VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Autonomous Institute affiliated to University of Mumbai]

SYLLABUS

FOR

M. Tech (Computer Engineering)

(Specialization in Computer Engineering)

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE,

[V.J.T.I.]

MATUNGA, MUMBAI 400 019.

[YEAR 2014-2015]

Scheme of Teaching and Evaluation
M Tech (Computer Engineering) (Semester I)

					Scheme of evaluation			
Sr No	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE(W) (hrs)**
1	CO0311	Computational Methods	3-1-0=4	4	20	20	60	3
2	CO0312	Advanced Compiler	3-1-0=4	4	20	20	60	3
3	CO0313_T	TCP/IP and Network Programming	3-0-0=3	3	20	20	60	3
	CO0313_P	TCP/IP and Network Programming Lab	0-0-2=2	1	100% CIE			
4	CO0314_T	Modern Information Systems	3-0-0=3	3	20	20	60	3
	CO0314_P	Modern Information Systems Lab	0-0-2=2	1	100% CIE			
5	CO0315	Elective 1	3-1-0=4	4	20	20	60	3
6	CO0316_T	Elective 2	3-0-0=3	3	20	20	60	3
	CO0316_P	Elective 2 Lab	0-0-2=2	1	100% CIE			
		Total	27	24				

Total for Semester	**L**	**T**	**P**	**Total Hours**	**Credits**
	18	**3**	**6**	**27**	**24**

Abbreviations: **L**: Lectures, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment, **IST**: In Semester Test/s,

ESE (W): End Semester Written Examination, **ESE (W) (hrs)**: End Semester Written Examination duration

Elective -1

1. Distributed systems
2. Design of Parallel Architecture and Programming
3. Wireless Networks And Mobile Computing
4. Computer Systems Performance Analysis

Elective -2

1. Multimedia Processing Systems
2. Algorithms And Complexity
3. Semantic Web and Social Networks
4. Web Personalization and Optimization

Scheme of Teaching and Evaluation
M Tech (Computer Engineering) Semester II

					Scheme of evaluation			
Sr No	**Course Code**	**Course Title**	**L-T-P (Hours/ Week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE(W) (hrs)**
1	CO0317	Research Methodologies	3-1-0=4	4	20	20	60	3
2	CO0318	Cloud Architecture Infrastructure and Technology.	3-1-0=4	4	20	20	60	3
3	CO0319_T	Advanced Database Management Systems	3-0-0=3	3	20	20	60	3
	CO0319_P	Advanced Database Management Systems Lab	0-0-2=2	1	100% CIE			
4	CO0320_T	Information Security	3-0-0=3	3	20	20	60	3
	CO0320_P	Information Security Lab	0-0-2=2	1	100% CIE			
5	CO0321	Elective 3	3-0-0=3	3	20	20	60	3
6	CO0322_T	Elective 4	3-0-0=3	3	20	20	60	3
	CO0322_P	Elective 4 Lab	0-0-2=2	1	100% CIE			
		Technical Seminar *	0-0-4=4	2	100% CIE			
		Total	30	25				

*Will be able into aspects of language proficiency

Elective 3:

1. Software Project Management
2. Programming Paradigms For Concurrency Control
3. Parallel & Distributed Algorithms
4. Big Data Analytics
5. Real Time Systems

Elective 4:

1. Network Attacks and Defense Mechanisms
2. Web Services and Service Oriented Architecture
3. Distributed & Cloud Database System
4. Pattern Recognition
5. Graph Mining
6. Multi Core Architecture and Parallel Algorithms

Total for Semester	L	T	P	Total Hours	Credits
	18	2	10	30	25

Abbreviations: Lectures, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment, **IST**: In Semester Test/s, **ESE (W)**:End Semester Written Examination, **ESE (W) (hrs)**: End Semester Written Examination duration

Scheme of Teaching and Evaluation

M Tech (Computer Engineering)
(Semester III)

Sr No	Course Code	Course Title	Credits	Evaluation pattern	Month of examination
1	CO0331	Project Stage-I	4	*	end August
2	CO0332	Project Stage –II Presentation	4	*	end November

M Tech (Computer Engineering)
(Semester IV)

Sr No	Course Code	Course Title	Credits	Evaluation pattern	Month of examination
1	CO0333	Project Stage-III	4	*	end March
2	CO0334	Presentation and Final Viva Voce	12	*	end June

* Evaluation pattern will be decided later

Program Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO0311**
Course Title	**:**	**Computational Methods**

Prerequisites: Mathematics

Course Objectives

1. To develop the mathematical model for Research.
2. To learn number theory
3. To learn Computational geometry .
4. Student will learn approximation algorithm.

Course Outcomes

1. Apply concepts of algorithms.
2. Understand and apply the concept of problem solving using algorithms
3. Apply matrix operations in solving problems

Course Contents

1.	**The Role of Algorithms in Computing Algorithms.** Algorithms as a technology fundamental of algorithmic problem solving., fundamental of the analysis of algorithm efficiency. analyzing algorithms ,designing algorithms growth of functions, asymptotic notation, , substitution method the recursion-tree method , the master method	10
2.	**Discrete Mathematics and Automata Theory**: Proofs, mathematical induction, functions, relations, set theory, summation and counting, Graph Theory, Finite automata, minimization of DFA Regular expressions, Context-free Grammars and its simplification, recursively enumerable languages, Undecidable problems, complexity	20
3.	**Number theory:** Divisibility, modular arithmetic, congruence and reminders, Chinese reminder theorem, Fermat's theorem, greatest common divisor; cryptography, cryptanalysis, and cryptosystems: public key, RSA key, digital signature.	10
4.	**Computational Geometry:** Line ,Segment properties, Finding Intersection of pair of segments ,Finding convex hull ,closest pair of points	10
5.	**Np-completeness :**Polynomial time verification ,Np-completeness and reducibility , Np-completeness proof and problems	10
6.	**Approximation algorithms :**Vertex cover problem ,Traveling salesman problem ,Set covering problem ,Randomization and linear programming ,Subset sum problems	10
7.	**First-Order Logic, Building a Knowledge Base :** Extensions and Notational Variations , Using	10

	First-Order Logic , Representing Change in the World	
8.	**Uncertainty & Probability theory :** Acting under Uncertainty , Basic Probability Notation , The Axioms of Probability , Bayes' Rule and Its Use	10
9.	**Fuzzy logic** : Fuzzy logic ,Classical sets ,Operations on crisp set ,Properties of classical set ,function mapping of classical set ,Fuzzy set operations, Fuzzy set properties ,classical relations ,fuzzy relations ,tolerance and equivalence relations ,Non-interactive fuzzy sets	10

Text Books	
1	"Introduction to algorithms " by Thomas cormen ,R.Rivest ,PHI Publication
2	Artificial Intelligence: A Modern Approach, 3/E Stuart Russell , Prentice Hall
Reference Books:	
1	"Principles of soft computing" by S.N.Sivanadam ,S.N.Deepa Wiley publication ,2nd edition
2	"Cryptography and Network Security", William Stallings, Fourth Edition, Pearson Education
3	Discrete mathematics structure by Bernard Kolman ,PHI Publication
4	Graph theory with Application by Dr.SukhendU Dey, Shroff Publications

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER I**
Course Code	**:**	**CO0312**	
Course Title	**:**	**Advanced Compiler**	

Course Prerequisites: complier construction

Course Objectives

1. To develop an understanding of the operation of compilers and the development and specification of computer-based languages.

2. To understand lexical, syntax and semantic analysis processes.

3. To understand context free grammar, and parse tree construction.

4. To determine code generation and optimization techniques.

5 To understand data representation and handling.		
Course Outcomes 1. To be able to build lexical analyzers and use them in the construction of parsers. 2. To be able to express the grammar of a programming language, build syntax analyzers and use them in the construction of parsers. 3. To perform the operations of semantic analysis. 4. To build a code generator.		
Course Contents		
1	**Lexical Analysis:** Compiler structure: analysis-synthesis model of compilation, various phases of a compiler, tool-based approach to compiler construction.: NFA, DFA, minimization , interface with input, parser and symbol table. Error reporting., LEX. Tools	20
2	**Syntax Analysis:** CFGs, ambiguity, associatively, precedence, top down parsing, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, operator precedence grammars, LR parsers (SLR, LALR, LR), YACC.	20
3	**Type Checking:** type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions.	10
4	**Run Time System:** storage organization, activation tree, activation record, parameter passing, symbol table, dynamic storage allocation. Intermediate code generation: intermediate representations, translation of declarations, assignments, control flow, Boolean expressions and procedure calls. Implementation issues.	20
5	**Code Optimization methods:** Loop optimization, Eliminating Induction variables, Loop unrolling ,Loop Jamming ,Branch optimization, Code motion, Common sub expression elimination, Constant propagation, Dead code elimination, Strength Reduction.	10
6	**Code Generation and Instruction Selection:** Issues, basic blocks and flow graphs, register allocation, code generation, dag representation of programs, code generation from DAGs, peep hole optimization, code generator generators, specifications of machine.	10
7	**Imperative and Object- Oriented programs:** Context handling, Source language ,data representation and handling ,Routines and their activation ,code generation for control flow statement and module	10
Text Books		
1	V. Aho, R. Sethi, and J. D. Ullman. Compilers: Principles, Techniques and Tools , Pearson Education.	
2	D.Brune ,H.Bal C.Jacobs ,K. Lagendon Modern compiler Design by Wiley Publication	

Reference Books	
1	A. C. Holub. Compiler Design in C, Pearson Education.
2	Compiler Design by Dr.O.G.Kakde university science press
3	Modern Compiler Implementation in Java: Basic Design, Cambridge Press. Fraser and Hanson.

Programme Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO0313_T**
Course Title	**:**	**TCP/IP and Network Programming**

Prerequisites: Principle of Communication Engineering

Course Objectives

(1) To study various network elements and devices and Network design.
(2) To study the various layers of the TCP/IP protocol suite and routing protocols.
(3) To study the various security protocols, vulnerabilities, attacks and defense mechanism
(4) To study the network programming using Java.

Course Outcomes

1. To gain the knowledge of various network devices and planning designing the network for the organization.
2. To express TCP/IP suite and different TCP/IP layers such as network layers, transport layers, application layers.
3. To gain the knowledge of network security, protocol security and network attacks, defence mechanism and their vulnerabilities etc.
4. To gain basic knowledge of network programming.

Course Contents

1.	**Network Design**: IP addressing, Internet work Connectivity –MAU'S, Multiplexers, cables, Repeaters, Bridges, Routers, layers switches, Hubs, Gate, VLANS, Planning A Network , Network Design .	10
2.	**Transport Layer:** User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Stream Control Transmission Protocol (SCTP)	10

3.	**Network Layer:** Internet protocol(IP), Address resolution protocol(ARP), Reverse address resolution protocol(RARP), Internet control Message protocol(ICMP), Internet group management protocol(IGMP) Real Time Traffic over the internet (RTP, RTCP),(RTP)Real time transport protocol,(RTCP) RTP control protocol etc	10
4.	**Application Layer Protocols:** Host Configuration: BOOTP and DHCP, Domain Name System (DNS), Hyper Text Transfer Protocol: HTTP, File Transfer: FTP and TFTP , Electronic Mail: SMTP, POP, and IMAP, Network Management: SNMP, World Wide Web: HTTP.	10
5.	**Routing Protocols**: Unicast Routing Protocols (RIP, OSPF, and BGP), Multicasting and Multicast Routing Protocols. RIP (Routing information protocol), OSPF (Open shortest path first), BGP(Border gateway protocol)	10
6.	**Network Security:** Security at the Transport Layer: SSL and TLS, Security at the Network Layer: IPSec, Networks attacks and defense mechanisms: Network scanning, Vulnerability scanning, Network capture and monitoring, Host monitoring etc	20
7.	**Network Programming** Introduction to java programming, Looking up the internet addresses, socket programming, UDP datagram and sockets, multicast sockets, URL connections, protocol handlers, Content handlers RMI and java mail API	30

Text Books	
1	Behrouz A. Forouzan, "TCP/IP Protocol Suite", III Edition, Tata McGraw Hill, 2005.
2	Elliotte Harold "Java Network Programming "O'relly Publications E. Comer, "Internetworking with TCP/IP Vol- III", (BSD Sockets Version), second Edition, PHI
Reference Books	
1	TCP/IP Network Administration, Craig Hunt, O'Relly Publication.
2	Internetworking with TCP-IP: Design, Implementation, and Internals, by D. E. Comer and D. L. Stevens Vol II, Prentice Hall.

Programme Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO0313_P**
Course Title	**:**	**TCP/IP and Network Programming Lab**
Course Prerequisites: C and Java		

Course Objectives

1. To understand Network Programming Analysis and Design
2. To understand Socket Programming Analysis and Design
3. To understand the Electronic Communication media management

Course Outcomes

1. To implement Network Programming Analysis and Design .
2. To implement end user Socket Programming Analysis and Design
3. To implement the design all electronic communication media project management

Course Contents		
1	Building Applications in network environment	10
2	Client Server socket programming.	10
3	Building E-Mail systems.	10
4	Implement FTP , chat applications.	10
5	Study Linux network command , network security and management	10
6	UDP socket programming	10
7	Managing and tuning the TCP connection.	10
8	Implement RMI,RPC using JAVA	10
9	Network tools :Wiresharak ,Nmap ,TCPDUMP	10
10	Network attack and defense mechanism tools	10

Text Books

1	"JAVA Network Programming" Wielly Publications	
2	Linux administration Handbook by Evi Nemeth ,Garth Snyder	

Reference Books

1	"TCP/IP Essentials" a lab based approach by Shivendra Panwar, Shiwen Mao, Jeong-dong Ryoo, and Yihan Li.	

Programme Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO 0314_T**
Course Title	**:**	**Modern Information Systems**

Course Prerequisites: Fundamentals of Object oriented Programming, Basics of Software engineering, , basic Data Structure and design analysis and algorithm.

Course Objectives

1. To explain the basic Object oriented concepts and various notations for static and dynamic modeling of unified modeling language
2. To understand Web Analysis and Design
3. To understand the project management
4. To understand how to build modern information systems.

Course Outcomes

(1) Discuss and identify the concepts of encapsulation, abstraction, inheritance and polymorphism and various notations of Static diagrams such as class diagrams, package diagram, deployment diagram, component diagram, object diagram etc and dynamic or behavioral diagram such as use case diagram ,state transition diagram, activity diagram collaboration diagram etc.

(2) Describe and understands the basic web modeling applications and various modeling techniques such as content modeling, hypertext modeling, presentation modeling, customization modeling and web application design such as presentation design, Interaction design and functional design etc.

(3) To understand the fundamental concepts of project management and apply the various techniques to solve the different project parameters such as project cost, project effort, duration and risk assessment and mitigation plan.

(4) Apply the technique to implement algorithms and problem solution to build modern information system.

Course Contents		
1.	**Software Requirement Specification**: structured systems analysis & design requirement modeling , design concept, architectural design, component level design, user interface design	20
2.	**Object Oriented Analysis & Design:** use case modeling, class modeling, dynamic modeling, action oriented design, data oriented design, object oriented design, formal techniques for detailed design	20
3.	**Web Engineering**: modeling web application, web application design	20
4.	**Software Reengineering :** Mapping Models to Code ,Software Security Engineering **,**	20

	reverse engineering and forward engineering	
5.	**Software Project Management**: Structured project, oo project & web project management	20

Text Books	
1	Software Engineering : A Practitioners Approach , Roger S. Pressman, TataMcGraw Hill
2	Web Engineering ,Gerti Kappel, Birgit Proll, Siegfried Reich, Werner Retschitzegger,Wiley Publication
Reference Books	
1	Software Security Engineering A guide for Project Managers :Julia llen ,Sean Barnum ,Nancy Mead
2	Object Oriented Software Engineering using UML,Pattern and Java Bearnd Bruegge ,Allen H. Dutoit ,2nd edition Pearson publication
3	Web Engineering A Practitioner's Approach , RogerS Pressman ,David Lowe,TataMcGraw Hill
4	Object Oriented and Classical Software Engineering, Stephan R. Schach ,TataMcGraw Hill

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – I**
Course Code	**:**	**CO 0314_P**	
Course Title	**:**	**Modern Information Systems Lab**	

Course Prerequisites: Fundamentals of Object oriented Programming

Course Objectives

i) To learn Object oriented Analysis & Design
ii) To learn project Management
iii) To learn web engineering

Course Outcomes

1. To explain the basic Object oriented concepts and various notations for static and dynamic modeling of unified modeling language
2. To understand Web Analysis and Design

3. To understand the project management 4. To understand how to build modern information systems.		
Course Contents		
	For the given case study	
1	Apply structured systems analysis and design	20
2	Apply object oriented analysis and design	20
3	Apply web engineering & Security	20
4	Apply OOAD & web based project management	20
5	Implement the given case study in c++/Java	20
Text Books		
1	Software Engineering : A Practitioners Approach , Roger S. Pressman, TataMcGraw Hill	
2	Web Engineering ,Gerti Kappel, Birgit Proll, Siegfried Reich, Werner Retschitzegger, Wiley Publication	
3	Object Oriented and Classical Software Engineering, Stephan R. Schach , TataMcGraw Hill	
	Reference Books	
1	Web Engineering A Practitioner's Approach , RogerS Pressman ,David Lowe,TataMcGraw Hill	
2	Software Security Engineering A guide for Project Managers :Julia llen ,Sean Barnum ,Nancy Mead	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – I**
Course Code	**:**	**CO0315**	
Course Title	**:**	**Elective1 :Distributed Systems**	
Course Prerequisites: Computer Architecture ,Operating system			

Course Objectives

1. To study distributed system topics and be exposed to recent developments in distributed systems research.

2. To provide in-depth design concepts and implementation techniques of distributed systems

Course Outcomes

1. Identify and explain detailed aspects of internal structures of distributed systems

2. Compare and contrast design issues for distributed systems.

3. Develop implementation skills for building distributed system with features with good security measures.

4. Analyze the requirements, make critiques and create design of distributed operating systems.

Course Contents

1.	**Introduction:** Introduction to Distributed systems, examples of distributed systems, challenges, architectural models, fundamental models , Introduction to inter process communications ,external data representation and marshalling, client server communication ,group communication	10
2.	**Distributed Objects and File System: :**Introduction , Communication between distributed objects , Remote procedure call , Events and notifications , Java RMI case Study ,Introduction to DFS , File service architecture , Sun network file system , Introduction to Name Services, Name services and DNS ,Directory and directory services.	20
3.	**Distributed Operating System Architecture :**The operating system layer , Protection , Process and threads, Communication and invocation , Operating system architecture , Introduction to time and global states , Clocks, Events and Process states , Synchronizing physical clocks , Logical time and logical clocks	10
4.	**Transaction and Concurrency Control –** Distributed Transactions , Nested transaction ,Locks , Optimistic concurrency control , Timestamp ordering , Comparison of methods for concurrency control , Introduction to distributed transactions , Flat and nested distributed transactions , Atomic commit protocols , Concurrency control in distributed transactions , Distributed deadlocks ,Transaction recovery.	20
5.	**Security and Replication:** Overview of security techniques , Cryptographic algorithms , Digital signatures , Cryptography pragmatics ,Replication , System model and group communications , Fault tolerant services ,Highly available services ,Transactions with	10

	replicated data	
6.	**Distributed Operating Systems Support :** lamport's logical clock; vector clock; causal ordering; global state; cuts; termination detection. distributed mutual exclusion , non-token based algorithms , lamport's algorithm ,token-based algorithms , suzuki-kasami's broadcast algorithm , distributed deadlock detection , issues ,centralized deadlock-detection algorithms , distributed deadlock-detection algorithms	20
7.	**Distributed Resource Management** distributed file systems, architecture, mechanisms , design issues , distributed shared memory , architecture , algorithm , protocols ,design issues. distributed scheduling.	10
Text Books		
1	George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design" Pearson Education Asia, 2002.	
2	Mukesh Singhal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw- Hill, 2000	
Reference Books		
1	Abraham Silberschatz, Peter B. Galvin, G. Gagne, "Operating System Concepts", Sixth Edition, Addison Wesley Publishing Co., 2003.	
2	Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – I**
Course Code	**:**	**CO0315**	
Course Title	**:**	**Elective 1:Design of Parallel Architecture and Programming**	
Course Prerequisites: Computer Architecture			
Course Objectives: To gain the knowledge required to analyze and design high-performance computer systems. To gain the knowledge of parallel Algorithms. To gain the knowledge of parallel Programming language.			
Course Outcomes Apply the techniques to implement new analyze and design high-performance computer systems. Apply the technique to implement Parallel processing algorithm. Apply the technique to implement Parallel software design			
Course Contents:			

1.	**Fundamental Concepts**: Introduction to Parallel Processing,,Types of Parallelism: A Taxonomy, Roadblocks to Parallel Processing ,Effectiveness of Parallel Processing, GPU computing , Multiprocessor Systems, Performance of Parallel Computers, Architectural Classification Schemes: Multiplicity of Instruction Data Streams, Serial versus Parallel Processing, Parallelism versus Pipelining	10
2.	**Multiprocessor Processor Parallel Memory Architecture**: Parallel Memory Organizations: Interleaved Memory Configurations, Performance Tradeoffs in Memory Organizations, Multicache Problems and Solutions, Multiprocessor Operating Systems: Classification of Multiprocessor Operating Systems, Software Requirements for Multiprocessors, Operating System Requirements, Exploiting Concurrency for Multiprocessing: Language Features to Exploit Parallelism, Detection of Parallelism in Programs, Program and Algorithm Restructuring GPU CUDA memory architecture Block ,Open CL memory block	10
3.	**Some Idioms for Synchronization Mechanism :** Semaphore ,Critical region ,monitor ,message passing ,RPC ,Case studies:Blood vessel segmentation ,Adaptive 3D grid based eulerian program	10
4.	**Parallel Software Design :**Pattern based parallel software method ,Problem analysis ,coordination design ,Communication design ,Detailed design ,Implementation and evaluation ,Parallel software architecture	10
5.	**A Taste of Parallel Algorithms**: Some Simple Computations, Architectures, Algorithms for a Linear Array, Binary Tree, 2D Mesh, Shared Variables. Asymptotic Complexity, Algorithm Optimality and Efficiency, Complexity Classes, Parallelizable Tasks and the NC Class ,Parallel Programming Paradigms.	10
6.	**PRAM and Basic Algorithms :**PRAM Sub-models and Assumptions ,Data Broadcasting , Semi-group or Fan-In Computation ,Parallel Prefix Computation ,Ranking the Elements of a Linked List , Matrix Multiplication	10
7.	**More Shared-Memory Algorithms:**Sequential Rank-Based Selection ,Parallel Selection Algorithm, Selection-Based Sorting Algorithm ,Alternative Sorting Algorithms ,Convex Hull of a 2D Point Set ,Some Implementation Aspects	10
8.	**Structures and Algorithms for Parallel Processing :** Masking and Data Routing Mechanisms, Inter PE communications , SIMD Matrix Multiplication, Parallel Sorting, Processing SIMD Computers and Performance Enhancement	10
9.	**MPI Programming :** Introduction to MPI Principles of Message - Passing Programming, The Building Blocks (Send and Receive Operations), MPI (the Message Passing Interface), Collective Communication and Computation Operations, Examples of Matrix - Matrix multiplication, One dimensional Matrix Vector Multiplication using MPI.	10
10.	**CUDA / Open CL Programming :** GPUs as Parallel Computers, Architecture of a Modern GPU, Data Parallelism,, CUDA Program Structure, Importance of Memory Access Efficiency, CUDA THREADS: CUDA Thread Organization, singblock Idx and threadIdx, Synchronization and Transparent Scalability, Thread Assignment, Thread Scheduling and Latency Tolerance.	10

Text Books:	
1	Introduction to Parallel Processing Algorithms and Architectures BY Behrooz Parhami (KLUWER ACADEMIC PUBLISHERS)
2	Programming Massively Parallel Processors(David B. Kirk and Wen-mei W. Hwu)
3	, "Parallel Programming in C with MPI and OpenMP" by Michael J. Quinn
3	Computer Architecture & Parallel Processing, by Kai Hwang & Briggs (McGraw Hill)
4	Hennessey and Patterson, "Computer Architecture: A quantitative Approach", Morgan Kaufman.
Reference Books :	
1	SIMA, "Advanced Computer Architectures", Addison-Wesley.
2	Patterns for Parallel Software Design by Ortega ,Arjona by Wiley Publications

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – I**
Course Code	**:**	**CO0315**	
Course Title	**:**	**Elective 1 (Wireless Networks and Mobile Computing)**	

Course Prerequisites: Basics of wireless communication

Course Objectives

1. Student will learn the concepts relevant to modern wireless systems.
2. Student will learn emerging mobile computing ideas and best practices.
3. Student will learn concepts and principles in mobile computing.

Course Outcomes:

1 Understand the concept of Wireless LANs, PAN, Mobile Networks and Sensor Networks.

2. Understand the structure and components for Mobile IP and Mobility Management.

3. Understand positioning techniques and location-based services and applications.

4. Understand the important issues and concerns on security and privacy.

Course Contents:		
1	**Introduction:** Wireless technology, Spectrum, Radio Propagation Mechanism, Characteristics of wireless Channel, Modulation, Multiple Access Technique, Voice Coding, Error Control.	10
2	**Wireless LAN and PAN:** Fundamentals of WLAN, IEEE 802.11 standards, HYPERLAN, Bluetooth, HomeRF.	10
3	**Wireless WAN and MAN:** Cellular Concept, Architecture, Generations, Wireless in Local Loop, Wireless ATM, IEEE 802.16 Standards, HYPERACCESS.	10
4	**Wireless Internet:** Introduction, Mobile IP, TCP in Wireless Domain, WAP, Optimizing Web Over Wireless.	10
5	**Ad Hoc Wireless Networks:** Introduction, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet.	10
6	**MAC Protocols for Ad Hoc Wireless Networks:** Introduction, Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols,Contention-Based MAC Protocols with Scheduling Mechanisms, MAC Protocols That Use Directional Antennas, Other MAC Protocols.	10
7	**Routing Protocols for Ad Hoc Wireless Networks:** Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classi cations of Routing Protocols, Table-Driven Routing Protocols, On-Demand Routing Protocols.	05
8	**Multicast routing in Ad Hoc Wireless Networks:** Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols.	10
9	**Transport Layer and Security Protocols for Ad Hoc Wireless Networks:** Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.	05
10	**Quality of Service in Ad Hoc Wireless Networks:** Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classifications of QoS Solutions, QoS Frameworks for Ad Hoc Wireless Networks.	10
11	**Energy Management in Ad Hoc Wireless Networks:** Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Power Management Schemes, System Power Management Schemes.	05

12	**Recent Advances in Wireless Networks.**	05
Text Books:		
1	Jochen Schiller, "Mobile communications", 2nd Edition, Pearson Education, 2008.	
2	C. Siva Ram Murthy and B.S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", 3rd Edition, Pearson education, 2008.	
Reference Books :		
1	C K Toh, "Ad Hoc Mobile Wireless Networks: Protocols and Systems", 1st Edition, Pearson education, 2002.	

Programme Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO0315**
Course Title	**:**	**Elective 1 Computer Systems Performance Analysis**

Course Prerequisites: Undergraduate level background in Operating Systems and Computer Networks, and Probability and Statistics. Basic implementation skills in a programming language, and scripting language.

Course Objectives

- To understand the basic methods of performance evaluation.
- To learn how to specify performance requirements, evaluate design alternatives, compare systems, tune systems, identify bottlenecks, characterize workloads, determine the number and size of components, and do forecasting.
- To use these methods in a major project and to gain experience with presentation.

Course Outcomes

- Students will be able the evaluate the performance of the various computer systems and network systems.
- Students Will be able to work on various performance metrics and analyze them.
- Students Will be able to use programming languages to simulate the performance of various computer systems within or outside the network

Course Contents

1	**Overview of Performance Evaluation:** Introduction, common mistakes and how to avoid them, selection of techniques and metrics.	15
2	**Measurement Techniques and Tools** Types of workloads, the art of workload selection, workload characterization & techniques, monitors, program-execution monitors and accounting logs, capacity planning and benchmarking, the art of data presentation.	20
3	**Probability Theory and use for Evaluation:** Introduction to probability refresher, conditional probability ,total probability, discrete and continuous random variables ,common distributions ,probability generating functions(pgf) and laplace transforms (lst) ,numerous examples from computer networking, stochastic processes.	15
4	**Queuing Theory** :Queuing models, little theorem application, markov chain formulation, discrete time and continuous time markov chains (dtmc, ctmc), mmd.	15
5	**Queuing System Models and Application:** Queuing system m/m/1, m/m/1/k, m/m/s/, m/m/¥queue analysis m-server case. Multidimensional markov chain application in circuit switching/g/1 queue, generalization of m/g/1 theory application to atm. imbedding instants in the m/g/1 theory m/g/1 with geometrically distributed messages. chain imbedded to cell transmission, message transmission completion. queue balance equation, finite buffer case, mean value analysis.	15
6	**Network Analysis:** Local area Network analysis, standard comment based analysis, contention based protocols, demand assignment protocols, nodes in packet switches networks, performance analysis of data link layer, Network layer. Traffic control and congestion in ATM networks, TCP/IP Traffic control.	10
7	**Simulation:** Introduction to simulation, simulation modeling and analysis in computer systems and networks, analysis of simulation results, random number generation, statistical analysis of simulation. overview of performance evaluation random variables and common distribution stochastic processes	10
Text Books		
1	Raj Jain, "The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation, and Modeling", Wiley-Interscience, 1991.	
Reference Books		
1	K.S. Trivedi, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2001.	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – I**

Course Code	**:**	**CO 0316_T**
Course Title	**:**	**Elective – 2(Multimedia Processing Systems)**

Course Prerequisites: Image processing

Course Objectives:

1. To learn fundamental techniques and concepts used in imaging and multimedia.

2. To learn different algorithms for image retrieval.

3. To learn different algorithms for Audio and video Processing and retrieval.

4. To learn current trends in video search.

Course Outcomes:

1. Understanding fundamental techniques and concepts used in imaging and multimedia.

2. Able to understanding different algorithms for image retrieval.

3. Able to understanding different algorithms for Audio and video Processing and retrieval.

4. Understanding the current trends in video search.

Course Contents:		
1	**Multimedia Processing systems** Introduction to Multimedia Retrieval systems Image Indexing and Retrieval Digital Image Representation, Representation of Grey scale and Color Images Image Enhancement- Random noise, salt and pepper noise, Gaussian filter, Laplacian Filter, Image Histogram, Edge Detection, Image Texture Feature Extraction.	30
2	**Content Based Image Retrieval (CBIR)** colour based Image Indexing and Retrieval Techniques, Image Retrieval based on Shape, Image Retrieval based on Texture. Algorithms: Hough Transform Algorithm, Exact Match Algorithm, Image Retrieval using Histogram	10
3	**Audio Processing Indexing and Retrieval** Basic characteristic of Audio signal, Digital Representation of Audio**,** Audio classification Sampling Quantization, coding, Brief introduction to speech Recognition and Retrieval ,Speaker Identification, Spoken Document Retrieval, Robust Speech Recognition and Retrieval Algorithms: Partial Matching Algorithm, Virtual Mode Algorithm using k-d tree	20
4	**Video Processing Indexing and Retrieval** Video Shot Detection and segmentation**,** Key Frame Extraction, Detecting shot boundary, Effective Video Representation and Abstraction, visual content discontinuities, discriminative and prior information, detection structure, Symantec Video Indexing ,Indexing and Retrieval based on r Frames of video shots, on Motion Information, on Objects, Symantec path Finder Algorithms: Antipole tree, Range Search Tree .	20
5	**Current Trends in Video Search** Introduction, Video Production, Video Distribution, the Video Web and User Interaction, Television Technology and Consumption, Trends in Media Devices, Media Processing Research, Deployments.	20

Text Books:	
1	Multimedia Database Management Systems : Guojun Lu, Artech House.
2	An Introduction to Information Retrieval : Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, Cambridge University Press , England .
Reference Books :	
1	Multimedia Content and the Semantic Web - Methods, Standards and Tools Edited by Giorgos Stamou and Stefanos Kollias, John Wiley & Sons Ltd.
2	Multimedia Image and Video Processing , Series Editor: Phillip A. Laplante, CRC Press
3	Digital Image Processing, Gonzales and Woods
4	Fundamentals of Digital Image Processing-Anil K Jain, Pearson Education

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – I**
Course Code	**:**	**CO 0316_P**	
Course Title	**:**	**Elective 2 (Multimedia Processing Systems Lab)**	

Course Prerequisites: Image processing

Course Objectives:

1. To learn fundamental techniques and concepts used in imaging and multimedia.

2. To learn different algorithms for image retrieval.

3. To learn different algorithms for Audio and video Processing and retrieval.

4. To learn current trends in video search.

Course Outcomes:

1. Understanding fundamental techniques and concepts used in imaging and multimedia.

2. Able to understanding different algorithms for image retrieval.

3. Able to understanding different algorithms for Audio and video Processing and retrieval.

4. Understanding the current trends in video search.		
Course Contents:		
1.	Program on multimedia database system	10
2.	Structured analysis and feature extraction techniques for text ,image ,audio ,video	15
3.	Various Indexing techniques for text , image ,audio ,video and implementation.	15
4.	Various similarity measure techniques for text , image ,audio ,video and implementation.	10
5.	Program on Image processing and content base image retrieval	15
6.	Program on speech recognition, audio retrieval	15
7.	Program on video search	10
8.	Study of various tools for Multimedia Processing System	10

Text Books:	
1	Multimedia Database Management Systems, Guojun Lu, Artech House.
2	An Introduction to Information Retrieval, Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, Cambridge University Press , England .
Reference Books :	
1	Multimedia Content and the Semantic Web - Methods, Standards and Tools Edited by Giorgos Stamou and Stefanos Kollias, John Wiley & Sons Ltd.
2	Multimedia Image and Video Processing , Series Editor: Phillip A. Laplante, CRC Press
3	Digital Image Processing, Gonzales and Woods
4	Fundamentals of Digital Image Processing-Anil K Jain, Pearson Education

Programme Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO0316_T**
Course Title	**:**	**Elective 2 Algorithms And Complexity**
Course Prerequisites: Fundamental of computer science, discrete mathematics and probability theory and statistics.		
Course Objectives		

1. To develop mathematical skills for algorithm design, analysis, evaluation and computational cost.
2. Ability to understand and design algorithms using greedy strategy, divide and conquer, dynamic programming
3. They will assimilate, evaluate and analyze information as a result of independent or group research.
4. Basic knowledge of computational complexity of algorithms.

Course Outcomes

1. They will conduct formal reasoning about complexity and algorithmic efficiency.
2. They will recognize the design technique of standard algorithms, and apply these techniques to develop new computational solution to problems.
3. Ability to analyze runtime asymptotic complexity of algorithms including formulating recurrence relations.
4. They will formulate practical solution to a problem, making effective use of time and resource available.

Course Contents		
1	**The Role of Algorithms in Computing Algorithms.** Algorithms as a technology fundamental of algorithmic problem solving. fundamental of the analysis of algorithm efficiency. analyzing algorithms ,designing algorithms growth of functions, asymptotic notation, , substitution method the recursion-tree method , the master method	20
2	**Graph Algorithms :** Graph traversals ,Minimum spanning trees , Single Source Shortest paths, All pair shortest path ,Maximum flow	20
3	**Divide and Conquer**: Merge sort, quick sort, binary search, binary tree traversal and related properties, multiplication of large integers , stassen's matrix multiplication closest pair and convex- hull problem by divide and conquer	10
4	**Dynamic Programming:** assembly-line scheduling, matrix-chain multiplication elements of dynamic programming. longest common subsequence optimal binary search trees.	15
6	**Greedy Algorithms**: An activity-selection problem ,elements of the greedy strategy huffman codes, theoretical foundations for greedy methods, sorting networks. a bitonic sorting network, a merging network, inverting matrices formulating problems as linear programs. the simplex algorithm.	15
7	**NP-completeness**: NP-completeness, Approximability of NP- Hard Problems Polynomial time , Polynomial-time verification , NP-completeness and reducibility, NP-completeness proofs NP-complete problems ,Formal models of NP-Completeness Complexity classes such as RP, NC , # P , PSPACE.	10
9	**Approximation Algorithms** : The traveling-salesman problem, The set-covering problem Randomization and linear programming, The subset-sum problem	10

Text Books		
1	T. H .Corman, C. E .Leiserson and R.L. Revest, Introduction to algorithms, MIT press 1990.	
2	Algorithm Design Jon Kleinberg ,Éva Tardos Pearson/Addison-Wesley	
Reference Books		
1	A. V. Aho, J. E Hopecroft and J.D. Ullman, The design and analysis of algorithm, Addision-Wesley, 1974.	

Programme Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO 0316_P**
Course Title	**:**	**Elective 2 Algorithms and Complexity Lab**

Course Prerequisites: Computer Algorithms

Course Objectives

1. To develop mathematical skills for algorithm design, analysis, evaluation and computational cost.
2. Ability to understand and design algorithms using greedy strategy, divide and conquer, dynamic programming
3. They will assimilate, evaluate and analyze information as a result of independent or group research.
4. Basic knowledge of computational complexity of algorithms.

Course Outcomes

1. They will conduct formal reasoning about complexity and algorithmic efficiency.
2. They will recognize the design technique of standard algorithms, and apply these techniques to develop new computational solution to problems.
3. Ability to analyze runtime asymptotic complexity of algorithms including formulating recurrence relations.
4. They will formulate practical solution to a problem, making effective use of time and resource available.

Course Contents		
1	Implementation of Searching and sorting programs.	20
2	Implementation of Dynamic Programming.	20
3	Implementation of Graph algorithms.	20
4	Implementation of NP-Completeness.	20
5	Implementation of Pattern matching .	20

Text Books		
1	T. H .Corman, C. E .Leiserson and R.L. Revest, Introduction to algorithms, MIT press 1990.	
2	Algorithm Design Jon Kleinberg ,Éva Tardos Pearson/Addison-Wesley	
Reference Books		
1	A. V. Aho, J. E Hopecroft and J.D. Ullman, The design and analysis of algorithm, Addision- Wesley, 1974.	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – I**	
Course Code	**:**	**CO 0316_T**		
Course Title	**:**	**Elective 2 Semantic Web and Social Networks**		
Course Prerequisites: Web Engineering				
Course Objectives 1. To learn Web Intelligence 2. To learn Knowledge Representation for the Semantic Web 3. To learn Ontology Engineering 4. To learn Semantic Web Applications, Services and Technology 5. To learn Social Network Analysis and semantic web				
Course Outcomes 1. To apply knowledge representation for the semantic web 2. To apply ontology engineering 3. To apply semantic web applications, services and technology				
Course Contents				
1	**Web Intelligence :**Thinking and intelligent web applications, the information age ,the world wide web, limitations of today's web, the next generation web, machine intelligence, artificial intelligence, ontology, inference engines, software agents, berners-lee www, semantic road map, logic on the semantic web.			10
2	**Knowledge Representation for the Semantic Web:** ontologies and their role in the semantic web, ontologies languages for the semantic web –resource description framework(rdf) / rdf schema, ontology web language(owl), uml,xml/xml schema.			20
3	**Ontology Engineering:** ontology engineering, constructing ontology, ontology development tools, ontology methods, ontology sharing and merging, ontology libraries and ontology mapping, logic, rule and inference engines.			10
4	**Semantic Web Applications, Services and Technology :**semantic web applications and services, semantic search, e-learning, semantic bioinformatics, knowledge base ,xml based web services, creating an owl-s ontology for web services, semantic search technology, web search agents and semantic methods,			20
5	**Social Network Analysis and Semantic Web:** what is social networks analysis, development of the social networks analysis, electronic sources for network analysis –			20

	electronic discussion networks, blogs and online communities, web based networks. building semantic web applications with social network features.web page speed, build on a css architecture	
6	**Developing Social Semantic Applications:** Building semantic web applications with social network features, flink- the social networks of the semantic web community, open academia: distributed, semantic-based publication management.	10
7	**Evaluation of Web-Based Social Network Extraction:** differences between survey methods and electronic data extraction, context of the empirical study, data collection, preparing the data, optimizing goodness of fit, comparison across methods and networks, predicting the goodness of fit, evaluation through analysis.	10
Text Books		
1	Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.	
2	Social Networks and the Semantic Web, Peter Mika, Springer, 2007.	
Reference Books		
1	Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies, R.Studer, P.Warren, John Wiley & Sons.	
2	Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)	
3	Information Sharing on the semantic Web - Heiner Stuckenschmidt;Frank Van Harmelen, Springer Publications.	
4	Programming the Semantic Web, T.Segaran, C.Evans, J.Taylor, O'Reilly, SPD.	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – I**
Course Code	**:**	**CO 0316_P**	
Course Title	**:**	**Elective 2 Semantic Web and Social Networks**	

Course Prerequisites:

Course Objectives

1. To learn Web Intelligence
2. To learn Knowledge Representation for the Semantic Web
3. To learn Ontology Engineering
4. To learn Semantic Web Applications, Services and Technology
5. To learn Social Network Analysis and semantic web

Course Outcomes

1. To apply Knowledge Representation for the Semantic Web
2. To apply Ontology Engineering
3. To apply semantic Web Applications, Services and Technology
4. Analysis ,design and optimized website implementation

Course Contents		
1.	Graphically represent ontology and construct ontology from semantic web.	20

2.	To construct Mashup in the semantic web for an application.	20
3.	To create semantic Web Applications	20
4.	To use XML Schema ,Asynchronous JavaScript and XML in the web application .	20
5.	Ontology Construction Using Protégé OWL by using ontology construction.	20

Text Books	
1	Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.
2	Social Networks and the Semantic Web, Peter Mika, Springer, 2007.
Reference Books	
1	Semantic Web Technologies, Trends and Research in Ontology Based Systems,J.Davies, R.Studer, P.Warren, John Wiley & Sons.
2	Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
3	Information Sharing on the semantic Web - Heiner Stuckenschmidt;Frank Van Harmelen, Springer Publications.
4	Programming the Semantic Web, T.Segaran, C.Evans, J.Taylor, O'Reilly, SPD.

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – I**
Course Code	**:**	**CO 0316_T**	
Course Title	**:**	**Elective 2 Web Personalization And Optimization**	

Course Prerequisites: Web technologies

Course Objectives

1. To know the modeling technologies for Web Applications.
2. To know methods and strategies for personalized web-pages.
3. To know Web-based applications based on different real-world examples.
4. To know Challenges and Optimization of Web-based applications.

Course Outcomes

1. Understanding different web modeling techniques, technologies for web personalization.
2. Understanding HTML, CSS rule syntax and principles behind the separation of presentation from content, server-side scripting.
3. Understanding different real-world adaptive applications.
4. Understanding the problems and challenges, Web page optimization, Web performance optimization.

Course Contents		
1	**Modeling Technologies:** User models for adaptive hypermedia and adaptive educational systems, User profiles for personalized information access**,** Data mining for Web personalization, Generic user modeling systems, Document modelling	10
2	**Adaptation Technologies:** Personalized search on the World Wide Web**,** Adaptive focused crawling**,** Adaptive navigation support**,** Collaborative filtering**,** Content-based filtering and recommendation**,** Hybrid Web recommender systems**,** Case-base recommendation**,** Adaptive 3D Web sites**,** Adaptive collaboration support for the Web, Adaptive presentation for the Web, Social Navigation, Social Web Search	20

3	**Applications:** Adaptive systems in health care**,** Adaptive techniques in Web-based education**,** Personalization in e-commerce applications**,** Web-based mobile guides, Adaptive news access	20
4	**Challenges:** Semantic Web metadata, ontologies, and reasoning for personalized information access on the Web**,** Privacy-enhanced web personalization**,** Open corpus adaptive hypermedia **,** Group recommendation, Empirical evaluation of personalized websites	20
5	**Web Page Optimization and CSS Optimization:** common web page problems**,** how to optimize your web page speed**,** build on a css architecture, tips for optimizing css	20
6	**Advanced Web Performance Optimization:** Server-Side Optimization Techniques, Client-Side Performance Techniques.	10
Text Books		
1	The Adaptive Web: Methods and Strategies of Web Personalization. Brusilovsky, P., Kobsa, A., Neidl, W. (eds.)	
2	Web Optimization, Andrew B. King, O'Reilly, 2008	
Reference Books		
1	Website Optimization Metrics, David Artz, Daniel Shields, and Andrew B. King	
2	Specifications Of Building Scalable Web Sites (Building, Scaling, And Optimizing The Next Generation Of Web Applications), Cal Henderson, O'Reilly Media, 2006	
3	Search Engine Optimization Secrets, Erik Dafforn, Danny Dover, 2011	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – I**
Course Code	**:**	**CO0316_P**	
Course Title	**:**	**Elective 2 Web Personalization and Optimization Lab**	

Course Prerequisites: Web technologies

Course Objectives

1. To know the modeling technologies for Web Applications.
2. To know methods and strategies for personalized web-pages.
3. To know Web-based applications based on different real-world examples.
4. To know Challenges and Optimization of Web-based applications.

Course Outcomes

1. Understanding different web modeling techniques, technologies for web personalization.
2. Understanding HTML, CSS rule syntax and principles behind the separation of presentation from content, server-side scripting.
3. Understanding different real-world adaptive applications.
4. Understanding the problems and challenges, Web page optimization, Web performance optimization.

Course Contents		
1	Analysis ,design and implementation of web site	30
2	Analysis and design and implementation of web personalization system	30
3	Analysis ,design of adaptive and responsive web design	20

4	Semantic Web applications and services, Semantic Search, e-learning	20
Text Books		
1	The Adaptive Web: Methods and Strategies of Web Personalization. Brusilovsky, P., Kobsa, A., Neidl, W. (eds.)	
2	Web Optimization, Andrew B. King, O'Reilly, 2008	
Reference Books		
1	Website Optimization Metrics, David Artz, Daniel Shields, and Andrew B. King	
2	Specifications Of Building Scalable Web Sites (Building, Scaling, And Optimizing The Next Generation Of Web Applications), Cal Henderson, O'Reilly Media, 2006	
3	Search Engine Optimization Secrets, Erik Dafforn, Danny Dover, 2011	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO0317**	
Course Title	**:**	**Research Methodologies**	

Prerequisites: statistics

Course Objectives

1. Demonstrate familiarity with major concepts, theoretical perspectives, empirical findings, and historical trends.

2. Understand and apply basic research methods including research design, data analysis, and interpretation.

3. Propose a research study and justify the theory as well as the methodological decisions, including sampling and measurement.

4. Understand the importance of research ethics and integrate research ethics into the research process.

Course Outcomes

1. To define research and describe the research process and research methods.

2. To understand the processes and requirements for conducting successful research.

3. To know how to apply the basic aspects of the research process in order to plan and execute a

research project. 4. To be able to present, review and publish scientific articles.		
Course Contents		
1	**Introduction to Research Methods:** Definition and Objectives of Research, Various Steps in Scientific Research, Types of Research; Research Problem , Research Design , Survey Research - Case Study Research	10
2	**Sampling and Data Collection** : , Sampling , Sampling errors, Non sampling errors, Measurement and Scaling techniques , Methods of data collection: Primary Data, Secondary Data; Procedure Questionnaire, Survey and Experiments , Design of Survey and Experiments , Sampling Merits and Demerits , Control Observations , Procedures, structured problems and algorithms , Efficient data reduction methods & strategies for optimization	15
3	**Computer Application in Research Methodology:** SPSS software ,Descriptive statistics ,Bivariare statistics ,Regression analysis, Data Processing and Modeling :Data processing & Measures Mathematical model formulation for queries using relational algebra, set theory & functions , Design of software Architecture ,Database design ,Algorithm Design ,GUI design ,	20
4	**Model Building and Decision making :**,Model building and decision making ,stages in model building and types of decision making models, Probability Distributions, Fundamentals of Statistical Analysis and Inference, Correlation and Regression ,Classification ,Clustering	20
5	**Report writing**: Structure and Components of Research Report, Types of Report, Layout of Research Report, Writing research proposal ,Mechanism of writing a research report, Performance evaluation and curve fitting, Result declaration by various graphs & charts	15
6	**Application Of Results and Ethics** , Environmental impacts , Ethical issues , ethical committees , Commercialization , Code of Research Ethics Intellectual property rights: ,Trademark ,Copyright, Patent ,Plagiarism , royalty, Citation and acknowledgement , Reproducibility and accountability ,IT Act.	10
6	**Case Studies**	10
Text Books		
1	Research Methodology by G.C.Ramamurthy Dreamtech Publications	
2	C.R. Kothari, Research Methodology Methods and Techniques, 2/e, VishwaPrakashan, 2006	
Reference Books		

1	Engineering Optimization methods and applications A.ravindran ,Wiley publication
2	Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd., 2006.

Programme Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO0318**
Course Title	**:**	**Cloud Architecture ,Infrastructure and Technology**

Prerequisites: distributed computing

Course Objectives

1. Student will learn basics of cloud computing
2. Students will learn virtualization
3. Student will learn Hypervisor

Course Outcomes

1. Students will be able to design Cloud Applications.
2. Students will be able to handle data in cloud .
3. Students will be able to use virtualization.

Course Contents

1.	**Cloud Computing Fundamentals :**Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Business Agility:. Application availability, performance	10
2.	**Cloud Architecture :** Benefits and challenges to Cloud architecture ,Cloud application architecture	10
3.	**Cloud Infrastructure :** Cloud Infrastructure models, Scaling cloud Infrastructure ,Cloud scale	10
4.	**Cloud Computing Technology :** Hardware and Infrastructure : Clients thin, thick ,security, data leakage, offloading work ,Network: basic public internet, the accelerated internet optimized internet overlay ,site-to-site vpn, cloud providers ,cloud consumers ,redundancy ,services ,identity integration, mapping ,payments , search **,** Virtualization technology , Hypervisor ,Accessing the Cloud : Platforms , Web Applications , Web APIs , Web Browsers ,Cloud Storage:	10

	Storage as a Service , Providers , Cloud Storage Providers , Standards	
5.	**Application Development:** Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App ,	10
6.	**Data in Cloud** :Cloud file systems :GFS ,HDFS ,Bigtable ,Hbase and Dynamo ,Cloud store :Datastore ,simpleDB ,Map reduce : Map reduce Model , Parallel efficiency of Map reduce ,Map reduce examples	10
7.	**Security in Cloud :**Infrastructure Security, Data Security and Storage, Security Management in Cloud Computing , Multi-tenancy Issues: Isolation of users/VMs from each other., Virtualization System Security Issues: e.g. ESX and ESXi Security, ESX file system security, storage considerations, backup and recovery; Virtualization System Vulnerabilities,VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities	10
8.	**Different cloud Environments** :Eucalyptus ,Azure, Aneka, Openstack	10
9.	**Conventional Encryption** : Algorithms, Confidentiality Using Conventional Encryption Public Key Cryptography, Message Authentication and Hash Functions Hash and MAC Algorithms	10
10	**Storage Introduction:**,Need for storage networking SAN, NAS, SAN/NAS Convergence .Distributed Storage Systems,	10

Text Books

1	Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" McGraw-Hill Osborne Media; 1 edition [ISBN: 0071626948], 2009.
2	Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications [ISBN: 978-0521137355].
3	Mastering Cloud Computing by Prof. Raj Buyya ISBN: 9781259029950 Mc-Graw Hill

Reference Books :

1	Greg Schulz, "Cloud and Virtual Data Storage Networking", Auerbach Publications [ISBN: 978-1439851739], 2011
2	Cloud Security and Privacy: An Enterprise Perspective.. by Tim Mather
3	Cloud Application Architectures: Building Applications and Infrastructure in the Cloud George Reese

Programme Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO0319_T**
Course Title	**:**	**Advance Database Management Systems**

Prerequisites: Database Systems, Relational Database Concepts, Relational Algebra, SQL

Course Objectives

1. To comprehend the essential principles of the design, analysis and use of

contemporary DBMS systems.

2. To implement Web database applications that interact with a back end DBMS.
3. To familiarize with techniques associated with data integration.
4. To implement web data mining application and its data integration.

Course Outcomes

1. Ability to understand the distributed concurrency control, database recovery, query optimization, spatial databases, parallel database, deductive database, multimedia database.

2. Ability to understand the background and knowledge of some contemporary topics in database research; typical topics are data mining, uncertainty data management, XML data.

3. Ability to understand the information management, cloud computing, web information management and social network technology.

4. Ability to understand and apply the techniques to web data mining.

Course Contents

1.	**Multimedia Databases :** multimedia database system fundamentals , multimedia data access, multimedia information modeling and querying , multimedia database, multimedia communication, multimedia storage and retrieval, multimedia programming	10
2.	**Spatial Databases :**Types of spatial data and queries, application involving spatial data. spatial indexes, indexing based on space filling curves, grid files, r-trees: point and region data, high dimensional indexing ,spatial database programming	10
3.	**Distributed Database :**Distributed dbms, data fragmentation, replication, and allocation techniques for distributed database design, query processing in distributed databases.	10
4.	**Parallel Database :**Introduction, i/o parallelism, inter-query parallelism, intra-query parallelism, intra-operation parallelism, inter-operation parallelism, design of parallel systems. parallel query processing .	10
5.	**Building Operational Systems :** Analysis& design of operational systems, data and processing modeling using multimedia data, implementation of operational systems.	10
6.	**Building Data Warehouse :** Modeling, architecture and practices, extraction, transformation and loading, implementation of data warehouse & testing. tools : informatica and cognoz .	10
7.	**Data Mining:** Classification, clustering, association, multimedia data mining. Web mining	10
8.	**Database Administration and security**	10
9.	**Transaction processing:** concurrency control and recovery management	10
10.	**Case Studies and Applications**	10

	Text Books	
1	Fundamentals of Database Management systems ,Elmasri ,Navathe ,Pearson Education	
2	Spatial database by Shashi shekhar,sanjay chawla “Pearson education”	
3	“Distributed database systems” by chhanda ray “Pearson publication”	
4	V.S. Subrahmanian, “Multimedia database systems”, Springer, 1996.	
	Reference Books	
1.	Jiawei Han and Micheline Kamber, “Data Mining –concepts and Technique”, 3rd Edition, Morgan Kaufmann, 2012.	
2.	Rajan Chattamvelli, “Data Mining Methods”, Alpha Science International, 2009.	
3.	Thomas Connolly and Carolyn Begg, “Database Systems” 3rd Edition, Addison-Wesley, 2005.	

Programme Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO0319_P**
Course Title	**:**	**Advance Database Management Systems Lab**
Course Prerequisites: Database management systems		
Course Objectives 1. Know database implementation and tools. 2. Introduce object databases, databases that handle complex data types. 3. Understand the difference between object-oriented databases and object-relational databases. 4. Identify and understand the components of warehousing.		
Course Outcomes 1. Understand operational database, warehousing and multidimensional need of data base to		

meet industrial needs.

2. Explain the Database Security and Authorization.

3. Identify and understand the Business analysis, query tools and application, OLAP etc.

4. Introduce with and gain knowledge about data mining, decision tree, neural networks and clustering.

Course Contents		
1.	Building Multimedia database systems	15
2.	Building Spatial database systems	10
3.	Building distributed & parallel database system	15
4.	To Build Data ware house system using oracle	15
5.	To apply data mining Algorithms on the data	15
6.	To study ETL Tools and Reporting tools and its application/use in building data ware house system	15
7.	Database administration and security	15

Text Books

1	Fundamentals of Database Management systems ,Elmasri ,Navathe ,Pearson Education
2	Spatial database by Shashi shekhar,sanjay chawla "Pearson education"
3	"Distributed database systems" by chhanda ray "Pearson publication"
4	V.S. Subrahmanian, "Multimedia database systems", Springer, 1996.

Reference Books

1	"Jiawei Han and Micheline Kamber, "Data Mining –concepts and Technique", 3rd Edition, Morgan Kaufmann, 2012.
2	"Rajan Chattamvelli, "Data Mining Methods", Alpha Science International, 2009.
3	"Thomas Connolly and Carolyn Begg, "Database Systems" 3rd Edition, Addison-Wesley, 2005.
4	"Shashi Shekhar and Sanjay Chawla, "Spatial Databases", Pearson Education, 2009.

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO0320_T**	
Course Title	**:**	**Information Security**	

Prerequisites: Computer Networks, Operating Systems, DBMS

Course Objectives

1. The course provides a comprehensive view of the Information security principles and measures to prevent vulnerability and security attacks.

2. To learn Program Security, System Security

3. To learn Network and Web Security

Course Outcomes

1. Understands the concept of threats, vulnerability and control
2. Will able to code: security in programs, including applications, operating systems, database management systems and networks.
3. Understands the fundamental concepts of web security.
4. Understands security law, privacy, ethics: non-technical approaches by which society controls computer security risks

Course Contents

1.	**Cryptography :** : introduction: what does 'security' mean? , attacks , computer security , computer criminals, Security Services, Security Mechanisms ,A Model for Network Security ,DES ,AES,RSA ,Diffie-Hellman Key Exchange, Hash Algorithm ,Digital signature , Cryptanalysis	10
2.	**Program Security:** secure software architecture design, architectural risk analysis , threat analysis , attack patterns , common software code vulnerabilities , software security testing , non-malicious program errors , virus and other malicious code , control against threats.	10
3.	**Database Security :** vulnerabilities in database , security requirements , reliability and integrity , sensitive data , inference , multilevel database , proposal for multilevel security , defense mechanism ,data mining and security	10
4.	**Web Security:** web security: obfuscation , web sites , web servers , web browsers , attacking application logic , attacking users: sql injection, cross-site scripting , a web application hackers methodology, attacks and defense mechanisms, Attacking web authorization , Attacking web authentication ,Attacking web application ,Web hacking tools	10

5.	**System Security :** protection in general-purpose operating system: vulnerabilities in operating system ,security and controls , protected objects and methods of protection ,memory and address protection , control of access to general objects , local access control (case study - linux) , user authentication, os hardening	20
6.	**Network Security:** vulnerabilities in network and web , network security controls , firewalls , intrusion detection systems , network layer, transport layer, application layer vulnerabilities , routing protocol vulnerabilities, Security protocols vulnerabilities ,attacks and defense mechanisms	25
7.	**Digital Forensic Analysis :** Forensic terminology and developing forensic science capabilities: traditional problems in computer investigations , processing crimes and incident scenes , working with dos and windows systems , current computer forensic tools , recovering graphic files , network forensic , email investigations , Processing of Evidence and Report Preparation	15

Text Books	
1	Charles P. Pfleeger, 'Security in Computing', Prentice Hall Publication.
2	Benard Menezes "Network security and Cryptography " Cengage learning publications
3	Kamini C. Nalavade, Dr. B. B. Meshram, 'Network Attack and Defense Mechanisms', Research India Publications.
Reference Books	
1	Hacking Exposed Web Applications, 3rd Edition By Joel Scambray, Vincent Liu, Caleb Sima, MC-Graw Hill
2	"Computer Forensics JumpStart " by Michael G. Solomon ,Diane Barrett, Neil Broom SYBEX publications
3	Marjie Britz, 'Computer Forensic and Cyber Crime', Pearson.
4	Nelson, Phillips, Enfinger, Steuart, 'Computer Forensic and Investigations', Cengage Learning, India Edition.

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO0320_P**	
Course Title	**:**	**Information Security Lab**	
Course Prerequisites: Computer Networks, Operating Systems, DBMS			

Course Objectives

1. The course provides a comprehensive view of the Information security principles and measures to prevent vulnerability and security attacks.

2. To learn Program Security, System Security

3. To learn Network and Web Security

Course Outcomes

1. Understands the concept of threats, vulnerability and control
2. Will able to code: security in programs, including applications, operating systems, database management systems and networks.
3. Understands the fundamental concepts of web security.
4. Understands security law, privacy, ethics: non-technical approaches by which society controls computer security risks

Course Contents		
1	**Program Security**: For the given case study apply secure software life cycle.	10
2	**System Security**: Information system security management, Study of Windows security, UNIX and Linux Security.	20
3	**Database Security**: Data Management, security Management, Performance Monitoring, backup and recovery using oracle	10
4	**Web Security**: Web Browser and Client Security, Web Security, Electronic Mail Security, Server Security,	10
5	**Network Security**: Network monitoring, Host monitoring, Network scanning Network attacks and Defense Mechanism tools, Firewalls, IDS.	10
6	**Study of Network Monitoring and analysis Tools:** Wireshark, PacketTracer, NetworkMiner, ntopng, Vulnerability scanning :Nessus,Nikto, webInspect etc	20
7	**Digital Forensic Analysis**: Case Study on Forensic analysis and documentation, Integrated Cyber Security. Forensic tools and Antiforensic tools	20

Text Books

1	Charles P. Pfleeger, 'Security in Computing', Prentice Hall Publication.
2	Benard Menezes "Network security and Cryptography " Cengage learning publications
3	Kamini C. Nalavade, Dr. B. B. Meshram, 'Network Attack and Defense Mechanisms', Research India Publications.

Reference Books

1	Hacking Exposed Web Applications, 3rd Edition By Joel Scambray, Vincent Liu, Caleb Sima, MC-Graw Hill
2	"Computer Forensics JumpStart " by Michael G. Solomon ,Diane Barrett, Neil Broom SYBEX publications
3	Marjie Britz, 'Computer Forensic and Cyber Crime', Pearson.
4	Nelson, Phillips, Enfinger, Steuart, 'Computer Forensic and Investigations', Cengage Learning, India Edition.

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO0321**	
Course Title	**:**	**Elective 3 Software Project Management**	

Prerequisites: Project Management

Course Objectives

1. The course provides a comprehensive view of Software Project Management
2. To learn Managing people

Course Outcomes:

1. Understands the concept of Software Project Management
2. Understands the fundamental concepts of Project Evaluation.

Course Contents:

1.	**Introduction To Software Project Management:** Project Definition , Contract Management , Activities Covered By Software Project Management , Overview Of Project Planning , Stepwise Project Planning.	10
2.	**Project Evaluation:** Strategic Assessment , Technical Assessment , Cost Benefit Analysis ,Cash Flow Forecasting , Cost Benefit Evaluation Techniques , Risk Evaluation.	10
3.	**Structured Project Management: :** Software Project Planning: Software scope ,Resources, Software Project Estimation ,Decomposition Techniques ,Empirical Estimation Model **,** Risk Analysis: Identification; Risk Projection; Assessment; Monitoring and Managing the Risk	20
4.	**Project Scheduling:** Project Scheduling Relationship between people and efforts ,Defining task set of project ,Selecting software engineering Tasks ,Defining a task network ,Scheduling	15
5.	**Object Oriented Software Project Management :**Technical metrics for Object Oriented systems ,Metrics for OO Design model ,class oriented metrics ,Operation oriented Metrics ,Metrics for object oriented testing ,Metrics for object oriented Projects	20

6.	**Web based Software Project Management:** The attributes of web based applications ,The WebE process ,framework for WebE, Formulate web based systems ,Design for web based application	15
7.	**Security in Software Project Management :**Secure software life cycle, Security in software project	10

Text Books:	
1	Roger Pressman "Software Engineering :A practitioner approach" TMH
2	Bob Hughes, Mikecotterell, "Software Project Management", Third Edition, Tata McGraw Hill, 2004.
Reference Books:	
1	Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
2	Royce, "Software Project Management", Pearson Education, 1999.
3	Jalote, "Software Project Management in Practice", Pearson Education, 2002.

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**	
Course Code	**:**	**CO0321**		
Course Title	**:**	**Elective 3 Programming Paradigms for Concurrency control**		
Prerequisites: operating system				
Course Objectives 1. To know basics of Programming Paradigms for concurrency. 2. To know the applications and case study of programming paradigms. To know the problems and issues in transaction and message passing programming paradigms.				
Course Outcomes 1. To apply mutual exclusion, concurrent objects and Linearizability. 2. To analyze case study on lazy,lock-free implementation and its properties. 3. To analyze performance and correctness issues in TM and message passing paradigms.				
Course Contents				
1	**Introduction:** Shared objects and synchronization ,producer consumer problem, parallel programming			20

2	**Mutual exclusion:** Time ,critical sections ,Thread solutions ,Filter lock	10
3	**Theory of Concurrent Objects:** concurrency and correctness, sequential objects ,Formal definitions ,Java Memory model , Proving Linearizability	20
4	**Foundations of shared memory:** The space of registers ,Register constructions ,atomic snapshots	10
5	**Monitors and Blocking synchronization :**Introduction,Monitor lock and conditions, Reader writer locks ,Semaphores	10
6	**Case study:** Concurrent Linked Lists fine-grained locking, optimistic, lazy, lock-free implementations	10
7	**Introduction to transactional memories:** Introduction**,** Hardware TM,Transactions and atomicity ,Hardware TM , Software transactional memories	10
8	**Linked list :**Introduction ,List based sets ,concurrency reasoning ,fine grained synchronization	10
Text Books:		
1	The Art of Multiprocessor Programming. Herlihy and Shavit, Morgan Kaufmann, 2008.	
2	Concurrent Programming in ML. Reppy, Cambridge University Press, 1999.	

Programme Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO0321**
Course Title	**:**	**Elective 3 Parallel and Distributed Algorithms**

Course Prerequisites: Data Structure, Algorithms.

Course Objectives

1. To provide students with contemporary knowledge in parallel and distributed computing.
2. To equip students with skills to design and analyze parallel and distributed applications.
3. To introduce basic algorithm, programming and Computer Engineering issues associated with the development of parallel applications.

Course Outcomes

1. Understand the evolution of high performance computing with respect to laws and contemporary notion that involves mobility for data, hardware devices and software agents.
2. Understand, appreciate and apply parallel and distributed algorithms in problem solving.
3. Evaluate the impact of network topology on parallel algorithm formulations and traffic

	their performance.	
Course Contents		
1	**Introduction to Distributed System:** Defining distributed system, hardware concepts, software concepts, architecture of distributed system, Distributed algorithms.	10
2	**Parallel architecture:** Inter-process communication, Synchronization, Mutual exclusion, Basics of parallel architecture, Parallel programming with message passing using MPI	15
3	**The Protocol Models:** The transition systems and Algorithms, Properties of transition system, Casual order of events and logical clocks, additional assumptions and complexity.	10
4	**Routing Algorithms and Deadlock-free packet switching:** Destination-based routing, All-pairs shortest path algorithm, Net change algorithm, Routing with compact routing tables, Hierarchical routing, introduction to packet-switching and deadlock in packet-switching network, structured solution, and unstructured solutions.	20
5	**Termination Detection:** Introduction and definition, Computation trees and forests, web-based solutions. other solutions**.**	10
6	**Election Algorithms:** Introduction, Ring Networks, Arbitrary network, The Korach-Kuttan-Moran Algorithm, Introduction to anonymous networks, A probabilistic election algorithm, two snapshot algorithms, preliminaries of sense of direction and orientation, Election in rings and chordal rings, computing in hypercubes and complexity related issues.	10
7	**Synchrony in Networks:** Introduction, Election in synchronous networks, Synchronizer algorithm, Application: BFS	05
8	**Fault tolerance in distributed system:** Reasons to use fault tolerance algorithms, Robust algorithms, stabilizing algorithms.	10
9	**Fault tolerance in asynchronous and synchronous systems:** Fault tolerance in asynchronous systems: Impossibility of consensus, initially dead processes, probabilistic consensus algorithm. Fault tolerance in synchronous systems: Synchronous Decision Protocols, Authenticating, protocols, Clock synchronization Failure detection and solving it with a Weakly accurate detector	05
10	**Principles of Parallel Algorithm Design:** Decomposition Techniques, Characteristics of task and interactions, Mapping technique for load balancing, Method for containing Interaction overhead, Parallel algorithm model.	05

Text Books	
1	Gerard Tel, “Introduction to Distributed Algorithms”, Cambridge University Press
2	Lynch, Nancy A. Lynch, “Distributed Algorithms”, The Morgan Kaufmann Series in Data Management Systems, Book, ISBN: 1558603484
3	Introduction to parallel programming by Ananth Garma ,Anshul Gupta Pearson Publication
Reference Books	
1	George F. Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems: Concepts and Design”, Pearson Education

Programme Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO0321**
Course Title	**:**	**Elective 3 Big Data Analytics**

Prerequisites: Database Management System, Java, AI, Machine Learning.

Course Objectives

1. Being able to utilize and apply the data analytics lifecycle to big data analytics projects.
2. Apply appropriate analytic technique and tools to analyze big data , develop ML and statistical models and recognize insights that leads to actionable work items.
3. Have a basic understanding of R and RStudio, data visualization technique, as well as hadoop.

Course Outcomes

1. Presented with data, students will choose the appropriate modeling technique, build the model, check validity of the model and revise if necessary and employ the model for estimation and prediction.
2. Students will propose and carry out projects , presenting results in written or oral form.
3. Students will use the model statistical computing environments, SAS and R to carry out the analysis of data.

Course Contents		
1	**Introduction To Big Data:** Introduction to BigData Platform , Challenges of Conventional Systems , Intelligent data analysis , Nature of Data , Analytic Processes	15

	and Tools , Analysis vs Reporting , Modern Data Analytic Tools , Statistical Concepts: Sampling Distributions , Re,Sampling , Statistical Inference , Prediction Error.	
2	**Data Analysis:** Regression Modeling , Multivariate Analysis , Bayesian Methods , Bayesian Paradigm , Bayesian Modeling , Inference and Bayesian Networks , Support Vector and Kernel Methods , Analysis of Time Series: Linear Systems Analysis , Nonlinear Dynamics , Rule Induction , Fuzzy Logic: Extracting Fuzzy Models from Data , Fuzzy Decision Trees	20
3	**Search Methods and Visualization:** Search by simulated Annealing , Stochastic, Adaptive search by Evaluation , Evaluation Strategies , Genetic Algorithm , Genetic Programming , Visualization , Classification of Visual Data Analysis Techniques , Data Types , Visualization Techniques , Interaction techniques , Specific Visual data analysis Techniques.	25
4	**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.	25
5	**Frameworks:** Map Reduce , Hadoop, Hive, MapR , Sharding , NoSQL Databases - S3 - Hadoop Distributed**,** File Systems , Case Study.	15
TextBooks:		
1	Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.	
2	Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.	
3	Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.	
4	Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007	
Reference Books		
1	Pete Warden, "Big Data Glossary", O'Reilly, 2011.	
2	Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.	
3	Da Ruan, Guoquing Chen, Etienne E.Kerre, Geert Wets, Intelligent Data Mining, Springer,2007	

4	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

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO0321**	
Course Title	**:**	**Elective3 :Real Time Systems**	

Course Prerequisites:

Course Objectives

1. To provide good understanding of fundamental concepts in real time systems.
2. To provide understanding of advanced topics in real time systems

Course Outcomes

1. Understand the basics and importance of real-time systems
2. To analyze Commercial RT Operating Systems

Course Contents		
1.	**Introduction :**Real-time systems, Applications ,Basic Model ,Characteristics ,Safety and Reliability, Real-Time tasks, Timing Constraints, Modelling Timing Constraints.	10
2.	**Scheduling Real-Time Tasks :**Concepts, Types of RT Tasks and their Characteristics, Task Scheduling, Clock-Driven Scheduling ,Hybrid Schedulers - Event-Driven Scheduling ,EDF Scheduling ,RMA – Issues with RMA,Issues in Using RMA in Practical Situations	20
3.	**Resource Sharing among RT Tasks & Scheduling RT Tasks:** Resource Sharing Among RT Tasks, Priority Inversion, PIP,HLP,PCP,Types of Priority Inversions Under PCP, Features of PCP, Issues in using Resource Sharing Protocol, Handling Task Dependencies, Multiprocessor Task Allocation, Dynamic Allocation of Tasks, Fault-Tolerant Scheduling of Tasks,Clocks in Distributed RT Systems , Centralized and Distributed Clock Synchronization.	20
4.	**Commercial RT Operating Systems :**Time Services, Features of RT OS,Unix as a RT OS,Unix Based RT OS, Windows as a RT OS,POSIX ,Survey of RTOS: PSOS ,VRTX, VxWorks,QNX - µC/OS-II,RT Linux,Lynx, Windows CE, Benching RT Systems.	10
5.	**RT Communication & Databases :**Examples of Applications Requiring RT Communication, Basic Concepts ,RT Communication in a LAN, Soft & Hard RT Communication in a LAN, Bounded Access Protocols for LANs, Performance Comparison ,RT Communication Over Packet Switched Networks ,QoS Framework	20

	,Routing, Resource Reservation, Rate Control, QoS Models , Examples Applications of RT Databases, RT Databases ,Characteristics of Temporal Data, Concurrency Control in RT Databases, Commercial RT Databases.	
6.	**Advances in Real time systems :** Distributed real-time systems, multiprocessor real-time systems	20
Text Books		
1	Jane W. Liu, "Real-Time Systems" Pearson Education, 2001.	
2	Rajib Mall, "Real-Time Systems: Theory and Practice," Pearson, 2008.	
Reference Books		
1	Krishna and Shin, "Real-Time Systems," Tata McGraw Hill. 1999.	
2	Alan C. Shaw, "Real-Time Systems and Software", Wiley, 2001.	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO0322_T**	
Course Title	**:**	**Elective 4 Network Attacks and Defense Mechanism**	
Course Prerequisites: Computer Networks, Information security			
Course Objectives 1. To gain the knowledge of Reconnaissance, Network Mapping and port scanning techniques. 2. To understand Vulnerabilities of different layers. 3. To understand about attacks on different layers and also the defense strategies. 4. To know about the Network Infrastructure devices and Security &Controls.			
Course Outcomes 1. They will be able to recognize Reconnaissance, Network Mapping and port scanning			

Techniques.

2. They will be able to recognize Vulnerabilities of different layers.

3. They will be able to secure different layer by knowing different attacks and by using the different defense strategies.

4. They will know about different Network infrastructure devices.

Course Contents		
1.	**Network Interface Layer Protocols attacks, vulnerabilities and defense mechanisms:** PPP Protocol ,Ethernet ,ARP: Protocol, vulnerabilities in ARP, attacks in ARP, defense mechanism for ARP **,** RARP: protocol, vulnerabilities in RARP , attacks in RARP, defense mechanism for RARP	10
2.	**Network Layer Protocols attacks, vulnerabilities and defense mechanisms:** IPV4/V6: protocol, vulnerabilities in IP V4/V6 ,attacks in IP V4/V6, defense mechanism for IP V4/V6, ICMP: Protocol vulnerabilities in ICMP, attacks in ICMP, defense mechanism for ICMP	10
3.	**Transport Layer Protocols: Attacks, vulnerabilities and Defense mechanisms:** TCP Protocol,. vulnerabilities in TCP,TCP Exploits , defense mechanism for TCP ,UDP Protocol,. vulnerabilities in UDP,UDP Exploits , defense mechanism for UDP	20
4.	**Application Layer Protocol:** DNS Protocol , vulnerabilities in DNS,DNS Exploits , defense mechanism for DNS , SNMP Protocol , vulnerabilities in SNMP , attacks in SNMP , defense mechanism for SNMP, FTP & TFTP Protocol , vulnerabilities in FTP & TFTP, attacks in FTP & TFTP, defense mechanism for FTP & TFTP, HTTP Protocol , vulnerabilities in HTTP, attacks in HTTP, defense mechanism for HTTP, SMTP Protocol , vulnerabilities in SMTP , attacks in SMTP , defense mechanism for SMTP	20
5.	**Routing Protocols and Vulnerability, Attacks and Defense mechanism:** Routing information protocol(RIP), vulnerabilities in RIP ,attacks in RIP , defense mechanism for RIP , vulnerabilities in OSPF ,attacks in OSPF, defense mechanism for OSPF, vulnerabilities in BGP ,attacks in BGP, defense mechanism for BGP , vulnerabilities in EGP ,attacks in EGP, defense mechanism for EGP .	20
6.	**TCP/IP security protocols:** vulnerabilities, attacks , defense mechanism of following protocols: IP security(IPsec),Secure socket layer,(SSL/TLS),secure shell(SSH),S/MIME architecture, Pretty good privacy(PGP),DNS security	20

Text Books	
1	Mrs.kamini Nalwade(Shirsath),Dr.B.B.Meshram "Network Attack and Defense Mechanism" by Research India Publication ,Delhi
Reference Books	
1	Kevin Lam, David LeBlanc, Ben Smith, Assessing Network Security , Publisher: Microsoft Press Released: June 2004
2	Chris McNab ,"Network Security Assessment", Publisher:O'Reilly Media Released:March 2004
3	Susan Young, dave Aitel "The hacker's Handbook", Auerbach publications

Programme Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO0322_P**
Course Title	**:**	**Elective 4 Network Attacks and Defense Mechanism Lab**

Course Prerequisites: Data Structure, Algorithms, security

Course Objective:

1. Study of network attacks
2. To learn defense mechanism
3. To learn packet analysis

Course Outcomes

1) Will be able to recognize different attacks techniques.

2) Understands different defense techniques.

3) Understands different security tools and software.

Course Contents		
1	Finding vulnerabilities in system	10
2	Port scan ,network scan	10

3	Attacks using Backtrack Operating system	20
4	Packet capture and analysis using wireshark	20
5	Configure Firewall	10
6	IDS-snort , IPS	10
7	Security services	20
Text Books		
1	Mrs.kamini Nalwade(Shirsath),Dr.B.B.Meshram "Network Attack and Defense Mechanism" by Research India Publication ,Delhi	
Reference Books		
1	Network Security Architecture By Sean Convery , ciscopress.	
2	Network Security Bible second edition by eric cole	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	
Course Code	**:**	**CO0322_T**	
Course Title	**:**	**Elective 4 Web Services and Service Oriented Architecture**	
Course Prerequisites: Web Technologies			
Course Objectives 1. Being able to utilize and apply the web technologies. 2. To learn Web Services 3. Have a basic understanding of soa lifecycle			
Course Outcomes 1. Students will use the web services 2. Students will use service orientation 3. Students will use XML,BPEL in Service Oriented Architecture			
Course Contents			
1.	**Introduction:** History of the Internet and World Wide Web ,HTML,HTTP, Introduction to JAVA Scripts ,Object Based Scripting for the web. Structures ,Functions ,Arrays ,Objects, Dynamic HTML,		10
2.	**Web server:**, Electronic Commerce ,E,Business Model ,Web Servers ,HTTP request types ,System Architecture ,Client Side Scripting and Server side Scripting ,Accessing Web servers ,IIS ,Apache web server.		10
3.	**Web Services :**XML,SOAP,WSDL,UDDI, Programming web services ,Restful example ,SOAP and REST		20
4.	**Service-Orientation:** Introduction to service-orientation, Problems solved by		10

	service-orientation, challenges introduced by service orientation, Effects of service-orientation on the enterprise, Origins and influences of service-orientation, Case study	
5.	**Principles Of Service Oriented Computing:** Use cases, Service oriented Architectures , Composing services	10
6.	**Introduction to BPEL:** File structure, scopes, message Exchange, variables and XPath , BPEL Activity Highlights: Start and assign activities; invoke, receive and reply activities. Web Service Application with JAX-WS and SAAJ.	20
7.	**Service Contracts**: Service Coupling Service Abstraction: Service Reusability: Service Autonomy Service Statelessness Service Discoverability: Contract explained, profiling this principle, Types of service contract standardization, Contracts and service design, Risk associated with service contract design	10
8.	**SOA Security:** SOA Security Goals and Fundamentals, Web Service Security Standards and Specifications, SOA Security Blueprints. Claiming and verifying identity with password, secure authentication with Kerberos	10
Text Books		
1	Service oriented Computing by M.Singh ,M.Huhns Wiley Publication	
2	SOA in practice by Nicolai M. Josuttis, OREILLY publications	
Reference Books		
1	Thomas Erl, "SOA Principles of Service Design", 1st Edition, Prentice Hall, 2007.	
2	SOA for business developer by Ben Margolis.	
3	Enterprise SOA by Dan Woods and Tomas Mattern O'Reilly publication	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO0322_P**	
Course Title	**:**	**Elective 4 Web Services and Service Oriented Architecture Lab**	

Course Prerequisites: Software Engineering

Course Objectives

1. To learn web service
2. To learn BPEL
3. To learn of SOA lifecycle

Course Outcomes

1. Students will be able to apply the web technogies
2. Students will be apply the techniques to implement xml schema

Course Contents		
1	XML schema	20
2	Creation of web service	20
3	To create a web service for adding few numbers using NetBeans and write client side code to invoke the web service	20
4	To create a web service for adding few numbers using NetBeans and write client side code to invoke the web service.	20
5	Create a SOA project with BPEL Module to compose a web service.	20
Text Books		
1	Michael Rosen, "Applied SOA", 1st Edition, Wiley India, 2008	
2	Shankar Kambhampaty, "Service-Oriented Architecture for Enterprise Applications", 1st Edition, Wiley, 2008.	
Reference Books		
1	Thomas Erl, "SOA Principles of Service Design", 1st Edition, Prentice Hall, 2007.	
2	Ramarao kanneganti and Prasad Chodavarapu, "SOA Security", 1st Edition, DreamTech Press, 2008.	

Programme Name	**:**	**M. Tech. (Computer Engineering)**
Course Code	**:**	**CO0322_T**
Course Title	**:**	**Elective 4 Distributed and Cloud Database System**
Prerequisites: Cloud Database, Map reduce		
Course Objectives 1. To learn Web services and REST. 2. To learn distributed systems and cloud computing 3. To learn Mapreduce		
Course Outcomes		

1. To apply heuristics to design high performing distributed database
2. To characterize algorithms that are optimally solved by MapReduce, to design and query large-scale databases, and to understand tradeoffs among distributed database, cloud databases, and data warehouses.
3. To provide an understanding of architecture and design tradeoffs of all aspects of distributed database

Course Contents

1.	**Introduction:** Introduction to distributed systems and cloud computing. Cloud architectures: SaaS, PaaS, IaaS. End-to-end system design. Networks and protocol stacks.	10
2.	**Client Server Computing** :Client-server computing. Sockets and remote procedure call.	10
3.	D**istributed File Systems :** Distributed file systems and cache consistency, NFS, AFS. Storage in the Cloud: Google file system	10
4.	**Web Services :**Web services and REST. Example: Amazon S3. The JAX-RS API. Persistent cloud services.	10
5.	**Three-Tier Middleware**.: Java EE APIs, Google App Engine, Contexts and dependency injection.	10
6.	**Transactions**. Atomic commitment protocols: 2PC and 3PC	10
7.	**Distributed Debugging:** Distributed debugging, Time and ordering of Events, Causal broadcasts.	10
8.	**Message Queues and Message Brokers**.: JMS and Atmosphere. Web sockets. Distributed snapshots. Highly available services. Replicated services, quorum consensus and viewstamp replication.	10
9.	**Database:** NoSQL data stores. Table-based: Google BigTable, Amazon Dynamo, Cassandra. Document-based: CouchDB, MongoDB.	10
10	**Batch cloud computing**: MapReduce and Hadoop. Applications in NoSQL data stores, Consensus and the Paxos algorithm. Applications in the cloud: Google Chubby, Yahoo Zookeeper.	10

Text Books

1	Principles of Distributed Database Systems - M. Tamer Özsu, Patrick Valduriez

Reference Books

1	Dominic Duggan , Enterprise Software Architecture and Design
2	Kristina Chodorow and Michael Dirolf , Mongodb: The Definitive Guide , O'Reilly, 2010

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO0322_P**	
Course Title	**:**	**Elective 4 Distributed and Cloud Database System Lab**	

Prerequisites: Distributed computing ,Database systems

Course Objectives

1. To learn Web services
2. To learn distributed systems and cloud computing
3. To learn Mapreduce.

Course Outcomes

1. To apply heuristics to design high performing distributed database
2. To characterize algorithms that are optimally solved by MapReduce, to design and query large-scale databases, and to understand tradeoffs among distributed database, cloud databases, and data warehouses.
3. To provide an understanding of architecture and design tradeoffs of all aspects of distributed database

Course Contents		
1	Program on web services	20
2	Program on Cloud storage	20
3	Program using App Engine	15
4	MapReduce programmes	15
5	Hadoop programmes	15
6	NoSQL data stores	15

Text Books :	
1	Principles of Distributed Database Systems - M. Tamer Özsu, Patrick Valduriez
Reference Books	
1	Dominic Duggan , Enterprise Software Architecture and Design
2	Kristina Chodorow and Michael Dirolf , Mongodb: The Definitive Guide , O'Reilly, 2010

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO322_T**	
Course Title	**:**	**Elective 4 :Pattern Recognition**	

Course Prerequisites: Fundamentals of probability and linear algebra.

Course Objectives

1. To study pattern recognition topics and be exposed to recent developments in pattern recognitions research.

2. To provide in-depth design concepts and implementation techniques of pattern recognitions

Course Outcomes

1. Identify and explain detailed aspects of internal structures of pattern recognitions

2. Compare and contrast design issues for statistical pattern recognition.

3. Develop implementation skills for building pattern recognition

Course Contents		
1.	**Introduction**: Machine Perception, What is Pattern Recognition (PR)?, Pattern Recognition system: sensing, segmentation & grouping, feature extraction, classification and post processing, Design cycle: data collection, feature choice, model choice, training, evaluation and computational complexity. Learning and adaptation: supervised learning, unsupervised learning and reinforcement learning. Examples of PR Applications, Pattern Recognition Extensions. ,Machine learning : Components of learning , learning models , geometric models , probabilistic models , logic models , grouping and grading , learning versus design , types of learning , supervised	10

	,unsupervised , reinforcement , theory of learning , feasibility of learning , error and noise ,training versus testing , theory of generalization , generalization bound , approximation-generalization tradeoff , bias and variance , learning curve	
2.	**Statistical Pattern Recognition (StatPR)**: Introduction to StatPR, baye's theorem, multiple features, conditionally independent features, decision boundaries, unequal costs of error, estimation of error rates, characteristic curves, estimating the composition of populations, introduction to Supervised Parametric Approaches and Unsupervised Approaches. Cluster analysis: clustering techniques, cluster analysis, cluster validity. Feature selection & extraction: feature selection criteria, feature set search algorithm, feature selection.	10
3.	**Tree Classifiers G with real classifiers** :(a) Decision Trees: CART, C4.5, ID3. ,(b) Random Forests	10
4.	**Linear Discriminants Discriminative Classifiers**: the Decision Boundary ,(a) Separability ,(b) Perceptrons ,(c) Support Vector Machines ,	10
5.	**Parametric Techniques :**Generative Methods grounded in Bayesian Decision Theory , (a) Maximum Likelihood Estimation , (b) Bayesian Parameter Estimation , (c) Sufficient Statistics , Non-Parametric Techniques :(a) Kernel Density Estimators ,(b) Parzen Window , (c) Nearest Neighbor Methods ,	10
6.	**Syntactic (Structural) Pattern Recognition (Syntpr):** Introduction to SyntPR, Syntactic PR: primitive selection & pattern grammars, higher dimensional grammars, syntactic recognition, automata, error – correcting parsing, shape & texture analysis, image database management. Structural Analysis Using Constraint Satisfaction and Structural Matching, The Formal Language-based Approach to SyntPR, Learning/Training in the Language-based Approach (Grammatical Inference). Problem solving methods for PR: problem solving models, problem solving algorithms.	20
7.	**Unsupervised Methods** : Exploring the Data for Latent Structure :(a) Component Analysis and Dimension Reduction , i. The Curse of Dimensionality ,ii. Principal Component Analysis , iii. Fisher Linear Discriminant , iv. Locally Linear Embedding (b) Clustering , i. K-Means , ii. Expectation Maximization , iii. Mean Shift ,	10
8.	**Classifier Ensembles :**(a) Bagging ,(b) Boosting / AdaBoost ,Algorithm Independent Topics Theoretical Treatments in the Context of Learned Tools , (a) No Free Lunch Theorem , (b) Ugly Duckling Theorem , (c) Bias-Variance Dilemma , (d) Jacknife and Bootstrap Methods ,	10
9.	**Neural Pattern Recognition (Neurpr)**: Neurons and Neural Nets, Feed forward Networks ,Hopfield (CAM) Approaches, Other Related Neural Approaches and Extensions, processing of waveforms and images Introduction, gray level scaling	10

	transformations, equalization, geometric image and interpolation, Smoothing, transformations, edge detection, Laplacian and sharpening operators, line detection and template matching, logarithmic gray level sealing, the statistical significance of image features.	
Text Books		
1	Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classification. Wiley-Interscience. 2nd Edition. 2001	
2	Eart Gose, Richard Johnsonburg and Steve Joust, "Pattern Recognition and Image Analysis", Prentice-Hall of India-2003.	
Reference Books		
1	Bishop, C. M. Pattern Recognition and Machine Learning. Springer. 2007.	
2	Marsland, S. Machine Learning: An Algorithmic Perspective. CRC Press. 2009.	
3	Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2008.	
4	Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence. 2003.	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO322_P**	
Course Title	**:**	**Elective 4 :Pattern Recognition Lab**	

Course Prerequisites: Fundamentals of probability and linear algebra.

Course Objectives

1. To study pattern recognition topics and be exposed to recent developments in pattern recognitions research.

2. To provide in-depth design concepts and implementation techniques of pattern recognitions

Course Outcomes

1. Identify and explain detailed aspects of internal structures of pattern recognitions

2 Develop program related with feature representation

3. Develop implementation skills for building pattern recognition		
Course Contents		
1.	Feature Representation	20
2.	Mean and Covariance	10
3.	Linear Perceptron Learning	10
4.	Generation of Random Variables	10
5.	Bayesian Classification	10
6.	MLE: Learning the classifier from data	10
7.	From two class to multiclass	10
8.	Data Clustering: K-Means, MST-based	20
Text Books		
1	Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classification. Wiley-Interscience. 2nd Edition. 2001.	
2	Eart Gose, Richard Johnsonburg and Steve Joust, "Pattern Recognition and Image Analysis", Prentice-Hall of India-2003.	
Reference Books		
1	Bishop, C. M. Pattern Recognition and Machine Learning. Springer. 2007.	
2	Marsland, S. Machine Learning: An Algorithmic Perspective. CRC Press. 2009.	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO322_T**	
Course Title	**:**	**Elective 4 :Graph Mining**	
Course Prerequisites: Fundamentals of probability and linear algebra.			

Course Objectives

1. To study graph mining and be exposed to recent developments in graph mining research.

2. To provide in-depth design concepts and implementation techniques of graph mining

Course Outcomes

1. Identify and explain detailed aspects of internal structures of graph mining

2. Develop implementation skills for building graph mining

Course Contents		
1.	**Introduction:** Terminology, Graph Databases	10
2.	**Graph Matching**—Exact And Error-Tolerant Methods And The Automatic Learning Of Edit Costs : Introduction, Definitions and Graph Matching Methods, Learning Edit Costs, Experimental Evaluation	10
3.	**Graph Visualization And Data Mining** : Introduction, Graph Drawing Techniques, Examples of Visualization Systems	10
4.	**Graph Patterns And The R-Mat Generator** : Introduction, NetMine and R-MAT, Experiments	10
5.	**Discovery Of Frequent Substructures** : Introduction, Preliminary Concepts, Apriori-based Approach, Pattern Growth Approach, Variant Substructure Patterns, Experiments and Performance study	10
6.	**Finding Topological Frequent Patterns From Graph Datasets** : Introduction, Frequent Pattern Discovery from Graph Datasets, Problem Definitions, FSG for the Graph-Transaction Setting, SIGRAM for the Single-Graph Setting, GREW, Scalable Frequent Subgraph Discovery Algorithm	10
7.	**Unsupervised And Supervised Pattern Learning In Graph Data** : Introduction, Mining Graph Data Using Subdue, Comparison to Other Graph-Based Mining Algorithms, Comparison to Frequent Substructure Mining Approaches, Comparison to ILP Approaches	10
8.	**Graph Grammar Learning** : Introduction, Related Work, Graph Grammar Learning, Empirical Evaluation	10
9.	**Constructing Decision Tree Based On Chunkingless Graph-Based Induction** : Introduction, Graph-Based Induction Revisited, Problem Caused by Chunking in B-GBI, Chunkingless Graph-Based Induction (Cl-GBI), Decision Tree Chunkingless Graph-Based Induction (DT-ClGBI)	10

10.	**Links Between Formal Concept Analysis And Graph Mining :** Presentation, Basic Concepts and Notation, Formal Concept Analysis, Extension Lattice and Description Lattice Give Concept Lattice, Graph Description and Galois Lattice, Graph Mining and Formal Propositionalization, Kernel Methods For Graphs : Introduction, Graph Classification, Vertex Classification	10
Text Books		
1	Mining Graph Data By Diane J. Cook , Lawrence B. Holder Wiley Publication ISBN: 978-0-471-73190-0	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO322_P**	
Course Title	**:**	**Elective 4 :Graph Mining Lab**	

Course Prerequisites: Fundamentals of probability and linear algebra.

Course Objectives

1. To study graph mining and be exposed to recent developments in graph mining research.

2. To provide in-depth design concepts and implementation techniques of graph mining

Course Outcomes

1. Identify and explain detailed aspects of internal structures of graph mining

2. Develop implementation skills for building graph mining

Course Contents		
1.	Implement Graph Matching	10
2.	Graph data sets	20
3.	Disk-based large-scale graph computation using Graphchi	10
4.	Dealing with undirected edges , understanding asynchronous computation using Graphchi	20
5.	Deal with a bipartite graph using Graphchi	10
6.	R-MAT graph generation programs	20

7.	PEGASUS: A Peta-Scale Graph Mining System	10
Text Books		
1	Mining Graph Data By Diane J. Cook , Lawrence B. Holder Wiley Publication Isbn: 978-0-471-73190-0	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO322_T**	
Course Title	**:**	**Elective 4 :Multi Core Architecture and Parallel Algorithms**	

Course Prerequisites: Parallel Computing.

Course Objectives

1. To understand the recent trends in the field of Computer Architecture and identify
2. To understand performance related parameters
3. To appreciate the need for parallel processing

Course Outcomes

1. To expose the students to the problems related to multiprocessing
2. To identify the different types of Multicore architectures
3. To implement GPU Computing

Course Contents		
1.	**Fundamentals Of Quantitative Design And Analysis :** Classes of Computers , Trends in Technology, Power, Energy and Cost ,Dependability ,Measuring, Reporting and Summarizing Performance , Quantitative Principles of Computer Design	20
2.	**Classes of Parallelism :** ILP, DLP, TLP and RLP , Multithreading , SMT and CMP	10
3.	**Architectures** : Limitations of Single Core Processors , The Multicore era , Case Studies of Multicore Architectures	10
4.	**DLP in VECTOR, SIMD and GPU Architectures :** Vector Architecture Introduction to Vector Architecture, Vector execution time - SIMD Instruction Set Extensions for Multimedia , Graphics Processing Units, Programming the GPU,NVIDIA GPU	10

	computational structures - Graphics Processing Units-Conditional branching in GPU's, Fermi GPU Architecture, Similarities and differences between Vector Architectures and GPU's Detecting and Enhancing Loop Level Parallelism , Case Studies	
5.	**TLP and multiprocessors :** Symmetric and Distributed Shared Memory Architectures , Cache Coherence Issues ,Performance Issues , Synchronization Issues , Models of Memory Consistency ,Interconnection Networks , Buses, Crossbar and Multi-stage Interconnection Networks. Multiple lanes, vector length registers, vector mask register, memory banks, programming vector architectures	10
6.	**RLP and DLP in Warehouse-Scale Architectures:** Programming Models and Workloads for Warehouse-Scale Computers , Architectures for Warehouse-Scale Computing , Physical Infrastructure and Costs , Case Studies.	10
7.	**Parallel Algorithms :**Some Simple Computations, Architectures, Algorithms for a Linear Array, Binary Tree, 2D Mesh, Shared Variables. Asymptotic Complexity, Algorithm Optimality and Efficiency, Complexity Classes, Parallelizable Tasks and the NC Class ,Parallel Programming Paradigms.	10
8.	**Multicore GPU Programming:** CUDA / OpenCL : Program Structure, Importance of Memory Access Efficiency, Many core architecture , Thread Organization	20
Text Books		
1	John L. Hennessey and David A. Patterson, " Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th. edition, 2012.	
2	Programming Massively parallel processor by David B.Kirk ,Morgan Kuffman publication	
Reference Books		
1.	Richard Y. Kain, "Advanced Computer Architecture a Systems Design Approach", PHI, 2011.	
2.	. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture : A Hardware/ Software Approach" , Morgan Kaufmann / Elsevier, 1997.	
3.	Introduction to Parallel Algorithms By C. Xavier, S. S. Iyengar Wiley publicaiton	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**	**CO322_P**	
Course Title	**:**	**Elective 4 :Multi Core Architecture and Parallel Algorithms Lab**	
Course Prerequisites: Parallel Computing.			

Course Objectives

1. To understand the recent trends in the field of Computer Architecture and identify
2. To understand performance related parameters
3. To appreciate the need for parallel processing

Course Outcomes

1. To expose the students to the problems related to multiprocessing
2. To identify the different types of Multicore architectures
3. To implement GPU Computing

Course Contents		
1.	To use OPENMP	20
2.	To create cluster for parallel programming usage	20
3.	Program using MPI	20
4.	Program using CUDA	20
5.	Other platform for Multicore & GPU Computing	20

Text Books

1	John L. Hennessey and David A. Patterson, " Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th. edition, 2012.	
2	Programming Massively parallel processor by David B.Kirk ,Morgan Kuffman publication	

Reference Books

1	Richard Y. Kain, "Advanced Computer Architecture a Systems Design Approach", PHI, 2011.	
2	. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture : A Hardware/ Software Approach" , Morgan Kaufmann / Elsevier, 1997.	
3	Introduction to Parallel Algorithms By C. Xavier, S. S. Iyengar Wiley publicaiton	

Programme Name	**:**	**M. Tech. (Computer Engineering)**	**SEMESTER – II**
Course Code	**:**		
Course Title	**:**	**Technical Seminar**	

Course Prerequisites: Domain knowledge

Course Objectives

i) To learn research methods in particular domain

ii)To learn different papers for literature survey

Course Outcomes

1.Student will able to put up proposed model to solve for a particular problem

2.Student will able to work on different methods for evaluating performance

Course Contents		
1	Paper review –at least 20 papers concerned of IEEE,ACM	20
2	Presenting literature survey	20
3	Proposal on the basis of literature survey	20
4	Implementation of Proposed model	20
5	Presentation & publication	20

Text Books

1	IEEE Journals of the particular domain	
2	ACM Journals of the particular domain	