MASTER OF COMPUTER APPLICATIONS

Department of Computer Science and Engineering

Master of Computer Applications (MCA) emphasizes on the design and application of information systems and provides a solid background in business functions and Information Technology and covers latest developments in areas where commerce and computing and in general, applications and technology blend together successfully and define the state of art.

MCA students acquire strength in principles, concepts and foundations of computer science, information technology and various applications. They would also have extensive programming / software development experience over a wide variety of platforms / applications. The curriculum has explicitly identified lab components for every course that discusses the principles with an implementation component.

The course is well balanced with significant emphasis on planning, designing and building complex commercial application software and system software. The application areas include transaction processing (such as banking, stock exchange order processing), simulation, database management, e-commerce, networking, embedded technologies, bioinformatics etc.

This MCA programme is not only a complete professional grooming for students for a successful career in the IT industry, but also, provides value-based education through a system of wholesome learning.

This is a 3 year Post Graduate program specializing on Computer Applications. The students admitted to this program are with a graduation (B.Sc) in Mathematics, Physics, Statistics, Computer Science, BCA and B.Com. Also there is a provision for academically bright students with BCA, B.Sc (Information Technology) and B.Sc (Computer Science), to directly join the second year of the MCA programme through the lateral entry scheme.

Curriculum

First Semester					
Course Code	**Title**	**L**	**T**	**P**	**Cr**
16MA201	Discrete Structures	3	1	0	4
16EN281	English for Professional Purposes	0	0	1	1
16CA201	Computer Organization and Architecture	3	0	1	4
16CA203	Computer Programming	3	0	1	4
16CA205	Database Management System	3	0	1	4
16CA207	Problem Solving Techniques	3	0	1	4
16HU601	Cultural Education*				P/F
*Non – credit course					**Total= 21**
Second Semester					
Course Code	**Title**	**L**	**T**	**P**	**Cr**
16MA202	Statistics and Numerical Methods	3	1	0	4
16CA202	Object Oriented Programming	3	0	1	4
16CA204	Data Structures	3	0	1	4
16CA206	Operating Systems	3	0	1	4
16HU282	Financial Accounting	2	0	0	2
	Lab 1	0	0	3	1
					Total= 19
Third Semester					
Course Code	**Title**	**L**	**T**	**P**	**Cr**
16CA301	Advanced Computer Networking and Internet	3	0	1	4
16CA303	Design and Analysis of Algorithms	3	1	0	4
16CA305	Advanced Software Engineering	3	0	1	4
16CA307	Basics of Operations Research	3	1	0	4
	Lab 2	0	0	3	1
	Lab 3	0	0	3	1
					Total= 18

Fourth Semester					
Course Code	**Title**	**L**	**T**	**P**	**Cr**
16CA304	Service-Oriented Architecture	3	0	1	4
16CA306	Data Mining and Applications	3	0	1	4
16CA308	Advanced Databases	3	1	0	4
	Elective I	3	0	0	3
	Elective II	3	0	0	3
16EN600	Technical Writing*				P/F
	Lab 4	0	0	3	1
	*Non – credit course				**Total= 19**
Fifth Semester					
Course Code	**Title**	**L**	**T**	**P**	**Cr**
16CA401	Software Architecture	3	1	0	4
16CA403	System Security	3	1	0	4
	Elective III	3	0	0	3
	Elective IV	3	0	0	3
	Lab 5	0	0	3	1
16CA498	Dissertation				5
					Total=20
Sixth Semester					
Course Code	**Title**	**L**	**T**	**P**	**Cr**
16CA499	Dissertation				12
				Total Credits	**109**
ELECTIVE I, II and III					
Course Code	**Title**	**L**	**T**	**P**	**Cr**
16CA314	Information Security	3	0	0	3
16CA316	Structure and Interpretation of Computer Programs	3	0	0	3
16CA318	Software Quality Assurance	3	0	0	3
16CA322	Computational Intelligence	3	0	0	3
16CA324	Bioinformatics	3	0	0	3
16CA328	Information Retrieval	3	0	0	3

16CA334	Intelligent Systems	3	0	0	3
16CA336	Open-Source Systems	3	0	0	3
16CA338	Natural Language Processing	3	0	0	3
16CA413	Distributed Computing	3	0	0	3
16CA417	Wireless Communications and Networks	3	0	0	3
16CA419	Computer Graphics and Visualization	3	0	0	3
16CA421	Computer Language Engineering	3	0	0	3
16CA423	Semantic Web Technologies	3	0	0	3
16CA425	Cloud Computing	3	0	0	3
16CA429	Database Administration	3	0	0	3
16CA431	Digital Image Processing	3	0	0	3
16CA433	Business Intelligence	3	0	0	3
16CA435	Network Management and System Administration	3	0	0	3
16CA437	Big Data Analytics and Visualization	3	0	0	3
16CA439	Modern Web Application Development using Mean Stack	3	0	0	3
Management Elective (ELECTIVE IV)					
16HU441	Principles of Economics and Management	3	0	0	3
16HU443	Software Project Management	3	0	0	3
Lab Courses*					
Course Code	**Title**	**L**	**T**	**P**	**Cr**
16CA451	Data Structures and Algorithms lab	0	0	3	1
16CA452	Java Programming	0	0	3	1
16CA453	GUI Programming using VB.Net	0	0	3	1
16CA454	Android Application Development	0	0	3	1
16CA455	Web Development using ASP.NET	0	0	3	1
16CA456	Database Management Systems Lab	0	0	3	1
16CA457	Operating Systems Lab	0	0	3	1
16CA458	Computer Organization and Architecture lab	0	0	3	1
16CA459	Web and XML Programming using Java and J2EE	0	0	3	1
*There are 5 one-credit lab courses extending over 4 semesters. The department may choose the lab courses to be offered at their respective campuses.					

SEMESTER I

16MA201 DISCRETE STRUCTURES 3-1-0-4

Logic: Logic- Prepositional Equivalence- Predicates and Quantifiers. Counting: Basics of Counting- The Pigeonhole Principle- Permutations and Combinations. Relations: Relations and their Properties- Representing Relations- Closure of Relations- Equivalence Relations. Matrices: Linear Systems of Equations- Rank of a Matrix- Linear dependence. Solutions of Linear Systems: Existence- Uniqueness- General Form- Eigen values- Eigen vectors- Symmetric- Skew-Symmetric and Orthogonal Matrices. Complex Matrices: Hermitian- Skew Hermitian- Unitary- Similarity of Matrices (Definition and Examples only)- Diagonalization. Graph Theory: Graph Terminologies- Representation of Graphs and Graph Isomorphism. Graph Connectivity - Planar Graphs and Graph Colouring. Modelling Computation: Languages and Grammars. Finite State Machines with Output and with no Output. Language Recognition- Turing Machine.

TEXT BOOKS/ REFERENCES:

1. Rosen K. H., "*Discrete Mathematics and its Applications*", Sixth Edition, Tata McGraw-Hill, New Delhi, 2007.

2. Grimaldi R. P., "*Discrete and Combinatorial Mathematics*", Fourth Edition, Pearson Education Asia, New Delhi, 2008.

3. E Kreyszig, "Advanced Engineering Mathematics", Eighth Edition, John Wiley and Sons, 2002.

16EN281 ENGLISH FOR PROFESSIONAL PURPOSES 0-0-1-1

Common errors committed while writing and speaking– An introduction to Pronunciation - Stress and Intonation– Body Language- Gestures and Postures-Affected Idiosyncrasies and Mannerisms - Self Introduction- Self Appraisals- Resume Writing- Participation in Conversations - Expressing ideas and information - Job interviews - Telephonic interviews - Group discussions - Panel discussions and Debates- Prepared speeches and Extempore speeches- Writing professional reports - Oral presentations-Office correspondence-(Letters).

TEXT BOOKS/ REFERENCES:

1. Garside, Barbara and Tony Garside. "*Essential Telephoning in English*", U.K.CUP, 2002.
2. Judith S. Van Alstyne, "*Professional and Technical Writing Strategies*: *Communicating in Technology and Science*", Fourth Edition, New Jersey: Prentice Hall, 1999.
3. Michael Swan. "*Practical English Usage*", Fourth Impression, International Students' Edition, Oxford University Press, 2000.

16CA201 COMPUTER ORGANIZATION AND ARCHITECTURE 3-0-1-4

Logic Circuits: Basic Logic Functions- Synthesis of Logic Functions- Minimization of Logic Expressions- K-Maps- Synthesis with NAND and NOR Gates- IC Packages- Decoders and Encoders- Multiplexers and De Multiplexers- Flip Flops- Registers- Counters. Basic Organization of a Computer: Functional Units- Basic Operational Concepts- Bus Structure - Instruction Code- Instruction Sets- Instruction Formats. Types of Instructions:ALU Instructions – Branch Instructions - I/O Operations -Subroutines- Program Examples-

Addressing Modes. RISC and CISC Architectures. Basic Processing Unit: Fundamental Concepts- Execution of a Complete Instruction- Multiple Bus Organization- Hardwired Control - Micro Programmed Control. Arithmetic: Addition and Subtraction of Signed Numbers - Design of Fast Adders - Multiplication of Positive numbers- Signed-Operand Multiplication. Memory System: Basic Concepts– Semiconductor RAM Memories– Read-Only Memories– Cache Memories– Mapping Functions– Replacement Algorithms– Performance Considerations– Virtual Memories. Input-Output Organization: Accessing I/O devices – Programmed Input / Output – Interrupts– Direct Memory Access- Buses – Interface circuits- Standard I/O Interfaces (PCI, SCSI, USB) – I/O devices and Processors.

TEXT BOOKS/ REFERENCES:

1. Carl Hamacher, ZvonkoVranesic and SafwatZaky, "*Computer Organization*", Fifth Edition, Tata McGraw-Hill, 2002.
2. David A. Patterson and John L. Hennessy, "*Computer Organization and Design: The Hardware / Software Interface*", Third Edition, Elsevier, 2005.
3. Thomas L.Floyd, "*Digital Fundamentals*", Ninth Edition, Prentice Hall, 2005.
4. M. Morris Mano, Computer System Architecture, 3rd Edition, Prentice Hall, 2013

16CA203 COMPUTER PROGRAMMING 3-0-1-4

Introduction to Structured Programming- Flow Chart- Algorithms-Data Types- Variables-Constants- Operators- Expressions- Type Cast- Enumerations- Typedef-Data Input and Output- Control Structures- Arrays – Strings- String Handling Functions- User defined functions- Recursion- Storage Classes- Pointers- Dynamic Memory Allocation- Structures-Union. File Access: File Operations for Binary and Text files- Command Line Arguments-Preprocessor- Macros-Graphics Library.

TEXT BOOKS/ REFERENCES:

1. Paul J.Deitel and Harvey M. Deitel, "*C: How to Program*", Sixth Edition, Prentice Hall, 2010.
2. Kernighan Brian W. and Ritchie Dennis M., "C Programming Language: [ANSI C]" Second Edition, PHI, 2012.
3. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", Third Edition, Manohar Publishers & Distributors, 2010.
4. YashavantKanetkar, "Let Us C", Thirteenth Edition, BPB, 2013.

16CA205 DATABASE MANAGEMENT SYSTEM 3-0-1-4

Introduction and the Relational Model: Introduction to DBMS- Data Models. Structure of Relational Databases- Relational Algebra Operations. SQL: Background- SQL Data Types and Schemas- Integrity Constraints– Data Definition- Basic Structure of SQL Queries- Set Operations- Aggregate Functions- Null Values. Database Design: Overview of the Design Process- The Entity-Relationship Model– Constraints - Entity-Relationship Diagrams. Database Design– The E-R Model– Constraints- E-R Diagrams- Design Issues- Weak Entity Sets - Extended E-R Features– E-R Reduction to Relational Schemas. SQL: Nested Sub Queries- Complex Queries- Views- Join Relations - Authorization - Functions and Procedural Constructs. Relational Database Design: Features of Good Relational Designs- Atomic Domains and 1NF- Decomposition using Functional Dependencies (2NF) – 3NF, 4NF,

BCNF- Functional Dependency Theory- Decomposition using Multi-valued Dependencies– PJNF and DKNF. Introduction to Transaction Management: Transactions-Concept- State-Atomicity and Durability- Concurrent Executions- Lock Based Protocols – Introduction to Deadlock Handling.
Query Evaluation and Optimization.

TEXT BOOKS/ REFERENCES:

1. Silberschatz A, Korth H.F. and Sudharshan.S, "*Database System Concepts*", Sixth Edition, Tata McGraw-Hill Publishing Company Limited, 2010.
2. Elmasri.R and Navathe.S.B, "*Fundamentals of Database Systems*", Sixth Edition, Pearson Education, 2010.
3. Date C.J, "*An Introduction to Database Systems*", Eighth Edition, Addison Wesley, 2003. (For SQL related topics).
4. Ramakrishnan.R. and Gehrke.J, "*Database Management Systems*", Third Edition, Tata McGraw-Hill, 2003.

16CA207 PROBLEM SOLVING TECHNIQUES 3-0-1-4

General Problem Solving Concepts: Problem Solving in Everyday Life- Types of Problems-Difficulties with Problem Solving- Defining Problem – Data representation in Computer:Constants and Variables, Data types, how the computer stores the data, operators– Introduction to testing and coding the solution – Software Development Life Cycle. Algorithms: Introduction to Programming :Local and global variables, parameters and return values, Threelogic structures: sequential logic, decision logic and loop logic. Sequential Logic Structure ,Flow chart for sequential logic, Decision Logic structures: If/Then/Else, Using straight – through logic, using positive logic, using negative logic, Logic conversion, The case logic structure, Flow chart for decision logic. Loop Logic structure: Incrementing, Accumulating, While/WhileEnd, Repeat/Until, Nested Loops, Flow chart for looping statements – Modules: Functions,Recursion Data Structures: Queues and Stacks, Lists and Higher Order functions - Trees and fractals using recursion.

TEXT BOOKS/ REFERENCES:

1. Maureen Sprankle and Jim Hubbar, "*Problem Solving and Programming Concepts*", Ninth Edition, Prentice Hall, 2011.
2. Hal Abelson, Ken Ledeen and Harry Lewis, "*Blown to Bits: Your Life, Liberty, and Happiness After the Digital Explosion*", Addison-Wesley Professional, First Edition, 2008.
3. Paul Vickers ,*"How to think like a programmer: Problem solving for the bewildered*", First Edition, Gaynor Redvers, 2008.
4. Dromey R.G, " *How to Solve it by Computers*", Fourth Edition, Prentice Hall, 2001.

SEMESTER II

16MA202 STATISTICS AND NUMERICAL METHODS 3-1-0-4

Probability Theory: Experiments - Outcomes- Probability- Conditional Probability and Bayes' Theorem. Random Variables and Probability Distributions- Mean and Variance of a Distribution. Binomial- Poisson and Normal Distributions. Statistics: Correlation and Regressions. Testing of Hypothesis. Testing of Population Mean (Normal and t distributions).

Chi-Square Test for Goodness of fit and Independence. Solving Non Linear Equations: Interval Halving - Secant Method- False Position Method- Newton's Methods. Fixed Point Iteration - Newton's Method for Polynomials. Solving System of Equations: Matrix Notations- Gaussian Elimination and Gauss Jordon Methods- Iterative Methods - Relaxation Method. Interpolation: An Interpolation Problem- Lagrangian Polynomials- Divided Differences - Case Studies.

TEXT BOOKS/ REFERENCES:

1. Curtis F. Gerald and Patrick O. Wheatley, "*Applied Numerical analysis*", Fifth Edition, Addison Wesley, 2002.
2. Jain M. K., Iyengar S. R. K. and Jain R. K., "*Numerical Methods for Engineering and Scientific Computation*", Third Edition, New Age International (P), 1995.
3. Ravichandran. J, "*Probability and Statistics for Engineers"*, First Edition, Wiley India, 2012.
4. Douglas C. Montgomery and George C. Runger, "*Applied Statistics and Probability for Engineers*", Third Edition, John Wiley and Sons Inc., 2003.
5. Ronald E. Walpole, "*Probability and Statistics for Engineers and Scientists*", Seventh Edition, Pearson Education, Asia, 2002.

16CA202 OBJECT ORIENTED PROGRAMMING 3-0-1-4

OO System Development Life Cycle- Object Oriented Methodologies - Comparison (OOP and SP)- Introduction to Object Oriented Programming- Object Basics. C++ Environment: Manipulators- Classes and Object- Data Members- Access Specifiers- Array within a Class- Array of Objects- Scope Resolution Operators- Inline Functions- Constructors- Default Constructors- Destructors - Static Members- This Pointer - Constant Members- Mutable- Initializer List- References and Reference Parameters- Default Arguments- Type Conversion- Free Storage Operators. Compile Time Polymorphism: Overloading Operators- Function Overloading- Overloading Constructors- Friend Functions- Friend Classes- Inheritance Types- Function Overriding- Virtual Base Class- Constructors in Base Derived Classes- Class Containership. Run time Polymorphism: Virtual Functions- Pure Virtual Functions- Abstract Class- Class Templates- Function Templates- Exception Handling- Data files – C++ stream Classes, Opening and Closing of files, file modes, Sequential Input and Output Operations, Error Handling file operations

.

TEXT BOOKS/ REFERENCES:

1. Stanley B. Lippman, "*The C++ Primer*" 5th Edition, Pearson Education, 2012.
2. Bjarne Stroustrup, "*The C++ Programming Language*", 4th Edition, Addison Wesley, 2013.
3. Deitel H.M and DeitelP.J , "*C++ How to Program*", 9th Edition, Prentice Hall, 2013.
4. Ali Bahrami, "*Object Oriented Systems Development*", 2nd Edition, McGraw-Hill, 2008.
5. E. Balagurusamy, Object Oriented Programming with C++" Tata McGraw – Hill, 5th Edition

16CA204 DATA STRUCTURES 3-0-1-4

Note: Basic operations and applications of all data structures shall be covered, Different implementations with efficiency analysis shall be discussed.

Abstract Data Types, Linear Data Structures: Arrays (single and multi-dimensional), Stack ADT, Multi Stack ADT, Queue ADT, Circular Queue, Singly Linked List, Doubly Linked List, Circular Linked List.

Nonlinear Data Structures: Trees - Array and List Representations: Binary Tree, Binary Search Tree and Threaded Binary Tree. Balanced Trees: Weight Balanced Trees, Applications of WBTs, Height Balanced Trees -AVL Trees, Red-Black Trees. BinaryHeaps: applications

Graphs: Matrix and List Representation of Graphs, Breadth First Search, Applications of BFS, Depth First Search, Applications of DFS, Spanning Trees

Advanced Data Structures: Dictionaries, Hashing techniques, Disjoint Sets, List, Tree and Array based implementation–Union/Find.

TEXT BOOKS/ REFERENCES:

1. Ellis Horowitz, SartajSahni and Susan Anderson-Freed, "*Fundamentals of Data Strucures in C*", Second Edition, Silicon Press, 2008.
2. Jean-Paul Tremblay and G. Sorenson, "*An introduction to Data Structures with Applications*", Second Edition, Tata McGraw-Hill, 2008.
3. Robert L.Kruse, Bruce P. Leung, Clovis.L. Tondo and ShasshiMogalla, "*Data Structure and Program Design in C*", Pearson Education, Second Edition, 1997.

16CA206 OPERATING SYSTEMS 3-0-1-4

Introduction to OS: Layered Approach- Kernel booting Users View- Basic Linux Commands and Linux Architecture. Interrupts- System Calls and Protection. Process Management: Process States - Schedulers - Operations on Processes - Inter-Process Communication – Synchronization- pipes- Linux Processes- Process Creation in Linux- Fork. CPU Scheduling- Scheduling Mechanisms in Linux and Solaris-Signals and Threads- Threading Concepts in C- Process Synchronization- Critical Section Problem- Synchronization Hardware - Semaphore- Classical Problems of Synchronization - Critical Region- Monitors- Deadlocks: Deadlock Characterization -Methods of handling Deadlocks- Deadlock Prevention- Avoidance- Detection and Recovery. Storage Management: Memory Management- Swapping- Contiguous Memory Allocation. Paging: Paging in Linux- Segmentation- Segmentation with Paging- Virtual Memory- Demand Paging- Page Replacement Algorithms- Thrashing. File Systems in Linux: Directory Structure-Directory implementation- Disk Scheduling- Experiments in VM. Virtual Machines: Overview of VMware and Linux Demos- Case Study: The Linux system- Android.

TEXT BOOKS/ REFERENCES:

1. Silberschatz and Galvin, "*Operating System Concepts*", 9th Edition, John Wiley andSons, 2012.
2. Andrew S. Tannenbaum, "*Modern Operating Systems*", 4th Edition, Pearson, 2015.
3. Robert Love, *"Linux Kernel Development"*, Third Edition, Addison-Wesley Professional, New York, 2010.

4. H. M. Deitel, P. J. Deitel and Choffnes, "*Operating System*", Third Edition, Prentice Hall, 2003.
5. D.M.Dhamdhere, "*Operating Systems – A Concept – based Approach*", Second Edition, Tata McGraw-Hill, 2006.

16HU282 FINANCIAL ACCOUNTING 2-0-0-2

Accounting Principles- Concepts. Conventions: Double Entry System of Book Keeping - Basic terms used in Accountancy - Journal Procedure Merits and Demerits - Ledger posting Procedure Merits and demerits. Cash Book: Simple Cash Book- Double Column Cash Book - Triple column cash book - Petty cashbook – Preparation - Merits and Demerits. Trial Balance: Need- Preparation- Uses- Trading and Profit and Loss Account- Balance Sheet of Sole Proprietary concerns with Simple Adjustments. Depreciation Accounting: Need– Objectives- Straight Line Method and Written down Method - Cash Budget- Need - Objectives - Preparation - Merits and Demerits.

TEXT BOOKS/ REFERENCES:

1. Nagarajan K.L, Vinayagam.N, and Mani P.L, "*Principles of Accounting*", Second Edition, Eurasia Publishing House(P), 2009.
2. Sharma R.K, and Shashi K. Gupta, "*Management Accounting*", Fifth Edition, Kalyani Publishers, 2009.
3. T.S.Grewal, "*Double Entry Book Keeping*", First Edition, New Age International (P), 2009.
4. Chandra Prasanna, "*Financial Management - Theory and Practice*", Sixth Edition, Tata McGraw-Hill, 2009.
5. Maheshwari S.N, "*Principles of Management Accounting*", Fourth Edition, Sultan Chand and Sons, 2009.
6. . K M Vineeth, K R Shabu – Introduction to Accountancy, Kalyani Publishers

SEMESTER III

16CA301 ADVANCED COMPUTER NETWORKING AND INTERNET 3-0-1-4

Overview - The Network Edge- The Network Core– Delay– Loss and Throughput in Packet Switched Networks - Application layer protocols – HTTP- DNS – PPP file sharing
Introduction to Transport Layer Services - Connectionless Transport- UDP - Principles of Reliable Data Transfer- Connection Oriented Transport- TCP Traffic Control: Packet Scheduling, TCP Congestion Control, - Leaky Bucket, Token Bucket-Internet protocol – Internet Layer-Class full Addressing – Class less addressing – Private Addresses – Subnets – Subnet masks –ARP – ICMP-Routing & Forwarding - Global Internet– RIP – OSPF – BGP – Broadcast & Multicast routing-Multimedia Networking – Multimedia networking applications – Streaming stored video and audio – Protocols for real time interactive applications

TEXT BOOKS/ REFERENCES:

1. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th Edition, Addison Wesley, 2008.
2. Larry Peterson and Bruce Davie, "Computer Networks: A Systems Approach", Fourth Edition, Morgan Kaufmann, 2007.

3. Richard Stevens, Bill Fenner and Andrew M. Rudoff, "UNIX Network Programming", Volume 1: "The Sockets Networking API", Third Edition, Addison Wesley, 2004.
4. Andrew S.Tanenbaum, "Computer Networks", Fourth Edition, Prentice Hall of India, 2002.

16CA303 DESIGN AND ANALYSIS OF ALGORITHMS 3-1-0-4

Introduction– Asymptotic Notations- Monotonicity vs. Nonmonotonicity - Examples.
Analysis of iterative programs, Analysis of recursive programs: Recurrence Relation: Substitution method, Recursion Tree Methods, Master Method.
Sorting: Bubble – Insertion Sort- Selection Sort. Divide and Conquer: Quick Sort- Merge Sort- Bucket Sort-Lower Bounds- Heap Sort – Comparisons of Sorting.
Greedy Algorithm: Fractional Knap-sack Problem- Task Scheduling Problem.
Dynamic Programming: Matrix Multiplication Problem- 0/1 Knap-sack Problem.
String Matching: FSA- KMP- Boyer- Moore Algorithm.
Graph Algorithms: Graph Traversals (DFS, BFS with Analysis) - Shortest Path Algorithms (with Analysis) – Dijkstra - Bellman Ford- Floyd Warshall's all Pair shortest path Algorithm- Minimum spanning Tree (with Analysis) – Kruskal– Prims.
NP Problems: Definition: P-NP-NP Complete-NP Hard. Examples:P-NP.

TEXT BOOKS/ REFERENCES:

1. CormenT.H ,Leiserson C.E, Rivest R.L and Stein C, "*Introduction to Algorithms*", Third Edition, Prentice Hall of India, 2009.

2. Baase.S and Gelder A.V., *"Computer Algorithms- Introduction to Design and Analysis*", Third edition, Pearson Education Asia, 2003.

3. Ellis Horowitz ,SartajSahni.S and Rajasekaran.S, "*Fundamentals of Computer Algorithms*", Silicon Press, 2008.
4. Goodrich M.T and Tamassia.R, "*Algorithm Design Foundations, Analysis, and Internet Examples*", Fourth Edition, John Wiley and Sons, 2002.
5. Dasgupta.S, Papadimitriou.C. andVazirani.U, "*Algorithms*", Eighth edition, Tata McGraw-Hill, 2009.

16CA305 ADVANCED SOFTWARE ENGINEERING 3-0-1-4

Software Engineering – Introduction - Software Classification - Layered Technology – Software Process –Practice - Generic Process Model , Process Assessment and Improvement – CMMI framework - Perspective Models - Specialized Models - Agile Process Models
Requirements Engineering – SRS - Requirement Analysis- Unified Modeling Language – Approaches - Scenario based Modelling - UML Models that supplement Use Cases – Activity and Swim lane Diagrams - Design Engineering - Architectural Design - Modeling Component level design - Performing User Interface Design.
Software Testing - Strategic Approach to Software Testing - , Test Strategies for conventional and Object Oriented Software - Validation Testing - System Testing – Art of Debugging - Testing Techniques - White Box Testing – Basis Path Testing,- Control Structure Testing - Black Box Testing .
Quality Management – Overview – Quality Concepts - McCall's Quality Factors – Review Techniques – Defect Removal Efficiency – Formal Technical Reviews – Product Metrics Overview.

Web Engineering – Application – Attributes – Category – WebE Process Framework – WebE Best Practices – Overview on Analysis, Design and Testing of WebApp projects - Requirements Modeling for WebApps, Web App Design, Testing Web Applications.

TEXT BOOKS/ REFERENCES:

1. Roger S. Pressman, "*Software Engineering-A Practitioner's Approach*", Seventh Edition, Tata McGraw-Hill, 2010.
2. Ian Sommerville "*Software Engineering*", Sixth Edition.
3. Richard Fairley , "*Software Engineering concepts*", Tata McGraw-Hill Publishing Company Pvt. Ltd., Seventh Edition

16CA307 BASICS OF OPERATIONS RESEARCH 3-1-0-4

Linear Programming: Introduction - Mathematical Formulations - Solutions - Graphical Method- Simplex Method - Artificial Variables- Big M - Two Phase Methods - Variants in Simplex Method - Duality Theory and Problems- Dual Simplex Method.
Transportation and its Variants: Definition - Transportation Algorithms and Solutions - Assignment Model - Hungarian Method- Traveling Salesman Problem - Transshipment Model.
Simulation: Definition - Types of Simulations - Monte Carlo Simulation. Queuing Theory: Characteristic of Queuing System - Steady State M/M/I Model Finite and Infinite Population and M/M/C Infinite Population Model.
Game Theory: Competitive Games - Rectangular Game - Saddle point - Minmax (Maxmin) Method of Optimal Strategies - Value of the Game. Solution of Games with Saddle Points - Dominance Principle. Rectangular Games without Saddle Point – Mixed Strategy for 2 X 2 Games.
PERT and CPM: Network Representation - Critical Path Method. PERT-time Estimates-Various Types of Floats- Critical Path Computation. Inventory Theory: Cost Involved in Inventory Problems - Single Item Deterministic Models - Economic Size Model with and without Shortages having Production Rate Infinite and Finite.

TEXT BOOKS/ REFERENCES:

1. Hamdy A. Taha, "*Operations Research – An Introduction*", Seventh Edition, Macmillan Publishing Company, 2004.
2. Kantiswarup, P. K. Gupta and Manmohan, "*Operations Research*", Seventh Edition Sultan Chand, 1991.
3. F. Hiller and G. J. Lieberman, "*Introduction to Operations Research*", Eighth Edition, Tata McGraw-Hill, 2006.
4. S. D. Sharma, "*Operations Research*", Eighth Edition, KedarNath, Ram Nath and Company, 1997.

SEMESTER IV

16CA304 SERVICE ORIENTED ARCHITECTURE 3-0-1-4

SOA Fundamentals: Defining SOA - Characteristics of contemporary SOA- Business Value of SOA – Architecture- Infrastructure Services Web Services Technologies: Web Services &

SOA - WSDL, SOAP – UDDI - UDDI – Message Exchange Patterns – Coordination – Orchestration – Choreography -WS- Transaction
WS- Security - WS- Reliable Messaging. WS- Policy - WS- Attachments. BPEL for Web Services. Service layers - Service-Oriented Design – BPEL for Web Services.
Tools Available for Appropriate Designing - Implementing SOA. SOA Platform Basics: SOA Support in J2EE, JAXWS, JAXB, JAXR, JAX-RPC, WSIT, SOA support in .NET, ASP.NET web services
Introduction to Cloud Computing: Cloud Computing (NIST Model) Properties - Service Models (XaaS) - Deployment Models. The Google File System - Virtualization Techniques in Cloud - Parallelization in Cloud – Privacy in Cloud - Data Processing in Large Clusters. Google's MapReduce Programming Model.

TEXT BOOKS/ REFERENCES:

1. Thomas Erl, "Service Oriented Architecture, Concepts, Technology and Design", Prentice Hall of India, 2005.
2. Norbert Bieberstein, Sanjay Bose, Marc Fiammente, Keith Jones and Rawn Shah, "Service Oriented Architecture compass: Business value, Planning and Enterprise Roadmap", Second Edition, IBM Press, 2005.
1. Sandy carter, "The new language of Business: SOA and web 2.0", IBM press, 2007.
2. Thomas Erl, "Service oriented Architecture: A field guide to integrating XML and web services", First Edition, Prentice Hall, 2004.
3. Toby Velte, Anthony Velte and Robert Elsen Peter ,"Cloud Computing A Practical Approach", First Edition, Tata McGraw-Hill,2009.

16CA306 DATA MINING AND APPLICATIONS 3-0-1-4

Introduction: Evolution and Importance of Data Mining-Types of Data and Patterns Mined-Technologies-Applications-Major Issues in Data Mining. Knowing about Data-Data Preprocessing: Cleaning– Integration–Reduction–PCA, Data Transformation and Discretization.
Mining Frequent Patterns: Basic Concept – Frequent Item Set Mining Methods - Mining Association Rules – Association to Correlation Analysis.
Classification and Prediction: Issues - Decision Tree Induction - Bayesian Classification – Rule Based Classification – k-Nearest-Neighbor Classification - Linear SVM. Prediction, Accuracy and Error measures - Regression – Linear, Logistic
Clustering: Overview of Clustering – Types of Data in Cluster Analysis – Major Clustering Methods-Partitioning Methods- k-Means, k-Medoids. Hierarchical Methods-Agglomerative and Divisive hierarchical clustering. Density-Based Methods-DBSCAN, Graph-based clustering (CHAMELEON)
Mining Data Streams- Mining Time-Series Data- Mining Sequence Patterns in Biological Data- Graph Mining – Social network Analysis
Mining Object, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Text Mining – Latent Semantic Analysis, Linear Discriminant Analysis, Fischer Discriminant, Mining the World Wide Web, Applications and Trends in Data Mining
Evaluation metrics – Precision, Recall, F-measure
Tools :Implementation of Data mining algorithms using Latest Open Source Data mining Tools.

TEXT BOOKS/ REFERENCES:

1. Jiawei Han, Micheline Kamber and Jian Pei, "Data mining concepts and Techniques", Third Edition, Elsevier Publisher, 2006.

2. K.P.Soman, Shyam Diwakar and V.Ajay, "Insight into data mining Theory and Practice", Prentice Hall of India, 2006.

16CA308 ADVANCED DATABASES 3-1-0-4

Introduction to Object Oriented Database: Abstraction, encapsulation, and information hiding, Classes, Inheritance Overloading Polymorphism and dynamic binding - Object-Oriented Data Model.
Complex Data Types – Structured Types and Inheritance in SQL – Table Inheritance – Array and Multiset Types in SQL – Object-Identity and Reference Types in SQL – Implementing OR Features – Persistent Programming Languages – Object – Relational Mapping.
Introduction to Database Implementation and Distributed Database Architectures: Distributed Databases -Transparency, performance and reliability–Introduction to distributed architectures–Distributed and parallel databases concepts – autonomy, distribution, and heterogeneity–Client/server, parallel and distributed architectures –Design strategies: Horizontal, vertical and hybrid fragmentation- Resource allocation.
Parallel Databases: I/O Parallelism – Interquery Parallelism – Intraquery Parallelism – Intraoperation Parallelism – Interoperation Parallelism.
Introduction to Transaction Management and Concurrency Control: Transaction model and properties–Transaction structure–Transaction serialization and recovery–Lock based concurrency control–Multi-phase locking protocols–Time stamp ordering–Serialization.
Concurrency Control: Optimistic concurrency control–Deadlock management – detection, avoidance, and resolution – Distributed deadlock – Structured (top actions, distributed nested) transactions.Distributed Query Processing
Recovery and Commit Protocols: Failure analysis– Reliability and availability– Sources of failure–Recovery techniques: shadow paging and write-ahead logging–Memory and storage management (Undo/redo and steal/force) –Two Phase Commit, Three phase commit.
Spatial and Temporal Data and Mobility: Time in Databases – Spatial and Geographic Data – Multimedia Databases – Mobility and Personal Databases.
Concepts of NoSQL Databases

TEXT BOOKS/ REFERENCES:

1. Database Systems Concepts; Silberschatz, Abraham, Henry F. Korth, and S.Sudarshan.
2. Principles of Distributed Database Systems; Ozsu, M. Tamer and Patrick Valduriez.
3. C. S. R. Prabhu, "Object Oriented Database Systems : Approaches and Architectures", Third Edition, PHI Learning Pvt. Ltd.
4. RamezElmasri and ShamkantNavathe, "*Fundamentals of Database Systems*", Sixth Edition, Addison Wesley, 2010
5. Hector Garcia-Molina, Jeffrey Ullman and Jennifer Widom, "*Database Systems: The Complete Book*", Second Edition, Prentice Hall, 2008.

16EN600 TECHNICAL WRITING P/F

Introduction to the Course – What is technical writing and how is it different from writing in general? Error detection – Technical Vocabulary. Mechanics of writing: Grammar rules – punctuation - spelling rules - tone and style- graphical Representation.

Different kinds of written documents: Definitions- descriptions- instructions- recommendations- manuals - reports – proposals, Instructions manual, job applications with Resume Introduction to Writing dissertations, papers, and technical proposals
Technical paper writing: Library research skills- documentation style - document editing – proof reading - formatting
Practice in oral communication: Group Discussion, Interviews, and Technical presentations

TEXT BOOKS/ REFERENCES:

1. Hirsh, Herbert. L "Essential Communication Strategies for Scientists, Engineers and Technology Professionals". II Edition. New York: IEEE press, 2002

2. Anderson, Paul. V. "Technical Communication: A Reader-Centred Approach". V Edition. Harcourt Brace College Publication, 2003

3. Strunk, William Jr. and White. EB. "The Elements of Style" New York. Alliyan& Bacon, 1999.

4. Riordan, G. Daniel and Pauley E. Steven. "Technical Report Writing Today" VIII Edition (Indian Adaptation). New Delhi: Biztantra, 2004.

SEMESTER V

16CA401 SOFTWARE ARCHITECTURE 3-1-0-4

Definition of Software Architecture- Importance of Software Architecture - The Many Contexts of Software Architecture
Understanding Quality Attributes – Availability- Interoperability - Modifiability - Performance – Security - Testability - Usability
Architectural Patterns: Layered - MVC - Broker – Pipes and Filters – Kernel - 6. Peer-to-Peer - Publish-Subscribe-Shared Data - Design patterns
Architecture and Requirements - Designing an Architecture - Architecture, Implementation, and Testing - Documenting Software Architectures - Architecture Evaluation
Architecture in Agile Projects - Architecture in the Cloud - Service Oriented Architecture – case studies

TEXT BOOKS/ REFERENCES:

1. Software Architecture in Practice Third Edition, By: Len Bass Paul Clements Rick Kazman

2. Stephen T. Albin,*The Art of Software Architecture, Wiley Dreamtech, 2003.*
3. Jeff Garland et al, Large Scale Software Architecture: A Practical Guide Using UML, Wiley Dreamtech, 2003.
4. Alan Shalloway and J R Trott, Design Patterns Explained, Pearson, 2004
5. Mary Shaw & David Garlan, Software Architecture – Perspectives on an Emerging Discipline, PHI, 1996.
6. Gamma, E. et. Al. Design Patterns: Elements of Reusable Object Oriented Software, Addison Wesley, 1995.

16CA403 SYSTEM SECURITY 3-1-0-4

Overview of Information Security:Confidentiality – Integrity – Access Control – Availability – Malicious Software (Viruses, Trojans, Rootkits, Worms, Botnets)
Program Security: Secure Program -Non Malicious Program Errors -Malicious Code - Program Controls.
Operating System Security: Memory Protection -Access Control -File Protection Mechanisms -User Authentication -Trusted Operating System
Database Security: Security Requirements -Reliability and Integrity-Sensitive Data – Inference -Multilevel Security
Network Security: Threats in Networks -Security Controls – Firewalls-Intrusion Detection Systems-Administering Security: Security Planning -Risk Analysis-Organizational Security Policies-Physical Security
Ethical Issues: Protecting Programs and Data -Information and the Law -Rights of Employers and Employees -Redress for Software Failures -Computer Crime -Ethical Issues. Case Study: Privacy Rights, Fraud, Accuracy of Information, Denial Of Service.

TEXT BOOKS/ REFERENCES:

1. Charles P. Pfleeger and Shari Lawrence Pfleeger, "*Security in Computing*", Fourth Edition, Prentice Hall, 2007.

2. Ross J. Anderson and Ross Anderson, "*Security Engineering: A Guide to Building Dependable Distributed Systems*", Wiley India Pvt Ltd, 2001.
3. C.K Shyamala, N. Harini and T.R.Padmanabhan, "*Cryptography and Security*", First Edition, Wiley India Pvt Ltd, 2011.
4. Matthew Bishop, "*Computer Security: Art and Science*", Addison-Wesley, 2003.
5. William Stallings, "*Cryptography and Network Security: Principles and Practice*", Fifth Edition, Pearson Education, 2011.

16CA498 DISSERTATION 0-0-0-5

The objective of Dissertation – Phase 1 is to gear up students for preparation of Dissertation-Phase 2 in Semester-VI. Dissertation provides an opportunity to the students to demonstrate independence and originality in thought and application. Students will select topics from the field of computer application and based on a thorough review of literature on that topic, they will identify the problems and decide on plans of research for dissertation. Under the supervision of faculty members, they will execute their plans involving theoretical and/or experimental work. Students will have to prepare proper documentation consisting of SRS, Modeling Techniques, Development Strategies and Implementation and Testing Strategies. Student may use any Design Methodologies such as SSAD, OOAD and UML etc. This is done during phase 1. Regular reviews will be conducted.

SEMESTER 6

16CA499 DISSERTATION 0-0-0-12

The results obtained in phase 1 will be analysed to arrive at a conclusion which will lead to some novelty in the field of computer application. Dissertation will be prepared as per the prescribed format/ guidelines and will be presented in the form of regular reviews. The Dissertation work will be evaluated continuously over the span of the semester as per the approved procedure. For the final review, the department may appoint external expert from industry or academics. Also, a technical paper based on the work done has to be submitted

and published at a reputed conference which indexes the publications in SCOPUS. The formalities insisted by the department in this regard has to be strictly adhered to.

ELECTIVES

16CA314 INFORMATION SECURITY 3-0-0-3

Introduction to Computer Security: Basic Concepts - Threat Models- Common Security Goals. Cryptography and Cryptographic Protocols including Encryption, Authentication, Message Authentication Codes, Hash Functions, One-way Functions, Public-key Cryptography, Secure Channels, Zero Knowledge in Practice
Cryptographic Protocols and their Integration into Distributed Systems and other Applications - Authentication: Overview – Requirements - Functions-Protocols – Applications –Kerberos – X.509 Directory Services.
Electronic Mail Security: Email Architecture – Security –Pretty Good Policy Variations – Operational Descriptions – PGP Session Keys Key Rings – Key management – Message Exchange formats – Trust Model - IP Security:
Introduction to IP - IP security Overview- Pros and Cons – IP Sec Applications – IP Security Architecture – IPSec Services - Authentication Header -Encapsulating Security Payload – IPSec Modes - Combining Security Associations - Key Management.
Web Security: Web Security Requirements- Secure Sockets Layer Objectives – Versions – Certificates – Protocols – Transport Level Security - Secure Electronic Transaction Entities – Certificates – DS Verification.

TEXT BOOKS/ REFERENCES:

1. C K Shyamala, N Harini and T R Padmanabhan, "*Cryptography and Security*", First Edition, Wiley India Pvt. Ltd, 2011.

2. Stallings W, "*Cryptography and Network Security*", Third Edition, Pearson Education Asia. Prentice Hall, 2000.
3. Forouzan B A, "*Cryptography and Network Security*", Special Indian Edition, Tata McGraw Hill, 2007.

16CA316 STRUCTURE AND INTERPRETATION OF COMPUTER PROGRAMS 3-0-0-3

Introduction to the Elements of Programming Languages: Different Types of Programming Languages - Modeling Programming Languages, Computability versus Complexity, Computer Science for Computation.
Introduction to LISP and Scheme - Building Abstractions with Procedures - The Elements of Programming Procedures and the Process they Generate – Formulating Abstractions with Higher-Order Procedures.
Building Abstractions with Data: Introduction to Data Abstraction- Hierarchical Data and the Closure Property – Symbolic Data – Multiple Representations for Abstract Data – Systems with Generic Operations.
Modularity, Objects, and State: Assignment and Local state – The Environment Model of Evaluation – Modeling with Mutable Data – Concurrency- Streams.
Metalinguistic Abstraction: The Metacircular Evaluator – Lazy Evaluation - Variation on a Scheme- Nondeterministic Computing – Logic Programming – Introduction to PROLOG.

TEXT BOOKS/ REFERENCES:

1. Abelson H and Sussman G J, "*Structure and Interpretation of Computer Programs*",

Second Edition, MIT Press, 2005.

2. Sebesta R W, "*Concepts of Programming Languages*", Ninth Edition, Addison Wesley, 2009.

3. Pierce B C, "*Types and Programming Languages*", MIT Press, 2002.
4. Sethi R, "*Programming Languages Concepts and Constructs*", Second Edition, Addison Wesley, 1996.
5. T W Pratt and Marvin V Z, "*Programming Languages: Design and Implementation*", Third Edition, Prentice Hall, 1995.

16CA318 SOFTWARE QUALITY ASSURANCE 3-0-0-3

Introduction: The Software Quality Challenge - Software Quality Factors-The Components of Software Quality System-Integrating Quality Activities in the Project Life Cycle.
Software Testing: Strategies and Implementation-Building the Software Testing Process-
Software Quality Management Components: Metrics and Costs-
Software Quality in the Business Context- Product Quality and Process Quality - ISO 9001: The Origins of ISO 9001- need for ISO 9001-Assessment and Audit Preparation-The Assessment Process
Software CMM and other Process Improvement Models-Software Configuration Management-
Introduction to Six Sigma - Case Studies: Indian Software Industry in Perspective.

TEXT BOOKS/ REFERENCES:

1. Daniel Galin, *"Software Quality Assurance: From theory to Implementation",* Pearson Education, 2008

3. Nina Godbole, "*Software Quality Assurance, Principles and Practice*", Narosa Publications, 2011.
4. William Perry, "*Effective Methods of Software Testing*", Third Edition, Wiley, 2006.

16CA322 COMPUTATIONAL INTELLIGENCE 3-0-0-3

Artificial Intelligence – a Brief Review – Pitfalls of Traditional AI – Need for Computational Intelligence – Importance of Tolerance of Imprecision and Uncertainty - Constituent Techniques – Overview of Artificial Neural Networks - Fuzzy Logic - Evolutionary Computation.
Neural Network: Biological and Artificial Neuron, Neural Networks, Supervised and Unsupervised Learning. Single Layer Perceptron - Multilayer Perceptron – Backpropagation Learning.
Neural Networks as Associative Memories - Hopfield Networks, Bidirectional Associative Memory. Topologically Organized Neural Networks – Competitive Learning, Kohonen Maps.
Fuzzy Logic: Fuzzy Sets – Properties – Membership Functions - Fuzzy Operations. Fuzzy Logic and Fuzzy Inference - Applications. Evolutionary Computation - Constituent Algorithms. Swarm
Intelligence Algorithms - Overview of other Bio-inspired Algorithms - Hybrid Approaches (Neural Networks, Fuzzy Logic, Genetic Algorithms etc.).

TEXT BOOKS/ REFERENCES:

1. LaureneFausett, Fundamentals of Neural Networks, 2nd edition,Pearson, 1993
2. Ross T J, "*Fuzzy Logic with Engineering Applications*", McGraw Hill, 1997.
3. Eiben A E and Smith J E, "*Introduction to Evolutionary Computing*", Second Edition, Springer, Natural Computing Series, 2007.
4. Kumar S, "*Neural Networks - A Classroom Approach*", Tata McGraw Hill, 2004.
5. Engelbrecht, A.P, "*Fundamentals of Computational Swarm Intelligence*", John Wiley & Sons, 2006.
6. Konar. A, "*Computational Intelligence: Principles, Techniques and Applications*", Springer Verlag, 2005.

16CA324 BIO INFORMATICS 3-0-0-3

Introduction to Bioinformatics**:** Definition - Importance and Uses of Bioinformatics- Information Technology - Systems Biology.
Introduction to Nucleic Acids**:** DNA and RNA as Genetic Materials - Structure of Nucleic Acids - Nucleosides and Nucleotides - DNA Double Helix. Central Dogma of Molecular Biology - Nature of Genetic Code - Deciphering Genetic Code - Wobble Hypothesis - Universalities and Exceptions.
Applications of Data Mining to Bioinformatics Problems - Biological Data – Databases - Protein Sequencing - Nucleic Acid Sequencing - Sequence to Structure Relationship.
Bioinformatics Software**:** Clustal V - Clustal W 1.7 - RasMol – Oligo – Molscript – Treeview – Alscript - Genetic Analysis Software- Phylip.
Biocomputing**:** Introduction to String Matching Algorithms - Database Search Techniques - Sequence Comparison and Alignment Techniques - Use of Biochemical Scoring Matrices – Introduction to Graph Matching Algorithms - Automated Genome Comparison and its Implication - Automated Gene Prediction - Automated Identification of Bacterial Operons and Pathways - Introduction to Signaling Pathways and Pathway Regulation. Gene Arrays - Analysis of Gene Arrays - Machine Learning Methods in Bioinformatics - Hidden Markov models - Applications of HMM in gene identification and Profiles HMMs - Neural Networks and Support Vector machines.

TEXT BOOKS/ REFERENCES:

1. Claverie J.M and Notredame C, "*Bioinformatics for Dummies*", Second Edition,Wiley, 2003.
2. Pierre Baldi and Soren Brunak, "*Bioinformatics - The Machine Learning Approach*", Second Edition,A Bradford Book, 2001.
3. RastogiS.C, Mendiratt N. and Rastogi P "*Bioinformatics: Concepts, Skills & Applications*", CBS Publishers & Distributors, 2004.
4. Fogel G.B. and Corne D.W, "*Evolutionary Computation in Bioinformatics*", Morgan Kaufmann, 2003.

16CA328 INFORMATION RETRIEVAL 3-0-0-3

Boolean Expression Based Retrieval: Vocabulary and Postings – Lists – Dictionaries and Tolerant Retrieval – Index Construction and Compression - Scoring and Vector Space Model – Score Computation – Evaluating Information Retrieval Systems – Relevance Feedback and Query Expansion – XML Based Retrieval– Probabilistic Models – Language Models – Text Classification – Vector Space Classification – SVM Based Document Classification – Latent Semantic Indexing – Web Search – Web Crawlers – Link Analysis – Unstructured Data Retrieval Semantic Web – Ontology - Implementations using Natural Language Toolkit.

TEXT BOOKS/ REFERENCES:

1. C. Manning, P. Raghavan and H. Schütze, "*Introduction to Information Retrieval*", Cambridge University Press, 2008.

2. R. Baeza-Yates and B. Ribeiro Neto, "*Modern Information Retrieval: The Concepts and Technology Behind Search*", Second Edition, Addison Wesley, 2011.
3. David A. Grossman and Ophir Frieder "*Information Retrieval: Algorithms and Heuristics*", Second Edition, Springer 2004.

16CA334 INTELLIGENT SYSTEMS 3-0-0-3

Introduction to Agents **:**Structure of Intelligent Agents – Problem Solving Agents- Formulating Problems
Overview of Uninformed Searching Strategies – Informed Search Methods . Game Playing as Search. Knowledge Based Agents Representation - Logics- First Order Logic - Reflex Agents Building a Knowledge Base - General Ontology -Inference - Logical Recovery. Planning Agents – Planning in Situational Calculus - Representation of Planning - Partial Order Planning- Practical Planners – Conditional Planning.
Agents Acting Under Uncertainty – Probability Notation – Bayes' Rule. Probabilistic Reasoning - Belief Networks - Utility Theory
Decision Network- Value of Information- Learning Agents – Learning from Observations – Knowledge in Learning -Case Studies on Applications of AI.

TEXT BOOKS/ REFERENCES:

1. Stuart Russell and Peter Norvig, "*Artificial Intelligence – A Modern Approach*", Third Edition, Prentice Hall, 2009.

2. Elaine Riche, Kevin Knight and Shivashankar B. Nair, "*Artificial Intelligence*", Third Edition, TMH Educations Pvt. Ltd., 2008.
3. Nils J. Nilsson, "*The Quest for Artificial Intelligence*", Second Edition, Cambridge University Press, 2009.

16CA336 OPEN SOURCE SYSTEMS 3-0-0-3

Overview of Free/Open Source Software**:** Definition - Examples of OSD - Compliant Licenses - Example Product - Development Process – History – BSD - The Free Software Foundation – Linux - Apache – Mozilla.
Open Source Software Qualification**:** Specific Characteristics of Open Source Software Transformation -Development Process - Taboos and Norms in OSS Development - Life Cycle.
Deriving a Framework for Analyzing OSS **:**Zachman's Framework for IS Architecture - CATWOE and Soft System Method. Deriving the Analytical Framework for OSS Environment. World View**:** Classifying OSS Motivations - Technological Micro-level Motivation - Economic Micro level and Macro-level Motivation - Socio-Political Micro-level and Macro-level Motivation.
Open Source Server Applications: Infrastructure Services - Web Servers - Database Servers - Mail Servers - Systems Management.
Open Source Desktop Applications**:** Graphical Desktops - Web Browsers - The Office Suite - Mail and Calendar Clients - Personal Software - Cost of OSS – Licensing. FOSS Programming: Python.

TEXT BOOKS/ REFERENCES:

Joseph Feller, Brian Fitzgerald and Eric S. Raymond, "*Understanding Open Source Software Development*", Addison Wesley Professional, 2000.

16CA338 NATURAL LANGUAGE PROCESSING 3-0-0-3

Introduction: Mathematical Foundations- Elementary Probability Theory- Essential Information Theory.
Linguistic Essentials: Part of Speech and Morphology- Phrase Structure. Corpus Based Work: Looking Up Text- Marked up Data. Statistical Inference: Bins-Forming Equivalence Classes- Statistical Estimators- Combining Estimators.
Word Sense Disambiguation: Supervised and Dictionary Based Disambiguation. Markov Models: Hidden Markov Models- Implementation- Properties and Variants.
Part of Speech Tagging: Hidden Markov Model Taggers- Transformation Based Learning Of Tags- Tagging Accuracy and Use of Taggers. Probabilistic Context Free Grammars and Probabilistic Parsing.
Statistical Alignment and Machine Translation: Text Alignment – Word Alignment – Statistical Machine Translation- Implementation Using Natural Language Toolkit (NLTK) and Open Source Tools.

TEXT BOOKS/ REFERENCES:

1. Christopher D. Manning and HinrichSchutze, *"Foundations of Statistical Natural Language Processing*", MIT Press, 1999.

2. James Allen, "*Natural Language Processing with Python*", O'Reilly Media, July 2009.
3. Daniel and James H Martin "*Speech And Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition*", Second Edition, Prentice Hall of India, 2008.

16CA413 DISTRIBUTED COMPUTING 3-0-0-3

Introduction to Distributed Systems – Primitives for Distributed Communication – Design Challenges – Distributed Systems like Models for Distributed Computations –
Overview of Distributed Databases -Structure of Distributed Databases. Virtual Time in Distributed System: Logical Time - Scalar Time – Vector Time Lamport's Algorithm - Case Study -Logical Clocks in Riak - Global and Snapshot Recording Algorithms – Model - Snapshot Algorithms for FIFO Channels - Chandy–Lamport Algorithm - Snapshot Algorithms for Non FIFO Channels. Message Ordering And Group Communication - Message Ordering Paradigms – Asynchronous and Synchronous Execution - Causal Order – Total Order – Group Communication – Case Study (Horus , Totem) –
Distributed Multicast Algorithms. Distributed Mutual Exclusion: Lamports Algorithm - Ricart– Agrawala Algorithm - Quorum-based Mutual Exclusion Algorithms. Deadlock Detection : Models of Deadlock – Classification of Deadlock Detection Algorithms - Mitchell and Merritt's algorithm for the Single Resource Model - Chandy–Misra–Haas Algorithm For The AND/OR Model. Consensus and Agreement Algorithms and Failure Detection - Agreement in Failure Free Systems and Systems with Failures –
The Consensus Problem – Byzantine Fault Tolerance. Case Study : Condor. Distributed Database Design: Design Strategies - Design issues - Fragmentation and Allocation. Semantic Data Control: View Management
Distributed Query Processing: Overview of Query Processing – Transforming Global Queries to Fragment Queries - Query Decomposition - Localization of Distributed data. Distributed Transaction Processing and Concurrency Control – 2PC -3PC.

TEXT BOOKS/ REFERENCES:

1. Ajay D. Kshemkalyani, MukeshSinghal, "*Distributed Computing: Principles, Algorithms, and Systems"*, Cambridge University Press, 2011.

2. George Coulouris, Jean Dollimaore, Tim Kindberg, Gordon Blair,"*Distributed Systems: Concepts & Design*", Fifth Edition, Addison Wesley, 2012.
3. Douglas Thain, Todd Tannenbaum, and MironLivny, "*Distributed Computing in Practice: The Condor Experience"*, Concurrency and Computation: Practice & Experience - Grid Performance, Volume 17, Issue 2-4, 2005.
4. M.TamerOzsu, PartrickValduriez,"*Principles of Distributed Database Systems*", Third Edition, Springer, 2010.

16CA417 WIRELESS COMMUNICATIONS AND NETWORKS 3-0-0-3

Introduction to Wireless Systems: Brief History of Wireless Communication. Transmission Fundamentals: Time Domain, Frequency Domain, Bandwidth vs. Data Rate - Channel Capacity - Transmission Media –
Protocols and TCP/IP Suite: TCP/IP Protocol Architecture - OSI Model. Antennas and Wave Propagation: Antennas, Propagation Modes, Fading in the Mobile Environment - Free Space Propagation.
Modulation Techniques: Signal Encoding, Digital Data - Analog Signal, Analog Data - Analog Signal, Analog Data - Digital Signal, Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS), Code Division Multiple Access (CDMA).
Wireless Networking: Satellite Communications- Capacity Allocation – Frequency Division, Time Division, WiMax and IEEE 802.16 Broadband Wireless Access Standards. Wireless LAN Technology: Infrared, Spread Spectrum, Narrowband LANS- Wi-Fi and IEEE 802.11 Standard, Bluetooth and IEEE 802.15 Standard.
Wireless Routing Protocols: Infrastructure, AdHoc Networks, ProActive vs. ReActive,Dynamic Source Routing(DSR), AdHoc On Demand Distance Vector (AODV),Temporarily Ordered Routing Algorithm(TORA), Destination Sequenced Distance Vector(DSDV). Case Study using NS2 / NS3.

TEXTBOOK / REFERENCES:

1. William Stallings,"*Wireless Communication and Networks*", Pearson Education, Third Edition, 2002.
2. Jochen Schiller, "*Mobile Communications*", Pearson Education, Second Edition, 2003.

16CA419 COMPUTER GRAPHICS AND VISUALIZATION 3-0-0-3

Computer Graphics Fundamentals**:** Overview of CG - Video Displays -Color Models- Output Primitives.
Introduction to OPENGL- Points, Lines – Specifying a 2D World Coordinate Reference Frame in OpenGL- OpenGL Point Functions, Line Functions Polygon Fill Area Functions, Vertex Arrays - Line Drawing Algorithms - Circle Generation Algorithm Filled Area Primitives OpenGL fill Area Functions - Scan Line Polygon Filling Algorithms - Boundary Fill - Flood Fill Algorithms
Attributes of Output Primitives. Geometric Transformations**:** Basic 2Dtransformations-Other Transformations- Reflection and Shearing. OpenGL Geometric Transformation Functions.
3D Object Representation: Fractals - Geometrical Transformation for - 3D Objects - Viewing and Clipping 2D Viewing Functions Clipping Operations. Three Dimensional Viewing: Viewing Pipeline, Viewing Coordinates. Projections: Parallel Projections, Perspective

Projections. OpenGL Two-Dimensional and Three-Dimensional Viewing Functions- OpenGL Animation.
Visible Surface Detection and Illumination Models: Visible SurfaceDetection Methods – Illumination Methods and Surface Rendering – Polygon. Rendering Methods: Constant Intensity Shading, Gouraud Shading, Phong Shading. OpenGL Illumination and Surface Rendering Functions, GUI – OpenGL Interactive Input Device Functions. The User Dialog – Interactive Picture Construction Techniques – Color Models - Computer Animation.

TEXT BOOKS / REFERENCES:

1. Donald Hearn and Pauline Baker, "*Computer Graphics with OpenGL* ", Third Edition, Prentice Hall of India, 2009.

2. Roy A. Plastock and Gordon Kalley, "*Schaum's Outline Series - Theory and Problems of Computer Graphics*", Second Edition, Tata McGraw-Hill, 2000.

3. Foley J.D, Van Dam A, Eiener S.K. and Hughes J.F., "*Computer Graphics Principles and Practice*", Second Edition, Pearson Education, 1996.

16CA421 COMPUTER LANGUAGE ENGINEERING 3-0-0-3

Introduction to Translators – Phases of Compiler and its Overview. Lexical Analysis: Regular Expressions, Finite Automata, Lexer Generator.
Parser: Context Free Grammars, Predictive Parsing, LR Parsing, Hierarchy of Parsers, Error Recovery, Parser generator.
Semantic Analysis: Symbol Table, Type Checking using Abstract Syntax Tree, Type Checking using Attributed Grammars .
Activation Records: Structure of Frames. Intermediate Representation: Conversion to IR Trees
Canonicalization of IR Trees and Three Address Code – Basic Block and Traces**.**

TEXTBOOKS / REFERENCES:

1. Appel A.W, "*Modern Compiler Implementation in Java*", Cambridge University Press, 2002.

2. Aho, Sethi, and Ullman, "*Compilers: Principles, Techniques and Tools*", Addison-Wesley, 1986.

3. Keith Cooper and Linda Torczon, "*Engineering a Compiler*", Second Edition, Morgan Kaufmann, 2011.

4. Kenneth C. Louden, "*Compiler Construction: Principles and Practice*", Course Technology Inc, 1997.

16CA423 SEMANTIC WEB TECHNOLOGIES 3-0-0-3

Introduction to Semantic Web: Semantic Web Concepts- Need for the Semantic Web- Information Overload - Stovepipe Systems - Poor Content Aggregation - XML and the Semantic Web - Web Services and the Semantic Web -Current Applications of the Semantic Web - Business Case for the Semantic Web Decision Support
Business Development - Information Sharing and Knowledge. Understanding the Resource Description Framework: What Is RDF - Capturing Knowledge with RDF - Other RDF

Features - RDF Schema – Non-Contextual Modelling. Web Ontology Language: Motivation and Overview –
The OWL Language- Defining the Ontology Spectrum - Thesaurus, Logical Theory - Ontology - Topic Maps Standards and Concepts – Occurrence – Association - Subject Descriptor – Scope.
Ontologies: Overview of Ontologies - Ontology Example – Definitions – Syntax – Structure – Semantics - and Pragmatics - Expressing Ontologies Logically - Ontology and Semantic Mapping Problem.
Knowledge Representation**:** Languages - Formalisms, Logics - Description Logics - Ontology Design and Management using the Protege Editor - Ontology Reasoning with Pellet/FACT++, Ontology Querying with SPARQL.

TEXT BOOKS / REFERENCES:

1. Michael C. Daconta, Leo J. Obrst and Kevin T. Smith, "*The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management*", Fourth Edition, Wiley Publishing, June 2003.

2. Jeffrey T. Pollock, "*Semantic Web FOR DUMMIES*", Wiley Publishing, 2009.

3. John Davies, Rudi Studer and Paul Warren John, "*Semantic Web Technologies: Trends and Research in Ontology-based Systems*", John Wiley and Sons, 2006.

4. John Davies, Dieter Fensel and Frank Van Harmelen, "*Towards the Semantic Web: Ontology-Driven Knowledge Management"*, John Wiley and Sons, 2003.

16CA425 CLOUD COMPUTING 3-0-0-3

Cloud Computing Overview: Cloud and Grid and Web 2.0 and Other Computing- Cloud Computing Environments- Platforms. Parallel and Distributed Computing- Virtualization: Characteristics-Taxonomy- Pros and Cons – Xen- VMware- Hyper V.
Cloud Computing Architecture- Service Models – Deployment Models- Infrastructure as a Service
Resource Virtualization-Server-Storage-Network-Platform as a Service- Cloud Platform and Management- Software as a Service- Case Study on Eucalyptus. Service Management in Cloud Computing
Service Level Agreement-Billing and Accounting- Managing Data. Cloud Security: Infrastructure, Data and Storage Security.

TEXT BOOKS / REFERENCES:

1. RajkumarBuyya, Christian Vecchiola and S. ThamaraiSelvi, "*Mastering Cloud Computing: Foundations and Applications Programming*" , First Edition, McGrawHill Education, 2013.

2. RajkumarBuyya, James Broberg and Andrzej M. Goscinski, "*Cloud Computing: Principles and Paradigms*", First Edition, Wiley, 2011.

3. Barrie Sosinsky , "*Cloud Computing Bible*", First Edition , Wiley-India, 2010.

4. Nikos Antonopoulos, Lee Gillam, "*Cloud Computing: Principles, Systems and Applications*",First Edition , Springer, 2012.

5. Ronald L. Krutz, Russell Dean Vines "*Cloud Security: A Comprehensive Guide to Secure Cloud Computing*", First Edition, Wiley-India, 2010.

16CA429 DATABASE ADMINISTRATION 3-0-0-3

Introduction: DBMS Architecture and Data Independence - DBA Roles and Responsibilities. SQL * PLUS Overview: SQL plus Fundamentals, Producing more readable outputs, Accepting Values at Runtime, Using iSQL *Plus.
Modifying Data**:** Using DML, TCL- Managing Constraints -Managing Views. User Access and Security**:** Creating and Modifying User Accounts, Managing User Groups with Profiles. Oracle Overview and Architecture**:** Overview of Logical and Physical Storage Structures. Managing Oracle Instances.
Control and Redo Log Files: Managing the Control Files. Managing Tables, Indexes and Constraints. Managing Users and Security.
Introduction to Network Administration: Network Design Considerations, Network Responsibilities for the DBA, Network Configuration, Overview of Oracle Net Features, Oracle Net Stack Architecture.
Backup and Recovery Overview: Defining a Backup and Recovery Strategy, Testing- The Backup and Recovery Plan. Introduction to Performance Tuning**:** Brief Overview of Tuning methodology, General Tuning Concepts

TEXT BOOKS/REFERENCES:

1. Craig S. Mullins, "*Database Administration: The Complete Guide to DBA Practices and*

Procedures", Second Edition, Addison Wesley, 2012.
2. C.J. Date, "*Introduction to Database Systems*", Eighth Edition, Addison Wesley, 2003.
3. Chip Dawes, Biju Thomas, "*Introduction to Oracle 9i SQL*", BPB, 2002.
4. Bob Bryla, Biju Thomas, "*Oracle 9i DBA Fundamental I*", BPB, 2002.
5. Joseph C. Johnson, "*Oracle 9i Performance Tuning*", BPB, 2002.

16CA431 DIGITAL IMAGE PROCESSING 3-0-0-3

Introduction and Fundamentals of Image Processing: Origins of Digital Image Processing – Examples - Fundamental Steps in Digital Image Processing - Elements of Visual Perception - A Simple Image Formation Model - Basic Concepts in Sampling and Quantization- Representing Digital Images- Zooming and Shrinking Digital Images - Some Basic Relationships between Pixels - Linear and Nonlinear Operations - Connectivity and Relations between Pixels.
Simple Operations- Arithmetic, Logical, Geometric Operations. Image Enhancement in the Spatial Domain and Frequency Domain: Some Basic Gray Level Transformations - Histogram Processing – Basics of Spatial Filtering - Smoothing Filters-Mean, Median, Mode Filters - Edge Enhancement Filters – Sobel, Laplacian, Robert, Prewitt filter, Contrast Based Edge Enhancement Techniques.
Design of Low Pass Filters - High Pass Filters- Edge Enhancement - Smoothening Filters in Frequency Domain. Butter Worth Filter, Homomorphic Filters in Frequency Domain. Comparative Study of Filters in Frequency Domain and Spatial Domain.
Image Restoration - Segmentation and Morphology: 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.
Edge Detection - Line Detection - Curve Detection - Edge Linking and Boundary Extraction - Thresholding Algorithms- Region Based Segmentation - Region Growing - Connected

Components Labeling - Region Growing and Region Adjacency Graph (RAG), Split and Merge Algorithms - Morphology - Dilation, Erosion, Opening and Closing.

TEXTBOOKS/ REFERENCES:

1. Rafael C. Gonzalez and Richard E. Woods,"*Digital Image Processing*",Third Edition, Addison Wesley, 2007.
2. Arthur R.Weeks, Jr., "*Fundamentals of Electronic Image Processing*",First Edition, PHI,1996.
3. Milan Sonka, Vaclav Hlavac and Roger Boyle,"*Image processing, Analysis, and Machine Vision*",ThirdEdition,Vikas Publishing House, 2007.

16CA433 BUSINESS INTELLIGENCE 3-0-0-3

Introduction to Business Intelligence: Introduction to OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, 3-tier data warehouse architecture, Data Marts

Data integration: Basics of Data Integration (Extraction Transformation Loading)- Concepts of data integration need and advantages of using data integration. Introduction to common data integration approaches, Introduction to ETL using SSIS, Introduction to data quality, data profiling concepts and applications.

Introduction to Multi-Dimensional Data Modeling-Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling,

OLAP operations, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, OLAP Servers – MOLAP, ROLAP, OLAP query model and query processing, indexing OLAP Data, Data Warehouse Implementation

Introduction to business metrics and KPIs, creating cubes using SSAS. Basics of Enterprise Reporting- Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, introduction to SSRS Architecture, enterprise reporting using SSRS.

TEXT BOOKS/ REFERENCES:

1. Loshin D, "Business Intelligence", First Edition, Elsevier Science (USA), 2003.
2. Jiawei Han, Micheline Kamber and Jian Pei, "Data mining concepts and Techniques", Third Edition, Elsevier Publisher, 2006.
3. Biere M, " Business intelligence for the enterprise" , Second Edition, IBM Press, 2003.
4. Moss L T, Atre S, "Business intelligence roadmap", First Edition, Addison-Wesley Longman Publishing Co., Inc. , 2003.

16CA435 NETWORK MANAGEMENT AND SYSTEM ADMINISTRATION 3-0-0-3

Basic Hardware**:** Network Fundamentals: Local Area Networking - Defining Networks with the OSI Model - Wired and Wireless Networks - Internet Protocol - Implementing TCP/IP in the Command Line- Working with Networking Services - Understanding Wide Area Networks - Defining Network Infrastructures and Network Security.

Security Fundamentals**:** Security Layers – Authentication – Authorization - Accounting - Security Policies - Network Security - Server and Client Protection.
Windows Server Fundamentals**:** Server Overview - Managing Windows Server 2008 R2 - Managing Storage - Monitoring and Troubleshooting Servers - Essential Services - File and Print Services - Popular Windows Network Services and Applications.
Linux Fundamentals**:** System Architecture-Determine and Configure Hardware Settings-Boot the System - Change Run Levels and Shut Down or Reboot System -Linux Installation and Package Management - File Systems- Create Partitions and File systems - Maintain the Integrity of File Systems - Control Mounting and Unmounting of File Systems.
Manage Disk Quotas - File Permissions and Ownership - Create and Change Hard and Symbolic Links. Network Management Lab: Windows Network Configurations and Linux Network Configurations.

TEXT BOOKS / REFERENCES:

1. 98-366*: "Networking Fundamentals, Microsoft Official Academic Course* (Microsoft Corporation)", Wiley, 2011.

2. 98-367: "*MTA Security Fundamentals, Microsoft Official Academic Course*(Microsoft Corporation)", Wiley, 2011.

3. 98-365: "*Windows Server Administration Fundamentals, Microsoft Official Academic Course* (Microsoft Corporation)", Wiley, 2011.

4. Adam Header, Stephen Addison Schneiter, James Stanger and Bruno Gomes Pessanha, LPI "*Linux certification in Nut shell*", Third edition, O'Reilly, 2010.

16CA437 BIG DATA ANALYTICS AND VISUALIZATION 3-0-0-3

Introduction of big data – Big data characteristics - Volume, Veracity, Velocity, and Variety – Data Appliance Challenges and Issues, Case for Big data, Big data sources, Features of data. - Evolution of Big data – Best Practices for Big data Analytics - and Integration tools
Introduction to Data Modeling, Data Models Used in Practice: Conceptual data models, Logical data models, Physical data models, Common Data Modeling Notations , How to Model Data : Identify entity types, Identify attributes, Apply naming conventions, Identify relationships, Apply data model patterns, Assign keys, Normalize to reduce data redundancy,
Introduction to elementary data analysis: Measures of center: Mean, Median, Mode, Variance, Standard deviation, Range. Normal Distribution: Center, Spread, Skewed Left, Skewed Right, outlier. Correlations: Correlation Patterns: Direction relationship, Magnitude Relationship. Introduction to Bayesian Modeling: Bayes Rule, Probabilistic Modeling
Introduction to Predictive Analytics: Simple Linear regression, Multiple Linear regression, Logistic Linear Regression. History of Visualization, Goals of Visualization, Types of Data Visualization: Scientific Visualization, Information Visualization, Visual Analytics, Impact of visualization
Introduction to Data Processing , Map Reduce Framework , Hadoop ,HDFS , S3 Hadoop Distributed file systems, Apache Mahout, Hive,Sharding, Hbase , Impala , Case studies : Analyzing big data with twitter ,Big data for Ecommerce , Big data for blogs.

TEXT BOOKS/ REFERENCES:

1. Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS Businessm.Series, 2012.

2. The Data Modeling Handbook: A Best-Practice Approach to Building Quality Data Models 1st Edition by Michael C. Reingruber (Author), William W. Gregory (Author) A Wiley QED publications
3. Colleen Mccue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis",Elsevier, 2007
4. Correlation and Regression: Applications for Industrial Organizational Psychology and Management (Organizational Research Methods) 1st Edition, by Philip Bobko (Author)
5. Multiple Regression and Beyond 1st Edition by Timothy Z. Keith (Author)

16CA439 MODERN WEB APPLICATION DEVELOPMENT USING MEAN STACK 3-0-0-3

1. Basics of HTML, CSS, and Javascript
HTML, CSS, Bootstrap, Javascript basics – Variables, functions, and scopes, Logic flow and loops, Events and Document object model, Handling JSON data, Understanding Json callbacks.
2. Introduction to Node JS
Installation, Callbacks, Installing dependencies with npm, Concurrency and event loop fundamentals, Node JS callbacks, Building HTTP server, Importing and exporting modules, Building chat application using web socket.
3. Building REST services using Node JS
REST services, Installing Express JS, Express Node project structure, Building REST services with Express framework, Routes, filters, template engines - Jade, ejs.
4. MongoDB Basics and Communication with Node JS
Installation, CRUD operations, Sorting, Projection, Aggregation framework, MongoDB indexes, Connecting to MongoDB with Node JS, Introduction to Mongoose, Connecting to MongoDB using mongoose, Defining mongoose schemas, CRUD operations using mongoose.
5. Building Single Page Applications with AngularJS
Single Page Application – Introduction, Two-way data binding(Dependency Injection), MVC in Angular JS, Controllers, Getting user input, Loops, Client side routing – Accessing URL data, Various ways to provide data in Angular JS – Services and Factories, Working with filters, Directives and Cookies, The digest loop and use of $apply.

16HU441 PRINCIPLES OF ECONOMICS AND MANAGEMENT 3-0-0-3

Introduction to Management**:** Managers and Management - History Module - The Historical Roots of Contemporary Management Practices, The Management Environment. Planning: Foundations of Planning - Foundations of Decision Making - Quantitative Module Quantitative Decision-Making Aids. Organizing: Basic Organization Designs - Staffing and Human Resource Management - Career Module Building Your Career - Managing Change, Stress, and Innovation .Leading-
Foundations of Individual and Group Behavior - Understanding Work Teams - Motivating and Rewarding Employees - Leadership and Trust - Communication and Interpersonal Skills. Introduction to Economics**:** The Firm and Its Goals - Review of Mathematical Concepts used in Managerial Economics, Supply and Demand - The Mathematics of Supply and Demand, Demand Elasticity - Applications of Supply and Demand, Demand Estimation and Forecasting, The Theory and Estimation of Production - The Multiple-Input Case - Expressing the Production Function with the Use of Calculus, The Theory and Estimation of Cost - A Mathematical Restatement of the Short-Run Cost Function - The Estimation of Cost.

Pricing and Output Decisions: Perfect Competition and Monopoly - The Use of Calculus in Pricing and Output Decisions - Break-Even Analysis (Volume-Cost-Profit), Monopolistic Competition and Oligopoly - Special Pricing Practices.

TEXTBOOKS/REFERENCES:

1. Stephen P, Robbins David A. De Cenzo**, "***Fundamentals of Management*", Prentice Hall, Sixth Edition, 2008.

2. Philip K. Y. Young, Steve Erfle and Paul G. Keat, "*Managerial Economics: Economic Tools for Today's Decision Makers*", Pearson, Seventh Edition, 2013.

16HU443 SOFTWARE PROJECT MANAGEMENT 3-0-0-3

Introduction to Software Project Management: Software Projects-Other Types of Projects - Problems with Software Projects. Project Evaluation and Programme Management: Evaluation of Individual Projects – Cost Benefit Evaluation Techniques – Risk Evaluation. Step Wise: An Overview of Project Planning. Selection of an Appropriate Project Approach: Build or Buy? - Waterfall Model – Spiral Model – Prototyping – Incremental Delivery – RAD – Agile Methods – XP - Scrum.
Software Effort Estimation**:** Bottom up Estimating – Top down Estimating – FP Analysis – COCOMO II – Cost Estimation**.** Activity Planning**:** Project Schedules - Sequencing and Scheduling Projects - Network Planning Models – AOA – AON - CPM - Shortening Project Duration – Crashing - Identifying Critical Activities.
Risk Management: A Framework for Dealing with Risk – Risk Management **–** PERT. Resource Allocation**:** Identifying Resource Requirements – Scheduling Resources – Publishing Resource Schedule – Cost Schedule.
Monitoring and Control: Visualizing Progress - Earned Value Analysis. Managing People in SW Environments: Organizational Behavior – Motivation. Working in Teams: Organizing Teams.
Software Quality Management: Defining Software Quality – Metrics – Process Capability Models – Software Reliability.CaseStudy: PMBOK - MS Project.

TEXTBOOK / REFERENCES:

1. Mike Cotterell and Bob Hughes, "*Software Project Management*", Fifth Edition, Tata McGraw-Hill, 2010.

2. Roger S. Pressman, "*Software Engineering a Practitioner's Approach*", Seventh Edition, Tata McGraw-Hill, 2010.

3.Jalote P, "*Software Project Management in Practice",* Addison Wesley, 2002.

LAB COURSES

16CA451 DATA STRUCTURES AND ALGORITHMS LAB 0-0-3-1

Posteriori analysis of iterative and recursive algorithms, plotting of growth rate. Implementation of singly linked list, doubly linked list, circular linked list. Stack and Queue implementation using array and SLL, comparison of efficiencies, Applications of Stack and Queue –Infix to postfix, postfix expression evaluation, Implementation of Polynomial ADT using SLL.

Binary search tree implementation. Heap implementation using array, Heap sort, Implementation of sorting algorithms – Bubble sort, Insertion Sort, Selection Sort, Quick

Sort- Merge Sort, performance comparison of sorting algorithms for various classes of inputs like nearly sorted, unsorted etc.

$O(V^2)$ and O(E log V) implementations of Dijkstra algorithm, BFS and DFS implementation, graph cycle detection using BFS. Topological sort using DFS, Prims and Kruskals MST. Dynamic Programming based solution for 0-1 Knapsack problem, Recursive matrix chain multiplication.

16CA452 JAVA PROGRAMMING 0-0-3-1

Overview of the Language: Compiling and Interpreting Java Applications. JDK Objects and Classes: Defining Class- Creating Object– Constructors- Access Modifiers - Encapsulation. Input / Output Streams: Overview of Streams - Bytes vs. Characters - File Object- Binary Input and Output - Reading and Writing Objects. Inheritance in Java: Casting - Method Overriding - Polymorphism - Super - Interfaces and Abstract Classes. Packages: The Import Statement - Static Imports. Package Scope Multithreading**:** Introduction to Threads - Creating Threads - Thread States - Runnable Threads - Coordinating Threads - Interrupting Threads. Runnable Interface Applets: Applet Architecture- Parameters to Applet - Embedding Applets in Web page. Designing Graphical User Interfaces in Java: Components and Containers - Layout Managers - AWT Components- Adding a Menu to Window- Extending GUI Features using Swing Components.

TEXT BOOKS/ REFERENCES:

1. Naughton P. and Schildt H., "*Java: The Complete Reference*", 9th Edition, Oracle Press, 2014.
2. Eckel.B, "*Thinking in Java", Fourth Edition,* Prentice Hall, 2006.
3. Arnold, Gosling and Holmes, "*The Java Programming Language*", Fourth Edition, Addison-Wesley, 2005.

16CA453 GUI PROGRAMMING USING VB.NET 0-0-3-1

Introduction to .NET, .NET Framework features & architecture, CLR, Common Type System, MSIL, Assemblies and class libraries. Introduction to visual studio, Project basics, types of project in .Net, IDE of VB.NET- Menu bar, Toolbar, Solution Explorer, Toolbox, Properties Window, Form Designer, Output Window, Object Browser. The environment: Editor tab, format tab, general tab, docking tab. visual development & event drive Programming -Methods and events.

The VB.NET Language- Variables -Declaring variables, Data Type of variables, Forcing variables declarations, Scope & lifetime of a variable, Constants, Arrays, types of array, control array, Collections, Subroutines, Functions, Passing variable Number of Argument Optional Argument, Returning value from function.

Control flow statements: conditional statement, loop statement. Msgbox&Inputbox. Working with Forms : Loading, showing and hiding forms, GUI Programming with Windows Form: Common Controls, scroll bar, Timer, ListView, TreeView, toolbar, StatusBar. Properties, Methods and events. OpenFileDilog, SaveFileDialog, FontDialog, ColorDialog, PrintDialog. Link Label. Designing menu. Object oriented Programming: Classes & objects, fields Properties, Methods & Events, constructor, inheritance. Access Specifiers: Public Private, Projected

Database programming with ADO.NET – Overview of ADO, from ADO to ADO.NET, Accessing Data using Server Explorer. Creating Connection, Command, Data Adapter and Data Set with OLEDB and SQLDB. Display Data on data bound controls, display data on data grid.

TEXT BOOKS/ REFERENCES:

1. Vb.net programming black book by Steven Holzner –Dreamtech publications
2. Mastering vb.net by EvangelosPetroutsos- bpb publications Introduction to .net framework-Worx publication

16CA454 ANDROID APPLICATION DEVELOPMENT 0-0-3-1

Menu, Dialog, List and Adapters
What is Menu?-Custom Vs. System Menus-Creating and Using Handset menu Button (Hardware)-What are Android Themes. What is Dialog? How to create an Alter Dialog?
List & Adapters
Database SQLite
IntroducingSQLite-SQLiteOpenHelper and creating a database-Opening and closing a database
Working with cursors Inserts, updates and deletes
Location Based Services and Google Maps
Using Location Based Services -Working with Google Maps
Multimedia Programming using Android
Multimedia audio formats-Creating and Playing -Multimedia audio formats-Kill / Releasing (Memory Management)-How to associate audio in any application-How to associate video playback with an event
WebView
How to develop your own custom made Web browser -How to use WebView object in XML Permission for using the Internet-Methods for associated with 'Go', 'Back', 'Forward' etc

TEXT BOOKS/ REFERENCES:

1. Head first Android Development

16CA455 WEB DEVELOPMENT USING ASP.NET 0-0-3-1

Understanding role of Web Server and Web Browser - Form Tag and comparison between Get and Post methods - Understanding HTML Form Tag and elements within it –
ASP.NET Introduction - First ASP.NET Application - Auto Postback Property - Event Handler Parameters - Comparison between HtmlControls and WebControls - ASP.NET Architecture
Life Cycle of ASP.NET Page - Master Pages - Validation Controls - ASP.NET State Management - Cookies-HttpCookie - Sessions-HttpSessionState
Application-HttpApplicationState -WebConfiguration File and Global.asax - Data Bound Controls - Publishing Web Application
Creating web application in IIS - Using Virtual Directory - Publishing ASP.NET Website.

16CA456 DATABASE MANAGEMENT SYSTEMS LAB 0-0-3-1

Table Design- Data Definition Language (DDL) commands - Table creation and alter(include integrity constraints such as primary key, referential integrity constraints, check, unique and null constraints both column and table level, Drop - Other database objects such as view, index, cluster, sequence, synonym etc. - Practice SQL Data Manipulation Language (DML) commands - Row insertion, deletion and updating - Retrieval of data - Simple select query - Select with where options (include all relational and logical operators) - Functions: Numeric,

Data, Character, Conversion and Group functions with having clause. - Set operators - Sorting data - Sub query (returning single row, multiple rows, more than one column, correlated sub query) - Joining tables(single join, self-join, outer join) - Data manipulations using date functions - User defined functions in a query- Transaction Control Language (TCL) commands (Grant, revoke, commit and save point options) - Usage of triggers, functions and procedures using PL/SQL constructs

16CA457 OPERATING SYSTEMS LAB 0-0-3-1

Basic Linux Commands -System calls -Fork, exec, getpid, exit, wait, close, stat,open, read, write etc- IPC- Pipes , Signals , Message queues , shared memory –Threads - Process synchronization using semaphore, monitor -Implementation of Scheduling Algorithms - FCFS, SJF, Priority - Implementation of Bankers Algorithm- Implementation of page replacement algorithms

16CA458 COMPUTER ORGANIZATION AND ARCHITECTURE LAB 0-0-3-1

Basic Organization and Hardware Components of a Personal computer-Assembling of Personal Computer-: Formatting- Partitioning the Hard Disk-Installation of Windows and Linux Operating System- Digital Circuits: Realisation of Logic Gates- Realization of logic functions with the help of universal gates-NAND Gate- Half /Full Adder & Half/Full Subtractor - Code Conversion

16CA459 WEB AND XML PROGRAMMING USING JAVA AND J2EE 0-0-3-1

Web server and Application Server - Client vs server-side programming - Servlets –
Session tracking - JSP –scriptlets, declarations, expressions and declaratives – JSP
Tag Libraries – EnterpriseJava Beans –Session Bean – Entity Bean – Message Driven Bean
XML Programming - DTDs & Schemas - XML parsers – DOM parsers - SAX parsers – Writing XML with Java
Introduction to Frameworks – Hibernate – Spring