Masters of Computer Science (24 months. Full Time)
Under
West Bengal University of Technology

Academic Summary

COURSE OBJECTIVE:

1. To insulate the students from fast obsolescence of computer technology by way of imparting fundamental knowledge, thinking skills and technical skills for superior mastery in the areas of computer science and its applications,

2. Enable the students to be well placed in leading business organizations anywhere in the world.

COURSE DURATION: The course duration is of 24 months spread over four Semesters with credit hours as per the WBUT norms. The course has sufficient emphasis on computing skills as well along with its science and management parts.

COURSE CURRICULUM PLAN: The Course Curriculum is based on comparative analysis of existing MCA and MSc Computer Science curriculums of other Universities. The curriculum has sufficient exposure to hands-on skills and is much more directed towards higher employability. It is also well suited for upward accommodation of science graduates and BCA graduates.

__Summary__

Semester No	Contact hr/wk	Credit
1	29	23
2	30	23
3	29	26
4	28	20
Total	`	92

3. Detailed Course Structure

Semester - I

SL. NO.	CODE	THEORY	L	T	P	TOTAL	CREDITS
A. THEORY							
			CONTACTS PERIODS/WEEK				**CREDITS**
1	MCS101	Principles of Programming Languages	4	1	-	5	4
2	MCS102	Advanced DBMS	4	1	-	5	4
3	MCS103	Information Systems & Software Engineering	4	1	-	5	4
4	MCS104	Discrete Mathematics & Numerical Methods	4	1	-	5	4
5	MCS105	Corporate Culture & Communication	3	0	-	3	3
Total of Theory						**23**	**19**
B. PRACTICAL							
6	MCS191	Programming Lab (C)	-	-	3	3	2
7	MCS192	Advanced DBMS Lab	-	-	3	3	2
Total of Practical						**6**	**4**
Total of Semester			**29**				**23**

Semester - II

SL. NO.	CODE	THEORY	L	T	P	TOTAL	CREDITS
A. THEORY							
			CONTACTS PERIODS/WEEK				**CREDITS**
1	MCS201	Object Oriented Analysis & Design	4	1	-	5	4
2	MCS202	Data Structure and Analysis of Algorithm	4	1	-	5	4
3	MCS203	Advanced Computer Architecture	4	1	-	5	4
4	MCS204	Data Communication & Networking	4	1	-	5	4
Total of Theory						**20**	**16**

		B. PRACTICAL					
5	MCS291	Object Oriented Programming Lab (using Java)	-	-	3	3	2
6	MCS292	Data Structure Lab	-	-	3	3	2
7	MCS293	Microprocessor and VHDL/Verilog Lab	-	-	3	4	3
Total of Practical						10	7
Total of Semester						30	23

Semester - III

A. THEORY							
SL. NO.	**CODE**	**THEORY**	**CONTACTS PERIODS/WEEK**				**CREDITS**
			L	**T**	**P**	**TOTAL**	
1	MCS301	Operation Research	4	1	-	5	4
2	MCS302	Advanced Operating System	4	1	-	5	4
3	MCS303	Artificial Intelligence	4	1	-	5	4
4	MCSE301 A/B/C	Elective – 1	4	1	-	5	4
Total of Theory						20	16
B. PRACTICAL							
5	MCS391	OR Lab	-	-	3	3	2
6	MCS392	OS Lab (Unix)	-	-	3	3	2
7	MCS393	Seminar	-	-	3	3	2
8	MCS394	Industrial Training	-	-	-	-	4
Total of Practical						09	10
Total of Semester						29	26

Semester - IV

<table>
<tr><td colspan="8">A. THEORY</td></tr>
<tr><td>SL.
NO</td><td>CODE</td><td>THEORY</td><td colspan="4">CONTACTS
PERIODS/WEEK</td><td>CREDITS</td></tr>
<tr><td></td><td></td><td></td><td>L</td><td>T</td><td>P</td><td>TOTAL</td><td></td></tr>
<tr><td>1</td><td>MCSE401
A/B/C</td><td>Elective – 2</td><td>4</td><td>1</td><td>-</td><td>5</td><td>4</td></tr>
<tr><td>2</td><td>MCSE402
A/B/C</td><td>Elective – 3</td><td>4</td><td>1</td><td>-</td><td>5</td><td>4</td></tr>
<tr><td colspan="6">Total of Theory</td><td>10</td><td>8</td></tr>
<tr><td colspan="8">B. PRACTICAL</td></tr>
<tr><td>3</td><td>MCS491</td><td>Dissertation</td><td>-</td><td>-</td><td>15</td><td>15</td><td>6</td></tr>
<tr><td>4</td><td>MCS492
A/B/C</td><td>Elective – 3 Lab</td><td>-</td><td>-</td><td>3</td><td>3</td><td>2</td></tr>
<tr><td>5</td><td>MCS493</td><td>Viva Voce</td><td>-</td><td>-</td><td>-</td><td>-</td><td>4</td></tr>
<tr><td colspan="6">Total of Practical</td><td>18</td><td>12</td></tr>
<tr><td colspan="6">Total of Semester</td><td>28</td><td>20</td></tr>
</table>

Elective Theory Papers for Semesters III & IV

Elective Set	Course Code	Topic
1	MCS E301A	Embedded Systems
	MCS E301B	Image Processing
	MCS E301C	Automata & Natural Language Processing
2	MCS E401A	Cloud Computing
	MCS E401B	Mobile Computing
	MCS E401C	Network Security
3	MCS E402A	Data Warehousing & Mining
	MCS E402B	Soft Computing
	MCS E402C	Social Network Analysis

Elective Practical Lab for Semester IV

Elective Set	Course Code	Topic
1	MCS 492A	Data Warehousing & Mining Lab
	MCS 492B	Soft Computing Lab
	MCS 492C	Social Network Analysis Lab

Note: One elective from each of the three Elective Sets as above may be opted for. The detailed syllabus/scope of electives shall be finalized in consultation with Board of Studies/ Academic Council of M.Sc. Computer Sc under WBUT.

Principles of Programming Languages (MCS101)

Concepts of programming languages, Programming domains, Language Evaluation Criteria, influences on Language design, Language categories, Programming Paradigms – Imperative, Object Oriented, functional Programming , Logic Programming. Programming Language Implementation – Compilation and Virtual Machines, programming environments.

Syntax and Semantics: general Problem of describing Syntax and Semantics, formal methods of describing syntax - BNF, EBNF for common programming languages features, parse trees, ambiguous grammars, attribute grammars, denotational semantics and axiomatic semantics for common programming language features.

Data types: Introduction, primitive, character, user defined, array, union, pointer and reference types, structure, design and implementation uses related to these types. Names, Variable, concept of binding, type checking, strong typing, type compatibility, named constants, variable initialization.

Expressions and Statements: Arithmetic relational and Boolean expressions, Short circuit evaluation mixed mode assignment, Assignment Statements, Control Structures – Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, guarded commands.

Subprograms and Blocks: Fundamentals of sub-programs, Scope and lifetime of variable, static and dynamic scope, Design issues of subprograms and operations, local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, parameters that are sub-program names, design issues for functions user defined overloaded operators, co routines.

Introduction and overview of logic programming, basic elements of prolog, application of logic programming, Introduction, fundamentals of FPL, LISP.

Text Books:

1. Programming Languages –Louden, Second Edition, Thomson
2. LISP Patrick Henry Winston and Paul Horn Pearson Education.
3. Programming in PROLOG Clocksin, Springer
4. Programming With C, Gottfried, TMH
5. C Programming Essentials – Kashi Nath Dey and Samir K Bandyopadhyay, Pearson Education

Advanced DBMS (MCS102)

Overview of Database Management, Conceptual Database Design, Logical Database Design,
Physical Database Design

Introduction to Relational Database : Relation, Optimization, The Catalog, Base Relvars and Views, Transactions, The Suppliers and Parts Database.

Relational Model Concepts, Relational Model, Constraining, Referential Integrity Constraints, Defining Referential Integrity Constraints, Update Operations on Relations, Structured Query Language (SQL), Data Definition Language Commands, Data Manipulation Language Commands, Transaction Control Commands, SQL Command Syntax and Usage, The Basic Query Block, Querying Data with Multiple Conditions, Basic Relational Algebra Operations, The Select Operation, Additional Relational Operations.

ER- and EER-to-Relational Mapping: ER- to Relational Mapping Algorithm, Summary of Mapping for Model Constructs and Constraints Mapping EER Model Concepts to Relations, Query, Processing and Optimization: Query Processing, Query Optimization, Database Tuning.

Object Oriented Database Systems: Characteristics of an Object-relation Database Management System (ORDBMS), Complex Objects, Inheritance, Function Overloading, Rules.

Distributed Database : Distributed Database System, Distributed Database Design, Data Fragmentation, Data Replication, Data Allocation, Query Processing in Distributed Databases.

Recovery : Transactions, Transaction Recovery, System Recovery, Media Recovery, Two-phase Commit.

Database Security : Security and Integrity Threats Intentional or Malicious Threats Defense Mechanisms, Security Policies, Authorization, Objects, View as objects, Granularity, Subject, Access Types.

Database Operating Systems : Features of a Database as Concurrency Control, A Concurrency Control Model Theory of Serializability Concurrency Control Algorithms, Concurrency Control Based on Timestamp Ordering Multiversion Concurrency Control Techniques, Optimistic Algorithm.

Multimedia Databases : Multimedia Data Formats, Continuous - Media Data, Similarity - Based Retrieval, Mobility and Personal Database, Database Technologies, Serving Database on the Web, Applying Databases to the Internet.

Text Books:

1.	Database System Concepts – 6th Edition by Silberschatz, Korth and Sudarshan
2.	Fundamentals of Database Systems – 5th Edition by R.Elmasri, S. Navathe
3.	Database Design and Relational Theory: Normal Forms and All That Jazz by C.J. Date

Information Systems & Software Engineering (MCS103)

Introduction and IS in Global Business Today. Global E-Business: How Business Use Information System, IT Infrastructure and Emerging Technologies, Foundations of Business Intelligence, Telecommunications, the internet, and wireless Technology, Securing Information Systems, Enterprise Applications, Knowledge Management, Enhancing Decision Making

information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, software planning and managing the project (single & multi variable model), design, software modularity & metrics, coding, testing, implementation, maintenance, software quality and reliability

Text Books:

1.	Management Information Systems: Managing the Digital Firm - 11th Edition by Kenneth C. Laudon Kenneth C. Laudon
2.	Software Engineering: A Practitioner's Approach, 7/e by Roger S Pressman, R. S. Pressman & Associates, Inc.
3.	An Integrated Approach to Software Engineering by P. jalote, Springer

Discrete Mathematics & Numerical Methods (MCS104)

Propositional logic, Logical equivalence, Permutation and combinations, Generating functions, Recurrence relations, Graph Theory Concepts Graphs, sub-graphs, cyclic graphs, Trees, spanning trees, binary trees, Algorithms- Kruskal's , Prim's , Dijkstra's , Flyod's ,Warshall's, DFS, BFS, Isomorphism, homomorphism

Finite automata – NFA, DFA, Conversion, Mealy M/C, Moore M/C, Introduction to Languages & Grammars and their relation with Automata.

Interpolation-Newtons Forward, Backward, Sterling & Bessel's Interpolation formula, Lagrange's Interpolation

Integration- Trapezoidal, Simpson's 1/3 rd, Weddel's Rule, Romberg Integration, Gauss-Legendre two & three point formula, Newton Cotes Formula.

Gram-Schmidt orthogonalisation, Tchebycheff polynomial

Solution of transcendental equations- Method of Iteration, Method of Bisection, Newton -Raphson Method, Regula-Falsi method, Secant Method.

Solution of system of linear equations- Gauss Elimination Method, Gauss-Jacobi, Gauss-Seidel, LU factorisation, Tri-diagonalisation.

Inverse Interpolation.

Least Square Curve fitting- linear & non-linear

Solution of Differential Equations- Picard's method, Euler-modified method,Taylor's Series method, Runge-Kutta method, Milne's Predictor-Corrector method

Text Books:
1.   Theory of Computer Science, Mishra & Chandrasekharan, PHI
2.   Discrete Mathematics for Comp. Scientists & Mathematicians, Mott, Kandel & Baker, PHI
3.   Discrete Mathematical Structure, C.L.Liu,TMH
4.   Discrete Mathematical Structure, G.S.RAO
5.   Numerical Analysis, Shastri, PHI

6. Numerical Methods for Mathematics ,Science & Engg., Mathews, PHI

7. Numerical Analysis & Algorithms, Pradeep Niyogi, TMH

Corporate Culture & Communication(MCS105)

Module – I (20 hrs)

1. Principles of Communication – Definition, Purpose, Process, Types [2L]

2. Verbal Communication – Target group profile, Barriers of Communication, Listening, Feedback, Presentation Skills,

Use of Aids, Public Speaking, Practice Presentation, Non Verbal Communication

[6L+ 6p]]

3. Written Communication – Stages of Writing, Composing Business Messages, Preparing Notes, Style, Punctuation,

Using simple words, Proof Reading. [4L]

4. Report Writing – Report Planning, Types of Reports, Developing an outline, Nature of Headings, Ordering of Points,

Logical Sequencing, Graphs, Charts, Executive Summary, List of Illustration, Report Writing.

[2L]

Module – II (20 hrs)

5. Internal Communication – Circulars, Notices, Memos, Agenda and Minutes [4L + 2P]

6. External Communication – Resume/CV, Using Facsimiles (Fax), Electronic Main, Handling Mail [4 L]

7. Writing Business Letters – Formats, Styles Types – Request, Enquiry, Placing Order, Instruction,

Action, Complaint, Adjustment, Sales, Reference, Good News & Bad News, Acknowledgement [2L + 4P]

8. Handling Business Information – Annual Report, House Magazine, Press Release, Press Report . [2 L + 2P]

<u>Text Books</u>

1. Blundell J. A & Middle N. M. G.: Career – English for the Business and Commercial World, Oxford University Press. .
2. Kaul , Asha - Effective Business Communication, Prentice Hall.
3. Raman, M & Singh, P - Business Communication, OUP
4. Rizvi, M. Ashraf - Effective Technical Communication, Tata McGraw Hill
5. Taylor, Shirley - Communication for Business, 4th Edn.-Pearson Education.

Object Oriented Analysis & Design (MCS201)

An Overview of Object Oriented Systems Development, Object Oriented Systems Development Life Cycle. Object Oriented methodologies, Rumbaugh Methodology - Booch Methodology - Jacobson Methodology, UML, Object Oriented Analysis & Design, software Quality and Usability, Case Studies

Object Oriented Languages, Java and its features, Inheritance, exception handling, multithreading, Input/Output, Applet, Event Handling, Swing components, concept of JDBC

Text Books:

1. Object-Oriented Analysis and Design by Sarnath Ramnath, Brahma Dathan, Springer
2. Object-Oriented Analysis And Design With Applications, 3/E by Booch
3. Java: The Complete Reference 7/E by Herbert Schildt, TMH

Data Structure and Analysis of Algorithm (MCS202)

Introduction to Data structure and algorithms. The running times of a program, Use of the Big-Oh, small o, Big-omega and small omega notation, Efficiency of algorithms, Analysis of recursive programs, Solving recurrence equation, Divide and conquer algorithms, Dynamic programming, Greedy algorithm.

Implementation of Abstact data Types (ADT), list, stack, queue hashing, Tree structures: binary trees, AVL trees, Red-Black trees, priority queues, Tree traversal

algorithms, Graphs and algorithms: Prim's algorithm, Kruskal's algorithm, Dijkstra's method, Backtracking minimum spanning trees, Sorting & Searching algorithms.

Introduction to NP Problem, Polynomial-time, Abstract Problems, Encoding, NP-Completeness and Reducibility, NP-Completeness, Circuit Satisfiability, NP-Complete Problems, The Vertex-cover Problem, The Subset-sum Problem, The Hamiltonian-cycle Problem, The Traveling-salesman Problem.

Text Books:

1. Data Structure using C and C++ - 2nd edition by Tanenbaum
2. Fundamentals Of Data Structures In C++ by Ellis Horowitz, Sahni, Dinesh Mehta
3. Introduction to Algorithm by Thomas H. Cormen, Charies E. Leiserson and Ronald. L. Riveit,
4. The Design and Analysis of Computer Algorithms by Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman.

Advanced Computer Architecture (MCS203)

Basic structure of Computer, Overview of von Neumann architecture, Number systems, Boolean postulates and laws, De-Morgan's Theorem, Boolean function, Minimization of Boolean expressions, SOP, POS, Karnaugh map, Logic Gates, Combinational and Sequential circuits.Overview on Arithmetic Unit, Processing Unit.
Memory Devices – RAM, ROM, Cache memory, Virtual memory, Secondary Storage

IO Organization - Accessing I/O devices, Interrupts, Direct Memory Access, Buses, Interface circuits, Standard I/O Interfaces - PCI, SCSI, USB

Basic Parallel Processing Architecture, Taxonomy- SISD. MISD, SIMD, MIMD structures, Serial, Parallel & Concurrent Computation, CISC Vs RISC
Concepts of pipelining, Hierarchical Memory Technology: Inclusion, Coherence and locality properties

Concepts of instruction-level parallelism (ILP), Superscalar, superpipelined and VLIW processor architectures; Vector and symbolic processors

Multiprocessor Architecture, Taxonomy of parallel architectures; Centralized shared-memory architecture, synchronization, memory consistency, interconnection networks, Distributed shared-memory architecture, Cluster computers.

Non von Neumann Architectures, Data flow Computers, Reduction computer architectures, Systolic Architectures.

Basic Features of Current Architectural Trends. DSP Processor, Dual core Technology

Text Books:

1. Digital Design, 3.edition by M. Morris Mano, PHI publication
2. Computer Organization and Architecture – Designing for Performance, 6th Edition by William Stallings
3. Advanced Computer Architecture: Parallelism, Scalability and Programmability by Kai Hwang

Data Communication & Networking (MCS204)

Fundamentals of data transmission, wired and wireless media, digital and analog transmission, data coding techniques, multiplexing, overview on OSI layers and TCP/IP model

Local Area Networks and data link protocols, point-to-point links and sliding window flow control, CSMA/CD, Ethernet, wireless LAN, cellular networks, and advanced multi-user communication (CDMA, SDMA/MIMO), mobility

Internetworking using TCP/IP: network programming using socket API, network client/server design

Packet/circuit switching and wide-area networks: store-and-forward networks, source routing, virtual/permanent, circuits and call set-up, LAN/WAN addressing, hop-by-hop vs. end-to-end control

Routing techniques - intra-domain routing (OSPF, RIP), inter-domain policy routing (BGP) and network connectivity

Transport protocols - TCP and UDP, Congestion control, TCP window control, multimedia streaming

High-level network services - DNS, HTTP, SMTP, network management (SNMP), network security

Text Books:

1. Computer Networks by AS Tanenbaum, Fourth Edition, 2002, Pearson Education
2. Data Communication and Networking by B. Forouzan
3. Data and Communication by W. Stallings,

Operation Research (MCS301)

Introduction to OR, Quantitative approach to management decision making, Analyzing and defining the problem, Developing a model, Selecting the inputs and putting the model to work, Typical applications of OR.

Linear Programming, Formulating maximization/minimization problems, Graphical solution, simplex methods, Special cases of LP, Duality of LP and its interpretation, Dual simplex methods, Post Optimality/sensitivity analysis, Applications of LP.

Transportation and Assignment problems, VAM method, Checking for optimally using MODI method, Unbalanced problem and degeneracy, Hungarian method for assignment problem, Traveling salesman problem.

Game theory - 2 Person zero sum games, Saddle point, Mixes strategies use of dominance rules, Solution by graphical methods.

Waiting lines - Characteristics of a queuing system, Arrival and service patterns, Single and multiple channel, Queue models with Poisson arrival and exponential service times.

Simulation Modeling - Monte Carlo simulation, Using random numbers, Applications in inventory analysis, Waiting lines, Maintenance and finance areas.

Replacement models - Types of replacement problems, Replacement of assets that deteriorate with time, Markov Analysis: Brand switching analysis, Prediction of market shares for future periods, Equilibrium conditions, Uses of Markov analysis.

PERT, CPM, Network Analysis, Critical Path, Determination of Float

Text Books:

1.   Operations Research by A Ravindran, Don T Philips and James J Solberg.
2.   Operations Research by Hamdy A Taha

Advanced Operating System (MCS302)

OS services and components, multitasking, multiprogramming, time sharing, buffering, spooling

Process & thread management, context switching, multithreading

Concurrency control, mutual exclusion requirements, semaphores, monitors, Dead locks - detection, recovery, avoidance and prevention

Memory management, partitioning, swapping, paging, segmentation, virtual memory, Demand paging, page replacement and allocation algorithm

I/O Systems, interrupt handlers, device drivers, and device independent I/O software

Secondary-storage structure, file system management

Protection & security, Implementation of access matrix, Encryption

Case studies on Linux & Windows 2000

Introduction to Distributed Systems, Architectures of Distributed Systems, communication networks, Mutual Exclusion in Distributed Systems, RMI, concept of Replication, Distributed File Systems (NFS, AFS, coda) overview, security in Distributed Systems

Multiprocessor operating systems, basic multiprocessor system architectures, overview on Database Operating systems

Real Time Operating System and Overview on Embedded System

Text Books:

1. Advanced Concepts In Operating Systems by Mukesh Singhal and Niranjan Shivaratri
2. Distributed Operating systems by Andrew s.Tanenbanm
3. Operating System Concepts, 5th ed. by Silberschatz and Galvin

Artificial Intelligence (MCS303)

Overview of Artificial Intelligence, AI Programming Languages – LISP/PROLOG
Knowledge Representation - Formalized Symbolic Logics. Dealing with Inconsistencies and Uncertainties. Probabilistic Reasoning. Structured Knowledge: Graphs, Frames, and Related Structures. Object-Oriented Representations.
Search and Control Strategies, General Problem solving, Production systems, Control strategies: forward and backward chaining Exhaustive searches: Depth first Breadth first search, Heuristic search techniques: Hill climbing, Branch and Bound technique, Best first search and A* algorithm, AND/OR Graphs, Problem reduction and AO* algorithm, Constraint Satisfaction problems Game Playing Minmax search procedure, Alpha-Beta cutoffs, Additional Refinements, Matching Techniques. Knowledge Organization and Management
Basic understanding of Fuzzy Logic, Artificial Neural Network, Perceptron, Natural Language Processing, Pattern Recognition, overview on Expert Systems

Text Books:
1. Introduction to Artificial Intelligence and Expert Systems by D.W. Patterson
2. Artificial Intelligence: A Modern Approach - 3rd edition by Stuart Russell & Peter Norvig
3. Artificial intelligence by Elaine Rich & Kevin Knight
4. Principles of Artificial Intelligence by J. Nilsson, Narosa Publishing House

Elective Theory papers:
Embedded Systems (MCSE301A)

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Relation between Microcontroller and Embedded System, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems

Embedded processors: Types of Embedded Processors, Microprocessors, Microcontrollers, DSP, Embedded Processors from Future Electronics, Applications for embedded processors, Choosing the Right Embedded Processor.

Embedded Systems- Application- and Domain- Specific: Washing Machine-Application Specific Example of Embedded System, Automotive- Domain Specific Example of Embedded System.

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS),

Embedded Memories: Scratchpad Memories, Cache Memories, Flash Memories, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators.

Communication Interface: Onboard and External Communication Interfaces.

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.
Task Communication: Shared Memory, Message Passing, Remote Procedure Call and

Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Trends in Embedded Industry: Processor Trends in Embedded System, Embedded OS Trends, Development Language Trends

Text Books:

1.   Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

Reference Books:

1.   Embedded Systems - Raj Kamal, TMH.
2.   Introduction to Embedded Systems - Shibu K V, TMH
3.   Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
4.   Embedded Systems – Lyla, Pearson, 2013
5.   An Embedded Software Primer - David E. Simon, Pearson Education.

Image Processing (MCSE301B)

Introduction:
Definition, Origins of Digital Image Processing, Applications, Fundamental Steps, Components, Mathematical Preliminaries

Digital Image Fundamentals:
Image sensing and Acquisition, Image sampling and Quantization, Some basic relationships between pixels, Linear and Nonlinear Operations

Image Enhancement in Spatial Domain:
Basic Gray Level Transformation, Histogram Processing, Enhancement using Basic Arithmetic Operations, Smoothing Spatial Filters,
Sharpening Spatial Filters

Image Enhancement in Frequency Domain:

Introduction to Fourier Transform and and the Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering, Implementation

Image Restoration:

Restoration Process, Noise Models, Restoration in the Process of Noise Only- Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering,
Linear Position Invariant Degradations, Estimating Degradations, Inverse Filtering,
Wiener Filtering, Constrained Least Square Filtering, Geometric Mean Filtering,
Geometric Transformations

Colour Image Processing:

Introduction, Colour Models, Pseudo Colour Image, Processing, Basics of Full-Colour Image Processing, Colour Transformations, Smoothing and Sharpening, Colour Segmentation, Noise, Compression

Image Compression:

Introduction, Compression Models, Elements of Information Theory, Error Free Compression, Lossy Compression, Image Compression Standards

Image Segmentation:

Detection of Discontinuity , Edge Linking and Boundary Detection, Threshholding, Region Based Segmentation, Use of Motion in segmentation

Implementation of Image Processing Operations Using MATLAB/ImageJ/SciLab:

Introduction to Image Processing Functions, Implementation of different Image Processing Operations, Implementation of general HP and LP filters, Implementation of Special Filters like Inverse, CLS, Weiner etc. Colour Image Processing

Text Books:

1.   Gonzalez and Woods, Digital Image Processing, Pearson
2.   Soloman, Fundamentals of Digital Image Processing, Wiley

Automata & Natural Language Processing (MCSE301C)

Module-1:

Deterministic finite automaton and non-deterministic finite automaton.

Transition diagrams and Language Recognizers.

Finite Automata: NFA with Î transitions - Significance, acceptance of languages.

Conversions and Equivalence: Equivalence between NFA with and without Î transitions.

NFA to DFA conversion. Minimization of FSM, Limitations of FSM

Module-2:

Regular Languages: Regular sets. Regular expressions, identity rules.

Constructing finite Automata for a given regular expressions, Regular string accepted by NFA/DFA

Pumping lemma of regular sets. Closure properties of regular sets.

Grammar Formalism: Regular grammars-right linear and left linear grammars.

Equivalence between regular linear grammar and FA.

Module-3:

Context Free Grammar and Constituency, Some common CFG phenomena for English, Top-Down and Bottom-up parsing,

Probabilistic Context Free Grammar, Dependency Parsing

Push down Automata: Push down automata, definition.

Turing Machine: Turing Machine, definition, Design of TM

Module 4:

Regular Expressions and Tokenization

Introduction to NLP

Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance

Morphology

Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and
Morphotactics, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers,
Porter Stemmer

Module 5:

Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted
Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models.

Module 6:

Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion
Analysis, Resources and Techniques

Module 7:

Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, Computational Lexical
Semantics – Thesaurus based and Distributional Word Similarity

Text Books:
1.   Hopcroft H.E. and Ullman J. D., Introduction to Automata Theory Language and Computation, Pearson.
2.   Mishra and Chandrashekaran, Theory of Computer Science, Automata Languages and computation, PHI

3. C.K.Nagpal, Formal Languages and Automata Theory, Oxford
4. Manning and Schutze, Foundation of Statistical Natural Language Processing, MIT Press

Cloud Computing (MCSE401A)

Introduction: Cloud computing definition, reference model, Characteristics, Benefits, Challenges, Distributed Systems, Virtualization, Service-oriented computing, Utility-oriented computing, Overview on computing platforms & technologies – AWS, Google AppEngine, MS Azure, Hadoop, Saleforce.com, Manjrasoft Aneka

Parallel & Distributed Computing: Parallel vs. Distributed computing, Elements of parallel computing, Parallel processing - hardware architecture & approaches, Concept & Component of Distributed Computing, RPC, Service-oriented computing

Virtualization: Cloud reference model – IaaS, PaaS, SaaS, Types of clouds – Public, Private, Hybrid, Community, Cloud interoperability & standards, scalability & fault tolerance, Security, trust & privacy

Concurrent Computing, High-throughput Computing and Data-Intensive Computing: Programming applications with Threads, Thread API, Parallel computation with Threads, Task computing, Frameworks for Task computing, Task-based application model, Data-intensive computing, characteristics, technology

Cloud Platforms and Applications: Overview on Amazon Web Services, Google AppEngine and Microsoft Azure, Cloud applications in scientific, business and consumer domain

Text Books:
1. Buyya, Vecciola and Selvi, Mastering Cloud Computing: Foundations and Applications Programming, Tata McGraw Hill

2.   Rittinghouse and Ransome, Cloud Computing: Implementation, Management, and Security, CRC Press

3.   Aravind Doss, Cloud Computing, Tata McGraw Hill

4.   Kris Jamsa, Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More, Jones & Bartlett Learning

Mobile Computing (MCSE401B)

Introduction and Application of Mobile Computing
Wireless Transmission: Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems

Medium Access Control:
Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; SOMA, FOMA

TOMA: Fixed TOM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, PRMA packet reservation multiple access, reservation TOMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access

CDMA: Spread Aloha multiple access

Telecommunication Systems: GSM: Mobile Services, System Architecture, radio interface, Protocols, Localization and Calling, Handover, Security, New Data Services, DECT, Systems Architecture

Protocol Architecture:
TETRA I, UMTS and IMT-2000, UMTS Basic Architecture, UTRA FDD mode, UTRA TDD mode

Satellite Systems: History, Applications, Basics: GEO, LEO, MEO, Routing, Localization. Handover

ExamplesBroadcast Systems: Overview, Cyclic Repetition, Digital Audio; broadcasting: Multimedia object transfer Protocol;Digital Video broadcasting

Wireless LAN: Infrared vs. Radio Transmission, Infrastructure and Ad Hoc networks, IEEE 802.11: System Architecture, Protocol Architecture, Physical Layer, Medium Access Control Layer, MAC management, Future development; HIPERLAN: Protocol architecture, Physical Layer Channel access control. Sublayer, Medium Access control sublayer, Information bases and networking;

Bluetooth:User Scenarios, Physical Layer, MAC layer, Networking, Security, Link management.

Wireless ATM: Motivation for WATM, Wireless ATM working group, WATM services,

Reference model: Example configurations, Generic reference model;

 Handover: Handover reference model, Handover requirements, Types of handover, Handover scenarios, Backward handover, Forward handover; Location management: Requirements for location management, Procedures and Entities; Addressing, Mobile quality of service, Access point control protocol.

Mobile Network Layer: Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery,Agent advertisement and discovery, Registration, Tunneling and Encapsulation, Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol, Ad hoc networks: Routing, Destination sequence distance vector, Dynamic source routing, Hierarchical algorithms, Alternative metrics.

Mobile Transport Layer: Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile

rcp, Fast retransmit/fast recovery, Transmission/time- out freezing, Selective retransmission, Transaction oriented TCP.

Support for Mobility:
File systems: Consistency, Examples; World Wide Web: Hypertext transfer protocol, Hypertext markup language, Some approaches that might help wireless access, System architectures;

Wireless application protocol: Architecture, Wireless datagraram protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Wireless markup language; WML script, Wireless telephony application, Examples "Stacks with WAP, Mobile databases, Mobile agents

Security and privacy aspects of Mobile Computing

Text Books:
1. Jochen Schiller, Mobile Communications, 2nd Edition, Pearson
2. William Stallings, Wireless Communications and Networks, PHI
3. Rappaport, Wireless Communications Principals and Practices , PHI
4. YI Bing Un , Wireless and Mobile Network Architectures, John Wiley

Network Security (MCSE401C)

Concepts and Terminology:
Threats, Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, Spoofing, Sniffing, Firewall.

Cryptography:
Techniques, Mathematical foundation, Stream Ciphers, Block Ciphers, Cryptanalysis, Hash Algorithms.

Secret Key Cryptography:

Block Encryption, DES rounds, S-Boxes IDEA: Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB, Multiple encryptions DES.

Hash Functions and Message Digests:
Length of hash, uses, algorithms (MD2, MD4, MD5, SHS) MD2: Algorithm (Padding, checksum, passes.) MD4 and 5: algorithm (padding, stages, digest computation.) SHS: Overview, padding, stages.

Public key Cryptography:
Algorithms, examples, Modular arithmetic (addition, multiplication, inverse, and exponentiation) RSA: generating keys, encryption and decryption. Other Algorithms: PKCS, Diffie-Hellman, El-Gamal signatures, DSS, Zero-knowledge signatures.

Authentication:
Password Based, Address Based, Cryptographic Authentication. Passwords in distributed systems, on-line vs offline guessing, storing. Cryptographic Authentication: passwords as keys, protocols, KDC's Certification Revocation, Inter-domain, groups, delegation. Authentication of People: Verification techniques, passwords, length of passwords, password distribution, smart cards, biometrics.

Security Policies and Security Handshake Pitfalls:
What is security policy, high and low level policy, user issues? Protocol problems, assumptions, Shared secret protocols, public key protocols, mutual authentication, reflection attacks, use of timestamps, nonce and sequence numbers, session keys, one-and two-way public key based authentication.

Network Security:
Electronic mail security, IP security, Network management security.

Security for electronic commerce: E-commerce security analysis, protocol, SSL, SET
System Security:

Intruders and Viruses, Firewalls, Intrusion Detection.

Case Studies

Web threats, E-mail threats, Domain controller threats, Extranet and VPN threats.

Assignment and Project work.

Text Books:

1.   Atul Kahate, Cryptography and Network Security, McGraw Hill
2.   Kaufman, c., Perlman, R., and Speciner, M., Network Security, Private Communication in a public world, 2nd ed., Prentice Hall PTR., 2002
3.   Stallings, W.,.Cryptography and Network Security: Principles and Practice, 3rd ed., Prentice Hall PTR.,2003
4.   Stallings, W. Network security Essentials: Applications and standards, Prentice Hall, 2000
5.   Cryptography and Network Security; McGraw Hill; Behrouz A Forouzan
6.   Information Security Intelligence Cryptographic Principles andApp. Calabrese Thomson
7.   D. P. Nagpal, Information Security, S. Chand Complany Limited
8.   7. Securing A Wireless Network Chris Hurley SPD.

Data Warehousing & Mining (MCSE402A)

Introduction: Data Mining Concept, Origin, Process, Applications, Techniques, Challenges

Data Preprocessing: Data types, Quality, Descriptive data summarization – central tendency and dispersion measure, Data cleaning, Data integration & transform, Data reduction

Data Warehousing & OLAP: introduction, ETL, Data Warehouse design, Data Warehouse implementation, Metadata, OLAP characteristics, Multidimensional view and Data cube, OLAP, roll up, drill down, slice and dice, OLAP software

Association Rule Mining: Market-basket analysis basics, Naïve algorithm, Apriori algorithm, Direct Hashing and Pruning (DHP), Software for Association Rule Mining

Classification and Prediction: Decision Tree, Classification by decision tree induction, Bayesian classification, Rule-based classification, Prediction – Linear and Nonlinear Regression, Classification software

Cluster Analysis: Types of data in cluster analysis, Partitioning methods, Hierarchical methods, Density-based methods, Quality & Validity of clustering methods
Cluster analysis software

Web Data Mining: Web content mining, Web usage mining, Web structure mining, Hubs and Authorities, HITS algorithm, Web mining software

Data Mining Application & Information Privacy: Applications and trends in data mining such as Web, finance, telecommunication, biology and medicine, science and engineering retail industry etc. Social impacts of data mining, information privacy and data security, IT Act overview

Text Books:
1. Tan, Steinbach and Kumar, Introduction to Data Mining, Pearson
2. Han and Camber, Data Mining: Concepts and Techniques, Morgan Kaufmann
3. Foreman, Data Smart:Using Data Science to Transform Information into Insight, John Wiley
4. Dunham, Data Mining : Introductory and Advanced Topics, Pearson

Soft Computing (MCSE402B)

Neural Networks: Supervised Learning Neural Networks – Perceptrons - Adaline – Back propagation Multilayer Perceptrons – Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning NetworksHebbian Learning.

Fuzzy Set Theory: Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules,Introduction to Fuzzy Reasoning – Extension Principle and Fuzzy Relations

Genetic Algorithm: Difference between Traditional Algorithms and GA, The basic operators, Schema theorem, convergence analysis, stochastic models, applications in search and optimization. Encoding, Fitness Function, Reproduction, Cross Over, Mutation, Application of Genetic Algorithm.

Neuro Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

Text Books:

1. M. Mitchell, An Introduction to Genetic Algorithms, Prentice-Hall, 1998.
2. D. E. Goldberg, Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley, 1989.
3. S. V. Kartalopoulos, Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications, IEEE Press - PHI, 2004.
4. S. Rajasekaran & G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, PHI, 2003.
5. S. N. Sivanandam & S. N. Deepa, Principles of Soft Computing, Wiley - India, 2007

Social Network Analysis (MCSE402C)

Introduction to Social Network Analysis: The Social Network Perspective, Historical Foudations, Fundamental Conc epts in Network Analysis, Distinctive Features of Social Network, Related statistical tools of Social Networks

Mathematical Representation of Social Networks: Notation for Social Network Data, Graph Theoretic Notation, Sociometric Notation, Algebraic Notation, Graphs and Matrices

Graphic Techniques for Exploring Social Network Data and Centrality: Degree centrality, Betweenness centrality, Closeness centrality, Igenvector centrality, Transitivity and Reciprocity

Software for Social Network Analysis: Introduction to the Tools of Social Networks, Overview on Gephi and Netlogo

Models and Methods in Social Network Analysis: Random Graph Model, Small World Model, Preferential Attachment Model and power-laws

Diffusion on Networks: Information Diffusion and Cascade Model, Epidemics – SIR & SIS Model, Threshold Model, Simple and complex contagion

Application of Data Mining in Social Networks: Overview on Data Mining and its various techniques, Overview on Web Mining

Recommendation system: Concept, Content-based method, Collaborative filtering, Applications

Text Books:

1. David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning about a Highly Connected World, Cambridge University Press, 2010
2. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014

Practical Papers

Programming Lab (C) (MCS191)

Programming using Basic concepts in C, Applying the syntax of conditional statements, Uses of different operators, apply the syntaxes of loop structures, designing programs based on the above conception, Understanding array-one dimensional, two dimensional. Using conception of pointer, working with pointers, String handling using C, Working with Formatted Input and Output, Working with Files. Static and dynamic scope, writing subprograms and operations, parameter passing methods, conception of Terminate and stay resident program using C.

Advanced DBMS Lab (ORACLE) (MCS192)

Introduction to SQL constructs. Review of Basic SQL statements Select, Project, Join, Describing Oracle tables ,Restricting row returns Creating basic reports, Using the set commands, Adding prompts to queries

Joining Oracle tables -Equi-join, Outer join Hiding joins by creating views,Using IN, NOT IN, EXISTS and NOTEXISTS, Subqueries, Exercise – write a subquery,Correlated subquery, Non-correlated subqueries

Advanced SQL operators -Between operator ,IN and NOT IN operators, Sub-queries-EXISTS clause, Using wildcards in queries (LIKE operator),Aggregation in SQL -Count(*),Sum, Avg, Min and max. Using the group by clause, SQL access methods ,Review of Basic joining methods-Merge join, Hash Join, Nested Loop join.

Object Oriented Programming Lab (using Java) (MCS291)

Object Oriented Programming Fundamentals, The Java environment, class, object, constructor, garbage collection, array, access control, method overloading, nested & inner class, inheritance & interface, package, exception handling, thread, I/O, applet & GUI, event handling, network (Socket) programming, RMI, JDBC, J2EE overview, Servlet & JSP.

Data Structure Lab (MCS292)

Implementation of list, stack, queue, hashing,two dimensional array, Tree structures: binary trees, AVL trees, Red-Black trees, priority queues, Tree traversal algorithms, Graphs and algorithms: Prim's algorithm, Kruskal's algorithm, Dijkstra's method, Backtracking minimum spanning trees, Sorting & Searching algorithms(using C)

Microprocessor and VHDL Lab (MCS293)

1. Study of 8086 microprocessor kit
2. Write a program using 8086 for division of a defined double word (stored in a data segment) by another double Word division and verify.
 3. Write a program using 8086 for finding the square root of a given number and verify
4. Write a program using 8086 for copying 12 bytes of data from source to destination and verify.
5. Write a program using 8086 and verify for: a. Finding the largest number from an array. b. Finding the smallest number from an array.
6. Write a program using 8086 for arranging an array of numbers in descending order and verify.
7. Write a program using 8086 for arranging an array of numbers in ascending order and verify.
 8. Write a program for finding square of a number using look-up table and verify.
 9. Write a program to interface a two digit number using seven-segment LEDs. Use 8085/8086 microprocessor and 8255 PPI.
 10. Write a program to control the operation of stepper motor using 8085/8086 microprocessor and 8255 PPI.

11. Write VHDL programs for the following circuits, check the wave forms and the hardware generated a. half adder b. full adder

12. Write VHDL programs for the following circuits, check the wave forms and the hardware generated a. multiplexer b. demultiplexer

13. Write VHDL programs for the following circuits, check the wave forms and the hardware generated a. decoder b. encoder

14. Write a VHDL program for a comparator and check the wave forms and the hardware generated

15. Write a VHDL program for a code converter and check the wave forms and the hardware generated

16. Write a VHDL program for a FLIP-FLOP and check the wave forms and the hardware generated

17. Write a VHDL program for a counter and check the wave forms and the hardware generated

18. Write VHDL programs for the following circuits, check the wave forms and the hardware generated a. register b. shift register

19. Implement the above mentioned VHDL circuits in FPGA kit.

OR Lab (MCS391)

[using C]

1) Linear Programming (Tranportation , Assignment , Duality , Simplex)

2)   Shortest Path(Dijkstra's , Floyd's Algorithm)

3)   Maximal Flow.

4)   Queuing Theory

5)   PERT/CPM

6)   Integer Programming Problem (Branch & Bound Problem)

OS Lab (Unix) (MCS392)

Shell Programming-creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).Process-starting a process, conditions, control structures, functions, commands),waiting for a process, zombie process Semaphore-programming with Semaphore.

Data Warehousing & Mining Lab (MCS492A)

Software Tools: Weka/SPSS/R/Oracle
Data exploration and visualization , Statistical analysis
Association Rule mining, Classification, Clustering, Developing small application/ program

Soft Computing Lab (MCS492B)

Basic skills lab using Guaje Fuzzy/Fingram Generator
Genetic Algorithm,Fuzzy System,Artificial Neural Network

Social Network Analysis Lab (MCS492C)

Software Tools: Netlogo, Gephi/Pajek
Measuring Network, Community Detection, Random Graph Generation, Giant Component, Preferential Attachment, Community Detection, SIR & SIS Model