Vivekananda Global University, Jaipur

Semester I **M.Tech (Computer Science & Engineering)**

MBA 204 : RESEARCH METHODOLOGY

3L+0T+0P+3C **MM:100**

Module I: MEANING AND IMPORTANCE OF RESEARCH –Review of Literature, Objectives of the research, Types of Research- Exploratory Research – Descriptive Research – Casual Research - Research Approaches- Research Process ––Defining Research Problem- Selection and necessity of defining the problem.

Module II: RESEARCH DESIGN –meaning, need and features of good research design- Important concepts related to research design. Experimental research designs: Before and After without control design, After only with control design, Before and after with control design, Completely randomized design (C.R Design).
Sampling and Sampling Design – Sampling Methods – Simple Random Sampling – Stratified Sampling – Systematic Sampling – Cluster Sampling – Multistage Sampling, Non–Probability Sampling – Convenience Sampling – Judgment Sampling – Quota Sampling- Snowball sampling.

Module III: **DATA COLLECTION** – Primary and Secondary Data – Designing of Questionnaire – **Measurement and Scaling** – Nominal Scale – Ordinal Scale – Interval Scale – Ratio Scale –Guttman Scale – Likert Scale – Schematic Differential Scale. Descriptive statistics- Measures of central tendency- Dispersion- Skewness -Correlation and Regression Analysis.

Module IV: **EDITING** – Coding – Classification of Data – Tables and Graphic Presentation –Basics of inferential statistics- Types of Errors- **Hypothesis testing** -Parametric test - T-test, Z test, Chi Square test- ANOVA Test. Introduction of SPSS.

Module V:**NON PARAMETRIC TESTS** – Kolmogorov – Smirnov Test – Runs Test for Randomness. Sign Test – Median Test –Factor Analysis.
Preparation and Presentation of Research Report- Types of reports- Layout of Research Report- Bibliography-References writing- Precautions for writing Research Report.

Suggested Books:

1. Mark Saunders, Philip Lewis, Adrian Thornbill, Research Methods for Business Students, Pearson,ND
2. Churchill, Iacobucci & Israel, Marketing Research: A South Asian Perspective, Cengage, New Delhi
3. C.R. Kothari, Research Methodology, New Age International.
4. Carver & Nash, Data Analysis with SPSS, Cengage, New Delhi
5. Alan Bryman & Emma Bell, Business Research Methods, Oxford University Press.
6. Donald R. Cooper & Pamela S. Schindler, Business Research Methods 8th Edition, Tata McGraw Hill.
7. K.V.S. Sarma, Statistics made sample, do it yourself on PC, Prentice Hall.
8. V P Michael, Research Methodology in Management, Himalaya, Mumbai

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Semester I **M.Tech (Computer Science & Engineering)**

MCS 101: ADVANCE OBJECT ORIENTED DESIGN

3L+1T+0P+3.5C **MM:100**

Module I: Object oriented programming concepts, objects, classes, methods and messages, abstraction and encapsulation, inheritance, abstract classes, polymorphism.

Introduction to C++, classes, access specifiers, function and data members, default arguments, function overloading, friend functions, const and volatile functions – static members, Objects, pointers and objects, constant objects, nested classes, local classes.

Module II: Constructors, default constructor, Parameterized constructors, Constructor with dynamic allocation, copy constructor, destructors, operator overloading, overloading through friend functions, overloading the assignment operator, type conversion, explicit constructor.

Module III: Function and class templates- Exception handling, try-catch-throw paradigm, exception specification, terminate and Unexpected functions, Uncaught exception.

Module IV: Inheritance, public, private, and protected derivations, multiple inheritance – virtual base class, abstract class, composite objects Runtime polymorphism, virtual functions, pure virtual functions, RTTI, typeid, dynamic casting, RTTI and templates, cross casting, down casting .

Module V: Streams and formatted I/O, I/O manipulators - file handling, random access, object serialization, namespaces - std namespace, ANSI String Objects, standard template library.

Text/Reference Books:

1. Dietel and Associates, “C++ How to Program”, 7th Ed., Prentice-Hall
2. Object Oriented Programming using C++, Robert Lafore, Pearson
3. Waite Groups C++ Primer Plus, Stephen Prata, Techmedia.
4. C++ Primer, Lippman & Lajoie, Pearson.
5. The C++ Programming Language, B.J. Stroustrup,Pearson.
6. C++ Complete Reference, Shield, MGH

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Semester I **M.Tech (Computer Science & Engineering)**

MVL 111: DIGITAL SYSTEM DESIGN

3L-0T-0P-3C **M.M.100**

Module 1 Review of Combinational & Sequential Logic Design **Introduction to Programmable Logic Devices:** Overview of PLDs, Simple PLD, Complex PLD, Architecture of CPLD & FPGA

Module 2 **Integrated Circuit Logic family:** Evolution of TTL, IIL (merged structure), CML logic, 10K and 100K series of ECL, Stacked ECL, EFL

Module 3 MSI Logic Circuits: Derived logic building blocks such Decoders/ drivers, Encoders, Multiplexers, De-multiplexers, Magnitude Comparators, applications

MESFET, MESFET Inverter, DCFL, supper buffer FET logic, BFL

Module 4 **MEMORY DEVICES:** General memory operations, Programmable logic devices, Semi-conductor memories, SRAM, DRAM, FAMOS, FLOTOX

Module 5 **TESTING & VERIFICATION:** Testing combinational circuits: Different fault models, path sensitization algorithm **Testing sequential circuits:** Sequential test methods; Functional & Timing simulation, delay models, boundary scan, faults, fault simulation, ATPG, BIST, DFT, Verification

Text / Reference Books:

1. R. J. Tocci : "Digital System: Principles & Applications" – PHI
2. Leo Chartrand, "Advanced Digital Systems: Experiments and Concepts with CPLDs", Cengage Learning.
3. John F. Wakerly, "Digital Design: Principles and Practices", Prentice Hall.
4. Charles H. Roth, "Fundamentals of Logic Design", 5th Ed., Cengage Learning.
5. M. Abramovici, M. A. Breuer & Arthur D," Digital Systems Testing & Testable Design", John-Wiley & Sons.

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Semester I **M.Tech (Computer Science & Engineering)**

MCS 102 : SEMINAR-I

0L+0T+2P+1C **MM:100**

Students will be grouped in two to three; will have to decide final research area of thesis, download research papers from IEEE, Elsevier, Springer etc.This activity may also require visiting Learning Resources Centre of other institute of national importance.

Summarizing paper–Reading abstracts and finding ideas, conclusion, highlight of their approach, the drawbacks of the papers. Generalize results from a research paper to related research problems.

Comparing the approach -identify weaknesses and strengths in recent research articles in the subject. Practice sessions on how to read, analyze and summarize research papers. Students in group will have to deliver *presentation*, prepare a report and a review paper based on analysis.

Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation.

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Semester I **M.Tech (Computer Science & Engineering)**

MCS 103 : ADVANCE OBJECT ORIENTED PROGRAMMING LAB

0L+0T+2P+1C **MM:100**

1. Design C++ classes with static members, methods with default arguments, friend functions. (For example, design matrix and vector classes with static allocation, and a friend function to do matrix-vector multiplication)
2. Implement complex number class with necessary operator overloading and type conversions such as integer to complex, double to complex, complex to double etc.
3. Implement Matrix class with dynamic memory allocation and necessary methods. Give proper constructor, destructor, copy constructor, and overloading of assignment operator.
4. Overload the new and delete operators to provide custom dynamic allocation of memory.
5. Develop a template of linked-list class and its methods.
6. Develop templates of standard sorting algorithms such as bubble sort, insertion sort, merge sort, and quick sort.
7. Design stack and queue classes with necessary exception handling.
8. Define Point class and an Arc class. Define a Graph class which represents graph as a collection of Point objects and Arc objects. Write a method to find a minimum cost spanning tree in a graph.
9. Develop with suitable hierarchy, classes for Point, Shape, Rectangle, Square, Circle, Ellipse, Triangle, Polygon, etc. Design a simple test application to demonstrate dynamic polymorphism and RTTI.
10. Write a C++ program that randomly generates complex numbers (use previously designed Complex class) and writes them two per line in a file along with an operator (+, -, *, or /). The numbers are written to file in the format (a + ib). Write another program to read one line at a time from this file, perform the corresponding operation on the two complex numbers read, and write the result to another file (one per line).

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Semester I **M.Tech (Computer Science & Engineering)**

MCS 104 : ADVANCE DATABASE MANAGEMENT SYSTEM LAB

0L+0T+2P+1C **MM: 100**

Following Experiments of ADBMS to be performed using WEKA and SQL server as a tool

1. SQL Queries involving Cartesian product, Joins, Nested query, Set Operation.
2. Demonstration of preprocessing on dataset Student.
3. Demonstration of preprocessing on dataset Labor.
4. Demonstration of Association rule process on dataset Contactlenses using Apriori algorithm
5. Demonstration of Association rule process on dataset Test using Apriori algorithm
6. Demonstration of clustering rule process on dataset Iris using simple K-means
7. Demonstration of clustering rule process on dataset Student using simple K-means

Vivekananda Global University, Jaipur

Semester I **M.Tech (Computer Science & Engineering)**

MCS 106: ADVANCE DATABASE MANAGEMENT SYSTEM

3L+0T+0P+3C **MM: 100**

Module I: REVIEW: DBMS concepts, Relational database systems, applications of DBMS, Structured Query Language. **SQL:** Basic SQL query, nested queries, aggregate operators, null values, integrity constraints,

Triggers, Functional Dependency and Normalization, Different normal forms 1NF, 2NF, 3NF,4NF, BCNF. Limitations of Relational Data Model, Null Values and Partial Information

Module II: TRANSACTION PROCESSING: ACID properties, Transaction & schedule, Concurrent execution of transaction, Lock-based concurrency control, crash recovery, Serializability and recoverability, Lock management, lock conversions, dealing with dead locks, Optimistic concurrency control, timestamp-based concurrency, multi version concurrency control, ARIES, logs, the write-ahead log protocol, check point, recovering from a system crash, media recovery

Module III: OBJECT ORIENTED DATABASE MANAGEMENT SYSTEMS: Complex data type, object oriented data model, object containment, persistence of objects. Design of distributed databases, security and integrity of databases. Deductive databases, image databases and multimedia databases.

Module IV: INTRODUCTION TO DATA WAREHOUSE: Data Warehouse Architecture: System Processes, Process Architecture, Hardware Architecture. Data Warehouse Design: Data Warehouse Schema, Partitioning strategy, Aggregations, Data Marting, Meta data, System & Process managers. Introduction to Data Mining and related topics. Data Mining Techniques:- Statistics, Similarity Measures, Decision Trees, Neural Networks, Genetic Algorithms.

Module V: ALGORITHMS FOR CLASSIFICATION: Statistical–based, Distance-based, Decision Tree- based, NN –based and Rule based. Algorithms for Clustering:- Hierarchical Algorithms, Partitional Algorithms, Clustering large Databases, Clustering with categorical Attributes. Associate Rules: - Basic Algorithms, Parallel and Distributed algorithms, Comparative study, Incremental Rules, Advanced Association Rule Technique, Metrics for Quality of a Rule. Web Mining:- Web Content mining, Structure Mining, Usage Mining.

Text/Reference Books:

1. Silberchatz, A., Korth, H. F. and Sudarshan, S., "Database System Concepts", 4th Ed., Tata-McGraw Hill.
2. Han, J. and Kamber, M., "Data Mining: Concepts and Techniques", 2nd Ed., Morgan Kaufmann.
3. Ray Chhanda, "Distributed Database Systems", Pearson.
4. Data Warehousing in the real world by Sam Anahory & Murray, Pearson Education publishers.

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Semester I **M.Tech (Computer Science & Engineering)**

MCS 107 : WEB SEARCH & MINING

3L+0T+0P+3C **MM: 100**

Module I: DATA WAREHOUSING: Introduction, scope, practical implications, structures and Functions, Types of data warehouses: Host based, single stage, LAN based, multistage, stationary, distributed and virtual data warehouses, Data warehouse: The building Blocks- Defining Features, data warehouses and data marts, overview of the components, metadata in the data warehouse.

Module II: DEFINING THE BUSINESS REQUIREMENTS: Dimensional analysis, information packages- a new concept, requirements gathering methods, requirements definition: scope and content.
Data warehouse architectures: Metadata, operational data & operational databases. Data warehouse architecture model, 2-tier, 3tier & 4 tier data warehouses. OLAP and DSS support in data warehouses.

Module III: PRINCIPLES OF DIMENSIONAL MODELING: Objectives, From Requirements to data design, the STAR schema, STAR Schema Keys, Advantages of the STAR Schema
Dimensional Modeling: Updates to the Dimension tables, miscellaneous dimensions, the snowflake schema, aggregate fact tables, and families of STARS.

Module IV: DATA MINING: Basic concept, technology and rules, platform tools, operational vs. Information systems, discussion of ethics & privacy issues with respect to invasive use
Data mining techniques: Exploration of data mining methodologies, decision tables, Decision trees, classification rules, association rules, clustering, statistical models & linear models.

Module V: WEB MINING: Introduction to web mining techniques, web basics and HTTP, data Sources on the web, personalization, working with logs, forms and cookies, user identification and path analysis. E-Metrics.

Reference/Text books:

1. Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber Harcourt India.
2. Data Mining Techniques – Arun K Pujari, University Press
3. Building the DataWarehouse- W. H. Inmon, Wiley Dreamtech India Pvt. Ltd
4. Data Warehousing in the Real World – Sam Anahory & Dennis Murray.Pearson Edn Asia.
5. Data Warehousing Fundamentals – Paulraj Ponnaiah Wiley Student Edition

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Semester I **M.Tech (Computer Science & Engineering)**

MCS 108 : CLOUD COMPUTING

3L+0T+0P+3C **MM: 100**

Module I: UNDERSTANDING CLOUD COMPUTING: Cloud Computing, History of Cloud Computing, Cloud Architecture, Cloud Storage, Why Cloud Computing Matters, Advantages of Cloud Computing, Disadvantages of Cloud Computing, Companies in the Cloud Today, Cloud Services

Module II: DEVELOPING CLOUD SERVICES: Web-Based Application, Pros and Cons of Cloud Service Development, Types of Cloud Service Development, Software as a Service, Platform as a Service, Web Services, On-Demand Computing, Discovering Cloud Services Development Services and Tools, Amazon Ec2, Google App Engine, IBM Clouds

Module III: CLOUD COMPUTING FOR EVERYONE: Centralizing Email Communications, Collaborating on Schedules, Collaborating on To-Do Lists, Collaborating Contact Lists, Cloud Computing for the Community, Collaborating on Group Projects and Events, Cloud Computing for the Corporation

Module IV: USING CLOUD SERVICES: Collaborating on Calendars, Schedules and Task Management, Exploring Online Scheduling Applications, Exploring Online Planning and Task Management, Collaborating on Event Management, Collaborating on Contact Management, Collaborating on Project Management, Collaborating on Word Processing - Collaborating on Databases, Storing and Sharing Files

Module V: OTHER WAYS TO COLLABORATE ONLINE: Collaborating via Web-Based Communication Tools, Evaluating Web Mail Services, Evaluating Web Conference Tools, Collaborating via Social Networks and Groupware, Collaborating via Blogs and Wikis

Text/Reference Books:

1. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.

2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.

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Semester I **M.Tech (Computer Science & Engineering)**

MCS 109 : DATA COMMUNICATION

3L+0T+0P+3C **MM: 100**

Module -I: DIGITAL MODULATION SCHEMES: BPSK, QPSK, 8PSK, 16PSK, 8QAM, 16QAM, DPSK – Methods, Band Width Efficiency, Carrier Recovery, Clock Recovery.

Module -II: BASIC CONCEPTS OF DATA COMMUNICATIONS, INTERFACES AND MODEMS: Data Communication Networks, Protocols and Standards, UART, USB, I2C, I2S, Line Configuration, Topology, Transmission Modes, Digital Data Transmission, DTE-DCE interface, Categories of Networks – TCP/IP Protocol suite and Comparison with OSI model.

Module -III: ERROR CORRECTION: Types of Errors, Vertical Redundancy Check (VRC), LRC, CRC, Checksum, Error Correction using Hamming code, Data Link Control: Line Discipline, Flow Control, Error Control, Data Link Protocols: Asynchronous Protocols, Synchronous Protocols, Character Oriented Protocols, Bit-Oriented Protocol, Link Access Procedures.

Module –IV MULTIPLEXING: Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM), Multiplexing Application, DSL. Local Area Networks: Ethernet, Other Ether Networks, Token Bus, Token Ring, FDDI, Metropolitan Area Networks**:** IEEE 802.6, SMDS, Switching: Circuit Switching, Packet Switching, Message Switching, Networking and Interfacing Devices: Repeaters, Bridges, Routers, Gateway, Other Devices.

UNIT -V: MULTIPLE ACCESS TECHNIQUES: Random Access, Aloha- Carrier Sense Multiple Access (CSMA)- Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), Controlled Access- Reservation- Polling- Token Passing, Channelization, Frequency- Division Multiple Access (FDMA), Time – Division Multiple Access (TDMA), Code - Division Multiple Access (CDMA), OFDM and OFDMA.

Reference/Text Books:

1. Data Communication and Computer Networking - B. A.Forouzan, 2nd Ed., 2003, TMH.
2. Advanced Electronic Communication Systems - W. Tomasi, 5th Ed., 2008, PEI.
3. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
4. Data and Computer Communications - William Stallings, 8th Ed., 2007, PHI.
5. Data Communication and Tele Processing Systems -T. Housely, 2nd Ed, 2008, BSP.
6. Data Communications and Computer Networks- Brijendra Singh, 2nd Ed., 2005, PHI.

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Semester II **M.Tech (Computer Science & Engineering)**

MGT 103 : PROJECT FORMULATION AND APPRAISAL

3L+0T+0P+3C **MM:100**

Module 1 **INTRODUCTION –** project attributes; project life cycle; role of managers; Management – scheduling; Gantt charts; CPM; PERT; crashing; Generation of project ideas – resource allocation; environment analysis – PEST analysis, porter's model; analysis of strategic capabilities – value chain, BCG matrix, flexibility

Module 2 **APPRAISAL METHODS IN PROJECT SCANNING AND SELECTION –** market appraisal; technical appraisal; environmental appraisal; evaluating intangibles, social appraisal – SCBA, UNIDO, LM, CSR

Module 3 Total quality management

Module 4 **FINANCIAL APPRAISAL:** Time value of money; cost of capital – equity, debt, preference; weighted average cost; marginal and average cost; Capital budgeting – investment appraisal techniques; NPY; IRR; Payback period; replacement decisions; selection of exact discount factor – problems, inflation, taxation;

Module 5: **RISK ANALYSIS MODELS –** single probability analysis; sensitivity analysis; break even analysis; certainty equivalent; uncertainty analysis, simulation; decision tree model; risk and utility.

References & Text Books

1. Khatua Sitangshu. *Project Management and Appraisal*, Oxford University Press
2. Pandey, I.M. *Financial Management*. Vikas Publishing House
3. Prasanna, Chandra. *Financial Management*. Tata McGraw-Hill
4. Maheshwari, S .N. & Maheshwari, S. K. *Advanced Management Accounting Vol.1 & Vol.2*. Vikas Publishing House
5. Paresh Shah. *Management Accounting*. Oxford University Press

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Semester II **M.Tech (Computer Science & Engineering)**

MCS 201: CRYPTOGRAPHY AND NETWORK SECURITY

3L+1T+0P+3.5C **MM:100**

Module I: INTRODUCTION: Basic objectives of cryptography, secret-key and public-key cryptography, one-way and trapdoor one-way functions, cryptanalysis, attack models, classical cryptography. Block ciphers: Modes of operation, DES and its variants, RCS, IDEA, SAFER, FEAL, BlowFish, AES, linear and differential cryptanalysis. Stream ciphers: Stream ciphers based on linear feedback shift registers, unconditional security.

Module II: PUBLIC-KEY PARAMETERS: Modular arithmetic, primality testing, Chinese remainder theorem, modular square roots, finite fields. Intractable problems: Integer factorization problem, Hash Function- Hash Function and Data Integrity, Security of Hash Function, Iterated Hash Functions, Message Authentication Codes. Message digest: Properties of hash functions, MD2, MD5 and SHA-1, keyed hash functions, attacks on hash functions.

Module III: ALGORITHMS: RSA problem, modular square root problem, discrete logarithm problem, Diffie-Hellman problem, known algorithms for solving the intractable problems. Public-key encryption: RSA, Rabin and EIGamal schemes, side channel attacks. Key exchange: Diffie-Hellman and MQV algorithms. Digital signatures: RSA, DAS and NR signature schemes, blind and undeniable signatures, Kerboros, X.509 Directory Authentication Services.

Module IV: EMAIL SECURITY: Pretty Good Privacy (PGP) and S/MIME. IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Association and Key Management. Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET)

Module V:THREATS & FIREWALLS: Basic concepts of SNMP, Intruders, Viruses and related threats, Virus Countermeasures, Firewall Design principles, Trusted Systems, Intrusion Detection Systems.

Text/Reference Books:

1. Silberchatz, A., Korth, H. F. and Sudarshan, S., "Database System Concepts", 4th Ed., Tata-McGraw Hill.
2. Han, J. and Kamber, M., "Data Mining: Concepts and Techniques", 2nd Ed., Morgan Kaufmann.
3. Douglas R. Stinson,"Cryptography and Practice ", Third Edition, Chapman & Hall/CRC,2006
4. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education, 2008.
5. Cryptography & Network Security by Behrouz A.Forouzan, TMH 2007
6. William Stallings, "Cryptography and Network Security: Principles and Practices", Third Edition, Pearson Education, 2006.

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Semester II **M.Tech (Computer Science & Engineering)**

MCS 202: ADVANCE OPERATING SYSTEM

3L+1T+0P+3.5C **MM:100**

Module I: ARCHITECTURES OF DISTRIBUTED SYSTEMS - System Architecture types - issues in distributed operating systems - communication networks - communication primitives. Theoretical Foundations - inherent limitations of a distributed system - lamp ports logical clocks - vector clocks - casual ordering of messages - global state - cuts of a distributed computation - termination detection. Distributed Mutual Exclusion - introduction - the classification of mutual exclusion and associated algorithms - a comparative performance analysis.

Module II: DISTRIBUTED DEADLOCK DETECTION -Introduction - deadlock handling strategies in distributed systems - issues in deadlock detection and resolution - control organizations for distributed deadlock detection - centralized and distributed deadlock detection algorithms -hierarchical deadlock detection algorithms. Agreement protocols - introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, applications of agreement algorithms. Distributed resource management: introduction-architecture - mechanism for building distributed file systems - design issues - log structured file systems.

Module III: DISTRIBUTED SHARED MEMORY-ARCHITECTURE- algorithms for implementing DSM - memory coherence and protocols - design issues. Distributed Scheduling - introduction - issues in load distributing - components of a load distributing algorithm - stability - load distributing algorithm - performance comparison - selecting a suitable load sharing algorithm - requirements for load distributing -task migration and associated issues.

Module IV: FAILURE RECOVERY AND FAULT TOLERANCE: introduction- basic concepts - classification of failures - backward and forward error recovery, backward error recovery- recovery in concurrent systems - consistent set of check points - synchronous and asynchronous check pointing and recovery - check pointing for distributed database systems-recovery in replicated distributed databases. Protection and security -preliminaries, the access matrix model and its implementations.-safety in matrix model- advanced models of protection. Data security - cryptography: Model of cryptography, conventional Cryptography- modern cryptography, private key cryptography, data encryption standard- public key cryptography - multiple encryption - authentication in distributed systems.

Module V: MULTIPROCESSOR OPERATING SYSTEMS - basic multiprocessor system architectures - inter connection networks for multiprocessor systems - caching - hypercube architecture. Multiprocessor Operating System - structures of multiprocessor operating system, operating system design issues- threads- process synchronization and scheduling.

Database Operating systems :Introduction- requirements of a database operating system Concurrency control : theoretical aspects - introduction, database systems - a concurrency control model of database systems- the problem of concurrency control - serializability - distributed database systems, concurrency control algorithms - introduction, basic synchronization primitives, lock based algorithms-timestamp based algorithms, optimistic algorithms - concurrency control algorithms, data replication.

Text/Reference Books:

1. Mukesh Singhal, Niranjan G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", TMH, 2001
2. Andrew S.Tanenbaum, "Modern operating system", PHI, 2003
3. Pradeep K.Sinha, "Distributed operating system-Concepts and design", PHI, 2003.
4. Andrew S.Tanenbaum, "Distributed operating system", Pearson education, 2003

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Semester II **M.Tech (Computer Science & Engineering)**

MCS 203: ADVANCE COMPUTING

3L+0T+0P+3C **MM:100**

Module I: ALGEBRIC STRUCTURES: Semigroups, Monoids, groups, Substructures and Morphisms, Rings, Fields; Lattices, Distributive, Modular and Complemented; Boolean Algebra, Normal Forms (Conjunctive and Disjunctive), Simplification of Boolean Expressions Using Laws and K-Map.
Logic and Proofs: Basic Logic: Propositional Logic: Logical Connectives; Truth Tables; Converse, Inverse, Contra Positive, Negation, and Contradiction, Validity; Predicate Logic; Limitations of Predicate Logic, Universal and Existential Quantifier; Modus Ponens and Modus Tollens.

Module II: PROOF TECHNIQUES: Notions of Implication, The Structure of Formal Proofs; Direct Proofs; Proof by Counter Example; Contraposition; Contradiction; Mathematical Induction; Simple Induction, Strong Induction. The Stable Marriage Problem, Counting: Counting Arguments; Pigeonhole Principle; Permutations and Combinations, Combinatories and Combinatorial Proofs, Inclusion-Exclusion, Recursive Mathematical Definitions; Well Orderings, Recurrence Relations, Generating Functions.

Module III: INTRODUCTION TO AUTOMATA : Alphabets, Languages & Grammars, Classification of Automata, Chomsky Hierarchy of Grammars.
Finite State Automata: Finite state Automata - Non Deterministic and Deterministic FSA, NFSA with ε- moves, Equivalence of Deterministic and Non-Deterministic Automata

Module IV: REGULAR LANGUAGES: Regular Expressions, Regular Grammars, Equivalence of Regular Expression, FSA and Regular Grammars. Closure Properties, Minimality of Automata, Decision Algorithms. Pumping Lemma, Myhill Nerode Theorem
Context Free Languages: Context Free Grammars, Derivation Trees and Ambiguity, Normal Forms, Push Down Automata, Acceptance by Empty Stack and Final State, Equivalence Between CFG and PDA. Self Embedding Property and Pumping Lemma. Closure Properties, Decision Algorithms

Module V: RECURSIVE AND RECURSIVELY ENUMERABLE LANGUAGES: Turing Machines, Grammars, and Variations in Turing Machines. Recursive Functions, Church's Thesis. Universal Turing Machine, Closure Properties, Context Sensitive Languages and Linear Bounded Automata
Undecidability: Decidability, Undecidablity/Non-Computability, Reductions. Halting Problem, Post Correspondence and Modified Post Correspondence Problems, Unsolvable Problems about Turing Machines, Unsolvable Problems about Grammars

Text/Reference Books:

1. Kenneth Rosen, Discrete Mathematics and its Applications, 6th ed., McGraw-Hill, New York
2. C.L. Liu, Elements of Discrete Mathematics, 2nd Edition, McGraw Hill.
3. Richard .A. Johnson, Miller & Freund's Probability and Statistics for Engineers, Eastern Economy Edition.

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Semester II **M.Tech (Computer Science & Engineering)**

MCS 204 : SEMINAR-II

0L+0T+2P+1C **MM:100**

Each student will separately now continue to download further the research papers in the area, analyze, and allocate individually, the set of papers.

Literature survey Overview -What is literature survey, Functions of literature survey, maintaining a notebook, developing a Bibliography.

Methods of data collection –Observation, survey, contact methods, experimental,determining sample design Searching for publications –Publication databases, search engines and patent databases,Find some/all of the references for a given paper, including those that are not on the web.

Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation.

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Semester II **M.Tech (Computer Science & Engineering)**

MCS 205: ADVANCED OPERATING SYSTEM LAB

0L+0T+2P+1C **MM:100**

1. **Shell Programming**: Creating a script, making a script executables, shell syntax (variables, conditions, control structures, functions, and commands).

2. **Process**: Starting new process, replacing, replacing a process image, duplacating a process image, and waiting for a process, Zombie process.

3. **Signal**: Signal handling, sending signals, signal interface, signal sets.

4. **Semaphore**: Programmng with semaphores (use functions semctl, semget, semop, set_sem value, del_sem value, semaphores_p, semaphore_v).

5. **POSIX Threads**: Programming with pthread function (viz. pthread_create, pthread_join,pthread_exit, pthread_attr_init, pthread_cancel)

6. **Inter-process communication**: pipes (use function pipe, popen, pclose), named pipes (FIFOs, accessing FIFO).

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Semester II **M.Tech (Computer Science & Engineering)**

MCS 207: ADVANCED COMPUTER NETWORKS

3L+0T+0P+3C **MM:100**

Module I: COMPUTER NETWORKS AND THE INTERNET: What is the Internet. The Network edge. The Network core, Access Networks and Physical media, ISPs and Internet Backbones, Delay and Loss in Packet, Switched Networks, History of Computer Networking and the Internet, Foundation of Networking Protocols: 5-layer TCP/IP Model, 7-Layer OSi Model, Internet Protocols and Addressing, Equal-Sized Packets Model: ATM. Networking Devices: Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, Router Structure.

Module II: THE LINK LAYER AND LOCAL AREA NETWORKS: Link Layer Introduction and Services, Error-Detection and Error-Correction techniques, Multiple Access Protocols, Link Layer Addressing, Ethernet, Interconnections: Hubs and Switches, PPL: The point-to-point Protocol, Link Virtualization. Routing and Internet Working: Network Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms. Interdomain Routing Protocols. Congestion Control at Network Layer.

Module III:LOGICAL ADDRESSING: IPv4 Addresses, IPv6 Addresses, Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6, Multicasting Techniques and Protocols: Basic Definitions and Techniques, Intradomain Multicast Protocols, Interdomain Multicast Protocols, Node-Level Multicast algorithms, Transport and End-to-End Protocols: Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport layer protocols, TCP Congestion Control, Application Layer: Principles of Network Applications, The web and HTTP, file Transfer: FTP, Electronic Mail in the internet, Domain Name system (DNS), PP File sharing, socket Programming with TCP and UDP Building a Simple Web Server.

Module IV: WIRELESS NETWORK AND MOBILE IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standards, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs), Optical Networks and WDM Systems**:** Overview of Optical Networks, Basic Optical Networking Devices, Large-Scale Optical Switches, Optical Routers, Wavelength Allocation in Networks, Case Study: An All, Optical Switch.

Module V :VPNS TUNNELING AND OVERLAY NETWORKS: Virtual Private Networks (VPNs), Multiprotocol Label Switching (MPLS), Overlay Networks, **VoIP and Multimedia Networking**: Overview of IP Telephony, VoIP Signaling Protocols, Real-Time Media Transport Protocols, Distributed Multimedia Networking, Stream Control Transmission Protocol, **Mobile Ad-hoc Networks:** Overview of Wireless Ad-hoc Networks, Routing in Ad-hoc Networks, Routing Protocols for Ad-hoc Networks, **Wireless Sensor Networks:** Sensor Networks and Protocol Structures, Clustering Protocols, Routing Protocols.

Text/Reference Books:

1. Computer Networking: A Top-Down Approach Featuring the Internet, James F, Keith W.Ross, Third Edition, Pearson Education, 2007.
2. Computer and Communication Networks, NaderF, Mir, Pearson Education, 2007.
3. Guide to Networking Essentials, Greg Tomsho,Ed Tittel, David Johnson,Fifth Edition, Thomson.
4. An Engineering Approach to Computer Networking, S.Keshav, Pearson Education.
5. Campus Network Design Fundamentals, Diane Teare, Catherine Paquet, Pearson Education (CISCO Press)
6. Computer Networks, Andrew S. Tanenbaum, Fourth Edition, Prentice Hall.
7. The Internet and Its Protocols, A.Farrel, Elsevier.

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Semester II **M.Tech (Computer Science & Engineering)**

MCS 208: ADVANCE COMPILER DESIGN

3L+0T+0P+3C **MM:100**

Module I: OVERVIEW OF COMPILATION: Phases of Compilation, Lexical Analysis, Regular Grammar and regular expression for common programming language features, pass and Phases of translation, interpretation, bootstrapping, data structures in compilation, LEX lexical analyzer generator.

Module II: PARSING: Context free grammars, Top down parsing, Backtracking, LL (1), recursive descent parsing, Predictive parsing, Preprocessing steps required for predictive parsing.

Bottom up parsing: - Shift Reduce parsing, LR and LALR parsing, Error recovery in parsing, handling ambiguous grammar, YACC, automatic parser generator.

Module III: SEMANTIC ANALYSIS: Intermediate forms of source Programs, abstract syntax tree, Attributed grammars, Syntax directed translation, Conversion of popular Programming languages language Constructs into Intermediate code forms, Type checker.

Module IV: SYMBOL TABLES: Symbol table format, organization for block structured languages, hashing, and tree structures representation of scope information. Block structures and non block structure storage allocation: static, Runtime stack and heap storage allocation, storage allocation for arrays, strings and records.

Module V : CODE GENERATION- Processing the intermediate Code- Interpretation, Code generation, Simple code generation, code generation for basic blocks, Register allocation,

Code optimization: Consideration for Optimization, Machine dependent and machine independent code optimization, Scope of Optimization, local optimization, loop optimization, frequency reduction, folding, DAG representation.

Text/Reference Books:

1. Compilers principles, techniques and tools A.V.Aho, Ravi Sethi& J.D. Ullman; Pearson ed.
2. Advanced Compiler Design Implementation, S.S.Muchnick, Elsevier
3. Modern Compiler Implementation in C- Andrew N. Appel, Cambridge University Press.

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Semester II **M.Tech (Computer Science & Engineering)**

MCS 209 : ADVANCED IMAGE PROCESSING

3L+0T+0P+3C **MM:100**

Module I: INTRODUCTION AND DIGITAL IMAGE FUNDAMENTALS - The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbors, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations.

Module II: IMAGE ENHANCEMENT IN THE SPATIAL DOMAIN - Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods. Image Enhancement in the Frequency Domain. Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering. Image Restoration.

Module III: A MODEL OF THE IMAGE DEGRADATION - Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position- Invariant Degradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, and Geometric Transformations.

Module IV: COMPRESSION - Image Compression Coding, Interpixel and Psycho visual Redundancy, Image Compression models, Elements of Information Theory, Error free comparison, Lossy compression, Image compression standards. Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

Module V: REPRESENTATION AND DESCRIPTION - Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms. Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods

Text/Reference Books:

1. Rafael C. Conzalez & Richard E. Woods, “Digital Image Processing”, 2nd edition, Pearson Education, 2004.
2. A.K. Jain, “Fundamental of Digital Image Processing”, PHI, 2003.
3. Rosefield Kak, “Digital Picture Processing”, 1999.
4. W.K. Pratt, “Digital Image Processing”, 2000.

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Semester II **M.Tech (Computer Science & Engineering)**

MCS 210: BIO INFORMATICS

3L+0T+0P+3C **MM:100**

Module I- INTRODUCTION TO BIOINFORMATICS AND DATA GENERATION : What is bioinformatics and its relation with molecular biology. Examples of related tools(FASTA, BLAST, BLAT, RASMOL), databases(GENBANK, Pubmed, PDB) and software(RASMOL,Ligand Explorer). Data generation; Generation of large scale molecular biology data. (Through Genome sequencing, Protein sequencing, Gel electrophoresis, NMR Spectroscopy, X-Ray Diffraction, and microarray). Applications of Bioinformatics.

Module II- BIOLOGICAL DATABASE AND ITS TYPES: Introduction to data types and Source. Population and sample, Classification and Presentation of Data. Quality of data, private and public data sources, General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL), Protein databases (Primary, Composite, and Secondary), Specialized Genome databases: (SGD, TIGR, and ACeDB), Structure databases (CATH, SCOP, and PDBsum)

Module III- DATA STORAGE AND RETRIEVAL AND INTEROPERABILITY: Flat files, relational, object oriented databases and controlled vocabularies. File Format (Genbank, DDBJ, FASTA, PDB, SwissProt), Introduction to Metadata and search; Indices, Boolean, Fuzzy, Neighboring search, The challenges of data exchange and integration. Ontologies, interchange languages and standardization efforts, General Introduction to XML, UMLS, CORBA, PYTHON and OMG/LIFESCIENCE.

Module IV- SEQUENCE ALIGNMENTS AND VISUALIZATION: Introduction to Sequences, alignments and Dynamic Programming, Local alignment and Global alignment (algorithm and example), Pairwise alignment , BLAST and FASTA Algorithm , multiple sequence alignment , Clustal W algorithm, Methods for presenting large quantities of biological data: sequence viewers (Artemis, SeqVISTA), 3D structure viewers (Rasmol, SPDBv, Chime, Cn3D, PyMol), Anatomical visualization.

Module V- GENE EXPRESSION AND AND REPRESENTATION OF PATTERNS AND RELATIONSHIP

General introduction to Gene expression in prokaryotes and eukaryotes, transcription factors binding sites. SNP, EST, STS, Introduction to Regular Expression, Hierarchies, and Graphical models (including Marcov chain and Bayes notes), Genetic variability and connections to clinical data.

Text/Reference Books:

1. Bioinformatics Basics, Hooman Rashidi, Lukas K. Buehler, CRC press, 2nd edition
2. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd edition, Wiley, 2003
3. Introduction to Bioinformatics, Stephen A. Krawetz, David D. Womble, May 2003, Humana Press, 2003

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Semester II **M.Tech (Computer Science & Engineering)**

MCS 211: CYBER FORENSICS

3L+0T+0P+3C **MM:100**

Module I: COMPUTER FORENSICS: Definition, requirement of cyber forensics in today's IT era, Computer Forensics Fundamentals – Types of Computer Forensics Technology – Types of Vendor and Computer Forensics Services, Cyber Crimes & Cyber Forensics,

Module II: DATA RECOVERY: Data Recovery – Evidence Collection and Data Seizure – Duplication and Preservation of Digital Evidence – Computer Image Verification and Authentication, Important software tools for Data Recovery, Network Forensics, Email Header investigation

Module III: ELECTRONIC EVIDENCE: Discover of Electronic Evidence, Identification of Data Reconstructing Past Events Networks, Electronic evidence and cyber laws, collecting evidence

Module IV: THREATS: Fighting against Macro Threats – Information Warfare Arsenal – Tactics of the Military – Tactics of Terrorist and Rogues – Tactics of Private Companies.

Module V: SURVEILLANCE: The Future Arsenal Surveillance Tools, Victims and Refugees, Advanced Computer Forensics, Case Studies

Reference/Text Book:

1. John R. Vacca, "Computer Forensics", Firewall Media, 2004.
2. Chad Steel, "Windows Forensics", Wiley India, 2006.
3. Majid Yar, "Cybercrime and Society", Sage Publications, 2006.
4. Robert M Slade, "Software Forensics", Tata McGraw Hill, 2004

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Semester II **M.Tech (Computer Science & Engineering)**

MCS 212: DISTRIBUTED OPERATING SYSTEMS

3L+0T+0P+3C **MM:100**

Module I: Introduction to Distributed Computing Systems, Evolution and models of Distributed Computing System, Introduction and issues in Designing a Distributed Operating System, Distributed Computing Environment (DCE), High - level protocols.

Module II: Logical time and event ordering. Global state and snapshot algorithms, mutual exclusion, clock synchronization, leader election, deadlock detection, termination detection, spanning tree construction. Programming models: remote procedure calls, distributed shared memory.

Module III: Distributed shared memory Introduction, Design and implementation issues, and Consistency models. CORBA Case Study: CORBA services. Threads, Virtualization, Clients, Servers, Code migration.

Module IV: Distributed Object - Based Systems Architecture, Processes, Communication, and Naming, Synchronization, Consistency and replication. Adaptive fault - tolerance, Fault detection and location in real - time systems.

Module V: Security Engineering, Protocols, Hardware protection, Cryptography: The Random Oracle model, Symmetric and Asymmetric Crypto-primitives, Modes of operations, Hash functions, Dependability concepts, Byzantine failures, Fault injection, Fault-tolerant techniques, performability metrics. Issues of Survivability, Emission Security: Introduction, Technical Surveillance and countermeasures, Passive Attacks, Active Attacks. Information warfare.

Text/Reference Books:

1. Pradeep. K. Sinha, “Distributed Operating Systems: Concepts and Design” , PHI, 2007.

2. Andrew S. Tennenbaum, and Maarten Van Steen, “Distributed Systems”, PHI, 2008.

3. George Coulouries, Jean Dollimore, Tim Kindberg “Distributed Systems Concepts and design” III Edition, Pearson Education Asia, 2004.

4. Ross J Anderson and Ross Anderson, “Security Engineering: A guide to building dependable distributed systems”, Wiley, 2001.

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Semester III **M.Tech (Computer Science & Engineering)**

MCS 301: DISSERTATION PART-I

0L+0T+0P+8C **MM:100**

Objective: To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

The project work can be a design project/experimental project and/or computer simulation project on any of the topics in Computer software design related topics. The project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential, they may be permitted to continue their project outside the parent institute. Department will constitute an Evaluation Committee to review the project work. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members. The student is required to undertake the master research project phase 1 during the third semester and the same is continued in the 4^{th} semester (Phase 2). Phase 1 consist of preliminary thesis work, two reviews of the work and the submission of preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4th semester. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members. The technical paper is to be submitted along with the thesis

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Semester III **M.Tech (Computer Science & Engineering)**

MCS 303 : SEMINAR-III

0L+0T+0P+4C **MM: 100**

Objective: To assess the debating capability of the student to present a technical topic. Also to impart training to students to face audience and present their ideas and thus creating in them self-esteem and courage that are essential for engineers.

Individual students are required to choose a topic of their interest from Computer Science & Engineering related topics preferably from outside the M.Tech syllabus and give a seminar on that topic about 30 minutes. A committee consisting of at least three faculty members (preferably specialized in Computer Science & Engineering) shall assess the presentation of the seminar and award marks to the students. Each student shall submit two copies of a write up of his/her seminar topic. One copy shall be returned to the student after duly certifying it by the chairman of the assessing committee and the other will be kept in the departmental library. Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation.

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Semester IV **M.Tech (Computer Science & Engineering)**

MCS 401: DISSERTATION PART- II

0L+0T+0P+16C **MM:100**

Objective: To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

Master Research project phase II is a continuation of project phase I started in the third semester. There would be two reviews in the fourth semester, first in the middle of the semester and the second at the end of the semester. First review is to evaluate the progress of the work, presentation and discussion. Second review would be a pre-submission presentation before the evaluation committee to assess the quality and quantum of the work done. This would be a pre-qualifying exercise for the students for getting approval by the departmental committee for the submission of the thesis. At least one technical paper is to be prepared for possible publication in journal or conferences. The technical paper is to be submitted along with the thesis. The final evaluation of the project will be external evaluation.