



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF INFORMATION TECHNOLOGY

IV Year – I SEMESTER

S.No	Course Code	Courses	L	T	P	Credits
1	IT4101	Cryptography and Network Security	3	0	0	3
2	IT4102	Machine Learning	3	1	0	4
3	IT4103	Advanced Computer Networks	3	0	0	3
4	OE4101	Open Elective II (Inter Disciplinary)	3	0	0	3
5	PE4101	Professional Elective III 1. Big Data Analytics 2. Social Networking 3. Ad-hoc and Sensor Networks 4. Cloud Computing 5. Design Patterns	3	0	0	3
6	PE4102	Professional Elective IV 1. Distributed Systems 2. DevOps 3. Internet of Things 4. Data Science 5. Biometrics	3	0	0	3
7	IT4104	Unified Modeling Language (UML) Lab *	0	0	2	1
8	PR4101	Project –I	0	0	0	2
9	MC4101	IPR & Patents	3	0	0	0
Total			21	1	2	22
*Relevant theory to be taught in the lab						



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IV Year – I Semester		L	T	P	C
		3	1	0	4
MACHINE LEARNING					

Course Objectives:

The course is introduced for students to

- Gain knowledge about basic concepts of Machine Learning
- Study about different learning algorithms
- Learn about of evaluation of learning algorithms
- Learn about artificial neural networks

Course Outcomes:

- Identify machine learning techniques suitable for a given problem
- Solve the problems using various machine learning techniques
- Apply Dimensionality reduction techniques
- Design application using machine learning techniques

UNIT I

Introduction: Definition of learning systems, Goals and applications of machine learning, Aspects of developing a learning system: training data, concept representation, function approximation.

Inductive Classification: The concept learning task, Concept learning as search through a hypothesis space, General-to-specific ordering of hypotheses, Finding maximally specific hypotheses, Version spaces and the candidate elimination algorithm, Learning conjunctive concepts, The importance of inductive bias.

UNIT II

Decision Tree Learning: Representing concepts as decision trees, Recursive induction of decision trees, Picking the best splitting attribute: entropy and information gain, Searching for simple trees and computational complexity, Occam's razor, Overfitting, noisy data, and pruning.

Experimental Evaluation of Learning Algorithms: Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing.

UNIT III

Computational Learning Theory: Models of learnability: learning in the limit; probably approximately correct (PAC) learning. Sample complexity for infinite hypothesis spaces, Vapnik-Chervonenkis dimension.

Rule Learning: Propositional and First-Order, Translating decision trees into rules, Heuristic rule induction using separate and conquer and information gain, First-order Horn-clause induction (Inductive Logic Programming) and Foil, Learning recursive rules, Inverse resolution, Golem, and Progol.

UNIT IV

Artificial Neural Networks: Neurons and biological motivation, Linear threshold units. Perceptrons: representational limitation and gradient descent training, Multilayer networks and backpropagation, Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks.

Support Vector Machines: Maximum margin linear separators. Quadratic programming solution to



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finding maximum margin separators. Kernels for learning non-linear functions.

UNIT V

Bayesian Learning: Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logistic regression. Bayes nets and Markov nets for representing dependencies.

Instance-Based Learning: Constructing explicit generalizations versus comparing to past specific examples. k-Nearest-neighbor algorithm. Case-based learning.

Text Books:

- 1) T.M. Mitchell, “Machine Learning”, McGraw-Hill, 1997.
- 2) Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

Reference Books:

- 1) Ethern Alpaydin, “Introduction to Machine Learning”, MIT Press, 2004.
- 2) Stephen Marsland, “Machine Learning -An Algorithmic Perspective”, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
- 3) Andreas C. Müller and Sarah Guido “Introduction to Machine Learning with Python: A Guide for Data Scientists”, Oreilly.

e-Resources:

- 1) Andrew Ng, “Machine Learning Yearning” <https://www.deeplearning.ai/machine-learning-yearning/>
- 2) Shai Shalev-Shwartz , Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms” , Cambridge University Press
<https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html>



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IV Year – I Semester		L	T	P	C
		3	0	0	3
ADVANCED COMPUTER NETWORKS					

Course Objectives:

This course is aimed at enabling the students to

- Gain core knowledge of Network layer routing protocols and IP addressing.
- Study Session layer design issues, Transport layer services, and protocols.
- Acquire knowledge of Application layer and Presentation layer paradigms and protocols.
- Provide the mathematical background of routing protocols.
- To develop some familiarity with current research problems and research methods in advance computer networks.

Course Outcomes:

After the completion of the course, student will be able to

- Illustrate reference models with layers, protocols and interfaces
- Describe the routing algorithms, Sub netting and Addressing of IP V4 and IPV6
- Describe and Analysis of basic protocols of computer networks, and how they can be used to assist in network design and implementation
- Describe the concepts Wireless LANS, WIMAX, IEEE 802.11, Cellular telephony and Satellite networks

UNIT I

Network layer: Network Layer Services, Packet Switching, Performance, provided transport layers, implementation connectionless services, implementation connection oriented services, comparison of virtual –circuit and datagram subnets. IPV4 Address, Forwarding of IP Packets, Internet Protocol, ICMP v4, Mobile IP

UNIT II

Routing Algorithms–Distance Vector routing, Link State Routing, Path Vector Routing, Unicast Routing Protocol- Internet Structure, Routing Information Protocol, Open Source Path First, Border Gateway Protocol V4, Broadcast routing, Multicasting routing, Multicasting Basics, Intradomain Multicast Protocols, IGMP.

UNIT III

IPv6 Addressing, IPv6 Protocol, Transition from IPv4 to IPv6.

Transport Layer Services, connectionless versus connection oriented protocols. Transport Layer Protocols: Simple Protocol, Stop and Wait, Go-Back-N, Selective repeat, Piggy Backing.

UDP: User datagram, Services, Applications.

TCP: TCP services, TCP features, segment, A TCP connection, Flow control, error control, congestion control.



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UNIT IV

SCTP: SCTP services SCTP features, packet format, An SCTP association, flow control, error control.

QUALITY OF SERVICE: flow characteristics, flow control to improve QOS: scheduling, traffic shaping, resource reservation, admission control.

UNIT V

WWW and HTTP, FTP, Telnet, Domain name system, SNMP, Multimedia data, Multimedia in the Internet.

Text Books:

- 1) Data Communication and Networking , Behrouz A. Forouzan, McGraw Hill, 5th Edition, 2012
- 2) Computer Networks , Andrew S. Tanenbaum, David J. Wetherall, Pearson Education India; 5 edition, 2013.

Reference Books:

- 1) Computer networks, Mayank Dave, CENGAGE.
- 2) Computer Networks: A Systems Approach , LL Peterson, BS Davie, Morgan-Kauffman , 5th Edition, 2011.
- 3) Computer Networking: A Top-Down Approach JF Kurose, KW Ross, Addison-Wesley , 5th Edition, 2009.

e-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105183/>



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Open Elective II					

Note: The student has to take any one **open elective course** offered in the other departments (or) SWAYAM/NPTEL courses offered by other than parent department. (12 week minimum).

Given below are some of the courses offered by NPTEL/SWAYAM

<p>Electronics & Communication Engineering</p> <ol style="list-style-type: none"> 1) Information Coding Theory 2) VLSI Design 3) Signals & Systems 4) Digital Signal Processing 	<p>Mathematics</p> <ol style="list-style-type: none"> 1) Optimization Techniques 2) Computational Number Theory and Cryptography
<p>Electrical and Electronics Engineering</p> <ol style="list-style-type: none"> 1) Networking Analysis 2) Fuzzy Sets, Logic and Systems & Applications 3) Energy Management Systems and SCADA 4) Industrial Safety Engineering 	<p>Civil Engineering</p> <ol style="list-style-type: none"> 1) Intelligent transportation engineering 2) Remote Sensing and GI 3) Engineering Mechanics 4) City and Metropolitan Planning 5) Sustainable Materials and Green Buildings
<p>Mechanical Engineering</p> <ol style="list-style-type: none"> 1) Industrial Automation and Control 2) Robotics 3) CAD 4) Mechatronics And Manufacturing Automation 5) Non Conventional Energy Resources 	



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BIG DATA ANALYTICS					

Course Objectives:

- To optimize business decisions and create competitive advantage with Big Data analytics
- To learn to analyze the big data using intelligent techniques
- To introduce programming tools PIG & HIVE in Hadoop echo system

Course Outcomes:

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

- Illustrate big data challenges in different domains including social media, transportation, finance and medicine
- Use various techniques for mining data stream
- Design and develop Hadoop
- Identify the characteristics of datasets and compare the trivial data and big data for various applications
- Explore the various search methods and visualization techniques

UNIT I

Introduction: Introduction to big data: Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs Reporting.

UNIT II

Stream Processing: Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies - Real Time Sentiment Analysis - Stock Market Predictions.

UNIT III

Introduction to Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analysing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment

UNIT IV

Frameworks and Applications: Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and ZooKeeper.



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UNIT V

Predictive Analytics and Visualizations: Predictive Analytics, Simple linear regression, Multiple linear regression, Interpretation of regression coefficients, Visualizations, Visual data analysis techniques, interaction techniques, Systems and application

Text Books:

- 1) Tom White, “Hadoop: The Definitive Guide”, Third Edition, O’reilly Media, Fourth Edition, 2015.
- 2) Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012.
- 3) Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, CUP, 2012.

Reference Books:

- 1) Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
- 2) Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, “Harness the Power of Big Data: The IBM Big Data Platform”, Tata McGraw Hill Publications, 2012.
- 3) Arshdeep Bahga and Vijay Madisetti, “Big Data Science & Analytics: A Hands On Approach”, VPT, 2016.
- 4) Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)”, John Wiley & Sons, 2014.



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		3	0	0	3
SOCIAL NETWORKING					

Course Objectives:

- Formalize different types of entities and relationships as nodes and edges and represent this information as relational data
- Plan and execute network analytical computations
- Use advanced network analysis software to generate visualizations and perform empirical investigations of network data
- Interpret and synthesize the meaning of the results with respect to a question, goal, or task
- Collect network data in different ways and from different sources while adhering to legal standards and ethics standards

Course Outcomes:

After completing the course student should:

- Know basic notation and terminology used in network science
- Be able to visualize, summarize and compare networks
- Illustrate basic principles behind network analysis algorithms
- Develop practical skills of network analysis in R programming language
- Be capable of analyzing real work networks

UNIT I

Social Network Analysis: Preliminaries and definitions, Erdos Number Project, Centrality measures, Balance and Homophily.

UNIT II

Random graph models: Random graphs and alternative models, Models of network growth, Navigation in social Networks, Cohesive subgroups, Multidimensional Scaling, Structural equivalence, roles and positions.

UNIT III

Network topology and diffusion, Contagion in Networks, Complex contagion, Percolation and information, Navigation in Networks Revisited.

UNIT IV

Small world experiments, small world models, origins of small world, Heavy tails, Small Diameter, Clustering of connectivity, The ErdosRenyi Model, Clustering Models.

UNIT V

Network structure -Important vertices and page rank algorithm, towards rational dynamics in networks, basics of game theory, Coloring and consensus, biased voting, network formation games, network structure and equilibrium, behavioral experiments, Spatial and agent-based models.



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Text Books:

- 1) S. Wasserman and K. Faust. “Social Network Analysis: Methods and Applications”, Cambridge University Press.
- 2) D. Easley and J. Kleinberg, “Networks, Crowds and Markets: Reasoning about a highly connected world” , Cambridge University Press, 1st edition,2010

Reference Books:

- 1) Maarten van Steen. “Graph Theory and Complex Networks. An Introduction”, 2010.
- 2) Reza Zafarani, Mohammed Ali Abbasi, Huan Liu. “Social Media Mining: An Introduction”. Cambridge University Press 2014.
- 3) Maksim Tsvetovat and Alexander Kouznetsov. “Social Network Analysis for Startups”. O’Reilly Media, 2011.

e-Resources:

- 1) <https://www.classcentral.com/course/edx-social-network-analysis-sna-9134>
- 2) <https://www.coursera.org/learn/social-network-analysis>



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		3	0	0	3
AD-HOC AND SENSOR NETWORKS					

Course Objectives:

From the course the student will learn

- Architect sensor networks for various application setups
- Devise appropriate data dissemination protocols and model links cost
- Understanding of the fundamental concepts of wireless sensor networks and has a basic knowledge of the various protocols at various layers
- Evaluate the performance of sensor networks and identify bottlenecks

Course Outcomes:

- Evaluate the principles and characteristics of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks
- Determine the principles and characteristics of wireless sensor networks
- Discuss the challenges in designing MAC, routing and transport protocols for wireless ad-hoc sensor networks
- Illustrate the various sensor network Platforms, tools and applications
- Demonstrate the issues and challenges in security provisioning and also familiar with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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



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UNIT V

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

Text Books:

- 1) Ad Hoc Wireless Networks – Architectures and Protocols, C. Siva Ram Murthy, B. S. Murthy, Pearson Education, 2004.
- 2) Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P. Aggarwal, World Scientific Publications / Cambridge University Press, March 2006.
- 3) Wireless Sensor Networks – Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010.

Reference Books:

- 1) Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009.
- 2) Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008.
- 3) Ad hoc Networking, Charles E. Perkins, Pearson Education, 2001
- 4) Wireless Ad hoc Networking, Shih-Lin Wu, Yu-Chee Tseng, Auerbach Publications, Taylor & Francis Group, 2007.



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		3	0	0	3
CLOUD COMPUTING					

Course Objectives:

- To implement Virtualization
- To implement Task Scheduling algorithms
- Apply Map-Reduce concept to applications
- To build Private Cloud
- Broadly educate to know the impact of engineering on legal and societal issues involved

Course Outcomes:

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

- Interpret the key dimensions of the challenge of Cloud Computing
- Examine the economics, financial, and technological implications for selecting cloud computing for own organization
- Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications
- Evaluate own organizations' needs for capacity building and training in cloud computing-related IT areas
- Illustrate Virtualization for Data-Center Automation

UNIT I

Introduction: Network centric computing, Network centric content, peer-to –peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing.

Parallel and Distributed Systems: introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, and model concurrency with Petri Nets.

UNIT II

Cloud Infrastructure: At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Inter cloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing.

Cloud Computing : Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, HPC on cloud.

UNIT III

Cloud Resource virtualization: Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades.

Cloud Resource Management and Scheduling: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feedback control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling



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UNIT IV

Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system. Apache Hadoop, Big Table, Megastore (Text book 1), Amazon Simple Storage Service(S3) (Text book 2)

Cloud Security: Cloud security risks, security – a top concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks

UNIT V

Cloud Application Development: Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming (Text Book 1), Google: Google App Engine, Google Web Toolkit (Text Book 2),

Microsoft: Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book 2)

Text Books:

- 1) Cloud Computing, Theory and Practice, 1st Edition, Dan C Marinescu, MK Elsevier publisher, 2013
- 2) Cloud Computing, A Practical Approach, 1st Edition, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH, 2017.

Reference books:

- 1) Mastering Cloud Computing, Foundations and Application Programming, 1st Edition, Raj Kumar Buyya, Christen vecctiola, S Tammarai selvi, TMH, 2013.
- 2) Essential of Cloud Computing, 1st Edition, K Chandrasekharan, CRC Press, 2014.
- 3) Cloud Computing, A Hands on Approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2014.



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		3	0	0	3
DESIGN PATTERNS					

Course Objectives:

- Demonstration of patterns related to object oriented design.
- Describe the design patterns that are common in software applications
- Analyze a software development problem and express it
- Design a module structure to solve a problem, and evaluate alternatives
- Implement a module so that it executes efficiently and correctly

Course Outcomes:

- Construct a design consisting of a collection of modules
- Examine well-known design patterns (such as Iterator, Observer, Factory and Visitor)
- Distinguish between different categories of design patterns
- Ability to understand and apply common design patterns to incremental/iterative development
- Identify appropriate patterns for design of given problem
- Design the software using Pattern Oriented Architectures

UNIT I

Introduction: Design Pattern, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

A Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation.

UNIT II

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

UNIT III

Structural Pattern: Adapter, Bridge, Composite, Decorator, façade, Flyweight, Proxy.

UNIT IV

Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer.

UNIT V

Behavioral Patterns: State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns.

What to Expect from Design Patterns, a Brief History, the Pattern Community an Invitation, a Parting Thought.



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Text Books:

- 1) “Design Patterns”, Erich Gamma, Pearson Education.

Reference Books:

- 1) “Head First Design patterns”, Eric Freeman & Elisabeth Freeman, O’REILLY, 2007.
- 2) “Design Patterns in Java”, Steven John Metsker & William C. Wake, Pearson education, 2006
- 3) “J2EE Patterns”, Deepak Alur, John Crupi & Dan Malks, Pearson education, 2003.
- 4) “Design Patterns in C#”, Steven John metsker, Pearson education, 2004.
- 5) “Pattern Oriented Software Architecture”, F.Buschmann & others, John Wiley & Sons.

e-Resources:

- 1) <https://www.javatpoint.com/design-patterns-in-java>
- 2) https://www.tutorialspoint.com/design_pattern/design_pattern_overview.htm



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DISTRIBUTED SYSTEMS					

Course Objectives:

- To understand the foundations of distributed systems.
- To learn issues related to clock Synchronization and the need for global state in distributed systems.
- To learn distributed mutual exclusion and deadlock detection algorithms.
- To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems
- To learn the characteristics of peer-to-peer and distributed shared memory systems

Course Outcomes:

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

- Enumerate the foundations and issues of distributed systems
- Illustrate the various synchronization issues and global state for distributed systems
- Demonstrate the Mutual Exclusion and Deadlock detection algorithms in distributed systems
- Describe the agreement protocols and fault tolerance mechanisms in distributed systems
- Describe the features of peer-to-peer and distributed shared memory systems

UNIT I

Introduction: Definition, Relation to computer system components, Motivation, Relation to parallel systems, Message-passing systems versus shared memory systems, Primitives for distributed communication, Synchronous versus asynchronous executions, Design issues and challenges.

A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state, Cuts, Past and future cones of an event, Models of process communications.

Logical Time: A framework for a system of logical clocks, Scalar time, Vector time, Physical clock synchronization: NTP.

UNIT II

Message ordering and group communication: Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order. Global state and snapshot recording algorithms: Introduction, System model and definitions, Snapshot algorithms for FIFO channels

UNIT III

Distributed mutual exclusion algorithms: Introduction – Preliminaries – Lamport’s algorithm – Ricart-Agrawala algorithm – Maekawa’s algorithm – Suzuki–Kasami’s broadcast algorithm. Deadlock detection in distributed systems: Introduction – System model – Preliminaries – Models of deadlocks – Knapp’s classification – Algorithms for the single resource model, the AND model and the OR model



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UNIT IV

Check pointing and rollback recovery: Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Coordinated check pointing algorithm – Algorithm for asynchronous check pointing and recovery. Consensus and agreement algorithms: Problem definition – Overview of results – Agreement in a failure – free system – Agreement in synchronous systems with failures.

UNIT V

Peer-to-peer computing and overlay graphs: Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry.

Distributed shared memory: Abstraction and advantages – Memory consistency models – Shared memory Mutual Exclusion

Text Books:

- 1) Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore and Tim Kindberg, Fifth Edition, Pearson Education, 2012.
- 2) Distributed computing: Principles, algorithms, and systems, Ajay D Kshemkalyani and Mukesh Singhal, Cambridge University Press, 2011.

Reference Books:

- 1) Distributed Operating Systems: Concepts and Design, Pradeep K Sinha, Prentice Hall of India, 2007.
- 2) Advanced concepts in operating systems. Mukesh Singhal and Niranjana G. Shivaratri, McGraw-Hill, 1994.
- 3) Distributed Systems: Principles and Paradigms, Tanenbaum A.S., Van Steen M., Pearson Education, 2007.

e-Resources:

- 1) <https://nptel.ac.in/courses/106/106/106106168/>



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IV Year – I Semester		L	T	P	C
		3	0	0	3
DevOps					

Course Objectives:

- DevOps improves collaboration and productivity by automating infrastructure and workflows and continuously measuring applications performance

Course Outcomes:

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

- Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility
- Describe DevOps & DevSecOps methodologies and their key concepts
- Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models
- Set up complete private infrastructure using version control systems and CI/CD tools

UNIT I

Phases of Software Development life cycle. Values and principles of agile software development.

UNIT II

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.

UNIT III

DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

UNIT IV

CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment, Benefits of CI/CD, Metrics to track CICD practices

UNIT V

Devops Maturity Model: Key factors of DevOps maturity model, stages of Devops maturity model, DevOps maturity Assessment

Text Books:

- 1) The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.
- 2) What is Devops? Infrastructure as code, 1st Edition, Mike Loukides ,O'Reilly publications, 2012.



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Reference Books:

- 1) Building a DevOps Culture, 1st Edition, Mandi Walls, O'Reilly publications, 2013.
- 2) The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline With Containerized Microservices, 1st Edition, Viktor Farcic, CreateSpace Independent Publishing Platform publications, 2016
- 3) Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, 1st Edition, Jez Humble and David Farley, 2010.
- 4) Achieving DevOps: A Novel About Delivering the Best of Agile, DevOps, and Microservices, 1st Edition, Dave Harrison, Knox Lively, Apress publications, 2019.

e-Resources:

- 1) <https://www.javatpoint.com/devops>
- 2) <https://github.com/nkatre/Free-DevOps-Books-1/blob>



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IV Year – I Semester		L	T	P	C
		3	0	0	3
INTERNET OF THINGS					

Course Objectives:

- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem
- Formalize a given problem in the language/framework of different AI methods
- Implement basic AI algorithms.
- Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports

Course Outcomes:

- Demonstrate knowledge and understanding of the security and ethical issues of the Internet of Things
- Conceptually identify vulnerabilities, including recent attacks, involving the Internet of Things
- Develop critical thinking skills
- Compare and contrast the threat environment based on industry and/or device type

UNIT I

The Internet of Things: An Overview of Internet of Things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles For Connected Devices

UNIT II

Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations ,Modified OSI Stack for the IoT/M2M Systems ,ETSI M2M domains and High-level capabilities ,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability

UNIT III

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

UNIT IV

Data link layer of IoT, Wireless Communication Technologies, Wired Communication Technologies, Manet Networks: Network Layer of IoT, 6lowPAN adaptation layer for devices with limited resources, Dynamic routing protocols for wireless adhoc networks Communication protocols for IoT, Service oriented protocol(COAP), Communication protocols based on the exchange of messages(MQTT), Service discovery protocols

UNIT V

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications/ Services/ Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet Of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems. Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications /Services

Text Books:

- 1) Internet of Things: Architecture, Design Principles And Applications,Rajkamal, McGraw Hill Higher Education.
- 2) Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015.
- 3) Internet of Things from Hype to Reality: The road to Digitization, Ammar Rayes Samersalam.



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Reference Books:

- 1) Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley.
- 2) Getting Started with the Internet of Things Cuno Pfister , Oreilly.
- 3) Internet of Things and Data Analytics Handbook, HWAIYU GENG, Wiley publications.



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IV Year – I Semester		L	T	P	C
		3	0	0	3
DATA SCIENCE					

Course Objectives:

From the course the student will learn

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

Course Outcomes:

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

- Describe what Data Science is and the skill sets needed to be a data scientist
- Explain in basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data
- Use R to carry out basic statistical modeling and analysis
- Apply basic tools (plots, graphs, summary statistics) to carry out EDA
- Describe the Data Science Process and how its components interact.
- Use APIs and other tools to scrap the Web and collect data
- Apply EDA and the Data Science process in a case study

UNIT I

Introduction, The Ascendance of Data, Motivating Hypothetical: Data Science, Finding Key Connectors, The Zen of Python, Getting Python, Virtual Environments, Whitespace Formatting, Modules, Functions, Strings, Exceptions, Lists, Tuples, Dictionaries defaultdict, Counters, Sets, Control Flow, Truthiness, Sorting, List Comprehensions, Automated Testing and assert, Object-Oriented Programming, Iterables and Generators, Randomness, Regular Expressions, Functional Programming, zip and Argument Unpacking, args and kwargs, Type Annotations, Type Annotations.

UNIT II

Visualizing Data: matplotlib, Bar Charts, Line Charts, Scatterplots. Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation.

Gradient Descent: The Idea Behind Gradient Descent, Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Using Gradient Descent to Fit Models, Minibatch and Stochastic Gradient Descent.

UNIT III

Getting Data: stdin and stdout, Reading Files, Scraping the Web, Using APIs,

Working with Data: Exploring Your Data Using NamedTuples

Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction.



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Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem

UNIT IV

Machine Learning: Modeling, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, k-Nearest Neighbors, Naive Bayes, Simple Linear Regression, Multiple Regression, Digression, Logistic Regression

UNIT V

Support Vector Machines, Decision Trees, Neural Networks: Perceptrons, Feed-Forward Neural Networks, Backpropagation. Clustering: The Idea, The Model, Choosing k, Bottom-Up Hierarchical Clustering.

Recommender Systems: Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization

Data Ethics, Building Bad Data Products, Trading Off Accuracy and Fairness, Collaboration, Interpretability, Recommendations, Biased Data, Data Protection

IPython, Mathematics, NumPy, pandas, scikit-learn, Visualization, R

Text books:

- 1) Joel Grus, "Data Science From Scratch", O'Reilly.
- 2) Allen B. Downey, "Think Stats", O'Reilly.

Reference Books:

- 1) Doing Data Science: Straight Talk From The Frontline, 1st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013.
- 2) Mining of Massive Datasets, 2nd Edition, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, v2.1, Cambridge University Press, 2014.
- 3) "The Art of Data Science", 1st Edition, Roger D. Peng and Elizabeth matsui, Lean Publications, 2015
- 4) "Algorithms for Data Science", 1st Edition, Steele, Brian, Chandler, John, Reddy, Swarna, Springer's Publications, 2016.

e-Resources:

- 1) <https://github.com/joelgrus/data-science-from-scratch>
- 2) <https://github.com/donnemartin/data-science-ipython-notebooks>
- 3) <https://github.com/academic/awesome-datascience>



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IV Year – I Semester		L	T	P	C
		3	0	0	3
BIOMETRICS					

Course Objectives:

- Describe the principles of the three core biometric modalities (face, fingerprint and iris), and know how to deploy them in authentication scenarios
- Organize and conduct biometric data collections, and apply biometric databases in system evaluation
- Calculate distributions of within- and between-class matching scores, and calculate various error estimates based on these distributions
- Identify the privacy and security concerns surrounding biometric systems, and know how to address them in such a way that balances both
- Recognize differences between algorithm design and systems engineering in biometrics
- Deploy statistical methods in biometric system evaluation
- Itemize the most up-to-date examples of real biometric applications in human authentication

Course Outcomes:

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

- Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems
- Analyze biometric systems at the component level and be able to analyze and design basic biometric system applications
- Illustrate to work effectively in teams and express their work and ideas orally and in writing
- Identify the sociological and acceptance issues associated with the design and implementation of biometric systems
- Elaborate various Biometric security issues in real world applications

UNIT I

Biometrics- Introduction, benefits of biometrics over traditional authentication systems, benefits of biometrics in identification systems, selecting a biometric for a system, Applications, Key biometric terms and processes, biometric matching methods, Accuracy in biometric systems

UNIT II

Physiological Biometric Technologies- Fingerprints, Technical description, characteristics, Competing technologies, strengths, weaknesses, deployment, Facial scan, Technical description, characteristics, weaknesses, deployment, Iris scan, Technical description, characteristics, strength, weaknesses, deployment

UNIT III

Physiological Biometric Technologies- Hand Biometric: Palm Print, Vein Pattern, Signature and Hand Writing Technology-Technical description, characteristics, strengths, weaknesses and deployment.



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UNIT IV

Behavioural Biometric Technologies- Voice Recognition and Key stroke dynamics: Introduction, working, strengths and weaknesses, Voice Recognition Applications, Understanding Voice Recognition, Choice of Features, Speaker modeling, Pattern Matching, Key Stroke Dynamics, Active and Passive Biometrics.

UNIT V

Multi biometrics and multi factor biometrics- two-factor authentication with passwords, tickets and tokens, executive decision, implementation plan, Securing Biometric Template- Cancelable Biometrics, Authentication, Security Analysis.

Text Books:

- 1) A Privacy Enhancing Biometric, Chuck Wilson, Vein pattern recognition, CRC press, 2010
- 2) Biometrics: Identity Verification in a Network, 1st Edition, Samir Nanavathi, Michel Thieme, and Raj Nanavathi, Wiley Eastern, 2002
- 3) Implementing Biometric Security, 1st Edition, John Chirillo and Scott Blaul Wiley Eastern Publication, 2005

Reference Books:

- 1) Security, Risk and the Biometric State: Governing Borders and Bodies, 1st Edition, Benjamin Muller, Routledge, 2010
- 2) Handbook of Biometrics, Jain, Anil K.; Flynn, Patrick; Ross, Arun A. (Eds.), Springer, 2008
- 3) Handbook of Biometrics, Anil K. Jain, Patrick Flynn, Arun A. Ross, Springer, 2007
- 4) Biometrics for Network Security, 1st Edition, John Berger, Prentice Hall, 2004



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IV Year – I Semester		L	T	P	C
		0	0	2	1
UNIFIED MODELING LANGUAGE (UML) LAB					

Course Objectives:

- To know the practical issues of the different object oriented analysis and design concepts
- Inculcate the art of object oriented software analysis and design
- Apply forward and reverse engineering of a software system
- Carry out the analysis and design of a system in an object oriented way

Course Outcomes:

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

- Know the syntax of different UML diagrams
- Create use case documents that capture requirements for a software system
- Create class diagrams that model both the domain model and design model of a software system
- Create interaction diagrams that model the dynamic aspects of a software system
- Write code that builds a software system
- Develop simple applications

Note: For performing the experiments consider any case study (ATM/ Banking/ Library/Hospital management systems)

Experiment 1:

Familiarization with Rational Rose or Umbrella environment

Experiment 2:

- a) Identify and analyze events
- b) Identify Use cases
- c) Develop event table

Experiment 3:

- a) Identify & analyze domain classes
- b) Represent use cases and a domain class diagram using Rational Rose
- c) Develop CRUD matrix to represent relationships between use cases and problem domain classes

Experiment 4:

- a) Develop Use case diagrams
- b) Develop elaborate Use case descriptions & scenarios
- c) Develop prototypes (without functionality)



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Experiment 5:

- a) Develop system sequence diagrams and high-level sequence diagrams for each use case
- b) Identify MVC classes / objects for each use case
- c) Develop Detailed Sequence Diagrams / Communication diagrams for each use case showing interactions among all the three-layer objects

Experiment 6:

- a) Develop detailed design class model (use GRASP patterns for responsibility assignment)
- b) Develop three-layer package diagrams for each case study

Experiment 7:

- a) Develop Use case Packages
- b) Develop component diagrams
- c) Identify relationships between use cases and represent them
- d) Refine domain class model by showing all the associations among classes

Experiment 8:

- a) Develop sample diagrams for other UML diagrams - state chart diagrams, activity diagrams and deployment diagrams



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IV Year – I Semester		L	T	P	C
		0	0	0	2
Project –I					

Note: The marks are awarded based on: Selection of Area, Defining the problem, Submission of the Abstract and Presentation of seminar.



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IV Year – I Semester	L	T	P	C
	3	0	0	0
IPR & PATENTS				

Course Objectives:

- To know the importance of Intellectual property rights, which plays a vital role in advanced Technical and Scientific disciplines
- Imparting IPR protections and regulations for further advancement, so that the students can familiarize with the latest developments

Course Outcomes:

- IPR Laws and patents pave the way for innovative ideas which are instrumental for inventions to seek Patents
- Student gets an insight on Copyrights, Patents and Software patents which are instrumental for further advancements

UNIT I

Introduction to Intellectual Property Rights (IPR): Concept of Property - Introduction to IPR – International Instruments and IPR - WIPO - TRIPS – WTO -Laws Relating to IPR - IPR Tool Kit - Protection and Regulation - Copyrights and Neighboring Rights – Industrial Property – Patents - Agencies for IPR Registration – Traditional Knowledge –Emerging Areas of IPR - Layout Designs and Integrated Circuits – Use and Misuse of Intellectual Property Rights.

UNIT II

Copyrights and Neighboring Rights: Introduction to Copyrights – Principles of Copyright Protection – Law Relating to Copyrights - Subject Matters of Copyright – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of Performers – Copyright Registration – Limitations – Infringement of Copyright – Relief and Remedy – Case Law - Semiconductor Chip Protection Act.

UNIT III

Introduction to Patents - Laws Relating to Patents in India – Patent Requirements – Product Patent and Process Patent - Patent Search - Patent Registration and Granting of Patent - Exclusive Rights – Limitations - Ownership and Transfer — Revocation of Patent – Patent Appellate Board - Infringement of Patent – Compulsory Licensing — Patent Cooperation Treaty – New developments in Patents – Software Protection and Computer related Innovations

UNIT IV

Introduction to Trademarks – Laws Relating to Trademarks – Functions of Trademark – Distinction between Trademark and Property Mark – Marks Covered under Trademark Law - Trade Mark Registration – Trade Mark Maintenance – Transfer of rights - Deceptive Similarities Likelihood of Confusion - Dilution of Ownership – Trademarks Claims and Infringement – Remedies – Passing Off Action.



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UNIT V

Introduction to Trade Secrets – General Principles - Laws Relating to Trade Secrets –Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreements Breach of Contract –Law of Unfair Competition – Trade Secret Litigation – Applying State Law. Cyber Law – Information Technology Act 2000 - Protection of Online and Computer Transactions – E-commerce - Data Security – Authentication and Confidentiality - Privacy - Digital Signatures – Certifying Authorities - Cyber Crimes - Prevention and Punishment – Liability of Network Providers.

References:

- 1) Intellectual Property Rights (Patents & Cyber Law), Dr. A. Srinivas. Oxford University Press, New Delhi.
- 2) Deborah E.Bouchoux: Intellectual Property, Cengage Learning, New Delhi.
- 3) Prabhuddha Ganguli: Intellectual Property Rights, Tata Mc-Graw –Hill, New Delhi
- 4) Richard Stim: Intellectual Property, Cengage Learning, New Delhi.
- 5) Kompal Bansal &Parishit Bansal Fundamentals of IPR for Engineers, B. S. Publications (Press).
- 6) Cyber Law - Texts & Cases, South-Western's Special Topics Collections.
- 7) R.Radha Krishnan, S.Balasubramanian: Intellectual Property Rights, Excel Books. New Delhi.
- 8) M.Ashok Kumar and MohdIqbal Ali: Intellectual Property Rights, Serials Pub.