Scheme of Examination for
Master of Technology in Computer Science & Engineering
(M. Tech. CSE) under Choice Based Credit System
w.e.f. academic session 2020-2021

M.TECH. CSE - SEMESTER-I

Course No.	Course Title	Credit	Int.	Ext.	Total
MT-FT-11	Advanced Database Systems	4	30	70	100
MT-FT-12	Advanced Data Structures	4	30	70	100
MT-FT-13	Advanced Operating Systems	4	30	70	100
MT-FT-14	Advanced Computer Architecture	4	30	70	100
MT-FT-15	Lab based on MT-FT-11 (implementation in PL/SQL)	2	-	50	50
MT-FT-16	Lab based on MT-FT-12 (implementation in C/C++)	2	-	50	50
Total		**20**	**120**	**380**	**500**

M.TECH. CSE - SEMESTER-II

Course No.	Course Title	Credit	Int.	Ext.	Total
MT-FT-21	Advanced Web Technology	4	30	70	100
MT-FT-22	MATLAB Programming	4	30	70	100
MT-FT-23	Elective – I	4	30	70	100
MT-FT-24	Elective – II	4	30	70	100
MT-FT-25	Lab based on MT-FT-21	2	-	50	50
MT-FT-26	Lab based on MT-FT-22	2	-	50	50
Total		**20**	**120**	**380**	**500**

MT-FT-23 Elective – I Courses' List

(i) Network Security
(ii) Advanced Computer Networks
(iii) Wireless Networks

MT-FT-24 Elective – II Courses' List

(i) Soft Computing
(ii) Machine Learning
(iii) Artificial Intelligence

M.TECH. CSE -SEMESTER-III

Course No.	Course Title	Credit	Int.	Ext.	Total
MT-FT-31	Modeling and Simulation	4	30	70	100
MT-FT-32	Research Methodology	4	30	70	100
MT-FT-33	Elective – III	4	30	70	100
MT-FT-34	Elective – IV	4	30	70	100
MT-FT-35	Lab on MT-FT-31 (in MATLAB)	2	-	50	50
MT-FT-36	Lab on MT-FT-32 (in MATLAB)	2	-	50	50
Total		**20**	**120**	**380**	**500**

MT-FT-33 Elective –III Courses' List

(i) Cloud Computing
(ii) Grid Computing
(iii) Quantum Computing

MT-FT-34 Elective – IV Courses' List

(i) Data Warehousing and Data Mining
(ii) Big Data Analytics
(iii) Data Science

M.TECH. CSE -SEMESTER-IV

Course No.	Course Title	Credit	Int.	Ext.	Total
MT-FT-41	Dissertation	14	100	250	350
Total		**14**	**100**	**250**	**350**

Total Programme Credits
M. Tech. CSE under CBCS

Semester	Max. Marks	Credits
I	500	20
II	500	20
III	500	20
IV	350	14
Sub-total	1850	74
Open Elective Courses	200	08
Programme Total	**2050**	**82**

MT-FT-11 Advanced Data Base System

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note:- Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Objectives:

To present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve information from a database efficiently and effectively.
To discuss issues arising related to transaction processing in multiuser database systems.
To impart knowledge about centralized, distributed databases, multimedia databases etc.

Learning Outcomes:

- Know the role of a database management system in an organization.
- Understand basic database concepts, including the structure and operation of the relational data model.
- Construct simple and moderately advanced database queries using Structured Query Language (SQL).
- Successfully apply logical database design principles, including E-R diagrams and database normalization.

UNIT – I

Database System Concepts and Architecture: Three - Schema Architecture and Data Independence, ER Diagrams, Naming conventions and Design Issues. Relational Model Constraints and Relational Database Schemas, EER model: Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization. Relational Model: Relational Model Concepts, Relational model Constraints and Relational Database Schemas

UNIT – II

Informal design guidelines for Relational schemas: Functional Dependencies, Normal forms based on Primary keys :1NF,2NF,3NF and BCNF, Properties of Relational Decomposition ,Multivalued dependencies and 4NF, JOIN dependencies and 5NF. SQL Data Definition and Data types, Specifying Basic Constraints and Queries in SQL, Views in SQL

UNIT – III

Introduction to Transaction processing: Concepts, Concurrency control techniques, Database recovery techniques: Deferred update and Immediate update, ARIES Recovery algorithm, Shadow paging, Database security issues

UNIT –IV

Data Warehousing: Components, Building a data warehouse, Data extraction, cleanup and transformation, OLAP **Future Trends in data models:** Semantic data models, Active and Spatial databases, Temporal databases, Multimedia databases, Distributed Database concepts and Client Server Architecture

Text Books:

1. Elmasri and Navathe, “Fundamentals of Database Systems”, Pearson Education.

Reference Books:

- Date C.J., “An Introduction to Database Systems”, Pearson Education.
- Hector G.M., Ullman J.D., Widom J., “Database Systems: The Complete Book”, Pearson Education.
- Silberschatz A., Korth H., Sudarshan S., “Database System Concepts”, Tata McGraw Hill.

MT-FT-12 Advanced Data Structures

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**

External – 70 Marks

Note:- Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Objectives:

- To evaluate how the selection of data structures and algorithm design techniques impacts the execution of programs.
- To select the proper data structure and algorithm strategy for a predetermined application.
- To consider the deliberate method of taking care of issues, different strategies for sorting out a lot of data.To utilize the various data structures to discover the solutions for explicit problems.

Learning Outcomes:

- describe usuage of various data structures.
- analyze the complexity of linear and nonlinear data structures.
- analyze various algorithms and determine algorithm correctness and time efficiency.
- to choose the appropriate data structure to solve a programming problem and apply theoretical and practical aspects in different application domains.
- provide deep knowledge of algorithmic and developing code to implement different data structures.

Unit - I

Basic Concepts of Data Types – Abstract Data Types, data and storage structures – Algorithms: performance analysis: time complexity and space complexity, The Role of Algorithms in computing – Analyzing Algorithms – Designing Algorithms – Growth of functions – Asymptotic Notations – Recurrences – Substitution method – Recurrence tree method –The Master method – Floors and Ceilings. Arrays-Abstract Data Types (ADTs) —The Stack ADT– The Queue ADT- Various types of queues and operations- Stacks and their application

Unit - II

The List ADT-Operations (Create, Access, Insert and Delete) - Singly– linked List - Doubly–linked List - Circular–linked List -

Implementation of Trees – Tree Traversals with an application – Operations, Application, Representation on Binary Trees – threading and their implementation- Binary Search Trees –AVL trees – Splay Trees–B Trees– Red and Black Trees- SPlay Trees- Multiway search tree

Unit - III

Representations of Graphs – Topological sort – Shortest – Path Algorithms – Network Flow Problems – Minimum Spanning Tree – Applications of Depth – First–Search – NP – Completeness -Graph Traversals - Breadth First Search - Depth First Search - Graph Processing Algorithms - Dijkstra's Algorithm for minimum cost path - Kruskal's Algorithm for minimum spanning trees and related algorithms.

Unit - IV

Sorting and Searching: Insertion Sort–Shell Sort–Heap Sort–Merge Sort–Quick Sort - Internal Sorting – Bubble Sort – Bin Sort – Radix Sort – External Sorting – Sorting Implementation in C or C++- Searching Techniques- Comparative study of sorting and searching techniques with their complexities.

Hashing: Hash Function – Separate Chaining – Open Addressing – Rehashing – Extendible hashing. Operations on a Hash Table – Create, Insert, Find and Retrieve

References:

1. Mark A.Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education,Fourth Edition.
2. Alfred V.AHO, John E.Hopcroft, Jeffrey D.Ullman, Data Structures and Algorithms, Pearson Education,.
3. Ellis Horowitz,Sartaj Sahni,Sanguthevar Rajasekaran, Fundamental of Computer Algorithms, 2nd Edition,Universities Press.
4. Michael T.Goodrich, Roberto Tamassia, David Mount, Data structures and Algorithms in C++, Second Edition, Wiley Publications.
5. Yedidyah Langsam, Moshe J.Augenstein, AAron M.Tenebaum, Data Structures using C and C++, Second Edition, Pearson Education.
6. Seymour lipschutz, Data structures with C, MacGraw Hill.

MT-FT-13 Advanced Operating Systems

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**

External – 70 Marks

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Objectives:

Some advanced concepts of operating systems will be covered in this course. The objective of this course is to study, learn, and understand the major concepts of advanced operating systems, namely, multimedia operating systems, distributed and real time operating systems, threads, security and design issues in operating systems.

Learning Outcomes:

From view points of knowledge and understanding, a learner shall be able to appreciate the potential benefits of distributed systems and to summarize the major security issues associated with modern operating systems as also the array of techniques that might be used to enhance the system security. Cognitively, the learners shall be able to apply standard design principles in the construction of these systems and select appropriate approaches for building a range of advanced operating systems.

Unit – I

Multimedia operating systems: Introduction to multimedia; multimedia files and video compression standards; process scheduling, file system, file placement, caching and disk scheduling for multimedia.

Unit – II

Distributed operating systems: Mulltiprocessor hardware and scheduling; multicomputer hardware and scheduling; distributed computing architecture; distributed system models; distributed shared memory and distributed file system; mutual exclusion and deadlocks in distributed systems; network operating system vs. distributed operating system.

Unit – III

Real-time operating systems: Characteristics and classification of real-time systems; scheduling in real-time operating systems; trends in kernel design, exo-kernel and micro-kernel; virtualization; threads – concept, advantages, implementation.

Unit – IV

Design issues in operating systems: Goals and nature of design problem; guiding principles and paradigms of interface design; issues in implementation of operating system; performance of operating system; security – cryptography, user authentication, inside and outside attacks, protection mechanism.

References:

1. Andrew S. Tanenbaum, Modern operating systems, 2e, Pearson – Prentice Hall.
2. Pramod Chandra P. Bhatt, An introduction to operating systems – concepts and practice, 3e, Prentice Hall, India.
3. Charles Crowley, Operating systems – A design oriented approach, Tata McGraw Hill.

MT –FT-14 Advanced Computer Architecture

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note: -Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition, 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Objectives:

- Understand the Concept of Parallel Processing and its applications.
- Analyze the performance of different scalar Computers.
- Develop the Pipelining Concept for a given set of Instructions.
- Distinguish the performance of pipelining and non pipelining environment

Learning Outcomes:

At the end of this course students should:

- know the classes of computers, and new trends and developments in computer architecture
- Understand pipelining, instruction set architectures, memory addressing.
- Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.
- Understand exploiting ILP using dynamic scheduling, multiple issue, and speculation.
- Know symmetric shared-memory architectures and their performance and multiprocessor cache coherence using the directory based and snooping class of protocols.
- Describe the various models to achieve memory consistency.

UNIT-I

Concurrent and Parallel Execution: Von-Neumann computational model, Basic concepts of Parallel processing, Types and levels of parallelism, Classifications of parallel architectures.

Instruction-Level-Parallel Processors: Dependencies between instructions, Principles of Pipelining. Pipelined instruction processing, Synchronous & Asynchronous pipeline, Linear Pipeline-clocking & timing control, speedup, efficiency & throughput, Non linear pipeline- reservation table, latency analysis, collision free scheduling, internal data forwarding.

UNIT-II

Introduction to ILP processors – Evolution of ILP, Dependencies between instructions, Principles of pipelining, Performance measures,VLIW architecture, Branch handling- delayed branching, branch processing, multiway branching, guarded execution, Code scheduling- basic block scheduling, loop scheduling, global scheduling.

UNIT-III

Memory Hierarchy Technology : inclusion, coherence and locality, virtual memory models, TLB, paging and segmentation, memory replacement policies, cache addressing models, cache performance issues, interleaved memory organization.

Distributed –Memory MIMD architectures: Direct interconnection networks-interconnection topologies , switching techniques, routing

UNIT-IV

Shared-Memory MIMD architectures: Dynamic interconnection networks- shared path, switching networks- crossbar & multistage networks. Cache coherence problem, Hardware based cache coherence protocol- Snoopy cache protocol, Directory scheme, hierarchical cache coherence protocol. UMA, NUMA, CC-NUMA and COMA multiprocessors.

References

- Hennessy J.D., Patterson D.A., "Computer Architecture A Quantitative Approach", Elsevier India.
- Sima D., Fountain T., Kasuk P., "Advanced Computer Architecture-A Design space Approach," Pearson Education.
- Kai Hwang, "Advanced computer architecture – Parallelism, Scalability, Programmability", Tata McGraw Hill.

MT-FT-21 Advanced Web Technology

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note: -Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition, 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course objectives:
The Objective of this course is to make the students get acquainted with skills for creating websites and web app through various technologies like HTML, CSS, JavaScript, PHP, MySQL, XML web services.

Learning Outcomes: The course is designed to provide the student an in-depth understanding of content management systems so as to be able to create and host modern websites. Students will gain the skills needed for entry into web application and development careers.

UNIT I

Overview of HTML – Common tags, XHTML, capabilities of HTML5, Cascading Style sheets, XML Relationship between HTML, SGML, and XML, Basic XML, valid Documents. Ways to use XML, The future of XML.

UNIT II

Java Script: Introduction, Client-Side JavaScript, Server-Side JavaScript, JavaScript Objects, Advanced PHP and MySQL**:** PHP/MySQL Functions, displaying queries in tables, Building Forms from queries, Sessions, Cookies.

UNIT III

Introduction: Search Engines: Searching techniques used by search engines, Keywords, advertisements, Search Engine Optimization (SEO) for individual web pages: SEO Web Design, Effective content writing plan, Achieving high rankings, SEO analysis intervals.

UNIT IV

What is CMS? Types of CMS, CMS Architecture, CMS Technologies, WordPress, Drupal, Joomla, Website Creation and maintenance, Web Hosting and Publishing Concepts.

TEXT BOOKS:

1. Peter Smith, “Professional Website performance”, Wiley India Pvt. Ltd.
2. Kogent Learning, "Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML, AJAX - Black Book”, Wiley India Pvt. Ltd.'
3. Web Design The complete Reference, Thomas Powell, Tata McGrawHill
4. J. C. Jackson, “Web Technologies”, Pearson Education,
5. CMS Security Handbook: The Comprehensive Guide for WordPress, Joomla, Drupal and Plone**,** Tom Canavan, Publisher(s): Wiley

REFERENCE BOOKS:

1. PHP: The Complete Reference by Steven Holzner, Tata McGrawHill
2. DT Editorial Services, “HTML 5 Black Book”, 2ndEdition, Wiley India, 2016.
3. S. Potts, “JAVA 2 Unleashed”, 6th Edition, Sams Publishing, 2002

MT-FT-22 MATLAB Programming

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**

External – 70 Marks

Note:- Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Objectives:

- Introduce the MATLAB software environment.
- Fortify an organized, top-down way to define and solve big problems.
- Introduce common approaches, structures, and conventions for creating and evaluating computer programs, primarily in a procedural paradigm with a introduction to object-oriented concepts and terminology.
- Apply a variety of common numeric techniques to solve and visualize engineering-related computational problems.
- To study various toolboxes to solve real life applications

Learning Outcomes:

- Use MATLAB effectively to analyze and visualize data.
- Apply numeric techniques and simulations to solve engineering-related problems.
- Apply a top-down, modular, and systematic approach to design, write, test, and debug sequential MATLAB programs to achieve computational objectives.
- Have in depth understanding and use of Matlab fundamental data structures (classes).
- Create and control simple plot and user-interface graphics objects in MATLAB.
- Be able to understand and use Matlab Toolboxes for solving real life problems.

Unit - I

MATLAB FUNDAMENTALS: What is MATLAB? , History of MATLAB, Origin, Growth and Development, Features of MATLAB, Why to use MATLAB? , Menus and the toolbar, computing with MATLAB, types of file , Editor Debugger, Some useful MATLAB Commands, MATLAB Help System,creating directory and saving files, Constants Variables and Expressions-Character Set, Data Type in MATLAB, Constants, Variables and Expressions, Operators, Hierarchy of Operations, Built-in-Function, Assignment Statements. Vectors and Matrices- Scalars and Vectors, Entering data in MAtrices, Line continuation, Matrices Subscripts, Muti-dimensional matrices and Arrays, Matrix Manipulation, Special MAtrices, Commands related to matrices, Structure Arrays, Cell Arrays.

Unit - II

Polynomials -Entering, Evaluation, Roots,Operations

Input/Output Statements- Data Input, Interactive Inputs, Reading/SToring DAta files, Output COmmands, Low level Input Output FUnctions.

Introduction to Data Import and Export, Other MATLAB I/O capabilities, Supported File Format, Working with Audio/Video File, Importing Audio/Video Data, Reading Audio/video Data From a file, Exporting Audio/Video Data, Example, Working with Spreadsheets, Writing to an XLS File, Reading from an XLS Files, Working with Graphics File, Importing Graphics data, Exporting Graphics data, MATLAB-GUI with GUIDE, Creating a simple GUI Programmatically, Dissertations of different components in GUIDE, Creating Menus.

Unit - III

Matlab Graphics- 2D/3D Plotting Visualization Using MATLAB

2D plot , Multiple Plot, Style options, legends, subplots, Specialized 2D plot- logarithmic,polar,area, bar,barh,hist,rose, pie, stairs,stem,compass. 3D plot - plot3, bar3, bar3h, pie3, stem 3, meshgrid, mesh, surf, contour, contour3.

Control Structures- loops- for,nested for, while, Branch Control STructure- if, switch, break, continue, error, try-catch, Debugging MatLab Programs.

Unit - IV

Introduction to MATLAB Toolboxes

Simulink Introduction, Image & Video processing Toolbox: Application Level Image Processing Techniques, MRI Image processing, Fuzzy Logic Toolbox, Neural Network Toolbox.

References:

1. Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar,MATLAB and its Application in Engineering, Pearson Education.
2. Ram N.Patel, Ankush Mittal, Programming in MATLAB, A Problrm Solving Approach, Pearson Education.
3. Jim Sizemore, John P.Mueller, MATLAB FOR DUMMIES", Wiley.
4. Stephen J.Chapman, Matlab Programming for Engineers, Thomson-Engineering Publisher, CENGAGE Learning.
5. Duane Hanselman, Bruce L Littlefield, Mastering MATLAB 7, Prentice Hall.
6. Amos Gilat, MATLAB: An Introduction with Application, Wiley Publisher.
7. Jaydeep Chakravorty, Introduction to MATLAB Programming , Toolbox and Simulink, Universities Press.
8. S.N. Sivanandam, S.N.Deepa, MATLAB with Control system, signal processing, Image processing toolboxes, Wiley.

MT-FT-23 (i) Network Security

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Objectives:

Objective of this course is to make the students familiar with the basic concepts of Networking. It will also make the students familiar with the working of latest network technologies and applications.

Learning Outcomes:

After getting though this course student will gain the knowledge of Networking models, different media for transmission, addressing types and their difference, routing protocols. Students will also gain knowledge of layered structure and working of different network technologies used in today's world.

Unit-I

Computer Security Concepts, Introduction, What is Security, security trends,, Components of Information System, OSI security architecture, Security Attacks, Goals for Security , security mechanisms, Integrity policies and Hybrid policies.

Unit-II

Cryptography: Concepts and Techniques, symmetric and asymmetric key cryptography

Symmetric key Ciphers:Classical encryption techniques, Block cipher design principles, DES, Advanced encryption standard, AES structure, Analysis of AES, Block cipher operations, principles of pseudorandom number generation and stream ciphers.

Asymmetric key Ciphers:Principles of public key cryptosystems, RSA algorithm, Analysis of RSA, Diffie-Hellman Key exchange.

Unit-III

Security services, Message confidentiality, message integrity, message authentication, key management, Message Authentication and Hash Functions:Authentication requirements and functions, MAC and Hash Functions, MAC Algorithms: Secure Hash Algorithm, Digital signatures, Key management and distribution, Intruders, Virus and Firewalls, Intruders, Intrusion detection, password management, Virus and related threats, Virus Countermeasures, Denial of service attacks, Firewall design principles, Types of firewalls.

Unit-IV

Security at layers(Network, Transport, Application),IPSec, Secure Socket Layer(SSL), Transport Layer Security(TLS), Secure Electronic Transaction(SET), Electronic Mail security: Pretty Good Privacy(PGP),S/MIME, Steganography & its application, watermarking & its application.

References:

- William Stallings, "Cryptography and Network Security: Principles and Practices", Third Edition, Pearson Education, 2006.
- Matt Bishop,Computer Security art and science, Second Edition, Pearson Education, 2002.
- Wade Trappe and Lawrence C. Washington, Introduction to Cryptography with Coding Theory 2e, Pearson Education, 2007.
- Jonathan Katz, and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press, 2007.
- Douglas R. Stinson, Cryptography Theory and Practice, Third Edition, Chapman & Hall/CRC, 2006.

MT-FT-23(ii) Advanced Computer Networks

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Objectives:

Objective of this course is to make the students familiar with the basic concepts of Networking. It will also make the students familiar with the working of latest network technologies and applications.

Learning Outcomes:

After getting though this course student will gain the knowledge of Networking models, different media for transmission, addressing types and their difference, routing protocols. Students will also gain knowledge of layered structure and working of different network technologies used in today's world.

Unit-I

Network Models: OSI reference model, TCP/IP reference model.
Transmission Media: Guided Media, Unguided Media.
Connecting LANs: Connecting Devices, Backbone Networks.
Ethernet: IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet.

Unit-II

Logical Addressing: IPv4 Addresses, IPv6 Addresses.
Unicast Routing Protocols and Multicast Routing Protocols
Intradomain and Interdomain Routing Protocols

Unit-III

Wireless LANs: IEEE 802.11, Bluetooth
Wireless Network and Mobile Network: LAN, PAN, Sensor Networks and Adhoc Networks.
Mobile IP
ATM reference model.

Unit-IV

World Wide Web and HTTP, FTP, E-Mail.
Domain Name System: Name Space, Domain Name Space, Distribution of Name Space, DNS in the Internet, Resolution.
Voice Over IP, IPSec, DDoS Attack

References:

- Behrouz A. Forouzan, Data Communications and Networking, Fourth Ed., Tata McGraw Hill, 2006.
- Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, Fourth Ed., Morgan Kaufmann, 2007.
- Jean Walrand and PravinVaraiya, High Performance Communication Networks, 2nd Ed., Morgan Kauffman, 1999.
- Markus Hoffmann and Leland R. Beaumont, Content Networking: Architecture, Protocols, and Practice, Morgan Kauffman, 2005.

MT-FT-23(iii) Wireless Networks

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note: -Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition, 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Objectives:

- To provide an overview of Wireless Network area and its applications.
- To explain the various terminology, principles, protocols and mobile communication technologies used in wireless network.
- To enhance the student's knowledge in the perspective field of wireless network.

Learning Outcomes: At the end of this course students will be able to:

- Explain working of different wireless Network technologies.
- Demonstrate application of different protocols for wireless communication technologies.
- Analyse the performance of different technologies in different scenarios/situations.
- Develop learning and research skills by undertaking a comprehensive study of research topic in wireless network.

UNIT-I: MULTIPLE RADIO ACCESS

Medium Access Alternatives: Fixed-Assignment for voice oriented networks, random access for data oriented networks, Handoff and Roaming Support, Security and Privacy.

UNIT-II: WIRELESS WANS

First Generation Analog, Second Generation TDMA- GSM, Short Messaging Service in GSM, Second Generation CDMA- IS-95,GPRS, Third Generation Systems- WCDMA,CDMA2000, Introduction to LTE.

UNIT-III: WIRELESS LANS

Introduction to Wireless LANs- IEEE 802.11 WLAN-Architecture and Services, Physical Layer-MAC Sublayer-MAC Management Sublayer, Other IEEE 802.11 standards, HIPERLAN, Wi-Max standard.

UNIT-IV: ADHOC AND SENSOR NETWORKS

Characteristics and Applications of MANET, Routing Protocols- Table-driven and Source-initiated on Demand routing protocols, Hybrid protocols.

Wireless Sensor Networks- Classification, MAC and Routing protocols. Wireless PANs- Architecture of Bluetooth systems, Physical and MAC layer details.

Reference:

- Vijay. K. Garg, Wireless Communication and Networking, Morgan Kaufmann Publishers.
- Kaveth Pahlavan, Prashant Krishnamurthy, Principles of Wireless Networks, Pearson Education.
- Adrian Farrel, Bruce S. Davie, P.Z & Larry L. Peterson, Wireless Networking Complete, Morgan Kaufmann Publishers.
- C. Siva Ram Murthy and B. S. Manoj, Ad hoc Wireless Networks, Pearson Education.
- William Stalling, Wireless Communications and Networks, Pearson/Prentice Hall of India.
- Dharma Prakash Agrawal & Qing-An Zeng, Introduction to Wireless and Mobile Systems, Thomson India Edition.

MT-FT-24 (i) Soft Computing

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**

External – 70 Marks

Note:- Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Objectives:

- Study the needs and applications of soft computing.
- To learn how natural and biological systems influence the computational field.
- Provide knowledge and applications of Neural Network, Fuzzy Logic , Genetic Algorithms, Natural Computing.

Learning Outcomes:

- Have an in-depth understanding of some of the soft computing techniques.
- Identify the situations for which it is beneficial to apply soft computing techniques.
- Describe and Apply suitable soft computing techniques for the problems which could not be otherwise solved efficiently.
- Be able to understand how large numbers of agents can self-organize and adapt.
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UNIT I

Basic concepts of neuro-computing: Artificial Neural Network (ANN) and their biological roots and motivations, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Applications of Artificial Neural Networks, Competitive learning networks, Kohonenself organizing networks, Hebbian learning; Hopfield Networks, Associative Memories, The boltzman machine; Applications.

UNIT II

Introduction to Fuzzy Logic: Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function. Operations on Fuzzy Sets: Compliment, Intersections-t-norms, Unions- t-conorms, Combinations of Operations, Aggregation Operations. Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables,Arithmetic Operations on Intervals & Fuzzy Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Fuzzy Logic: Classical Logic, Uncertainty Based Information

UNIT III

Genetic Algorithm (GA): Evolutionary computing, conditions for evolution, Simple Genetic
Algorithm (SGA), different types of operators: Selection, Crossover, mutation and replacement, optimization problems and traditional optimization methods, differences between GA and traditional methods, Holland's Schemata theorem.

UNIT IV

Random Optimization, Swarm Intelligence, Natural Computing, Simulated Annealing, Tabu Search, Ant Colony Optimization, Particle Swarm Optimization, Memetic Algorithms, Applications.

References:

- David.E. Goldberg, Genetic Algorithms in Search, Optimization and machine learning, Addison Wesley.
- Zbigniew Michalewicz, Genetic algorithms +Data Structures = Evolution Programs, Springers-Verlag.
- M. Mitchell, An Introduction to Genetic Algorithms, Prentice-Hall.
- S. Rajasekaran & G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, PHI.
- S. N. Sivanandam & S. N. Deepa, Principles of Soft Computing, Wiley - India.
- J-S. R. Jang, C.-T. Sun, E. Mizutani, Neuro-Fuzzy and Soft Computing, PHI.
- Simon O. Haykin, Neural Networks, A Comprehensive Foundation, PHI.

MT-FT-24(ii) Machine Learning

L/T - 4 **Total Credits – 4** **Internal Marks 30**

External Marks 70

Notes: - Total 09 questions are to bet set by the examiner. First question will be compulsory consisting of 5 short answer type question (each carry 2 marks) covering the entire syllabus uniformly. In addition, 08 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A Candidate is required to attempt five questions in all selecting one from each unit including the compulsory question.

Course Objectives:

1. Be able to understand and apply supervised and unsupervised learning algorithms.
2. Understand the fundamental concepts in machine learning and popular machine learning algorithms.
3. Understand the basic concept of Deep Learning.
4. Be able to solve the problems related to the application of machine learning algorithms with programming.

Learning Outcomes:

1. Recognize major programming languages.
2. Identify potential applications of machine learning in practice.
3. Select the suitable machine learning tasks for given application.
4. Implement feature extraction and selection to represent data as features to serve as input to machine learning models.

Unit 1

Introduction to Machine Learning. Artificial Intelligence and Machine Learning. Types of Machine Learning. Key Elements of Machine Learning. Applications. Hypothesis Space and Inductive Bias.

Unit II

Supervised Learning: Introduction, methods. Classification: Decision Tree, Random Forest, Naive Bayes. Regression: Linear Regression, Multivariable Regression, Logistic Regression. Support Vector Machine.

Unit III

Unsupervised Learning: Association Learning. Clustering: K-Means, Adaptive Hierarchical, Gaussian Mixture, Fuzzy C-Means. Dimension Reduction: Principal Component Analysis, Linear Discriminant Analysis, Generalized Discriminant Analysis.

Unit IV

Ensemble Learning. Reinforcement Learning. Introduction to Deep Learning. Neural Network Basics. Deep Neural Network. Convolutional Neural Network, Recurrent Neural Network, Graph Neural Network.

Reference Books:

1. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008.
2. Machine Learning. Tom Mitchell. First Edition. McGraw- Hill, 1997
3. Machine Learning for Hackers. Drew Conway, Jobn Myles. O'Reilly. 2012
4. Deep Learning Ian Goodfellow, Yoshua Bengio, Aaron Courville. MIT Press. 2016.
5. Introduction to machine learning, E. Alpaydin. MIT Press, 2e, 2009
6. Machine Learning in Action , P. Harrington. Manning Publication. 2012.
7. Machine Learning and Pattern Recognition. C.M. Bishop. Springer.

MT-FT-24(iii) Artificial Intelligence

L/T - 4 **Total Credits – 4** **Internal Marks 30**

External Marks 70

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Objectives:

- To study about intelligent agent and search methods.
- To study the concept of expert systems.
- To study about representing knowledge.
- To construct plan and methods for generating knowledge.

Learning Outcomes: By the end of the course students will be able to:

- Understand what the AI is.
- Apply search and knowledge representation techniques to solve AI problems.
- Have ability to identify the solution of AI problems.

UNIT-I

The predicate calculus

Syntax and semantic for propositional logic and FOPL, Censual form, inference rules, resolution and unification.

Knowledge: representation: Network representation-Associative network & conceptual graphs, structured representation: Frames & Scripts.

UNIT-II

Search Strategies & Production Systems

Strategies for state space search-data driven and goal driven search; search algorithms- uninformed search (depth first, breadth first, depth first with iterative deepening) and informed search (Hill climbing best first, AN algorithm, mini-max etc.), computational complexity, Properties of search algorithms-Admissibility, Monotonicity, Optimality, Dominance, etc.

Types of production system control of search in production system.

UNIT-III

Rule based expert systems

Architecture, development, managing uncertainty in expect systems (Bayesian probability theory, Non-monotonic logic and reasoning with beliefs.

Fuzzy logic: definition, Fuzzy logic systems architecture, difference between Boolean and fuzzy logic.

UNIT-IV

Knowledge acquisition& Prolog

Types of learning, learning automata, genetic algorithms, intelligent editors, learning by induction, Programming with Prolog.

Reference:

- George F. Luger, William A. Stubblefield, Artificial Intelligence, The Benjamin/Cummings Publishing Company, Inc.
- Dan W. Patterson, Introduction to Artificial Intelligence and Expert system, PHI.
- Eugene Charniak, Drew McDermott, Introduction to Artificial Intelligence" Addison Wesley.
- Wils J. Nilsson, Principles of Artificial Intelligence, Narosa Publishing house.
- Jackson Peter, Introduction to Expert systems, 3rd edition, (Addison Wesley -2000).

MT-FT-31 SIMULATION AND MODELING

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note:- Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Learning Objectives:

1. Fundamentals of creating mathematical models of physical systems and implementation on computers to analyse the system.
2. The different mathematical approaches to modelling that are covered in the course can be characterized into differential and difference equation based models, probability based a model which includes stochastic differential equations, cellular automata and event based approaches, and matrix based models.
3. The course is interdisciplinary in nature and looks at many systems from physics, biology, finance, engineering etc. from a modelling perspective.
4. Each topic is followed by many examples from different disciplines.

Course Learning Outcomes:

1. to create a relevant model for a multitude of problems from science and engineering, by extracting the necessary and relevant information regarding the problem.
2. They would also be able to define the different modelling terms by analysing the system or the data that is present.
3. They would be able to implement the model on the computer and from the results check for the validity of the model and correctness of the assumptions present in the model.

Unit-1

Introduction: System Concepts, System boundaries and environment, continuous and discrete systems, system modeling, Type of Models, Modeling Methodology, Model validation, Principles & Nature of Computer modeling and simulation, Steps in Simulation Study, Pitfalls in Simulation, When to use Simulation?, Physical and Interactive Simulation, Real-Time Simulation, Simulation and Analytical Methods, Areas of Application.

Unit-II

Continuous & Discrete: Analog vs. Digital Simulation, Continuous simulation vs. Numerical Integration; Time Flow Mechanism, Concepts of simulation of continuous and discrete system with the help of live examples- Pure Pursuit Problem, Inventory Problem, Chemical Rector; Generation of random numbers, Monte Carlo Computation vs Stochastic Simulation, Generation of non-uniformly distributed random numbers, Discrete Probability Functions, Cumulative Distribution Function, Measures of Probability Function-Central Tendency & Dispersion, Generation of Poisson and Erlang variates.

Unit III

Simulators for the live systems: Simulation of a water reservoir system, Simulation of a hypothetical Computer. Simulation of queuing Systems: Basic concepts of queuing theory, Simulation of single-server, two server and general queuing systems, Simulation in Inventory Control systems : Elements of inventory theory, inventory models, simulators for complex Inventory systems.

Unit IV

Design and Evaluation of Simulation Experiments: Length of simulation run, variance reduction techniques. Experiment layout and Validation. Simulation Languages: Continuous and discrete simulation languages, Block-Structured continuous simulation languages, Expression based languages, discrete system simulation languages: GPSS, SIMSCRIPT, SIMULA, Factors in selection of discrete system simulation languages.

Text/Reference Books:

1. Gordon G.: System Simulation" , Prentice-Hall of India Pvt. Ltd. New Delhi 1993.
2. Narsingh Deo: System Simulation with Digital Computer:, PHI New Delhi, 1993
3. Neelamkavil Frances: "Computer Simulation and modelling, John Wiley & Sons,NewYork 1987,
4. Payne, James A.: " Introduction to Simulation: Programming Techniques and Methods of Analysis, McGraw-Hill International Editions, Computer Science Services, New York(1998).
5. Reitman Julian: "Computer Simulation Experiments", Wiley- Interscience, 1971.

MT-FT-32 RESEARCH METHODOLOGY

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note:- Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Learning Objectives:

1. Identify and discuss the role and importance of research in the social sciences.
2. Identify and discuss the issues and concepts salient to the research process.
3. Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.
4. Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.

Course Learning Outcomes:

1. Explain key research concepts and issues
2. Read, comprehend, and explain research articles in their academic discipline.

UNIT I

Objectives and types of Research: Motivation and Objectives- Research Methods vs. Methodology, Types of Research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs, Empirical.

Research Formulation: Defining and formulating the research problem-. Selecting the problem, necessity of defining the problem, Importance of Literature Review in defining a problem, literature review- Primary and secondary source reviews, Hypothesis- Definition, Qualities of a good hypothesis, null hypothesis and alternatives.

UNIT II

Research design and methods: Basic principles, Need of research design- features of good design, Important concepts relating to research design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Sampling Methods, Measurement: Concept of measurement, Problems in measurement in research - Validity and Reliability. Levels of measurement- Nominal, Ordinal, Interval, Ratio.

UNIT III

Data Collection and Analysis: Execution of the research, observation and collection of data, methods of data collection, data processing and analysis strategies, data analysis with statistical packages, hypothesis testing, generalization and Interpretation, Univariate Analysis (frequency tables, bar charts, pie charts, percentages).

UNIT IV

Meaning of Interpretation, Need of Interpretation, Technique of Interpretation, Precaution in Interpretation, Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Reports and Thesis Writing: Structure and components of scientific reports, Types of report- Technical reports and thesis, Writing-synopsis, abstract, illustrations and tables, results, summary, reference citing and Listing.

Text/Reference Books:

1. J. Garg, B.L., Karadia, R., Aggarwal, F, and Aggarwal, U.K., 2002. An Introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methedology: Methods and Techniques. New Age International.
3. N, Gurumani, Scientific Thesis Writing and Paper Presentation, MJP Publishers. Montgomery, Douglas C., Design and Analysis of Experiments, Wiley India Pvt. Ltd.

MT-FT-33(i) CLOUD COMPUTING

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Learning Objectives

1. Basics of cloud computing.
2. Key concepts of virtualization.
3. Different Cloud Computing services
4. Cloud Implementation, Programming and Mobile cloud computing
5. Cloud Backup and solutions

Course Learning Outcomes:

1. Define Cloud Computing and memorize the different Cloud service and deployment models
2. Describe importance of virtualization along with their technologies.
3. Use and Examine different cloud computing services
4. Analyze the components of open stack & Google Cloud platform and understand Mobile Cloud Computing
5. Describe the key components of Amazon web Service
6. Design & develop backup strategies for cloud data based on features

UNIT I

Introduction: Essentials, Benefits and need for Cloud Computing - Business and IT Perspective - Cloud and Virtualization - Cloud Services Requirements - Cloud and Dynamic Infrastructure - Cloud Computing Characteristics Cloud Adoption.

Cloud Models: Cloud Characteristics - Measured Service - Cloud Models - Security in a Public Cloud Public versus Private Clouds - Cloud Infrastructure Self Service

Cloud as a Service: Gamut of Cloud Solutions - Principal Technologies - Cloud Strategy Cloud Design and Implementation using SOA - Conceptual Cloud Model - Cloud Service Defined

UNIT II

Cloud Solutions: Cloud Ecosystem - Cloud Business Process Management - Cloud Service Management - Cloud Stack - Computing on Demand (CoD) – Cloud sourcing.

Cloud Offerings: Information Storage, Retrieval, Archive and Protection - Cloud Analytics Testing under Cloud - Information Security - Virtual Desktop Infrastructure - Storage Cloud.

Cloud Management: Resiliency – Provisioning - Asset Management - Cloud Governance - High Availability and Disaster Recovery - Charging Models, Usage Reporting, Billing and Metering.

UNIT III

Cloud Virtualization Technology: Virtualization Defined - Virtualization Benefits - Server Virtualization - Virtualization for x86 Architecture - Hypervisor Management Software - Logical Partitioning (LPAR) - VIO Server - Virtual Infrastructure Requirements.

Cloud Virtualization: Storage virtualization - Storage Area Networks - Network-Attached storage - Cloud Server Virtualization - Virtualized Data Center.

UNIT IV

Cloud and SOA: SOA Journey to Infrastructure - SOA and Cloud - SOA Defined - SOA and IaaS - SOA-based Cloud Infrastructure Steps - SOA Business and IT Services.

Cloud Infrastructure Benchmarking: OLTP Benchmark - Business Intelligence Benchmark - e-Business Benchmark - ISV Benchmarks - Cloud Performance Data Collection and Performance Monitoring Commands - Benchmark Tools.

Text/Reference Books:

1. Roger Jennings, *Cloud Computing*, Wiley India
2. John Rhoton, *Cloud Computing Explained*, Recursive Press
3. Barry Sosinsky, *Cloud Computing Bible*,Wiley
4. Rajkumar Buyya, James Broberg, *Cloud Computing: Principles and Paradigms*, Wiley
5. Judith Hurwiz, *Cloud Computing for Dummies*,Wiley Publishing.
6. Rosenberg and Matheos, *The Cloud at your service*, Manning Publications
7. Dr. Kumar Saurabh, *Cloud Computing – Insight into New Era Infrastructure* , Wiley India.

MT-FT-33(ii) GRID COMPUTING

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Learning Objectives: The course is aimed at following:

1. To discuss the basic idea behind the grid computing.
2. To learn the concepts of grid security and resource management.
3. To understand the concept of grid portals
4. To learn the concept of grid middleware.
5. To learn how to set up and administer a grid

Course Learning Outcomes: At the end of the course, a student will possess the following:

1. A fair knowledge about the objectives of grid computing
2. A fair knowledge of grid computing and its basic principles
3. Knowledge about the cost efficient and high performance computing systems
4. Idea about the concepts related to design and architecture of grid computing
5. A basic knowledge about the technology application for grid computing.

UNIT I

Introduction: Cluster and Grid computing, Meta-computing, Web services and Grid Computing, e-Governance and the Grid

Technologies and Architectures for Grid Computing: Issues in Data Grids, Functional requirements in Grid Computing, Standards for Grid Computing, Recent technologies trends in Large Data Grids.

Web Services and the Service Oriented Architecture: Service Oriented Architecture, SOAP and WSDL, Creating Web Services, Server Side.

UNIT II

OGSA and WSRF: OGSA for Resource Distribution, Stateful Web Services in OGSA, WSRF, WSRF Specification

Globus Toolkit: History, version, Applications, Approaches and Benefits, Infrastructure Management, Monitoring and Discovery, Security, Data Choreography and Coordination, GT4 Architecture, GT4 Containers.

The Grid and Databases: Requirements, Storage Request Broker, Integration of Databases with the Grid, Architecture of OGSA-DAI for offering Grid Database services.

UNIT III

Cluster Computing: Approaches to Parallel Computing, Definition and Architecture of a Cluster, Categories of clusters.

Cluster Middleware: Levels and Layers of Single System Image, Design objectives, Resource Management and Scheduling, Cluster programming Environment and Tools.

Networking, Protocols and I/O for clusters: Networking and Interconnection/Switching Devices, Design Issues, Design Architecture, HiPPI, ATM, Myrinet, Memory Channel

UNIT IV

Setting Up and Administering a Cluster: Setup of simple cluster, setting up nodes, clusters of clusters, System monitoring, Global Clocks Sync.

Cluster Technology for High Availability: High availability clusters, high availability parallel computing, types of failures and errors, cluster architectures and configurations for high availability, Failure/Recovery clusters.

Process Scheduling: Job management System, Resource management system, policies of resource utilization, Scheduling policies.

Load Sharing and Load Balancing: Introduction, Strategies for load balancing, Modelling parameters.

Text/Reference Books:

1. Grid and Cluster Computing by C.S.R. Prabhu, PHI
2. The Grid: Blueprint for a New Computing Infrastructure, Ian Foster, Carl Kesselman, Elsevier Series, 2004.
3. Grid Computing for Developers, Vladimir Silva, Charles River Media, January 2006.
4. Global Grids and Software Toolkits: A Study of Four Grid Middleware Technologies, High Performance Computing: Paradigm and Infrastructure, Laurence Yang and Minyi Guo (editors), Wiley Press, New Jersey, USA, June 2005. 4
5. Grid Resource Management: State of the Art and Future Trends, Jarek Nabrzyski, Jennifer M. Schopf, Jan Weglarz, International Series in Operations Research & Management Science, Springer; First edition, 2003

MT-FT-33(iii) QUANTUM COMPUTING

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Learning Objectives: The course is aimed at following:

1. To introduce the fundamentals of quantum computing
2. To understand the problem solving approach using finite dimensional mathematics
3. To learn the algebra of complex vector spaces and quantum mechanics

Course Learning Outcomes: On successful completion, students will gain understanding about:

1. The basic principles of quantum computing.
2. The fundamental differences between conventional computing and quantum computing.
3. Several basic quantum computing algorithms.
4. The classes of problems that can be expected to be solved well by quantum computers.

UNIT I

Introduction to Quantum Computation: Concept and need of quantum computing, Quantum bits and quantum operations, Postulates of quantum mechanics, Bloch sphere representation of a qubit, multiple qubits, classical gates versus quantum gates.

UNIT II

Background Mathematics and Physics: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.

Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum circuits

UNIT III

Quantum Information and Cryptography: Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem, Quantum programming languages, Probabilistic and Quantum computations.

UNIT IV

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.

Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation

Text/Reference Books:

1. Quantum computing for computer scientists, Noson S. Yanofsky, Mirco A. Mannucci, Cambridge University Press 2008
2. Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, Benenti G., Casati G. and Strini G., World Scientific, 2004.
3. An Introduction to Quantum Computing Algorithms, Pittenger A. O., 2000.
4. Quantum computing explained, David McMahon, John Wiley & Sons, Inc. Publication 2008
5. Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press 2010
6. Introduction to Quantum Mechanics, 2nd Edition, David J. Griffiths, Prentice Hall New Jersey 1995

MT-FT-34(i) DATA WAREHOUSING AND DATA MINING

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note:- Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Learning Objectives

1. To identify the scope and essentiality of Data Warehousing and Mining.
2. To analyze data, choose relevant models and algorithms for respective applications.
3. To study spatial and web data mining.
4. To develop research interest towards advances in data mining.

Course Learning Outcomes:

1. Understand Data Warehouse fundamentals, Data Mining Principles
2. Design data warehouse with dimensional modeling and apply OLAP operations.
3. Identify appropriate data mining algorithms to solve real world problems
4. Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
5. Describe complex data types with respect to spatial and web mining.
6. Benefit the user experiences towards research and innovation. Integration.

Unit I

Data Mining: Introduction: Motivation, Importance, data mining, kind of data, Functionalities, interesting patterns, classification of data mining system, Major issues, Data Mining Primitives.

Data Preparation: Preprocess, Data cleaning, Data Integration and transformation, Data reduction, Discretization and concept hierarchy generation.

Unit II

Data warehouse and OLAP Technology for data mining: data warehouse, difference between operational data base systems and data warehouse, A Multidimensional Data Model, Architecture, Implementation, data warehousing to data mining, Data warehouse usage.

Unit III

Association Rule Mining: Mining single-dimensional Boolean association rules from transactional databases, mining multilevel association rules from transaction databases, Mining multidimensional association rules from relational databases and data warehouses, From association mining to correlation analysis, constraint-based association Mining.

Unit IV

Classification and prediction, issues, classification by decision induction, Bayesian classification, classification by back propagation, classification based on concepts from association rule mining other classification methods .Cluster Analysis: What is Cluster Analysis, Types of Data in Cluster Analysis, Applications and Trends in Data Mining.

Text/Reference Books:

1. Ale Berson, Stephen Smith, Korth Theorling, *Data Mining*,TMH.
2. Adruaans, Longman, Addison-Wesley *Data Mining,*
3. Addison-Wesley Longman, *Data Warehousing in the Real World.*
4. Chanchal Singh, *Data Mining and Warehousing*, Wiley.
5. John E, Herbert P, *Data Mining*.

MT-FT-34(ii) BIG DATA ANALYTICS

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Learning Objectives:

1. To provide an overview of an exciting growing field of big data analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.
3. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
4. To enable students to have skills that will help them to solve complex real-world problems in for decision support.

Course Learning Outcomes:

1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
2. Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
3. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
4. Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

UNIT I

Introduction, Wholeness of Big Data, Big Data Sources and Applications, Big Data Architecture.

UNIT II

Distributed Computing Using Hadoop, Parallel Processing with Map Reduce, Application and Programming. NoSQL Databases, Big Data Programming Languages – Apache Hive, Apache Pig.

UNIT III

BIG DATA PRIVACY, ETHICS AND SECURITY - Privacy – Reidentification of Anonymous People – Why Big Data Privacy is self regulating? , Ethics – Ownership – Ethical Guidelines – Big Data Security – Organizational Security

UNIT IV

SECURITY, COMPLIANCE, AUDITING, AND PROTECTION- Steps to secure big data – Classifying Data – Protecting – Big Data Compliance – Intellectual Property Challenge – Research Questions in Cloud Security – Open Problems, HADOOP SECURITY DESIGN Kerberos – Default Hadoop Model without security - Hadoop Kerberos Security Implementation & Configuration, DATA SECURITY & EVENT LOGGING Integrating Hadoop with Enterprise Security Systems - Securing Sensitive Data in Hadoop – SIEM system – Setting up audit logging in hadoop cluster.

Text/Reference Books:

1. Mark Van Rijmenam, “Think Bigger: Developing a Successful Big Data Strategy for Your Business”, Amazon, 1 edition, 2014.
2. Frank Ohlhorst John Wiley & Sons, “Big Data Analytics: Turning Big Data into Big Money”, John Wiley & Sons, 2013.
3. SherifSakr, “Large Scale and Big Data: Processing and Management”, CRC Press, 2014.

4. Sudeesh Narayanan, “Securing Hadoop”, Packt Publishing, 2013.
5. Ben Spivey, Joey Echeverria, “Hadoop Security Protecting Your Big Data Problem”, O’Reilly Media, 2015.
6. Boris Lublinsky, Kevin Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.
7. Chris Eaton, Dirk Deroos et al., “Understanding Big data ”, McGraw Hill, 2012. 3. Tom White, “HADOOP: The definitive Guide” , O Reilly 2012

MT-FT-34(iii) DATA SCIENCE

L/T - 4 **Total Credits – 4** **Internal - 30 Marks**
External – 70 Marks

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of 5 short (each 2 marks) questions covering entire syllabus uniformly. In addition 8 more questions will be set unit wise comprising 2 questions from each unit of the given syllabus. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Course Learning Objectives:

1. To know the fundamental concepts of data science and analytics
2. To learn various techniques for mining data streams
3. To learn event modelling for different applications.
4. To know about Hadoop and Map Reduce procedure

Course Learning Outcomes: Upon the completion of the course the student should be able to:

1. Work with big data platform and its analysis techniques.
2. Design efficient algorithms for mining the data from large volumes.
3. Model a framework for Human Activity Recognition
4. Development with cloud databases

UNIT I

INTRODUCTION TO DATA SCIENCE – Applications - Data Science Process – Exploratory Data analysis – Collection of data – Graphical presentation of data – Classification of data – Storage and retrieval of data – Big data – Challenges of Conventional Systems - Web Data – Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

UNIT II

DATA ANALYSIS: Correlation – Regression – Probability – Conditional Probability – Random Variables – Analysis using Mean, Median, Mode, Standard Deviation, Skewness, Kurtosis- Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics –

UNIT III

DATA MINING TECHNIQUES: Rule Induction - Neural Networks: Learning and Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods- Neuro-Fuzzy Modelling – Association rule mining – Clustering – Outlier Analysis – Sequential Pattern Mining – Temporal mining – Spatial mining – Web mining.

UNIT IV

FRAMEWORKS AND VISUALIZATION: Map Reduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – Cloud databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques – Social Network Analysis – Collective Inferencing – Egonets - Systems and Applications.

Text/Reference Books

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. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008.
5. Rachel Schutt, Cathy O'Neil, “Doing Data Science”, O'Reilly Publishers, 2013.
6. Foster Provost, Tom Fawcet, “Data Science for Business”, O'Reilly Publishers, 2013.
7. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications“, Wiley Publishers, 2014.
8. S. N. Sivanandam, S. N Deepa, “Introduction to Neural Networks Using Matlab 6.0”, Tata McGraw- Hill Education, 2006.