BHARATI VIDYAPEETH UNIVERSITY, PUNE
FACULTY OF ENGINEERING AND TECHNOLOGY

Programme: B. Tech. (Computer) – SEM VII – 2014 Course

Sr. No.	Subject	Teaching Scheme (Hrs/Week)			Examination Scheme (Marks)							Credits		
		L	P/D	T	End Semester Examination	Continuous Assessment			TW & Practical	TW & Oral	Total	Theory	TW	Total
						Unit Test	Attendance	Assignments						
1	Distributed Systems	3		1	60	20	10	10	--	--	100	3	--	3
2	Network Security and Cryptography	3	2	--	60	20	10	10	50	--	150	3	1	4
3	Big Data Analytics and Architecture	3		--	60	20	10	10	--	--	100	3	--	3
4	Compiler Design	3		--	60	20	10	10	--	--	100	3	--	3
5	Elective III	3		--	60	20	10	10	--	--	100	3	--	3
6	Programming Lab - V	--	2	--	--	--	--	-	50	--	50	--	1	1
7	*Industrial Training	--		--	--	--	--	--	--	50	50	--	3	3
8	*Seminar	--	2		--	--	--	-	--	50	50	-	1	1
9	*Project Stage- I	--	8		--	--	--	-	--	50	50	-	4	4
	TOTAL	**15**	**14**	**1**	**300**	**100**	**50**	**50**	**100**	**150**	**750**	**15**	**10**	**25**

Elective -III: a) Grid Computing b) VLSI and Embedded System c) Artificial Intelligence and Robotics d) Ad-Hoc and Sensor Networks

BHARATI VIDYAPEETH UNIVERSITY, PUNE

FACULTY OF ENGINEERING AND TECHNOLOGY

Programme: B. Tech. (Computer) – SEM VIII– 2014 Course

Sr.no	Subject	Teaching Scheme (Hrs/Week)			Examination Scheme (Marks)							Credits		
		L	P/D	T	End Semester Examination	Continuous Assessment			TW & Practical	TW & Oral	Total	Theory	TW	Total
						Unit Test	Attendance	Assignments						
10	Machine Learning	3	2	1	60	20	10	10	--	50	150	4	1	5
11	Image Processing and Pattern Recognition	3	2	--	60	20	10	10	50	--	150	3	1	4
12	Elective -IV	3	2	--	60	20	10	10	50	--	150	3	1	4
13	Data Mining and Knowledge Discovery	3	2	--	60	20	10	10	50	--	150	3	1	4
14	*Project Stage - II		16	--	--	--	--	--	--	150	150	--	8	8
	TOTAL	**12**	**24**	**1**	**240**	**80**	**40**	**40**	**150**	**200**	**750**	**13**	**12**	**25**

Elective - IV: a) Mobile Computing b) Design Patterns c) Network Management System d) Parallel and Distributed Computing

Total Credits
Semester - VII = 25
Semester –VIII = 25
Grand Total = 50

Distributed Systems

TEACHING SCHEME:		EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory:	3 Hours / Week	End Semester Examination: 60 Marks	Theory: 03
		Internal Assessment: 40 Marks	

Course Pre-requisites:

Data Structures, Operating System, Computer Networking.

Course Objectives:

1. Understand foundation of distributed system
2. Introduce the idea of peer to peer services and file system
3. Understand in detail the system level and support required for distributed system
4. Understand the issues involved in studying process and resource management

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

1. Discuss trends in distributed Systems.
2. Apply network virtualization.
3. Apply remote method interaction and objects.
4. Design process and resource management systems

UNIT - I Introduction: (6 Hours)

Need of Distributed system(DS), Examples of Distributed Systems, Pros and Cons of distributed System, models of DS, Trends in Distributed Systems ,focus on resource sharing, challenges, case study world wide web, System model , Inter process communication, The API for internet protocols, External data representation and multicast communication network, Virtualization, Overlay networks.

UNIT - II **Communication in Distributed System** : **(6 Hours)**

Case study MPUI remote method Invocation and object : Remote invocation and object : Remote invocation introduction, request reply protocols, remote procedure call, remote method invocation, case study java RMI group communication, publish, subscribe system message queues, shared memory approaches. Distributed objects case study Enterprise java beans from objects to components.

UNIT - III **Peer to peer services and file system**: **(6 Hours)**

peer to peer system introduction, napster and its legacy peer to peer systems middleware routing overlays case studies: pastry , japestry, distributed file system introduction file service architecture Andrew file system file system features file model file accessing models file sharing semantics Naming identifiers, address Name resolution, Name space Implementation, name cache LDAP.

UNIT - IV **Synchronization and replication**: **(6 Hours)**

Introduction, clocks, events and process states, synchronizing physical clock, logical time and logical clocks, global states, coordination and agreement, Introduction of distributed mutual exclusion, elections transactions and concurrency control, nested transactions, locks, optimistic concurrency control, time stamp ordering, atomic commit

protocols, distributed deadlocks, Replication , Case study CODA.

UNIT - V **Process and resource management:** **(6 Hours)**

Process management, process migration, features, mechanism, Threads, models, issues, implementation resource management, introduction, features of scheduling algorithms, task assignment approach, load balancing approach, load sharing approach.

UNIT - VI **Security:** **(6 Hours)**

Main threads and techniques for ensuring security (secure channels, firewalls) Fault tolerance and availability (passive /active replication, gossip architectures) application. Pervasive computing environments: active office, home and city, mobility and location- tracking etc.

Assignment:

1. Study of design and implementation issues of Distributed System.
2. Demonstrate the Mutual Exclusion and Deadlock detection of any Distributed System.
3. Study of CORBA RMI and CORBA-SERVICEs.
4. Design and implementation issues of Distributed Shared Memory (DSM).
5.Design and implementation of any scheduling algorithm of any new DS
6. Study of Security aspects in Distributed System.
7. Case Study NFS and AFS.
8. Study of process management in CODA.
9.Case study : applications of pervasive Computing
10. Study of recourse management in Amoeba.

Text books:

1. George Coulouris, Jean Dolimore and Jim Kindberg "Distributed Systems Concepts and Design"

fifth edition, Pearson education, 2012.

2. Pradeep K Sinha, "Distributed Operating Systems Concept and Design" Prentice Hall of India .

3. Tanenbaum A.S., Van Steen M ".Distributed Systems, Principles and Paradigms." Pearson education 2007.

References:

1. Liu M. L. " Distributed Computing Principles and Applications," Pearson Education 2004.

2. Nancy A. Lynch, "Distributed Algorithms" Morgan Kaufman publishers USA.

3. Speciner, Kaufman and Perlman, "Network Security" Pearson Education 2009.

Network Security and Cryptography

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 3 Hours / Week	End Semester Examination: 60 Marks	Theory: 03
Practical: 2 Hours / Week	Internal Assessment: 40 Marks	TW &Practical: 01
	Term Work & Practical: 50 Marks	

Course Pre-requisites:

Basic knowledge of computer network.

Course Objectives:

1 To understand basics of cryptography, how it has evolved, and some key encryption techniques.

2 To learn security policies such as authentication, integrity and confidentiality.

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

1 Understand the basics of network security
2 Learn different techniques of cryptography
3 Discuss details of key and certificate management
4 Learn about system security
5 Recite Network and Transport Layer security
6 Apply knowledge of network security and cryptography in real life

UNIT - I **Introduction to network security:** **(6 Hours)**

Goals of security, Threat scenarios, Types of attacks: Denial of service, Non-repudiation, Principles of security, A Model for

Network Security, Security approaches and policies, Authentication, Authorization and Accounting, Physical and logical access control, User authentication, Biometrics devices, Security services and mechanisms, Privacy and data protection, Cyber laws.

UNIT - II **Symmetric and Asymmetric key cryptography:** **(6 Hours)**

Symmetric and Asymmetric key cryptography:-Plain Text and Cipher Text, Substitution techniques, Transposition Techniques, Encryption and Decryption, Data Encryption standards, Block Cipher Design Principles ,Advanced Encryption Standards, RC4/RC5 algorithm, IDEA, RSA, Blowfish, S-Box theory, EIGamal Cryptosystem. Steganography, COMSEC, TRANSEC.

UNIT - III **Key and Certificate Management** **(6 Hours)**

Hash Functions, Digital Signatures, Digital Certificates, Knapsack Algorithm, Certificate & DDOS-Distributed Dos based authentication, Smart Cards, PKIX model, PKI components and Applications, LDAP protocol, Creating Digital certificates using Java, DNS certificates, Key agreement protocols: STS protocol, Diffie-Hellman Key Exchange

UNIT - IV **System Security:** **(6 Hours)**

Secure Socket Layer, Secure Electronic Transaction, 3-D Secure protocol, Secure HTTP, Time stamping protocol, Email Security, SMTP, PEM, PGP, Wireless Application protocol, Authentication applications- X.509, Kerberos. Key Distribution Centre, Single Sign ON approaches, Security in GSM and 3G.

UNIT - V **Security in Network and Transport Layer:** **(6 Hours)**

ICMP redirect hazard, ARP hazard, secures network infrastructure services: DNS, NTP, SNMP, Secure RSVP, TCP/IP protocol Suite, IP Security-IP security services, Security Associations. IPv4/IPv6 encapsulation header, IKE protocol,

Point to Point Tunneling Protocol, Layer 2 Tunneling Protocol, Replay Attacks, Encapsulating Security Payloads, Data Compression Using Zip.

UNIT - VI **Network Security Practices:** **(6 Hours)**

Types of firewalls, Firewall Configurations and Implementation, Firewall forensic, Firewall services and limitations, Network address Translation (NAT), DMZ networks, Source masking and hidden channels, VPN Architecture, Intruders, Intrusion Detection, Network based and host based Intrusion Prevention System, Intrusion Detection tools, Architecture for Distributed Intrusion Detection, System Integrity Verifiers, Log File Monitors, Honeypots.

Term Work:

1. Introduction to Cryptography based Security Tools.
2. Write a Program in C/Java to implement symmetric encryption.
3. Write a Program in C/Java to implement asymmetric encryption.
4. Introduction to GnuPG encryption system.
5. Implementation of Decryption techniques using secret key in GnuPG.
6. Implementation of various cryptographic algorithms using HashCalc.
7. Study of how Firewall works in computing.
8. Study of how Antivirus works according to offline or online mode.
9. Implement mini project to develop antivirus application.
10. Case study on cyber security

Assignments:

1. Introduction to security and types of attacks.
2. Discuss Security approaches and policies.
3. Study of any one Symmetric key cryptography algorithm.
4. Explain any one Asymmetric key cryptography algorithm.
5. Explain the concept of digital certificates.
6. Explain email security and it's security protocols.
7. Study of Key agreement protocols
8. Discuss system level security
9. Study of various protocols in network security

10. Study of network security practices

Text books:

1. Atul Kahate, "Cryptography and Network Security", 2nd Edition, Tata McGrawHill
2. William Stallings, "Cryptography and Network Security", Pearson Education.

References:

1. Bruce Schneier ,"Applied Cryptography-Protocols, Algorithms, and Source Code in C".
2. William R. Cheswick. Steven M. Bellovin, Aviel D. Rubin, Addison-Wesley. *"Firewalls and Internet Security*, *Repelling the Wily Hacker".*
3. J.W. Rittiaghouse and William M.Hancok – Elseviers. "Cyber Security Operations Handbook".
4. Menezes, van Oorschot and Vanstone, "*Handbook of Applied Cryptography*".

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

Big Data Analytics and Architecture

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 3 Hours / Week	End Semester Examination: 60 Marks	Theory: 03
	Internal Assessment: 40 Marks	

Course Pre-requisites:

Knowledge on Database Management System, Distributed Computing, Data Mining, File

System, Statistics.

Course Objectives:

This course focuses on the basic concepts of big data, methodologies for analyzing structured and unstructured data using Hadoop & R.

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

1 To outline the Big Data fundamentals and various data challenges getting introduced.

2 To accurately and objectively examine, and critically investigate Big Data Technologies and Infrastructure concepts, theories.

3 To apply the novel architectures and platforms introduced for Big data, in particular Hadoop and MapReduce.

4 Being able to describe and apply the Data Analytics lifecycle to Big Data projects

5 To analyze methods and algorithms with respect to data and application requirements, and make appropriate design choices when solving real-world problems.

6 To Understand and apply secured policy oriented techniques for solving real-world problems.

UNIT - I Introduction to Big Data: (6 Hours)

Types of Data, Characteristics of big data Information, Phases: capture, organize, integrate, analyze, and act, Defining Structured Data, exploring sources of big structured data, Understanding the role of relational databases in big data, Defining Unstructured Data, exploring sources of unstructured data, Understanding the role of a CMS in big data management, Integrating data types into a big data environment.

UNIT - II **Statistics & Analytics:** **(6 Hours)**

Numerical Data, Summary Statistics, Sampling and Confidence Intervals, From Population to Sampled Data, Different Types of Biases, Probability, Statistical Inference, Conditional Probability and Bayes Rule, Random Variables, Linear Regression, Bayesian Modeling, , Text Analytics, Characteristics of big data analysis, Linear Models, Decision trees, Neural Networks,

UNIT - III **Predictive Analysis Process and R:**

Data Analytics Lifecycle, Discovery, Data Preparation, Model Planning, Model Building, communicate results, Operationalize, Building a Predictive model.

Introduction to R, R graphical User Interfaces, Data import and Export, Dirty Data, Data Analysis, Statistical Methods for Evaluation, Linear regression with R, Clustering with R hypotheses testing.

UNIT - IV **Big Data Storage and Computing Platforms**: **(6 Hours)**

Distributed computing for big data, the changing economics of computing, the problem with latency, Demand meets solutions, Physical infrastructure layer, Big Data Stack, Layer 0: Redundant Physical Infrastructure, Layer 1: Security Infrastructure, Layer 2: Operational Databases, Layer 3: Organizing Data Services and Tools, Layer 4: Analytical Data Warehouses, virtualization in big data, Traditional RDBMS, NoSQL, Design Goals for MongoDB

UNIT - V **Hadoop:** **(6 Hours)**

The Core of Hadoop: MapReduce, Hadoop's Lower Levels: HDFS and MapReduce, Improving Programmability: Pig and Hive, Common

building blocks, Key/value pairs, Getting your data into Hadoop, Other Hadoop Components, Hadoop in action.

UNIT - VI **Case Studies and Data Privacy**: **(6 Hours)**

Defining Privacy and Security, Data and User Anonymization Fraud and Big Data, Risk and Big data, Credit Risk Management, Big Data & Algorithm Trading, Advertising and Big Data, The Privacy Landscape, Rights and Responsibilities, Case Study: Recommendation Engine, Sentiment Analysis and Digital Marketing, Healthcare applications.

Assignment:

1. Quizzes and Surprise tests will be conducted for testing the knowledge of students for particular topic.
2. Case study on Resilient Distributed Datasets.
3. Case study on Big Data Analytics with Hadoop.
4. Case study on Big Data Analytics with Spark.
5. Case study on how data analytics stacks work and the factors influencing their performance.
6. Discuss in brief the Association analysis.
7. Prepare a case study on Deep Analysis.
8. Illustrate how WEKA can be used for big data Analysis
9. Illustrate and setup a single node Hadoop cluster.
10. Illustrate the best practices for setting-up and using Hadoop.

Text books:

Vignesh Prajapati, “Big Data Analytics with R and Hadoop,” Packt Publishing Ltd, 2013,

References:

1. John Wiley & Sons, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, EMC Education Services, 2015, 1118876059, 9781118876053
2. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”,, IGI Global, 2014, 1466658657, 9781466658653,
3. Wiley CIO, Michael Minelli, Michele Chambers, Ambiga Dhiraj, John Wiley & Sons, “ Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses”, 2012, 1118239156, 9781118239155

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Compiler Design

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 3 Hours / Week	End Semester Examination: 60 Marks	Theory: 03
	Internal Assessment: 40 Marks	

Course Pre-requisites:

1. The students should have learnt Theory of Computation.
2. Basic of the structure of any Programming Language and Grammars.
3. Know the basics of Computer organization and Assembly Language Programming.

Course Objectives:

1. To study the Compiler Design Tools.
2. To understand the Compiler for various Programming Languages.

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

1. To have knowledge of LEX and YACC Tools.
2. The students will have the knowledge of Lexical Analysis and formation of TOKENS.
3. Understand Parser and its various techniques.
4. Understand Syntax Directed Translation Scheme
5. Understand the use of Hash Tables and Symbol Tables.
6. Learn the techniques of Code Optimization

UNIT - I **The Phases of a Compiler:** **(6 Hours)**

Translator issues, why to write Compiler, Compilation process in brief, Frontend and Backend Model, Compiler Construction tools, Interpreter and the related issues, Cross Compiler, Incremental Compiler, Boot Strapping, Byte code Compilers.

Lexical Analysis: The role of Lexical Analyzer, Input Buffering, Specification of tokens, recognition of tokens, and language for specifying Lexical Analysis alphabet, Token, Lexical error, Block schematic of Lexical Analyzer, "Automatic Construction of Lexical Analyzer-(LEX), LEX Specification and Features. Pattern Matching Algorithms and their Optimization, use of LEX.

UNIT - II **Syntax Analysis Introduction**: **(6 Hours)**

Role of Parsers, Review of Context Free Grammar for Syntax Analysis. Top down-RD parser, Predictive parsers, LL (k) parsers, Bottom up Parsers - Operator Precedence Parsers, Shift-Reduce: SLR, LR (k),

LALR etc. using Ambiguous Grammars. Error Detection and Recovery, Automatic Construction of Parsers (YACC), YACC specifications. Canonical LR parsers, handling of ambiguous grammars, Error Reporting in LL (1), Operator Precedence and LR Parsing, Efficient Generation of LALR (1) sets, Optimization of LR parsers, Optimization of transformations, Detection, Reporting, Recovery and Repair of errors in the Compilation Process.

Semantic Analysis Need of Semantic Analysis, Type Checking and type Conversion Overloading of Functions and Operators, Polymorphic Functions, Unification Algorithm.

UNIT - III **Syntax Directed Translation:** **(6 Hours)**

Syntax Directed Translation Schemes, Implementation of Syntax Directed Translators , Intermediate Code, Postfix Notation, Parse Trees and Syntax Trees, Three-Address code, Quadruples, and Triples, Translation of Assignment Statements, Boolean Expressions, Translation with a Top-Down Parser. Runtime Environment.

UNIT - IV **Code Optimization:** **(6 Hours)**

Basic blocks and folding, optimization within iterative loops, global optimization through flow graph analysis, Code-Improving Transformations, Machine Dependent Optimization

Introduction, Classification of optimization, Principle sources Of Optimization, optimization of basic blocks, Loops in flow graphs, Optimizing transformations: compile time evaluation, Common sub-expression elimination, variable propagation, code movement, strength reduction, dead code elimination and loop optimization, Local optimization, Global Optimization: Control and data flow analysis, Computing Global Data flow information: Meet over paths, Data flow equations, Data flow analysis, Iterative Data Flow Analysis: Available

expressions, Live Range Identification.

UNIT - V **Code Generation Introduction**: **(6 Hours)**

Intermediate languages, Translation of Declarations & Assignments statements. Design issues of a Code generator, Target machine, Runtime storage Management, Basic blocks and flow graphs. Issues in code generation, Target machine description, Basic blocks and flow graphs, next-use information, Register allocation and assignment, Dag representation of basic blocks, Peephole optimization, Generating code from a DAG, Dynamic programming, Semantic stacks, Attributed Translation, Analysis of syntax, Directed Translation, Evaluation of expressions, control structures, Procedure calls.

UNIT - VI **Case Study of GCC**: **(6 Hours)**

Architecture, Command Line Options for assembly, preprocessing and Intermediate tokens. Optimization Levels of GCC. GCC Help

Assignment:

1. Study LEX and YACC Tools.
2. Divide a 'C' Language Program into Tokens and design a Lexical Analyzer Program to display the list of tokens in it. Display Libraries used, functions and variables defined
3. Study Top down Parser.
4. Study Bottom up Parser.
5. Study Different Syntax Directed Translation Scheme.
6. Represent High Level Language Instruction in the form of 3 address Code, Quadruples and Triples.
7. Study the different methods of Code Optimization.
8. Write a program to generate a Code for C Language Statements.
9. Study of GCC
10. Create a language translator from C to PHP.

Text books:

1. K. Cooper, L, Torczon, "Engineering a Compiler", Morgan Kaufinann Publishers, ISBN 81-8147-369-8.
2. K. Louden, "Compiler Construction: Principles and Practice", Thomson Brookes/Cole (ISE), 2003, ISBN 981 - 243 - 694-4.
3. J. R. Levine, T. Mason, D. Brown, "Lex & Yacc", O'Reilly, 2000, ISBN 81-7366 -061-X.
4. S. Chattopadhyay, "Compiler Design", Prentice-Hall of India, 2005, ISBN 81-203-2725-X.
5. D. M. Dhamdhere, “Compiler Construction—Principles and Practice”, (2/e), Macmillan India.
6. Andrew Appel, “Modern Compiler Implementation in C”, Cambridge University press.
7. K C. Louden “Compiler Construction—Principles and Practice” India Edition, CENGAGE.
8. Bennett J.P., “Introduction to Compiling Techniques”, 2/e (TMH).

References:

1. A V Aho, R. Sethi, .J D Ullman, "Compilers: Principles, Techniques, and Tools", Pearson Education, ISBN 81 - 7758 - 590 – 8.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Elective –III a):Grid Computing

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 3 Hours / Week	End Semester Examination: 60 Marks	Theory: 03
	Internal Assessment: 40 Marks	

Course Pre-requisites:

Knowledge of distributed systems.

Course Objectives:

1. Understand how Grid computing helps in solving large scale scientific problems.
2. Learn how to program the grid.
3. Understand the security issues in the grid.

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

1. Understand basic concepts grid computing with the help of case studies.
2. Understand basic architecture of grid.

UNIT - I **Introduction to the Grid:** **(6 Hours)**

History and Evolution of Computing from Mainframe to Grid, Difference between Grid and Cloud Computing, Introduction to High Performance Computing and Distributed Computing, Definition of Grid, Characterization of the Grid, Architecture of the Grid, Types of Grids, Scope and Applications of Grid Computing Applications. Grid Computing Organizations and Their Roles: Developing Grid Standards & Best Practice Guidelines.

UNIT - II **Grid Services and Monitoring :** **(6 Hours)**

Introduction to Open Grid Services Architecture (OGSA) – Motivation – Functionality Requirements – Practical & Detailed view of OGSA/OGSI – Data intensive grid service models – OGSA services. Grid Monitoring Architecture.

UNIT - III **Grid Development Toolkits:** **(6 Hours)**

GlobusGT3 Toolkit :Architecture - Programming Model Implementation-

High-Level Services

UNIT - IV **Grid Scheduling and Resource Management**: **(6 Hours)**

Introduction, Scheduling Paradigms, Working principles of Scheduling, A Review of Condor, SGE, PBS and LSF, Grid Scheduling with QoS.

UNIT - V **Grid Security:** **(6 Hours)**

Introduction, Cryptography, Grid Security Infrastructure and Authorization Models, Possible Vulnerabilities.

UNIT - VI **Grid Portals and Grid Applications:** **(6 Hours)**

Introduction, First and Second Generation of Grid Portals, GT3 Use Cases, Resource Management Case Studies, Grid Portal Use Cases.

Assignment:

1. Case Studies on Grid Computing.
2. Case Studies on Performance Analysis.
3. Illustrate difference between Grid Computing & Cloud Computing.
4. Explain Grid Monitoring Architecture in detail.
5. Describe Scheduling Paradigms of Grid Computing.
6. Illustrate difference between Condor, SGE, PBS and LSF.
7. Explain Grid Security Infrastructure.
8. Describe Grid Services.
9. Case study of GlobusGT3 Toolkit.
10. Case study of Resource Management.

Text books:

1. Joshy Joseph, and Craif Fellenstein, “Grid Computing”, IBM Press, Pearson education, 2011.

2. Maozhen Li, Mark Baker, "The Grid: Core Technologies", ISBN: 978-0-470-09417-4.
3. Paul E. Ceruzzi, "A History of Modern Computing" Second Edition

References:

1. Fran Berman, Geoffrey Fox, Anthony J. G. Hey "Grid Computing: Making the Global Infrastructure a Reality", John Wiley & Sons.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Elective –III b):VLSI and Embedded System

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 3 Hours / Week	End Semester Examination: 60 Marks	Theory: 03
	Internal Assessment: 40 Marks	

Course Pre-requisites:
Digital Logic, Analog Circuits, Operating system, System Software, Computer Architecture and Organization, Basic Microprocessors, Theory of Computation, Discrete Mathematics.

Course Objectives:
To make students aware of basic embedded system architecture ,tools for developing embedded systems and to develop ARM programming model

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

1 Understand the basic architecture of Embedded System.
2 Describe the various embedded system development tools
3 Develop a ARM programming model
4 Explain basic MOS transistor action
5 Analyze Combinational and Sequential Logic
6 Design Mealy and Moore state models using Verilog.

UNIT - I	**Introduction to Embedded Systems:** Architecture of Embedded System, Design Methodology, Design Metrics, General Purpose Processor, System On chip. Embedded system design and development, Life-Cycle Models, Development tools. System design specifications Functional design, Architectural design, Prototyping.	**(6 Hours)**
UNIT - II	**ARM Architecture:** ARM Design Philosophy, Registers, PSR, Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families ARM architectural support for operating System, Memory subsystem architecture, Designing a cache system, Memory allocation, Communication protocols.	**(6 Hours)**
UNIT - III	**ARM Programming Model:** Instruction Set: Data Processing Instructions, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions. Register Usage, Other Branch Instructions, Data Processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions ,Instruction Scheduling, Register Allocation, Conditional Execution and Loops.	**(6 Hours)**
UNIT - IV	**Introduction to MOS Technology**: Basic MOS Transistor action: Enhancement and Depletion Modes. Basic electrical properties of MOS, Threshold voltage and Body Effect. Design of MOS inverters with different loads, Basic Logic Gates with CMOS: INVERTER, NAND, NOR, AOI and OAI gates. Transmission gate logic circuits, Bi-CMOS inverter.	**(6 Hours)**
UNIT - V	**Combinational Logic:** Manchester, Carry select and Carry Skip adders, Crossbar and barrel shifters, Multiplexer. **Sequential Logic**: Design of Dynamic Register Element, Dynamic RAM Cell, Static RAM Cell.D flip flop using Transmission gates. NOR and NAND based ROM Memory Design.	**(6 Hours)**
UNIT - VI	**Introduction to HDLs**: Basic Concepts of Verilog, Data Types, System Tasks and Compiler Directives. Behavioural Modelling: Structured Procedures,	**(6 Hours)**

Procedural Assignments, Timing control, Conditional statements, Sequential and Parallel Blocks, Generate Blocks. Switch level Modelling.
Tasks, Functions, Procedural Continuous Assignments, Design of Mealy and Moore state models using Verilog.

Assignment:

1. Define Embedded system and explain it's architecture
2. Study various tools used in development of embedded systems
3. Analyze various memory allocation algorithms
4. Explain in detail ARM architecture
5. Study instruction set required for developing ARM programming model
6. Explain use of basic logic gates in designing a transmission circuit
7. Distinguish between combinational and Sequential logic
8. Explain in detail various types of of flip-flops
9. Describe in detail concept of Verilog
10. Case study Embedded system

Text books:

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, 2008.
2. Michael D. Ciletti, "Advanced Digital Design with Verilog HDL",PHI, 2005.
3. Kamran Eshraghian, Douglas A. Pucknell, and Sholeh Eshraghian, "Essentials of VLSI circuits and Systems", PHI, 2011.
4. John P. Uyemura, "Introduction to VLSI Circuits and Systems", Modern VLSI Design – Wayne Wolf, 3rd Ed., 1997, Pearson Education.
5. Steve Furber, "ARM System-on-Chip Architecture", Second Edition, Pearson Education Publication.
6. James K. Peckol, "Embedded Systems: A Contemporary Design Tool", WILEY Student Edition Publication.
7. Tammy Noergaard, "Embedded Systems Architecture", Elsevier Publication.

References:

1. "Introduction to VLSI Systems: A Logic, Circuit and System Perspective",Ming-BO Lin, CRC Press, 2011.
2. "Principals of CMOS VLSI Design",N.H.E Weste, K. Eshraghian,, 2nd Ed., Addison Wesley.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Elective –III c):Artificial Intelligence and Robotics

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 3 Hours/Week	End Semester Examination: 60 Marks	Theory: 03
	Internal Assessment: 40 Marks	

Course Pre-requisites:

Data Structures, Algorithms, Discrete Mathematics,

Course Objectives:

To make student aware of basics of Artificial Intelligence (AI), Knowledge representation methods, learning concept and basics of robotics

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

1 Understand the basic search algorithms
2 Describe the various knowledge representation strategies
3 Understand plan generation systems
4 Describe various learning methods
5 Understand basic robotics concepts
6 Understand kinematics of robot

UNIT - I **Introduction to AI and Production systems:** **(6 Hours)**

Definition, Problem formulation Control strategies ,Search strategies, Problem Characteristics, Production systems, Problem Solving methods,- Problem Graphs Indexing, Heuristic functions, Hill Climbing, Best First Search, Minimax Search for two player games Constraints Satisfaction,- Related algorithms, Performance measure and analysis of search algorithms

UNIT - II **Knowledge Representation:** **(6 Hours)**

Knowledge Representation using predicate logic, Predicate calculus, Resolution, Knowledge representation using predicate calculus Knowledge representation using other logic, Structured representation of knowledge. Production based systems, Frame based systems, Scripts, Conceptual dependency Forward and backward chaining, Rule value approach, Fuzzy

reasoning., Bayesian theory

UNIT - III **Planning:** **(6 Hours)**

Basic plan generation systems, Components of planning system Advanced, Strips plan generation systems, K-strips strategic explanation Planning with state-space search – partial-order planning – planning graphs – planning and acting in the real world

UNIT - IV **Learning:** **(6 Hours)**

Learning concept, Supervised and unsupervised learning, Learning from observation - Inductive learning – Decision trees – Explanation based learning – Statistical Learning methods - Reinforcement Learning

UNIT - V **Robotics an Application of AI** : **(6 Hours)**

Brief history, types, classification and usage, Science and Technology of robots, Elements of robots -- joints, links, actuators, and sensors
Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters,

UNIT - VI **Kinematics of Robots**: **(6 Hours)**

Kinematics of serial robots, Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators, Generation of symbolic equations of motion using a computer, Simulation Kinematics of parallel robots Dynamics of serial and parallel robots , Modeling and analysis of wheeled mobile robots

Assignment:

1. Analyze various search algorithms.
2. Illustrate different knowledge representation strategies with example.
3. Explain in detail Bayesian theory.
4. Describe in detail components of planning system.
5. Describe in detail planning and acting in the real world.
6. Case study learning.
7. Explain in detail the basics of robotics.
8. Describe in detail link representation using DH parameters.
9. Describe in detail kinematics of robotic.
10. Case study robotics.

Text books:

1. Stuart Russel and Peter Nurving, “AI-A Modern Approach”, 2nd Edition, Pearson Education.

2. Peter Jakson,' Introduction to expert systems",3 rd Edition ,Pearson Education,2007
3. Ashitava Ghoshal "Robotics:Fundamental Concepts and Analysis", Oxford University Press,Second reprint, May 2008.
4. Deepak Khemani , "Artifitial Intelligence", Tata Mc Graw Hill Education ,2013

References:

1. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence :a logical approach", Oxford University Press, 2004.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Elective – III d): Ad-Hoc and Sensor Networks

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 3 Hours / Week	End Semester Examination: 60 Marks	Theory: 03
	Internal Assessment: 40 Marks	

Course Pre-requisites:

1. Knowledge of Internet and its working, types of networks.

Course Objectives:

1. Create awareness among the students about the basic fundamentals of Ad-Hoc and Sensor networks.
2. Developing the students with the knowledge of updated networking technology.

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

1. Understand the basics of ad hoc and sensor networks.
2. Understand the communication mechanism of Ad-Hoc & sensor networks.
3. Learning different routing protocols in Ad-Hoc & sensor networks.
4. Discuss the importance of security in Ad-Hoc & sensor networks.
5. Apply the knowledge about quality of service to Ad-Hoc networks.
6. Learning the structure of Ad-Hoc & Sensor networks by considering real life applications.

UNIT - I **Introduction:** **(6 Hours)**

Basics of Ad Hoc and Sensor networks, Need of Ad-hoc networks, Types of Ad-hoc networks, Ad-hoc network architectures, Need of sensor networks, Types of sensor networks, Combined approach: Architectures of Ad-hoc & Sensor networks, Working of Ad-hoc & Sensor networks.

UNIT - II **Communication in Ad-hoc & Sensor Networks:** **(6 Hours)**

Wireless communication technology, information transport through electromagnetic spectrum, role of radio waves in wireless networks, wireless channels, wired channels, internet working, Ad-hoc and Sensor network connections, requirement for Ad-Hoc and sensor network connectivity, wireless LAN configuration, multichannel MAC, IEEE 802.11 standards.

UNIT - III **Ad-Hoc & Sensor Network Protocols:** **(6 Hours)**

TCP/IP in Ad-hoc networks, MAC protocols: Ad-hoc networks, sensor networks, Routing Protocols: Ad-hoc networks, multicast routing protocols: an architecture reference model for multicast routing protocols, classifications of multicast routing protocols, comparisons of multicast routing protocols.

UNIT - IV **Security in Ad-hoc and Sensor Networks:** **(6 Hours)**

Need of security in Ad-hoc and sensor network , role of transport layer in ad-hoc and sensor networks, architecture of security layer in Ad-hoc networks, transport layer security protocols, TCP over Ad-hoc wireless networks, security in sensor networks, network security requirements, issues and challenges in security provisioning, network security attacks , secure routing in Ad-hoc and wireless sensor networks, issues in designing a transport layer protocol for Ad-hoc and sensor networks, real life example to understand need of security in Ad-hoc and sensor networks.

UNIT - V **QoS and Energy Management :** **(6 Hours)**

Classifications of QoS Solutions: MAC Layer, Network Layer, Security, QoS Frameworks for Ad hoc Wireless Networks, energy management in Ad-hoc wireless networks, different schemes, types of energy resources, transmission power management schemes, system power management schemes, energy efficiency and utilization schemes in Ad-hoc and Sensor networks, issues and challenges in providing QoS in Ad-hoc and sensor Networks.

UNIT - VI **Applications of Ad-hoc and Sensor Networks:** **(6 Hours)**

Mobile Ad-Hoc Network (MANET), Wireless Sensor Networks (WSNs), role and applications of Ad-hoc and Sensor networks in Internet of Things, Ad-hoc and sensor network approach: Zigbee, Raspberry pi, Arduino, Wi-Fi modems, Real life examples of Ad-hoc & Sensor networks, Case studies of Ad-hoc and sensor networks.

Assignment:

1. Explain working of Ad-Hoc networks with considering real life example.
2. Explain working of Wireless Sensor networks with real life example.
3. Explain working of MAC protocol with real life example.
4. Explain different IEEE 802.11 standards.
5. Problems based on Ad-hoc routing/ multicast routing protocols.
6. Program code in C/Java/ other to implement any functionality of Ad-hoc and sensor networks.
7. Explain role of transport layer in Ad-hoc networks.
8. Research proposal of mini project to establish own Ad-hoc & Sensor networks.
9. How the QoS can be maintained while establishing Ad-hoc & Sensor networks.
10. Case study of Ad-hoc & Sensor networks.

Text Books:

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
2. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", WILEY, 2013.

References:

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks: Theory and Applications", ISBN: 978-81-7596-792-2 Cambridge University Press India Pvt. Ltd.
3. C. K. Toh, "Ad Hoc Mobile Wireless Networks Protocols and Systems", Prentice Hall
4. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000
5. Erdal Cayirci, Chunming Rong, "Security in Wireless Ad Hoc and Sensor Networks", WILEY, 2009.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Programming Lab- V

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Practical: 2 Hours / Week	Term Work & Practical: 50 Marks	TW & Practical: 01

Course Pre-requisites:

If students have any programming experience at all, he should be able to pick up the general R syntax quite easily.

Course Objectives:

To develop ability to use the computational languages necessary for engineering practice

To provide hands- on experience of the recent platform, technologies and design methodologies used in developing applications.

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

1. Recite R language fundamentals and basic syntax
2. Demonstrate how R is used to perform data analysis
3. Recite major R data structures
4. Illustrate visualizations using R
5. Implement various functions using R studio.
6. Design different Statistical models.

UNIT - I **Understanding Big Data and R basics:** **(6 Hours)**

Evolution of R, Features of R, Local Environment Setup, R Command Prompt, R Script File, Comments, R –Data Types, R –Variables, Types of Operators, the alternatives to R.

UNIT - II **Data structures in R:** **(6 Hours)**

Vectors, Vectors and assignment, Vector arithmetic, Generating regular sequences, Character vectors, Index vectors, Lists: Constructing and modifying lists, Matrices ,Arrays, Factors: Ordered and unordered factors, Data Frames: Making data frames, Working with data frames

UNIT - III **R programming fundamentals:** **(6 Hours)**

Conditions and loops, R Programming, R -If Statement, R –If...Else Statement, The if...else if...else Statement, R –Switch Statement, R -Repeat Loop, R-While Loop, R –For Loop, Loop Control Statements, Functions in R, Built-in Function, User-defined Function, Calling a Function, Objects and Classes, Debugging.

UNIT - IV **Working with data in R**: **(6 Hours)**

Getting and Setting the Working Directory, Reading data from files (CSV, EXCEL), The read. table() function, The scan() function, Accessing built-in datasets, , Reading text files, Reading XML File, XML to Data Frame,R-JSON file, JSON to a Data Frame Writing and saving data objects to file in R.

UNIT - V **Strings and Dates in R:** **(6 Hours)**

String operations in R:String Manipulation, Concatenating Strings -paste()

function, Extracting parts of a string, Regular Expressions, Dates in R, R – Pie Charts, 3D Pie Chart , R-bar chart, Group Bar Chart and Stacked Bar Chart, use of functions ggplot & ggplot2

UNIT - VI **Statistical models in R:** **(6 Hours)**

Defining statistical models; formulae, Linear models, Generic functions for extracting model information, Analysis of variance and model comparison, ANOVA tables, Updating fitted models, Generalized linear models, Graphical procedures, OS facilities, Research and industry Applications of R .

Term Work:

1. Introduction to Big Data Analytics.
2. Assignment based on Looping.
3. String Handling.
4. Storing and Retrieving Data Using Vectors and Data frames
5. Class and object using R.
6. Create Relationship Model & Get The Coefficients
7. Case studies: Perform regression analysis on existing datasets.
8. Plot The Pie Chart With Title And Rainbow Colour Pallet.
9. Reading And Writing Excel CSV Text Files
10. Subject Teacher should take one Mini Project in the group of 2 students based on above syllabus.

Text books:

1. The R Book, by Michael J Crawley 2nd Edition, wiley

2. Hands-On Programming with R: Write Your Own Functions and Simulations by Garrett Grolemund

3. Beginning R: the Statistical Programming Language, wiley

References:

1. "Using R for Numerical Analysis in Science and Engineering", Chapman & Hall/CRC, 2014, Victor A,Bloomfield.

Industrial Training

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
	End Semester Examination: 50 Marks	Term Work & Oral: 03

Course Pre-requisites:

Professional Skills, Knowledge of core computer engineering subjects.

Course Objectives:

- To provide exposure for the students on practical engineering fields
- To have better understanding of engineering practice in general and a sense of frequent possible problems.
- To develop problem Identification abilities in real world
- To experience use of technology /tools for software development.
- To Identify their skills, values, beliefs, interests and personal abilities to develop the skills.
- To prepare and present a report.

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

I. Propose a solution to solve real world problems with the help of technology.
II. Apply software engineering principles.

III. Evaluate and compare the various methodologies to solve a real world problem.

IV. Report hands on experience of using modern software development tools.

V. Assess their skills, values, beliefs, interests and personal abilities and act in congruence with them.

VI. Identify social and ethical responsibilities and develop skills to compete for lifelong learning.

As a part of the B.Tech Computer Engineering curriculum, Industrial Training is a Practical course, which the students B.Tech Computer Engineering should undergo in reputed Private / Public Sector / Government organization / companies as industrial training of 45 days weeks to be undergone by the student in the summer vacation after the semester VI. Examination. And Oral examination will be conducted at the end of the semester VII.

The Industrial Training Report:

An Industrial Training report should be prepared by each student.. The report is expected to demonstrate development of practical and professional skills in Engineering through technical experience and application of theoretical knowledge. Development of skills in dealing with people, and communication skills form part of the training experience. Students should seek advice from their employers to ensure that no confidential material is included into the report. The student should be able to present the report to prospective employers,

The following should be observed:

i. Length of training

ii. Preliminary information

iii. iii. Technical report/diary References should be made in the text to books, technical papers, standards etc., used during the training period and should be listed.

iv. Finally, a conclusion should include comprehensive comments on the type and value of experience gained, and how this relates to your professional career.

v. A copy of the report should be submitted to his/her employer, another copy to the Department (through the respective Adviser). Students should also retain a personal copy of the report.

Seminar

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED
Practical: 2 Hours / Week	End Semester Examination: 50 Marks	Term Work & Oral: 01

Course Pre-requisites:

Basics of Software engineering, Knowledge of core computer engineering subjects.

Course Objectives:

- To develop problem Identification abilities in real world.
- To study the use of technology for societal benefits.
- To acquire the knowledge of intellectual topics in computer engineering.
- To prepare and present a document .

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

I. Describe the broader trends of technological growth in the computer, engineering fields.
II. Interpret that technology has profound impact as a trigger for global change.
III. Develop skills to explore intellectual topics in computer engineering.
IV. Develop better skills to succeed in the career.

V. Understand the responsibility and the of ethics as an engineer

The student has to prepare for the seminar presentation and present it before the group of students It is recommended that a student should meet the guide regularly during the course of the seminar.

The following are the guidelines for the seminar:

- He /She can select a paper from his/her area of interest.
- Recent research papers from any reputed journals like Springer/ACM/IEEE can be selected.
- After selecting the paper, the student has to get approval from the concerned faculty In charge /Seminar guide.
- Students are required to acquire a thorough knowledge on the subject by referring back papers and reference books.
- The student has to prepare a MS power point Preparation of slides and present it in front of group of students from the same class in presence of seminar guide followed by question answer session
- He /She have to write a comprehensive report about the seminar at the end of the semester.

The term work can be accessed based on selection of topic, decorum, communication skill, preparation of presentations/slide and seminar report.

Project Stage-I

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Practical: 8 Hours / Week	End Semester Examination: 50 Marks	TermWork&Oral: 03

Course Pre-requisites:

Basics of Software engineering, Software testing and knowledge of core computer engineering subjects.

Course Objectives:

- To develop problem solving abilities using mathematics.
- To apply algorithmic strategies while solving problems.
- To develop time and space efficient algorithms.
- To develop software engineering documents and testing plans.
- To use algorithmic solutions using distributed, Embedded, concurrent and parallel environments.

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

I. Review and understand how previous experiences had an impact on affective states and intellectual performance.

II. Identify and define the problem.

III. Decide critically to solve the problem.

IV. Demonstrate the ability to synthesize complex information from a variety of sources in decision-making.

V. Predict and develop a group process and desired outcomes.

VI. Plan and perform collaboratively towards a common purpose.

1. The project will be undertaken preferably by a group of at least3- 4 students who will jointly work and implement the project over the academic year. The work will involve the design of a system or subsystem in the area of Computer Engineering.

2. If the project is chosen a hardware project it will involve the designing a system or subsystem or upgrading an existing system. The design must be implemented into a working model with necessary software interfacing and a user manual.

3. If the project is chosen in the pure Software Application it must involve the detail Software Design Specifications, Data Structure Layout, File Design, Testing with complete documentation and user interface, with life cycle testing and as an executable package.

4. The group will select a project with the approval of the guide (Staff-members assigned) and submit the name of the project with a synopsis of 2 or 3 pages in the month of August in the academic year. A preliminary study report by the group must be submitted and certified at the end of seventh Semester.

5. It is expected that at least one research paper is published by each group with guide.

The project report stage-I will contain the details

Problem definition and requirement specification, acceptance test procedure (ATP).

a) System definition, requirement analysis.
b) System design with UML.
c) Documentation and references.

Documentation will use UML approach with Presentation, Category, Use Case, Class Diagrams, etc.

Machine Learning

TEACHING SCHEME:		EXAMINATION SCHEME:	CREDITS ALLOTTED:	
Theory:	3 Hours / Week	End Semester Examination: 60	Theory:	04
Practical:	2 Hours / Week	Internal Assessment: 40	TW &Oral:	01
Tutorial:	1 Hour / Week	Term Work & Oral: 50		

Course Pre-requisites:

Artificial intelligence, Discrete Mathematics, Database Management System, Engineering Mathematics, Programming Languages.

Course Objectives:

To provide a strong formal foundation of Machine Learning concepts and techniques

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

5. Explain significance of Machine Learning
6. Distinguish between paradigms of Machine Learning.
7. Illustrate use of algorithms in Supervised Learning and Unsupervised Learning.
8. Build Learning Model.
9. Analyze performance of Supervised and Unsupervised Learning
10. Tackle real world problems in the domain of Data Mining, Information Retrieval, Computer vision, Linguistics and Bioinformatics.

UNIT - I **Introduction:** **(6 Hours)**

Introduction to statistics, Introduction to Learning Systems, Structure of Learning System, Testing vs Training, learning vs Designing, Goal and Applications of Machine Learning, Examples of Machine Learning Problems, Need of Learning, Machine Intelligence

UNIT - II **Machine Learning Techniques:** **(6 Hours)**

Introduction to Machine Learning Techniques: Supervised Learning(SL) Vs Semi Supervised Learning(SSL) vs Unsupervised Learning(USL), Examples of SL, SS, and US Learning, how to choose Machine Learning Technique, Machine Learning Models, and Types, Examples: Linear based Models, Logic Based and Algebraic Models, Probabilistic Models

UNIT - III **Classification:** **(6 Hours)**

What is Classification?, Types: Naive Bayes Classifier, Decision Trees, Support Vector Machines, Rule based Classification, Backpropagation, Associative Classification, Classifier Accuracy Measures, Precision and Recall Measures.

UNIT - IV **Regression:** **(6 Hours)**

What is Regression? Types: Linear Regression, Logistic Regression, Classification vs Regression, Issues Regarding Classification, and Regression, Assessing performance of Regression, Predictor error measures, Applications of Supervised Learning.

UNIT - V Unsupervised Learning: **(6 Hours)**

Introduction to Clustering, Types: K Means Clustering Algorithm, Mixture Models, Hierarchical Clustering, Anomaly Detection, Neural Networks, Self-Organizing Map(SOM), Applications of Unsupervised Learning.

UNIT - VI **Trends in Machine Learning:** **(6 Hours)**

Ensemble methods for increasing accuracy: Bagging and Boosting, multitask learning, online learning and Sequence Prediction, Data Streams and Active Learning, Introduction to Deep Learning and Reinforcement Learning, Case Study: Latest Machine Learning Tools.

Term Work:

1. Distinguish between Supervised and Unsupervised Machine Learning.
2. Implement Linear and Nonlinear Learning models.
3. Implement Distance based Learning techniques.
4. Write study assignment to build tree based models.
5. Write study assignment to build rule based models.
6. WEKA: Tool for Machine Learning.
7. SCIKIT-LEARN: Tool for Machine Learning.
8. SHOGUN: Tool for Machine Learning.
9. ACCORD: Tool for Machine Learning.
10. Study assignment on Reinforcement Learning technique.

Assignment:

1. Distinguish between Learning and Designing with example.

2. Explain in detail Need of Machine Learning.

3. Explain in detail How to choose Machine Learning Algorithm.

4. Differtiate between different Machine Learning Models.

5. Explain in detail how Classification by Decision Tree Induction.

6. Explain in detail Support Vector Machine for Supervised Learning.

7. Distinguish between Classification and Regression with suitable example.

8. Demonstrate the use of Linear Regression for Supervised Machine Learning.

9. Implement K-Means Clustering Algorithm for Unsupervised Machine Learning.

10. Explain in detail Anomaly Detection.

11. What are the methods used to increase accuracy of machine learning algorithms? Explain.

12. Define Reinforcement Learning with example.

Text books:

1. Jiawei Han, Jian Pei, Micheline Kamber, " Data mining concepts and techniques", 3rd Edition.

2. K.P. Soman, R. Loganathan, V. Ajay, "Machine Learning with SVM and Other Kernel Methods"

3. Witten I.H. Author, "Data Mining Practical Machine Learning Tools and Techniques" 2nd Edition.

4. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press, Edition 2012.

5. Hastie, Tibshirani, Friedman, "Introduction to Statistical Machine Learning with Applications in R", Springer, 2nd Edition-2012.

References:

1. T. M. Mitchell, “Machine Learning”, McGraw Hill.
2. C. M. Bishop ,” Pattern Recognition and Machine Learning”, Springer 1st Edition-2013.
3. Ethem Alpaydin, “Introduction to Machine Learning”

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT –II , UNIT –III.
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Image Processing and Pattern Recognition

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITSALLOTTED:4**
Theory: 3 Hours / Week	End Semester Examination: 60	Theory: 03
Practical: 2 Hours / Week	Internal Assessment: 40	TW& Practical: 01
	Term Work & Practical: 50	

Course Pre-requisites:

Set theory, Linear algebra and statistics, Computer Graphics and visualization, Signals and system, Digital signal processing.

Course Objectives:

1 Students should be able to understand digital image processing and advanced concepts.

2 Students should be able to properly implement algorithms using modern computing tools such as MATLAB, and to interpret and present the results.

3 To study fundamentals of colour Image Processing

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

1 To explain the digital image processing and digital image formation.

2 To illustrate different mathematical preliminaries to deal with digital image processing

3 To explain the concept of Image restoration and image segmentation.

4 To apply the concept of pattern recognition and its different phases

5 To apply knowledge/ skills for solving real world problems.

UNIT – I **Digital Image Fundamentals**: **(6 Hours)**

Introduction, Fundamental steps and Components of Digital Image Processing**,** Image Sampling and Quantization**:** Basic concepts in Sampling and Quantization, Representing Digital images, Spatial and intensity resolution, Relationship between Pixels**,** Histogram Processing: Definition, Histogram Equalization,

UNIT – II **Image Enhancement**: **(6 Hours)**

Fundamentals of Spatial Filtering- The Mechanics of Spatial Filtering, Generating Spatial, Filter Masks, Noise Model, Smoothing Spatial Filters: Linear filters – Mean filters Non-linear (Order Statistic filters): Median, Mode, Max, Min filters, Image Enhancement by Frequency Domain Methods: Basic steps for Filtering in Frequency Domain, Frequency Domain low pass (Smoothing),High pass (Sharpening)

UNIT – III **Image Compression and Segmentation**: **(6 Hours)**

Fundamentals: Coding Redundancy, Spatial and temporal (Interpixel) Redundancy, Some Basic Compression Methods: Lossless Compression methods-Huffman coding, LZW coding, Fundamentals : Point , Line and Edge Detection, Line Detection, Edge Models, Basic Edge detection, Canny edge detector Thresholding : Foundation, Basic Global Thresholding, Optimal global thresholding, Multiple Thresholds.Region based segmentation: region growing, region splitting and merging.

UNIT – IV **Morphological Image Processing and Color Image Processing**: **(6 Hours)**

Morphological Image Processing, Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms: Boundary Extraction, Hole (Region) Filling, thinning, Color Image Processing: Color Fundamentals and Color Models Basics of Full-Color Image Processing, Color Transformations.

UNIT – V **Basics of Pattern Recognition:** **(6 Hours)**

Introduction and examples, Clustering vs. Classification; Supervised vs. unsupervised, Decision Boundaries, Decision region / Metric spaces/ distances, Object detection.

UNIT – VI **Clustering and Classification**: **(6 Hours)**

Bayes decision rule, Error probability, Linear Discriminates Function (equal covariance matrices)and non- Linear Decision Boundaries (unequal covariance matrices). Clustering: Basics of Clustering; similarity / dissimilarity measures; clustering criteria. Minimum within cluster distance criterion. K-means algorithm, K-medoids, DBSCAN-Density-based Spatial clustering of application

with Noise.

Term Work:

1. Display of Grayscale Images.
2. Write a MATLAB code that reads a gray scale image and generates the flipped image of original image.
3. To enhance contrast using Histogram Equalization
4. Write a program for image enhancement.
5. Write a program for image compression
6. Write a program for Edge detection
7. Write a program for image segmentation
8. Write a program for image morphology
9. Illustrate and discuss use of various method of pattern recognition.
10. Write a program for face detection in MATLAB.

Assignment:

1. Write and explain concepts of histogram processing.
2. Write and explain edge detection and Line detection.
3. Write in details about Filtering in Frequency Domain.
4. Write any two algorithms for segmentation.
5. Write in detail about colour image processing.
6. Write and explain concepts of object detection.

7. Write and explain K-means algorithm.

8. Write and explain DBSCAN.

9. Case study on radiographic images to reduce noise in image.

10. Case study on pattern recognition.

Text books:

1. Rafael C Gonzalez, Richard E Woods, “Digital Image Processing”, Pearson Education ,2008.

2. S.Jayaraman, S Esakkirajan,T Veerakumar “Digital Image Processing”, McGrawHill Publication,2009.

3. R.O.Duda, P.E.Hart and D.G.Stork, “Pattern Classification”, John Wiley.

References:

1. K. Fukunaga,” Statistical pattern Recognition”, Academic Press.

2. S.Theodoridis and K.Koutroumbas,” Pattern Recognition”, 4th Ed., Academic Press, 2009.

3. Anil K Jain, “Fundamentals of Digital Image Processing”, PHI

4. B Chanda & Dutta Majumdar, “Digital Image Processing and Analysis”, PHI

5. Rafael C Gonzalez, Richard E Woods, Eddins, “Digital Image Processing using MATLAB”,Pearson Education

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Elective-IV a):Mobile Computing

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 3 Hours / Week	End Semester Examination: 60 Marks	Theory: 03
Practical: 2 Hours / Week	Internal Assessment: 40 Marks	TW & Practical: 01
	Term Work & Practical: 50 Marks	

Course Pre-requisites:

Computer Network , Fundamentals of Data Communication.

Course Objectives:

1. Understand the basic concept of mobile computing
2. Be familiar with network protocol stack
3. Learn the basics of mobile telecommunication
4. Develop system to be used in Ad-Hoc networks
5. Gain knowledge about different mobile platforms and application development

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

1. Explain the basic of mobile telecommunication system
2. Choose the required functionality at each layer
3. Application identity solution for each functionality at each layer
4. Use similar tool and design Ad-hoc networks
5. Develop mobile application

UNIT - I **Introduction:** **(6 Hours)**

Mobile computing: mobile computing compared with wireless networking, mobile computing applications, characteristics of mobile computing, structure of mobile computing application: MAC protocol, wireless MAC issues, fixed assignment schemes, Random assignment schemes, and reservation based schemes.

UNIT - II **Mobile Internet Protocol & Transport Layer:** **(6 Hours)**

Overview of mobile IP, features of mobile IP, key mechanism in mobile IP, route optimization. Overview of TCP/IP, Architecture of TCP/IP, Adaption of TCP window, Improvement in TCP performance.

UNIT - III **Mobile Telecommunication System:** **(6 Hours)**

Global system for mobile communication (GSM), General packet radio service(GPRS),universal mobile telecommunication system(UMTS) Mobile technology generation, comparison between GMS vs UMTS vs 3G vs 4G vs 5G

UNIT - IV **Mobile AD-HOC Network:** **(6 Hours)**

Ad –Hoc basic concept, characteristic, Application, Design issues, Routing, Essential of traditional routing protocol, popular routing

protocol, vehicular Ad-hoc networks (VANET), MANET VS VANET-security.

UNIT - V **Mobile Operating System & Application:** **(6 Hours)**

Mobile device operating systems, special constrains & requirements, commercial mobile operating system, software development kit, iOS, iOS architecture, Android, Android architecture, How to develop application via Android, compiling & executing programs in Android, blackberry, window phone.

UNIT - VI **Mobile Payment System using Mcommerce:** **(6 Hours)**

Mcommerce- structure, pros & cons, mobile payment system, security issues, application issues, GSM mobility management administration.

Term Work:

1. Explain features of mobile IP & mechanism in mobile IP.
2. Explain comparison between GMS vs UMTS vs GPRS.
3. Explain comparison between 3G vs 4G vs 5G.
4. Develop small application in Android.
5. Develop small application in iOS.
6. Simulate the working of Android networking/Communication entities using software tools.

Assignment:

1. Discuss characteristics and applications of mobile computing
2. Explain structure of mobile computing application.
3. Describe TCP/IP architecture in detail.
4. Explain GPRS system with diagram.
5. Prepare a case study on Mobile OS : Android
6. Discuss in detail the implementation of TCP/IP stack in Mobile networks
7. Prepare a caste study on MANET & VANET
8. Prepare a case study on Mobile OS : IOS
9. Prepare a case study on GSM architecture.

10. Prepare a case study on Mobile Payment System.

Text books:

1. Prashant Kumar Patnaik, Rajib mall , “Fundamental of mobile computing”, PHI learning Pvt. Ltd.,2012

2. Jochen h schiller, “Mobile Communication”, second edition Pearson education 2007

References:

1. Dharma Prakash Agarwal ,Qing and An Zeng, “Introduction to wireless and mobile system”, Thomson Asia Pvt. Ltd. 2005
2. Ume Hansmann, Luther mark martin s, Nicklons & Thomas Strober, “principles of mobile computing “ ,springer,2003
3. William C.Y.Lee, ”Mobile cellular telecommunication Analog and Digital systems”, second edition, Tata Mc Graw Hill Edition 2006
4. C. K. Toh, “AdHoc Mobile wireless Networks”, first Edition, Pearson Education 2002

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Elective – IV b): Design Patterns

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	Theory: 03
Practical: 02 Hours / Week	Internal Assessment: 40 Marks	TW & Practical : 01
	Term Work & practical: 50 Marks	

Course Pre-requisites:

Aware about basic java programming concepts.

Course Objectives:

1. To understand the concept of patterns and the catalog
2. To discuss the Presentation tier design patterns and their affect on: sessions, client access

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

1. To demonstrate a thorough understanding of patterns and their underlying principles
2. To know what design pattern to apply to a specific problem
3. To demonstrate what tradeoffs need to be made when implementing a design pattern
4. To use design patterns for developing software.
5. To understand the variety of implemented bad practices related to the Business
6. To learn how to use design patterns to keep code quality high without overdesign.

UNIT - I Introduction To Design Patterns: (6 Hours)

Introduction to design patterns: Design Pattern Definition, Strategy, Observer, Factory, Singleton, Command, Adapter, Facade, Template Method, Iterator, Composite, State, Proxy Design Patterns in Small Talk MVC, Describing Design Patterns, Organizing the Catalog, Solving of Design Problems using Design Patterns, Selection of a Design Pattern, use of Design Patterns.

UNIT - II **Designing A Document Editor:** **(6 Hours)**

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 - III **Design Patterns Catalog:** **(6 Hours)**

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

UNIT - IV **Structural Patterns:** **(6 Hours)**

Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy, Discuss of Structural Patterns

UNIT - V **Behavioral Patterns:** **(6 Hours)**

Behavioral Patterns- Chain of Responsibility Command, Interpreter, iterator, Mediator, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns, Expectations from Design Patterns.

UNIT - VI **Case Studies:** **(6 Hours)**

The World Wide Web - a case study in interoperability, Air Traffic

Control – a case study in designing for high availability, Celsius Tech – a case study in product line development.

Term Work:

1. Review the engineering design for the part of the product that you must implement. (Engineering Design)
2. Create a new project for this assignment and create a package within the project named scoring.
3. Implement creational pattern.
4. Implement the Score interface. (Design Specifications)
5. Implement the Abstract Score class. (Design Specifications)
6. Implement the Leaf Score class. (Design Specifications)
7. Implement the Composite Score class. (Design Specifications)
8. Solve any two Design Problems using Design Patterns.

Assignment:

1. A journal on PCs would like to investigate some properties of different PCs, e.g. the price, performance, etc. The results need to be sorted in a list. There are several sorting algorithms for sorting all the PCs depending on specific characteristics. These sorting algorithms behave differently with respect to the time and space performance. Therefore, it is required to select and switch to a different sorting algorithm at run-time.

a) Which design pattern can be applied to fulfill these requirements?

b) Draw a class diagram that incorporates this pattern.

2. In the future it is expected that class Computer Equipment will be extended with additional operations. The present structure of computer equipment is assumed not to change. It is also not desired to 'pollute' all the existing component classes with new operations.

a) Which design pattern would be suitable for this problem?

3. Study on Template Method in design pattern
4. Study on Proxy Design Patterns in Small Talk MVC.
5. Solve the Design problems using design patterns.
6. Study on Behavioral pattern.

7. Designing a Document Editor for any system
8. Comparison of design pattern catalogs
9. Study of various structural patterns.
10. Case study on Interpretability.

Text books:

1. Gamma, Belm, Johnson ,"Design Patterns: Elements of Reusable Object Oriented Software," PEA.

2. Eric Freeman, "Head First Design Patterns", Oreilly.

References:

1. Cooper "Java Design Paterns", , Pearson.
2. Horstmann, "Object Oriented Design and Pattetrns", Wiley.
3. Ali Bahrami, "Object Oriented Systems Development", MCG.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Elective-IV c):Network Management System

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 3 Hours / Week	End Semester Examination: 60 Marks	Theory: 03
Practical: 2 Hour / Week	Internal Assessment: 40 Marks	TW & Practical: 01
	TW & Practical: 50 Marks	

Course Pre-requisites:

Computer Network, Discrete Mathematics.

Course Objectives:

1. To help students to understand the principles of network management.
2. To provide knowledge about the various network management strategies and network management protocols.

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

1. To understand network management architectures and protocols.
2. To gain knowledge about basic components of network management.
3. To gain the information about management communication patterns
4. To understand the protocols associated with network management
5. To gain the knowledge about remote monitoring
6. To understand network management metrics

UNIT – I **Introduction to Network Management:** **(6 Hours)**

Importance of network management, The Players: Different Parties with an Interest in Network Management, Case studies of Networking and Management, Challenges of Information Technology Managers, Current Status and future of Network Management,

The Network Operator's Arsenal:

Device Managers and Craft Terminals, Network Analyzers, Element Managers, Management Platforms , Collectors and Probes

UNIT - II **The Basic Ingredients of Network Management:** **(6 Hours)**

The Network Devices and its types with Configuration, The Management System, The Management Network, The Management Support Organization: Network Operations Center (NOC).

UNIT - III **Management Communication Patterns:** **(6 Hours)**

Layers of Management Interactions, Manager Initiated Interactions: Request and Response, Configuration Operations, Agent Initiated Interactions: Events and Event-Based Management.

UNIT - IV **Common Management Protocols:** **(6 Hours)**

SNMP (Simple Network Management Protocols): Classic and Perennial Favorite , SNMP Operations , SNMP Messages and Message Structure , SNMPv2/ SNMPv2c , SNMPv3, The SNMP Communication Model, Functional model, SNMPv2 Protocol, Major Changes in SNMPv2, SNMPv2 System architecture, SNMPv2 Structure of Management, Information, The SNMPv2 Management Information Base, SNMPv2 Protocol, Compatibility with SNMPv1.

UNIT - V **SNMP Management: RMON (Remote Monitoring):** **(6 Hours)**

Remote Monitoring Basics, RMON SMI (Structure of Management Information) and Management Information Base (MIB), RMON1, RMON2, ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON.

Telecommunications Management Network(TMN):

Fundamentals of TMN, TMN Conceptual Model, TMN Standards, TMN Architecture, TMN Management Service Architecture, An Integrated View of TMN, Implementation Issues.

UNIT - VI **Management Metrics: Assessing Management Impact and Effectiveness:** **(6 Hours)**

Network Management Business Impact, Factors that Determine Management Effectiveness, Assessing Network Management Effectiveness.

Web-Based Management:

NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management, Embedded Web-Based Management

Term Work:

1. Installation and study of Packet Analyzer tool Wireshark.
2. Installation and study of Honeypots tool.
3. Installation and study of Ethereal tool.
4. Installation and study of Wi-Fi manager.
5. Installation and study of open source Network Management platform (Network Management Information System).
6. Installation and study of Icinga 2 (Open source network monitoring tool).
7. Installation and study of Zabbix.
8. Configure SNMP Protocol on Cisco Packet Tracer.
9. Configure VLAN on Cisco Packet Tracer.
10. Installation and study of Packet Sniffer.

Assignments:

1. Explain the significance of network management system.
2. Describe the components of network management.
3. Justify the role of device Managers and craft terminals in The Network Operator's Arsenal
4. Explain the layers of management interactions.
5. Illustrate SNMP Messages and Message Structure
6. Explain SNMP communication model
7. Explain the improvement in SNMPv2 over the SNMPv1
8. Explain the RMON (Remote Monitoring) with SMI (Structure of Management Information) and Management Information Base (MIB)
9. Describe the TMN (Telecommunications Management Network) architecture.
10. Explain the NMS(network management system) with the context of Web Interface and Web-Based Management

Text Books

1. Mani Subramanian, "Network Management: Principles and Practice", sixth edition Pearson Education.
2. Alexander Clemm, "Network Management Fundamentals "
3. D.C. Verma, "Principles of Computer Systems and network Management"
4. Morris,Network management, Pearson Education.

5. Mark Burges, Principles of Network System Administration, Wiley Dreamtech.

Reference Books

1. William Stallings, "SNMP, SNMPv2, SNMPv3, and RMON 1 and 2" third edition, Addison-Wesley Professional
2. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud", Addison-Wesley Professional

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Elective – IV d): Parallel and Distributed Computing

TEACHING SCHEME:		EXAMINATION SCHEME:		CREDITS ALLOTTED:
Theory:	3 Hours / Week	End Semester Examination:	60 Marks	Theory: 03
Practical:	2 Hours / Week	Internal Assessment:	40 Marks	TW & Practical: 01
		Term Work & Practical:	50 marks	

Course Pre-requisites:

C/C++/Java Programming Languages, Data Structures, Linux/Unix Operating System, Distributed Computing, Computer Organization.

Course Objectives:

To focus on the principles of parallel and distributed computing environment and the

implementation and performance issues associated with them.

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

1. Ability to recite, explain and model the fundamental concepts and reasoning principles for parallel and distributed systems.
2. Ability to Identify and describe limitations and Challenges of Parallel and Distributed Systems.
3. Ability to adapt and apply the architectural models for various real time applications.
4. Ability to design, analyze algorithms for execution in parallel and distributed settings
5. Ability to report and account for models, limitations, and fundamental concepts in the area of message passing and shared memory concurrency, and apply this understanding to example systems and algorithms.
6. Ability to Outline and assess the significance of high performance computing and its impact in a Computer environment.

UNIT - I Fundamental of Parallel & Distributed Computing: (6Hours)

Introduction to Parallel Processing Paradigms, Modeling and Characterizing Parallel Algorithms, Balanced Trees, Divide and Conquer, Partitioning, Combining, Language Categories and Parallel Programming Languages.

Introduction to Distributed Computing: Computation Model, Client-Server Systems, Peer to Peer Systems, Modularity, Message Passing, Messages on worldwide web.

UNIT - II Promises and Challenges of Parallel and Distributed Systems: **(6Hours)**

Cost vs. Performance Evaluation, Software and General-Purpose PDC, Turing Machine as the Basis, and Consequences, Complexity Measures for Parallelism, Complexity Measures for Distributed Systems, Processing Technology, Networking Technology, Software Tools and Environments, Neural Networks and Complexity Issues, Tolerating Processor Failures in Synchronous Systems, Tolerating Processor Failures in Asynchronous Systems, Wait-Free Implementations of Shared Objects.

UNIT - III **Parallel and Distributed Architectures:** **(6Hours)**

Computational Model, Engineering Model, RISC Architectures, Superscalar and VLIW Processors, SIMD-Processing: Concepts and Systems, MIMD Architectures: Shared and Distributed Memory Designs, Memory Hardware Technology, Memory System Architecture, User-Level Memory Models, and Memory Consistency Models.

UNIT - IV **Algorithms & Data Structure for Parallel Programming**: **(6Hours)**

Arrays and Balanced Binary Trees, Linked Lists, Euler Tour vs. Parentheses String, Priority Queues (Heaps), Search Trees/Dictionaries, Impact of Data Distribution, CU/PE Overlap, Parallel Reduction Operations, Parallel Graph Algorithms, Parallel Computational Geometry.

UNIT - V **Communication and its Framework**: **(6Hours)**

Message-Passing Model, Distributed Shared Memory Model, Message-Passing System: Desirable Features, Socket-Based Message Passing, p4, Parallel Virtual Machine, Message-Passing Interface(MPI), Separation of Data and Control Functions.

Directory-Based Cache Coherence, Shared Memory Consistency Models,

Distributed Memory Architectures, Basic Model: RMI, CORBA, DCOM, Comparison of the Three Paradigms.

UNIT - VI Applications, Tools & Technologies: (6Hours)

HPC, Mixed-Mode Systems, Examples of Existing Mixed-Machine Heterogeneous Computing Systems, Overview of Clustering, Distinct Uses of Clusters, General-Purpose Parallel Computers, Optical Communication: Free-Space Interconnection, Considerations in Choosing the Interconnection Topology, Broadband Integrated Service Data Network (B-ISDN), Parallel and Distributed Computing Environment Over ATM, Parallelizing Compilers and Preprocessors, Performance Monitoring and benchmarking tools, Performance Visualization, Case Studies: Molecular Modeling, Genetic and Protein Sequence Data.

Term Work:

1. To implement a program that plays Conway's Game of Life. Conway's Game of Life is an example of discrete event simulation, where a world of entities live, die, or are born based on their surrounding neighbors. Each time step simulates another round of living or dying.
2. To implement parallel matrix multiply using Pthreads and evaluate the scalability of your implementation as you increase the problem size and the number of threads.
3. Client-server socket programs - To Design a multi-threaded server, using signals, and learning about the HTTP protocol.
4. To Study about CUDA. Implement a forest fire simulator using CUDA.
5. To Understand Locality, Load balancing, and Synchronization Effects using p-Threads.
6. To analyze the tradeoffs among different synchronization algorithms in terms of their latency, fairness, scalability, traffic, and storage requirements.
7. To understand the role of data communication using MPI as the message passing model. Setup the Environment and use the program of Gaussian Elimination.
8. To write a word count program on map-reduce framework.
9. To write a Jacobi Method to solve a system of linear equations using Map-reduce method.

Assignment:

1. To study about Hadoop Architecture.
2. To Study about Spark Architecture.
3. Prepare a case study on CUDA supporting Parallel programming and distributed application.
4. Case study on how to use Java-based TCP communication through a design of chat client and server program.

5.Case study on how to write a parallel-computing application using MPI Java

6.Case study on MPI

7. Note on comparing RMI and mobile agents in terms of programmability and performance.

8. Case study on design and implementation of a very simple distributed file system.

9.Prepare a presentation and case study on A Modern Multi-Core Processor: Forms of Parallelism + Understanding Latency and BW

10.Prepare a presentation and case study on Workload-Driven Performance

Text Books:

1) "Parallel and Distributed Computing: A Survey of Models, Paradigms and Approaches", A Wiley-Interscience publication, Volume 12 of Wiley Series on Parallel and Distributed Computing, Claudia Leopold, 0471358312, 9780471358312.

References:

1. "Tools and Environments for Parallel and Distributed Computing, Salim Hariri, Manish Parashar, Volume 34 of Wiley Series on Parallel and Distributed Computing", John Wiley & Sons, 0471474843, 9780471474845
2. "Parallel and Distributed Computing: Theory and Practice. Springer Science & Business Media", 3540580786, 9783540580782.
3. Péter Kacsuk, Dieter Kranzlmüller, Zsolt Németh, Jens Volkert,"Distributed and Parallel Systems: Cluster and Grid Computing, Volume 706 of The Springer International Series in Engineering and Computer Science", Springer Science & Business Media, 2012, 1461511674, 9781461511670
4. Jacek Błażewicz, Klaus Ecker, Brigitte Plateau, Denis Trystram, "Handbook on Parallel and Distributed Processing, International Handbooks on Information Systems", Springer Science & Business Media, 2013, 3662043033, 9783662043035

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Data Mining and Knowledge Discovery

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 3 Hours / Week	End Semester Examination: 60 Marks	Theory: 03
Practical: 2 Hours / Week	Internal Assessment: 40 Marks	TW &OR : 01
	Term Work & Practical: 50 Marks	

Course Pre-requisites:

Knowledge of Statistics, Database Management System.

Course Objectives:

1. Identify the scope and necessity of Data Mining & Warehousing for the society.
2. Describe the designing of Data Warehousing so that it can be able to solve the root problems.
3. Understand various tools of Data Mining and their techniques to solve the real time problems.
4. Develop ability to design various algorithms based on data mining tools.

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

1. Define, describe, and clearly state the objectives of Knowledge Discovery and Data Mining.
2. Describe data mining algorithms
3. Suggest appropriate solutions to data mining problems
4. Analyze data mining algorithms and techniques
5. Identify and or develop software to execute the specified algorithm(s)/data mining technique(s)
6. Identify and distinguish data mining applications from other IT applications

UNIT - I Introduction to Knowledge Discovery and Data Mining: (6 Hours)

Data mining fundamentals, Classification of Data mining systems, Integration of Data mining system with Data warehouse, Data Preprocessing,KDD Fundamentals, KDD Process, Data clearing, Data integration and transformation, Data Reduction, Data mining Statistics.

UNIT - II **OLAP**: **(6 Hours)**

Characteristics of OLAP system, Multidiamensional view and data cube, Data Cube implementations and operations, Difference between OLAP, OLTP and OLAP Server-ROLAP, MOLAP, HOLAP Queries.

UNIT - III **Association Rule Mining**: **(6 Hours)**

Introduction, The Task and Naive Algorithm,Apriori Algorithm,Improving the efficiency of Apriori algorithm, Direct hashing and pruning(DHP),Dynamic Item set counting(DIC),Mining frequent patterns without candidate generation(FP Growth).

UNIT - IV **Classification:** **(6 Hours)**

Decision Tree,The Tree Induction Algorithm,Split algorithms based on information theory,Split Algorithm based on Gini Index,Decision tree Rule,

UNIT - V **Knowledge discovery:** **(6 Hours)**

Introduction, KDD Process KDD process steps, Models, Integration of KDD with Database system,KDD system architecture, KDD Lifecycle,

UNIT - VI **Clustering:** **(6 Hours)**

Cluster analysis, Categorization of major clustering methods such as Partitioning methods, Hierarchical methods, Density based methods, grid based methods, Model based clustering methods, clustering high dimensional data, Constraint based analysis, Data mining applications

Term Work:

1. Implementing Web document browsing a OLAP using existing ontologies.
2. Show the implementation of Naïve Bayes algorithm.
3. Demonstration of Association rule process on any dataset using apriori algorithm.
4. Case Study: How New York's Fire Department Uses Data Mining
5. Comparison of various data mining tool
6. Implementation/usage of WEKA for classification of social network dataset
7. Implementation/usage of k-nearest neighbor classifier
8. Find predominant themes in a collection of documents (clustering).
9. Clustering images based on feature localization.
10. Case Study on Data mining applications.

Assignment:

1. Explain Data mining Tasks, Issues, Evalution and Terminologies.

2. Implementation of various KDD models.
3. Define hypercube? How do they apply in OLAP system?
4. State Codd's guidelines for OLAP system?
5. Case study on OLAP.
6. Apply Apriori algorithm to the dataset from Table 13.1 (textbook) and extract all frequent itemsets with support count ≥3. For one longest itemset construct association rules using confidence threshold 50%. Show all your work (candidates, frequent itemsets, etc.).
7. List and explain Association rule mining algorithms in detai.
8. Implementation of Data Cube.
9. Compare various clustering algorithm.
10. Case Study :clustering algorithm

Text books:

1. Jiawei Han & Micheline Kamber, "Data Mining – Concepts and Techniques",Morgan Kaufmann Publishers, Elsevier,2nd Edition, 2006.
2. ",Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining, Pearson education.

References:

1. Arun K Pujari, "Data Mining Techniques",2nd edition, Universities Press.
2. Sam Aanhory & Dennis ,"Data Warehousing in the Real World",Murray Pearson Edn Asia.
3. K.P.Soman,S.Diwakar,V.Ajay, "Insight into Data Mining",PHI,2008.
4. Paulraj Ponnaiah, "Data Warehousing Fundamentals ",Wiley student Edition.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Project Stage-II

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Practical: 16 Hours / Week	End Semester Examination: 150 Marks	Term Work & Oral: 08

Course Pre-requisites:

Basics of Software engineering, software testing and knowledge of core computer engineering subjects.

Course Objectives:

- To develop problem solving abilities using mathematics.
- To apply algorithmic strategies while solving problems.
- To prepare software engineering documents and design test cases.
- To demonstrate use of algorithmic solutions in real time problem.
- To encourage and expose students for participation in National/ International paper presentation activities.
- Exposure to Learning and knowledge access techniques using Conferences, Journal papers and participation in research activities.

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

I. Understand how to solve the problem.

II. Demonstrate the ability to synthesize complex information from a variety of sources in decision-making

III. Plan and perform collaboratively towards a common purpose.

IV. Demonstrate self-advocacy skills and self-reliant behavior.

V. Demonstrate the ability to develop and maintain satisfying interpersonal relationships.

VI. Evaluate and conclude the results with documentation.

1. The project will be undertaken preferably by a group of at least 3- 4 students who will jointly work and implement the project over the academic year. The work will involve the design of a system or subsystem in the area of Computer Engineering.

2. If the project is chosen a hardware project it will involve the designing a system –subsystem or upgrading an existing system. The design must be implemented into a working model with necessary software interfacing and a user manual.

3. If the project is chosen in the pure Software Application it must involve the detail Software Design Specifications, Data Structure Layout, File Design, Testing with complete documentation and user interface. With life cycle testing and as an executable package.

The group will submit at the end of Semester-VIII,

i) The workable project.
ii) The details of Research paper published in National/ International paper conferences/journals for the project work carried out.
iii) Project Report in the form of bound journal complete in all aspects, 3 copies for the institute and 1 copy of each student in the group for certification.

The examiner in consultation with the guide will assess the term work.

Oral examination will be based on the project work completed by the candidate.

The project report will contain the following details:

1. Problem definition and requirement specification, acceptance tests procedure (ATP).
2. System definition, requirement analysis.
3. System design.
4. System implementation-code documentation –dataflow diagram / algorithm.
5. Test results and procedure, test report as per ATP.
6. Platform choice, use.
7. Appendix tools used, references.
8. Documentation will use UML approach with Presentation, Category, Use Case, Class Diagrams, etc.