	-	-	1	1	1	1	1	1	1	1	1	2	-	-	1	-	-
CO 3	-	-	3	-	-	-	-	1	1	1	1	1	1	1	1	1	2	-	-	2	-	-
CO 4	-	1	2	-	-	-	-	1	1	1	1	1	1	1	1	1	2	-	-	2	-	-

Mapping of COs and POS

rooms and exchange messages.	Experiment 8	Build API to handle file uploads & Store files on server or cloud (e.g. AWS S3).	CO3
Advanced Topics			
Experiment 9	Deploy a full-stack web application using cloud platforms like Heroku, AWS, or Netlify.	Optimize the performance of a web application by implementing lazy loading, caching, minification.	CO4
Experiment 10	Perform Testing on frontend and backend using tools like Jest or Mocha. Unit testing (Jest/Karma), end-to-end testing (Cypress/ Playwright), best practices.	Optimize API responses with pagination and compression.(Code splitting, lazy loading, OnPush strategy, caching)	CO4
Experiment 11			CO4
Experiment 12			CO4
Experiment 13	Mini Project (Mandatory)		CO4
List of Submission:			
		Minimum number of Experiments : 10	
Text Books			
1.	Yakov Fain, Anton Moiseev "Angular Development with TypeScript",Manning Publications.(Unit:1,2)		
2.	Mario Casciaro, Luciano Mammino "Node.js Design Patterns", Packt Publishing (Unit:3)		
3.	Jesse Palmer, Corinna Cohn"Testing Angular Applications", Manning Publications (Unit:5,6)		
4	Charles Bihis, "Mastering OAuth 2.0", O'Reilly Media (Unit:4)		
Reference Books			
1.	Zama Khan Mohammed "Angular Projects: Build Modern Web Apps with Angular 17"(Packt Publishing)		
2.	Shannon Bradshaw, Eoin Brazil, Kristina Chodorow (O'Reilly Media)"MongoDB: The Definitive Guide"		
Useful Links			
1.	https://www.coursera.org/courses?query=full%20stack%20web%20development		

Laboratory Scheme:			
Practical	02 Hrs/week	01	ESE
Total Credits			50

Course Outcomes (CO): Students will be able to			
CO1	Apply advanced string matching algorithms to solve real-world problems		
CO2	Analyse and implement graph and network flow algorithms for solving problems in various domains.		
CO3	Design and evaluate approximation algorithms and randomized techniques to develop near-optimal solutions where exact solutions are computationally infeasible.		
CO4	Demonstrate the ability to solve algorithmic problems for efficient decision-making in real-world applications.		

Course Contents	
CO	

Implementation of following concepts	
Experiment 1	Naive, KMP, and Boyer-Moore String Matching Algorithms
Experiment 2	Plagiarism Detection using KMP or Boyer-Moore Algorithm
Experiment 3	Dijkstra's and Bellman-Ford Algorithms
Experiment 4	Ford-Fulkerson and Edmonds-Karp Algorithm for Max Flow
Experiment 5	Greedy Approximation for Vertex Cover and Set Cover Problems
Experiment 6	Metric TSP Approximation Using MST (2-Approximation Algorithm)
Experiment 7	Randomized Quick Sort and Hashing Techniques
Experiment 8	Online Paging using Least Recently Used (LRU) and Optimal Algorithms
Experiment 9	Parallel Matrix Multiplication Using Multithreading / Multiprocessing
Experiment 10	Solving Linear Programming Problems using Simplex Method
Experiment 11	Integer Programming and Convex Optimization using Python Solver
Experiment 12	Case Study: 1. Optimization in AI – Resource Allocation in Cloud using LP 2. Optimization in Machine Learning Hyper parameter Tuning using Grid Search with LP Constraints
List of Submission: Course coordinator should give new problem statement based on above list of experiments.	
Minimum number of Experiments : 10	

Mapping of COs and POs												
PO →	CO 1	CO 2	CO 3	CO 4	1: Slight (Low)	2: Moderate (Medium)	3: Substantial (High)	PO 1	PO 2	PO 3	PO 4	PO 5
PO 1	-	-	-	-	-	-	-	-	-	-	-	-
PO 2	3	-	-	-	-	-	-	-	-	-	-	-
PO 3	-	-	3	-	-	-	-	-	-	-	-	-
PO 4	-	-	-	-	-	-	-	-	-	-	-	-
PO 5	-	-	-	-	-	-	-	-	-	-	-	-
PO 6	-	-	-	-	-	-	-	-	-	-	-	-
PO 7	-	-	-	-	-	-	-	-	-	-	-	-
PO 8	-	-	-	-	-	-	-	-	-	-	-	-
PO 9	-	-	-	-	-	-	-	-	-	-	-	-
PO 10	2	-	-	-	-	-	-	-	-	-	-	-
PO 11	1	-	-	-	-	-	-	-	-	-	-	-
PSO 1	1	1	1	1	1	1	1	1	1	1	1	1
PSO 2	2	2	2	2	2	2	2	2	2	2	2	2

Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task 1	15	15	15	15	15	15	15	15	15	15	15
Task 2	05	05	05	05	05	05	05	05	05	05	05
Task 3	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25



Chairman, Bos IT
[Signature]

Government College of Engineering, Karad

Third Year (Sem – VI) B. Tech. Information Technology

IT3609: Mobile Application Development Lab

Laboratory Scheme:		
Practical	02 Hrs./week	
Total Credits	01	

Prerequisite: Android, Java Programming

Course Outcomes (CO): Students will be able to

CO1	Understand the key features of various Mobile Operating System
CO2	Summarize essential Android and ios programming concepts
CO3	Demonstrate and implement Data Base Connectivity Applications
CO4	Design and develop Android and ios platform

Course Contents		CO
------------------------	--	-----------

Implementation of following concepts

Experiment 1	Set-up of Android development environment, managing AVD and understanding its various components available in Android Application Installation of x-code on MAC.	CO1
Experiment 2	Design Android Activities using LinearLayout, RelativeLayout, GridView, FrameLayout, and ConstraintLayout	CO2
Experiment 3	Develop code to demonstrate different ways of Handling different events (onClick, onLongClick etc.) over Button, EditText etc. to perform action in Android application at run-time	CO2
Experiment 4	Develop code to demonstrate Event handling of CheckBox and RadioButton selection.	CO2
Experiment 5	Develop code to navigate between different activities and pass the data from one activity to other activity using Intent.	CO2
Experiment 6	Develop an android application to store data locally using SharedPreferences and access-modify in different activities.	CO3
Experiment 7	Develop the code to implement the ListView and the Spinner views, perform add, update, remove items operations and implement the item selection event handling over ListView and Spinner for appropriate example.	CO2
Experiment 8	Communication media-SMS/Email	CO3
Experiment 9	Write a program to create a simple calculator in swift operations. Write a program to demonstrate different UI controllers and the use of table control / views	CO3
Experiment 10	Develop an application in database connectivity using iOS (crud operation).	CO4
Experiment 11	Write an application which can play audio and video operations using iOS	CO4
Experiment 12	Mini Project: Develop a project using android or iOS programming with using all controllers, notifications, database and views (Mandatory)	CO1, CO2, CO3, CO4

List of Submission: Course coordinator should give new problem statement based on above list of experiments.

Minimum number of Experiments : 10



Chairman, BOS IT
[Signature]
HEAD

Department of Information Technology
Govt. College of Engineering, Karad



HEAD

Chairman, BOS IT

ISE	Task III	Task II	Task I	Skill Level (as per CAS Sheet)	Avg
25	05	05	15	Exp 1	Exp 14
25	05	05	15	Exp 2	Exp 13
25	05	05	15	Exp 3	Exp 12
25	05	05	15	Exp 4	Exp 11
25	05	05	15	Exp 5	Exp 10
25	05	05	15	Exp 6	Exp 9
25	05	05	15	Exp 7	Exp 8
25	05	05	15	Exp 8	Exp 7
25	05	05	15	Exp 9	Exp 6
25	05	05	15	Exp 10	Exp 5
25	05	05	15	Exp 11	Exp 4
25	05	05	15	Exp 12	Exp 3
25	05	05	15	Exp 13	Exp 2
25	05	05	15	Exp 14	Exp 1

Guideline for Assessment Pattern:

PO →	CO 1	CO 2	CO 3	CO 4	1: Slight (Low)	2: Moderate (Medium)	3: Substantial (High)
PO 1	3	2	2	1	1	1	1
PO 2	2	2	3	2	1	1	1
PO 3	1	2	3	1	3	1	1
PO 4	2	3	2	1	1	1	1
PO 5	2	3	2	1	1	1	1
PO 6	1	1	1	1	1	1	1
PO 7	1	1	1	1	1	1	1
PO 8	1	1	1	1	1	1	1
PO 9	1	1	1	1	1	1	1
PO 10	1	1	1	1	1	1	1
PO 11	1	1	1	1	1	1	1
PO 12	1	1	1	1	1	1	1

Mapping of COs and POs

HEAD

Chairman, BOS IT



Government College of Engineering, Karad			
Third Year (Sem – VI) B. Tech. Information Technology			
IT3611 : IoT and Cloud Analytics Lab			
Laboratory Scheme:		Examination Scheme:	
Practical		02 Hrs/week	
Total Credits		01	
Prerequisites: Computer Network, Python Programming			
Course Outcomes (CO): Students will be able to			
CO1	Design and develop IoT applications using Arduino, ESP32 & Raspberry Pi by interfacing sensors		
CO2	Implement cloud connectivity for IoT devices using Wi-Fi, Bluetooth & MQTT protocols		
CO3	Apply security measures in IoT communication by configuring TLS encryption, using AWS IoT		
CO4	Develop and deploy IoT-based systems for real-world applications predictive maintenance		
Course Contents			
CO			
Implementation of following concepts			
Experiment 1	Setting up Arduino/ESP32/Raspberry Pi for IoT applications. Interfacing DHT11 (Temperature), LDR (Light), and Ultrasonic sensor with ESP32/Arduino	CO1	
Experiment 2	Reading and displaying sensor data on a serial monitor, Connecting an IoT device to the internet using Wi-Fi and Bluetooth & Sending sensor data to ThingSpeak for real-time visualization.	CO2	
Experiment 3	Publishing and subscribing to MQTT messages using Mosquitto broker & Configuring and using Node-RED for IoT data visualization	CO1	
Experiment 4	Integrating Google Cloud IoT for real-time data processing.	CO2	
Experiment 5	Registering and managing devices on AWS IoT Device Management.	CO3	
Experiment 6	Implementing TLS encryption for secure IoT communication.	CO2	
Experiment 7	Configuring IBM Watson IoT for real-time device monitoring. Detecting and analyzing security threats using AWS IoT Device Defender.	CO1	
Experiment 8	Implementing event-based processing using AWS IoT Events. Storing and analyzing time-series IoT data with InfluxDB.	CO3	
Experiment 9	Deploying AWS IoT Greengrass for edge computing. Creating an IoT dashboard with Node-RED and Grafana.	CO2	
Experiment 10	Deploying AWS IoT Greengrass for edge computing & Developing a home automation system using IoT cloud	CO2	
Experiment 11	Building an IoT-based health monitoring system. Implementing predictive maintenance using IoT analytics	CO4	
Experiment 12	Mini Project OPEN Ended problem: Students are required to submit an IoT based project using the Microcontroller or a Raspberry Pi and connecting various sensors and actuators. The data for the same should be displayed via a webpage or a web app.(Mandatory)	CO2	
Requirement Tools :	IOT Kit contains following items: 1. Arduino Uno with USB Cable 2. ESP8266 (ESP01) Serial WiFi Module 3. 1-Channel Relay Module 4. Breadboard (Regular) 5. Assorted Jumper Wires (20) 6. LM35 Temperature Sensor 7. Assorted LEDs (10)		
List of Submission: Course coordinator should give new problem statement based on above list of experiments.		Total number of Experiments : 10	
I			

[illegible]

	1: Slight (Low)						2: Moderate (Medium)						3: Substantial (High)					
PO →	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2					
CO ↑	-	-	3	2	1	-	-	2	-	-	-	1	-					
CO 1	-	-	-	2	3	1	-	-	2	-	-	1	-					
CO 2	-	-	-	1	1	3	-	-	-	-	-	1	2					
CO 3	-	-	-	1	1	3	-	-	-	-	-	1	2					
CO 4	-	-	-	2	1	3	-	-	-	-	-	1	2					

Mapping of COs and POS

Government College of Engineering, Karad

Third Year (Sem – VI) B. Tech. Information Technology

IT3614: Program Elective-02: Software Project Management

Teaching Scheme			
Lectures	03 Hrs/week		
Tutorials	00 Hrs/week		
Total Credits	03		
Prerequisite : Software Engineering			
Course Outcomes (CO): Students will be able to			
CO1 Discuss importance of Software Project Management			
CO2 Discuss project plan, evaluate and estimate efforts.			
CO3 Perform activity planning and risk management.			
CO4 Apply resources for selected projects and perform allocation.			
Course Contents			
CO	CO1	Hours	

Unit 1
Introduction to Software Project Management:
 Importance of Software Project Management, Software Project versus other type of project, Contract management and technical project management, activities covered by software project management, plans, Categorization of project management, stakeholders, Management control.
 Agile Software Development- Agile Methods, Plan-driven and agile development, Extreme programming, Agile project management, Scaling agile methods.

Unit 2
Project Evaluation and Programme Management:
 Introduction, A Business case, Project Portfolio Management, Evaluation of individual projects, cost-benefit evaluation techniques, Programme management, strategic programme management, Programme creation, Aids to Programme management.
(Self-Study: Classroom Software Engineering)

Unit 3
Activity Planning:
 Stepwise project planning, analysis of project characteristics, analysis of project characteristics, activity risk identification, Objectives of activity planning, Project schedules, Project and activities, Sequencing and scheduling activities, network planning models, forward pass, backward pass, shortening project duration, Activity-on-arrow networks, Applying PERT techniques, Monte Carlo simulation **(Self Study: Critical Chain concept in risk management)**

Unit 4
Resource Allocation:
 The nature of resources, Identification of resource requirements, Scheduling resources, Critical path creation, Cost counting, publishing the resource schedule, cost schedules, The scheduling sequence, Continuous Integration and Continuous Deployment/Delivery (CCID).

Unit 5
Managing Contracts: Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management
 Managing People in Software Environments: Understanding Behavior, Organizational Behavior, Selecting the Right Person for the Job, Instruction in the Best Methods, Motivation, The Oldham-Hackman Job Characteristics Model, Stress Management, Health and Safety Ethical and Professional Concerns.

Unit 6
Working in Teams: Becoming a Team Decision Making, Organization and Team Structures, Coordination Dependencies Dispersed and Virtual Teams Communication, Genres Communication Plans
 Software Quality: The Place of Software Quality in Project Planning, Importance of Software Quality, Defining Software Quality Models, ISO 9126 Product and Process Metrics, Product versus Process Quality Management, Quality Management Systems, Software Reliability
 Project Closeout: Reasons for Project Closeout, Project Closeout Process, Performing a Financial Closeout, Project Closeout Report

Text Books



Chairman, BOS IT

HEAD

Department of Information Technology
 Govt. College of Engineering,



Chairman, BOS IT
HEAD

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	10
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

1: Slight(Low)												2: Moderate(Medium)										3: Substantial(High)											
PO →	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11
CO 1	-	1	3	-	2	1	1	3	2	2	2	-	1	1	2	1	1	1	2	2	2	2	-	1	2	2	2	2	2	2	2	2	2
CO 2	-	1	2	-	2	1	1	3	2	2	2	-	1	1	2	1	1	1	2	2	2	2	-	1	2	2	2	2	2	2	2	2	2
CO 3	-	2	3	-	1	1	1	3	2	2	2	-	1	1	2	1	1	1	2	2	2	2	-	1	2	2	2	2	2	2	2	2	2
CO 4	-	3	1	-	-	2	1	1	3	2	2	-	1	1	2	1	1	1	2	2	2	2	-	1	2	2	2	2	2	2	2	2	2

Mapping of COs and POs

1.	Bob Hughes and Mike Cottrell, "Software Project Management", McGraw-Hill Education, 6 th edition, ISBN: 9387067181, 2018. (Unit 1,2,3,4,5,6)
Reference Books	
1.	Robert K. Wysocki, "Effective Software Project Management", Wiley publication, 2011.
2.	Walker Royce, "Software Project Management", Addison Wiley, 1998.
3.	Gopalwamy Ramesh, "Managing Global Software Projects", Mc Graw Hill Education, 2013.
Useful Links	
1.	http://elearn.psgcas.ac.in/nptel/courses/video/106105218/L47.html Prof. Durga Prasad Mohapatra NIT Raurkela
2.	https://nptel.ac.in/courses/106105218 Prof. Rajib Mall IIT Kharagpur.
3.	https://dipeshhagrawal.wordpress.com/software-engineering-project-management/

Government College of Engineering, Karad

Third Year (Sem – VI) B. Tech. Information Technology

IT3624: Program Elective-02: Advanced Machine Learning

Teaching Scheme			
Lectures	03 Hrs/week		
Tutorials	00 Hrs/week		
Total Credits	03		
Examination Scheme			
MSE	20	Duration of ESE	02 Hrs 30 Min
ISE	20		
ESE	60		

Prerequisite : Machine learning, Database management system

Course Outcomes (CO): Students will be able to

CO1	Understand ensemble learning, reinforcement learning, Bayesian learning techniques to real-world problems in various domains.
CO2	Build the recommender system for given application scenario.
CO3	Explore and investigate deep learning architectures components.
CO4	Illustrate the technique of Convolution (CNN) and Recurrent Neural Network (RNN) for implementing Deep Learning models.

Course Contents			CO	Hours
Unit 1	Ensemble Learning and Reinforcement Learning	Classification trees, Regression trees, Regularization and pruning, Gini Index, Gain ratio, ID3, C4.5, CART, Random Forest, Ensemble Learning: Bagging, boosting, Ad boost, Introduction to Reinforcement Learning, Markov Decision Process.	CO1	(07)
Unit 2	Bayesian Learning	Classical, Empirical, Subjective methods, Types of events, Types of probabilities, Normal Distribution, Bayes' Theorem, Naïve Bayes' classifier, Bayesian Learning. (Self-study: Exploring Bayesian networks.)	CO1	(06)
Unit 3	Recommendation System:	Machine Learning based Recommendation System, Top recommendation Systems on the Internet, Approaches to recommendation system design: Collaborative Filtering, Content based Filtering and hybrid approach, ML Ops.	CO2	(06)
Unit 4	Deep Neural Network:	Introduction to Neural Networks, Training Neural Networks: Backpropagation and Forward propagation Activation Functions, Loss Functions, Hyper-parameters, Gradient-Based Learning.	CO4	(07)
Unit 5	Convolution Neural Network (CNN):	Introduction, CNN architecture overview, The Basic Structure of a Convolutional Network- Interleaving between Layers, Local Response Normalization, (Self-study: Application of CNNs in image classification, object detection, and medical imaging.)	CO4	(07)
Unit 6	Recurrent Neural Network (RNN):	Recurrent and Recursive Nets, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Long Short-Term Memory and Other Gated RNNs, selecting hyper parameters. (Self-Study: Optimization for long-term dependencies).	CO4	(07)

Text Books

1. Tom Mitchell, "Machine learning", McGraw-Hill series in Computer Science (Unit 1,2,3)
2. Goodfellow I., Bengio Y. Courville A., "Deep Learning", MIT Press, 2016.(Unit 4,5,6)

Reference Books

1. Parag Kulkarni: Reinforcement and Systematic Machine Learning for Decision Making, Wiley IEEE Press, July 2012.
2. Ethem Alpaydm, "Introduction to Machine Learning", PHI 2nd edition-2013.
3. Charu Agarwal, "Neural Networks and deep learning", Springer 2023, ISBN:978-3-031-29642-3.
4. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", 2nd Edition. MIT Press. ISBN 0262039249
5. SethWeidman, "Deep Learning from Scratch: Building with Python from First Principles", O'Reilly, ISBN:978-93-



Chairman, BOS IT

HEAD

Department of Information Technology
Govt. College of Engineering, Karad



Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

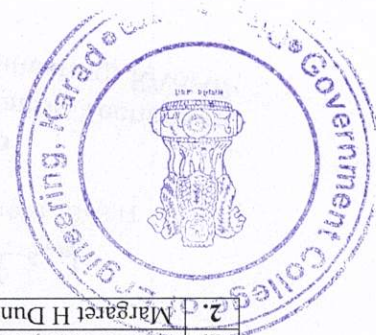
Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

PO →	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
CO ↑	1	2	3	4	5	6	7	8	9	10	11	1	2
CO 1	2	1	3	2	-	-	-	-	1	-	2	2	2
CO 2	2	2	1	1	2	-	-	-	2	-	1	2	2
CO 3	3	2	2	1	2	-	-	-	2	-	2	2	2
CO 4	2	1		2	2	-	-	-	1	-	2	2	2

Mapping of COS and POS

5213-902-6.	Useful Links
1.	https://onlinecourses.nptel.ac.in/noc21_cs25/preview , Prof. Balaraman Ravindran IIT Madras..
2.	https://onlinecourses.nptel.ac.in/noc23_cs49/preview , Prof. M. K. Bhuyan IIT Guwahati.
3.	https://onlinecourses.nptel.ac.in/noc25_cs49/preview , Prof. Balaji Srinivasan, Prof. Ganapathy Krishnamurthi IIT Madras



Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Information Technology				
IT3634: Program Elective-02: Data Warehousing and Data Mining				
Teaching Scheme				
Lectures	03 Hrs/week	MSE	20	
Tutorials	00 Hrs/week	ISE	20	
Total Credits	03	ESE	60	
		Duration of ESE	02 Hrs 30 Min	
Prerequisite : Basic Programming Skills, Database Management Systems (DBMS)				
Course Outcomes (CO): Students will be able to				
CO1	Define foundational concepts underlying data mining.			
CO2	Explain data warehouse system and perform business analysis with OLAP tools.			
CO3	Apply data mining tools to real-world problems..			
CO4	Design and deploy appropriate classification and clustering techniques for data analysis.			
Course Contents				
Unit 1	Data Warehousing: Introduction, Need for Data Warehouses, The Building Blocks: Defining Features, Data Warehouses and Data Marts, Overview of the Components, Metadata in the Data Warehouse; Overview of Data Extraction, Clean-up and Transformation tools.	CO1, CO2	CO2	(06) Hours
Unit 2	Dimensional Modeling and OLAP: Fact Table, Data Granularity, Star Schema Keys, Advantages of Star Schema, The Snowflake Schema, OLAP in The Data Warehouse: Demand For OLAP, Major Features and Functions – Dimensional Analysis, Hypercubes, Drill Down and Roll Up, Slice and Dice or Rotation; OLAP Models –MOLAP, ROLAP, HOLAP, OLTP.	CO2	CO2	(07)
Unit 3	Data Mining: Introduction, Kinds of Data and Patterns to be Mined, Technologies used, Applications, Major Issues in Data Mining. Know Your Data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity.	CO1	CO1	(07)
Unit 4	Mining Frequent Patterns, Associations and Correlations: Basic Concepts: Market Basket Analysis, Frequent Itemsets, Closed Itemsets and Association Rules; Frequent Itemset Mining Methods: Apriori Algorithm, Generating Association Rules from Frequent Itemsets; Pattern Evaluation Methods: lift and χ^2 . (Self-study: Data Mining for Online Retail Industry).	CO1, CO3	CO3	(07)
Unit 5	Classification and Prediction: Basic Concepts, Issues Regarding Classification and Prediction, Decision Tree: DT Induction, Attribute Selection Measures; Bayes Classification Methods: Bayes' Theorem, Naive Bayesian Classification; Rule-Based Classification: Using IF-THEN Rules for Classification, Rule Extraction from a Decision Tree. (Self-study: Rule Induction Using a Sequential Covering Algorithm).	CO4	CO4	(07)
Unit 6	Cluster Analysis: Introduction, Requirements, Overview of Basic Clustering Methods; Partitioning Methods: k-Means, k-Medoids; Hierarchical Methods: BIRCH; Density-Based Methods: DBSCAN. (Self-study: Evaluation of Clustering, Euclidean Distance Measure).	CO4	CO4	(06)
Text Books				
1.	Paulraj Ponniah, "Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals", John Wiley & Sons, 2 nd Edition, ISBN: 0-471-41254-6, 2001. (Unit-1,2)			
2.	Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Elsevier, 3 rd Edition, 2012. (Unit 3,4,5,6)			
Reference Books				
1.	Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw Hill, 2016.			
2.	Margaret H Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, 1st Edition, ISBN:			

978-0130888921, 2002	
Useful Links	
1.	https://nptel.ac.in/courses/106/105/106105174/ Prof. P. Mitra IIT Kharagpur
2.	https://onlinecourses.swayam2.ac.in/ccc20_cs12/preview Prof. L. Abraham David

Mapping of COs and POs

	PO →	CO ↓	CO 1	CO 2	CO 3	CO 4	1: Slight (Low)	2: Moderate (Medium)	3: Substantial (High)
PO →	PO	PO	PO	PO	PO	PO	PO	PO	PO
CO ↓	1	2	3	1	2	1	2	1	1
CO 1	3	1	1	1	1	1	1	1	1
CO 2	2	2	2	1	2	2	2	2	2
CO 3	2	1	2	2	2	2	2	2	2
CO 4	3	1	2	2	2	2	2	2	2

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60



HEAD
Department of Information Technology
Govt. College of Engineering, KARAPARY

Chairman, BOS IT

[Signature]

Chairman, BOS IT



Government College of Engineering, Karad			
Third Year (Sem – VI) B. Tech. Information Technology			
IT3644: Program Elective-02: Blockchain Technology			
Teaching Scheme		Examination Scheme	
Lectures	03 Hrs/week	MSE	20
Tutorials	00 Hrs/week	ISE	20
Total Credits	03	ESE	60
Prerequisite : Digital Systems		Duration of ESE	
		02 Hrs 30 Min	
Course Outcomes (CO): Students will be able to			
CO1	Understand the concept of Blockchain Technology, transactions, block, PoW, Consensus		
CO2	Illustrate the simulation of blockchain technology without any central controlling or trusted agency and how bitcoin cryptocurrency work.		
CO3	Interpret the concept of digital currency, how it can be protected against fraud, scam, hacking and devaluation.		
CO4	Explore the concept of bitcoin and Ethereum.		
Course Contents			
Unit 1	Blockchain Technology:	CO1	(06)
Basics of blockchain, History, Uses of Blockchain, Structure of a block, Transactions, networks, Types of blockchains, Objectives of consensus mechanisms, famous hacks, wallet, security and safeguards Public Ledger, Distributed Consensus.			
Unit 2	Cryptographic Primitives and Overview of blockchain:	CO2	(07)
Hash Chain, Hash tree- Merkle Tree, Public Key cryptography, Digital signatures, Use of hash functions and digital signatures in blockchain, recording transaction, (Self Study: confirmation and verification of transaction)			
Unit 3	Distributed Consensus:	CO2	(07)
Consensus building, Consensus mechanism: PoW, PoS, PoB, PoA, blockchain architecture, Merkle root tree.			
Unit 4	Bitcoin :	CO3	(07)
History of bitcoin, Double Spending, Script (FORTRAN), Mining Process, History, Architecture, Account Types, Gas, Transactions.			
Unit 5	Ethereum :	CO3	(07)
Introduction to ethereum, Ethereum Virtual Machine, Ethereum Mining process, Solidity. Hyperledger Fabric: Features of hyperledger, Architecture, ordering service, Transaction Flow, Membership and Identity Management.			
Unit 6	Privacy and Security issues in Blockchain :	CO4	(06)
General Data Protection Regulation (GDPR), Pseudo-anonymity vs. anonymity, Zcash and ZK-SNARKS for anonymity Preservation, Case Study: Blockchain in Government Digital Identity, Healthcare, Land Registration, (Self Study: Supply Chain Management)			
Text Books			
1.	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Princeton University Press 2016 (Unit 1,2,3,4,5,6)		
2.	Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3 rd Edition, Imran Bashir, Packt Publishing, 2020, ISBN: 9781839213199		
Reference Books			
1.	'Blockchain Technology: Cryptocurrency and Applications, S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Oxford University Press, 2019.		
2.	Blockchain: The Blockchain for Beginners, Guild to Blockchain Technology and Blockchain Programming, Josh Thompson		
3.	Blockchain Revolution, Don Tapscott, Alex Tapscott, ISBN No. 9781101980132		
Useful Links			
1.	Hyperledger Tutorials - https://www.hyperledger.org/use/tutorials		
2.	Ethereum Development Resources - https://ethereum.org/en/developers		



HEAD

Chairman, BOS IT

[Signature]

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	-	-	-
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

		1: Slight(Low)										2: Moderate(Medium)										3: Substantial(High)									
PO →	CO ↑	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28		
CO 4		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
CO 3		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
CO 2		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
CO 1		3	2	2	2	3	1	1	1	1	1	1	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
PSO	PSO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28		

Mapping of COs and POs

for

[illegible]

Guideline for Assessment Pattern:

PO →	PO 1	PO 2	1: Slight (Low)			2: Moderate (Medium)			3: Substantial (High)					
			PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1
CO 1	-	1	3	-	-	-	-	-	-	-	1	1	2	3
CO 2	-	1	2	-	2	-	-	-	-	-	2	1	3	2
CO 3	-	2	3	-	-	-	-	-	1	-	2	1	2	2
CO 4	-	3	1	-	-	-	-	-	1	-	2	1	2	2

Mapping of COs and POS

Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Information Technology				
IT3610: Program Elective-02 lab: Software Project Management Lab				
Laboratory Scheme:				
Practical		02 Hrs/week		
Total Credits		01		
			ESE	-
			ISE	25
Examination Scheme:				
Prerequisite : Software Engineering				
Course Outcomes (CO): Students will be able to				
CO1	Analyze Agile Software Development methods.			
CO2	Illustrate the concepts of Distributed and Component-based Software Engineering.			
CO3	Plan Service-oriented Architectures and Embedded Software designs			
CO4	Interpret the Aspect oriented and Object oriented Software Engineering Techniques.			
Course Contents				
CO				
Experiment 1	Overview of different project management tools (e.g. Jira)			
Experiment 2	Perform version control and code management using GitHub and SVN.			
Experiment 3	Version management using Jira.			
Experiment 4	Workflow and task management.			
Experiment 5	User and role management.			
Experiment 6	Project Monitoring and Reporting.			
Experiment 7	Issue management.			
Experiment 8	Bug tracking and reporting tool.			
Experiment 9	Project Estimation Model			
Experiment 10	Case Study on given problem statement based on Software Project Management.			
List of Submission: Course coordinator should give new problem statement based on above list of experiments.				
Minimum number of Experiments : 10				



HEAD

Chairman, BOS IT

PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	2	1	-	-	1	1	1	1	-	-	-	1	2
CO 2	-	3	1	-	1	1	1	1	-	-	-	2	1
CO 3	1	-	2	1	2	1	1	1	-	-	-	3	1
CO 4	2	-	2	2	2	1	1	1	-	-	-	2	2

2: Moderate (Medium)
3: Substantial (High)

Mapping of COs and POs

Minimum number of Experiments : 10		List of Submission: Course coordinator should give new problem statement based on above list of experiments.	
Experiment 1	Ensemble learning.	CO1	
Experiment 2	Bagging & Boosting	CO1	
Experiment 3	Random Forest	CO1, CO2	
Experiment 4	Markov Decision Process and Bayesian learning.	CO2	
Experiment 5	Recommendation system – Collaborative and Content-based.	CO2	
Experiment 6	Perceptron Model	CO3	
Experiment 7	Train a CNN on any image dataset and perform classification using contents of images and measure the performance of the model.	CO3	
Experiment 8	Train a CNN on any video dataset and measure the performance of the model.	CO3	
Experiment 9	Generate summary of given document using RNN model.	CO3	
Experiment 10	Implement an RNN model to classify the sentiment using suitable dataset.	CO3	
Experiment 11	Experiment with different types of RNNs (vanilla RNN, LSTM, GRU) and analyse their performance for above statement.	CO4	
Experiment 12	Mini Project (Mandatory)	CO4	
Implementation of following concepts			
Course Contents		CO	
CO1	Demonstrate the ability to implement ensemble learning techniques, including bagging and boosting, to solve complex problems.		
CO2	Develop and evaluate recommendation systems using collaborative, content-based, and hybrid approaches.		
CO3	Apply advanced neural network architectures, including CNNs and RNNs, for diverse machine learning tasks.		
CO4	Build and train single-layer and multi-layer neural networks, incorporating various activation functions and visualizing performance metrics.		
Course Outcomes (CO): Students will be able to			
Prerequisite : Machine Learning, Python Programming			
Laboratory Scheme:		Examination Scheme:	
Practical	02 Hrs./week	ISE	25
Total Credits	01	ESE	-
IT3620: Program Elective-02 lab: Advanced Machine Learning Lab			
Third Year (Sem – VI) B. Tech. Information Technology			
Government College of Engineering, Karad			



Chairman, BOS IT
[Signature]

ISE	25	25	25	25	25	25	25	25	25	25	25	25
Task III	05	05	05	05	05	05	05	05	05	05	05	05
Task II	05	05	05	05	05	05	05	05	05	05	05	05
Task I	15	15	15	15	15	15	15	15	15	15	15	15
Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg	

Guideline for Assessment Pattern:



HEAD

Chairman, BOS IT

PO →	CO 1	CO 2	CO 3	CO 4
PO 1	2	1	2	1
PO 2	2	1	2	2
PO 3	2	1	2	2
PO 4	2	1	2	2
PO 5	2	1	2	2
PO 6	2	1	2	2
PO 7	2	1	2	2
PO 8	2	1	2	2
PO 9	2	1	2	2
PO 10	2	1	2	2
PO 11	2	1	2	2
PO 12	2	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping of COs and POs

Minimum number of Experiments : 10	
List of Submission: Course coordinator should give new problem statement based on above list of experiments.	
Experiment 12	Hierarchical Methods: BIRCH and Density-Based Methods: DBSCAN.
Experiment 11	Apriori Algorithm and Partitioning Methods (K-means/k-Medoids).
Experiment 10	Association between data and to find the frequent item set for text mining Using WEKA tool.
Experiment 9	Web mining technique clustering algorithm for the given dataset Using WEKA tool.
Experiment 8	Naive Bayes Classification for testing the given dataset Using WEKA tool.
Experiment 7	Linear Regression for training the given dataset using WEKA tool.
Experiment 6	Convert a text file to ARFF (Attribute-Relation File Format) and convert ARFF (Attribute-Relation File Format) into text file using WEKA tool.
Experiment 5	Data Mining/Machine Learning Tool Kit and file formats for the data mining using the WEKA tools.
Experiment 4	Design fact and dimension tables Using WEKA tool.
Experiment 3	Perform various OLAP operations such as slice, dice, roll up, drill up and pivot.
Experiment 2	Write ETL scripts and implement those using data warehouse tools.
Experiment 1	Build Data warehouse/Data Mart (Using Open source tools, Data Integration Tool or other data warehouse tools).
Implementation of following concepts	
Course Contents	
CO 1	Understand and implement the process of building data warehouses and data marts using open-source and commercial tools, including ETL processes.
CO 2	Perform and analyze various OLAP operations such as slice, dice, roll-up, drill-up, and pivot to explore multidimensional data.
CO 3	Apply foundational data mining algorithms, including Apriori, for association rule mining, and evaluate machine learning algorithms using tools like WEKA.
CO 4	Apply advanced data mining techniques like clustering and hierarchical methods (BIRCH), Web Text Mining
Course Outcomes (CO): Students will be able to	
Prerequisite : Database Management Systems, Java Programming	
Total Credits	01
Practical	02 Hrs/week
Laboratory Scheme:	Examination Scheme:
IT3630: Program Elective-02 lab: Data Warehousing and Data Mining Lab	
Third Year (Sem – VI) B. Tech. Information Technology	
Government College of Engineering, Karad	



Govt. College of Engineering, KARAD
Department of Information Technology

HEAD

Chairman, BOS IT

[Handwritten signature]

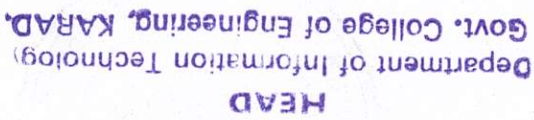
Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

Guideline for Assessment Pattern:



[Signature]

Government College of Engineering, Karad			
Third Year (Sem – VI) B. Tech. Information Technology			
IT3640: Program Elective-02 lab: Blockchain Technology Lab			
Laboratory Scheme:		Examination Scheme:	
Practical	02 Hrs/week	ISE	25
Total Credits	01	ESE	-
Prerequisite :			
Course Outcomes (CO): Students will be able to			
CO1	Understand the Fundamental Concepts of Blockchain		
CO2	Develop and Deploy Smart Contracts		
CO3	Build and Interact with Decentralized Applications (DApps)		
CO4	Implement Blockchain Solutions for Real-World Applications		
Course Contents			
CO			
Implementation of following concepts			
Experiment 1	Introduction to Blockchain and Genesis Block		
	- Set up a private blockchain using Ethereum (Geth) or Hyperledger Fabric - Explore block structure, hash linking, and block mining		
Experiment 2	Cryptographic Hashing and Digital Signatures		
	- Implement SHA-256 hashing - Generate and verify digital signatures using ECDSA		
Experiment 3	Building a Simple Blockchain in Python		
	Implement a basic blockchain with transaction validation and proof-of-work		
Experiment 4	Consensus Mechanisms: Proof of Work (PoW) and Proof of Stake (PoS)		
	- Simulate PoW mining - Compare PoW vs. PoS energy efficiency and security		
Experiment 5	Smart Contract Development in Solidity		
	- Write and deploy a simple Solidity contract on Ethereum - Test the contract using Remix, Truffle, and Ganache		
Experiment 6	Decentralized Application (DApp) Development		
	Build a basic DApp (e.g., voting system, to-do list) using React and Web3.js		
Experiment 7	Ethereum Token Creation (ERC-20)		
	- Develop a custom ERC-20 token - Deploy the token on a testnet (e.g., Ropsten, Goerli)		
Experiment 8	Hyperledger Fabric Network Setup		
	- Set up a Hyperledger Fabric private blockchain network - Deploy and execute chaincode (smart contracts)		
Experiment 9	InterPlanetary File System (IPFS) for Decentralized Storage		
	Store and retrieve files using IPFS		



[Signature]

Assessment Pattern (with revised Bloom's Taxonomy)

Guideline for Assessment Pattern:

Mapping of COs and Pos

	• Link IPFS with Ethereum smart contracts	
Experiment 10	NFT (Non-Fungible Token) Experiment • Create and deploy an ERC-721 or ERC-1155 NFT contract • Mint and transfer NFTs • Develop a basic NFT marketplace	CO4
Experiment 11	Supply Chain Management using Blockchain • Develop a blockchain-based supply chain prototype • Track products using smart contracts and IoT devices	CO4
Experiment 12	Blockchain Performance Testing and Scalability Solutions • Measure transaction throughput and latency • Experiment with Layer 2 solutions (e.g., Lightning Network, Rollups)	CO4
List of Submissions: Course coordinator should give new problem statement based on above list of experiments.		
Minimum number of Experiments : 10		