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.

18CA201   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 ExamplesAddressing 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*", Fourth Edition, Elsevier, 2012.
3. Thomas L.Floyd, "*Digital Fundamentals*", 11th Edition, Prentice Hall, 2015.
4. M. Morris Mano, Computer System Architecture, 3rd Edition, Prentice Hall, 2013

18CA202   COMPUTER PROGRAMMING   3-0-1-4

Introduction to Structured Programming- Flowchart- 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 of 1-D and 2-D arrays - Structures-Union. File Access: File Operations for Binary and Text files- Command Line Arguments-Preprocessor- Macros-Graphics Library.

TEXT BOOKS/ REFERENCES:
1. ReemaThareja, "Computer fundamentals and Programming In C", Oxford University Press, Second Edition
2. E Balaguruswamy, "Programming in ANSI C", MULTICOLOUR Edition, Sixth Edition Second Edition, PHI, 2012.
3. Behrouz A Forouzan, "Computer Science: A Structured Programming Approach Using C", Third Edition
4. ReemaThareja, "Programming In C", Oxford University Press, Second Edition.

18CA203   DATABASE MANAGEMENT SYSTEMS   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*", Seventh 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. andGehrke.J, "*Database Management Systems*", Third Edition,Tata McGraw-Hill, 2003.

18CA204   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, Three logic 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.

18CA211   DATA STRUCTURES USING C++   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. Binary Heaps: 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.

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.
DevOps - JUnit - git - github - Docker - Containers - Continous Integration - Selenium - HTTP load testing tool - Design patterns.

TEXT BOOKS/ REFERENCES:

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

18CA212   MICROPROCESSORS AND EMBEDDED SYSTEMS   3-0-1-4

8085 microprocessor architecture; Instruction set, instruction types and formats; Instruction execution, instruction cycles, different types of machine cycles and timing diagram. - 16-bit microprocessors, 8086 architecture, registers, memory segmentation and addressing, 32-bit/64-bit microprocessor families
Introduction to IoT – Architecture - Applications
Introduction to Arduino: The Arduino Platform, Architecture, Pin functions, overview of main features such as I/O Ports, Timers, interrupts serial port, PWM, ADC, etc.
Introduction to Arduino IDE, writing, saving, compiling and uploading sketches.
Interfacing discrete LEDs, Binary counter, Seven Segment LEDs. Interfacing LCD, switch Interface. Interfacing with different type of sensors and communication modules
Raspberry Pi Introduction: Board, ARM SoC (system-on-chip) architecture, Hardware interfaces
Basic Programming of the Pi: Hello World, Access the World Wide Web, Play audio, Control Peripherals with a Pi

TEXT BOOKS/ REFERENCES:

1. Gaonkar, R.S., "Microprocessor Architecture, Programming and Applications", 5th Edition, Penram International, 2007.
2. 8086/8088 Microprocessor: Architecture, Programming, and Interfacing by Barry B. Brey
3. Programming Arduino Next Steps: Going Further with Sketches- by Simon Monk
4. Raspberry Pi Programming Genius: How to learn Python Easily & Manage Your Own Project Now.

18CA213   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. BjarneStroustrup, "*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

18CA214   **OPERATING SYSTEMS**   **3-0-0-3**

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 CProcess 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 and Sons, 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.

18CA215   **SOFTWARE ENGINEERING TECHNIQUES**   **2-0-1-3**
2. Ian Sommerville "*Software Engineering*", Ninth Edition, 2011
3. Richard Fairley , "*Software Engineering concepts*", Tata McGraw-Hill Publishing Company Pvt. Ltd., Ninth Edition
4. Alan Richarson, Selenium Simplified, second edition.

18CA302   **ADVANCED DATABASES**   **3-0-0-3**

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

Distributed Databases - Introduction to distributed architectures–Distributed and parallel databases concepts – 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 serialization and recovery–Lock based concurrency control–Multi-phase locking protocols–Timestamp ordering

Concurrency Control: Optimistic concurrency control–Deadlock management – Distributed deadlock – 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.

MySQL - MongoDB - Redis–Memcached

TEXT BOOKS/ REFERENCES:
1. Silberschatz, Abraham, Henry F. Korth, and S.Sudarshan, Database Systems Concepts, sixth edition, McGraw-Hill Education, 2010
2. Ozsu, M. Tamer and Patrick Valduriez, Principles of Distributed Database Systems; Springer, 3rd Edition, 2011
3. C. S. R. Prabhu, "Object Oriented Database Systems : Approaches and Architectures", Third Edition, PHI Learning Pvt. Ltd.,2010
4. RamezElmasri and ShamkantNavathe, "*Fundamentals of Database Systems*", Seventh Edition, Addison Wesley, 2010

| 18CA305 | 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.

Branch and Bound - backtracking

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 - Applications of BFS and DFS.

Network Flow algorithms

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.

18CA306   **COMPUTER NETWORKING AND INTERNET**   **3-0-1-4**

Computer Networks and the internet - Protocol layers -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
Common network services and tools - ifconfig, nw.js - netcat - netstat - DNS - dhcp - apache - Nginx - Go language

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", Fifth Edition, Prentice Hall of India, 2011.

18CA307   WEB APPLICATIONS DEVELOPMENT   **2-0-1-3**

Introduction to Internet: The domain name system – Client / Server model – Internet Services of the Internet – Ports – IP addresses – Web architecture – Parsing in Browsers – Web site design standards. Client Side Technologies: Introduction to Markup languages HTML 5. Building a form and form elements - Introduction to CSS 3 - Style Sheets formatting with Style Sheets - Inline Styles - Linking External Style Sheets. Introduction to scripting languages, JavaScript, Creating Simple JavaScript - using and Storing Values -Strings and Arrays. Integrating JavaScript with Various Elements of HTML - jQuery. JDBC - MySQL – MongoDB
Web Application development using Spring MVC
Server Side Technologies: Servlets - Java Server Pages –PHP - AJAX Controls for PHP- Basic Node.js
Web Security: Sessions and Cookies.

TEXTBOOKS / REFERENCES:
1. Bates C, *"Web Programming - Building Internet Application",* Second Edition, Wiley-Dreamtech India Pvt. Ltd., 2002.
2. Pitter K, Amato S and Callahan J et al*, "Every students guide to the Internet",* Tata McGraw Hill, 2005.
3. "*Head First JavaScript Programming -A Brain-Friendly Guide*" By Elisabeth Robson, Eric Freeman Publisher: O'Reilly Media, March 2014
4. Deitel and Deitel, "*Internet and WWW — How to Program?*" Fifth Edition, Prentice Hall, 2012.

18CA308   **PROGRAMMING WITH JAVA2-0-1-3**

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 -Extending GUI Features -using Swing Components.Spring Framework. Networking: Classes to be covered Socket, ServerSocket, IPAddress, URL connections – Swing controls – JDBC - Writing JDBC applications using select, insert, delete, update.

TEXT BOOKS/ REFERENCES:
1. Naughton P. and Schildt H., "*Java: The Complete Reference*", 10th Edition, OraclePress, 2014.
2. Eckel.B, "*Thinking in Java", Fourth Edition,* Prentice Hall, 2006.
3. Balagurusamy, Programming with Java, TMH, 4th Edition, 2010
4. Cay S. Hortsmann, "Core Java Volume I- Fundamentals", 10th Ediiton, Prentice Hall, 2016
5. H. M. Dietel& P. J. Deitel, Java: How to program, 10/e, (Early Objects) PHI, 2014.

18CA312   **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 - Regression – Linear, Logistic - Accuracy and Error measures –Introduction to Ensemble methods
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), Evaluation in Clustering
Mining Data Streams- Mining Time-Series Data- Mining Sequence Patterns in Biological Data-Graph Mining – Social network Analysis - Text Mining – Mining the World Wide Web, Applications and Trends in Data Mining

Tools :Implementation of Data mining algorithms using Latest Open Source Data mining Tools.Tensorflow, python, R

TEXT BOOKS/ REFERENCES:
1. Jiawei Han, MichelineKamber and Jian Pei, "Data mining concepts and Techniques", Third Edition, Elsevier Publisher, 2006.
2. K.P.Soman, ShyamDiwakar and V.Ajay, "Insight into data mining Theory and Practice", Prentice Hall of India, 2006.
3. Yanchang Zhao, "R and Data Mining", Elsevier, 2013
4. AurélienGéron, Hands-On Machine Learning with Scikit-Learn and TensorFlow, O'Reilly Media, 2017
5. Itay Lieder, YehezkelResheff, Tom Hope, Learning TensorFlow, O'Reilly Media, 2017

18CA313   **WEB SERVICES AND CLOUD**

Introduction to Web Services, Web service Architecture XML, XSD, DTD, XSLT, Parsers. WSDL- Purpose of WSDL, Types of WSDL, Message Exchange Patterns, Message Exchange Formats.
WS- standard, WS- Co-ordination, WS- Reliable messaging, WS- policy, JAX-WS, Web Services in .Net , UDDI, SOAP.
Introduction to Cloud Computing- Architecture, types of Cloud- Public cloud, private cloud, Community Cloud and hybrid clouds, Cloud service models- IAAS, SAAS, PAAS, and XAAS. Cloud an organization perspective- Cloud Migration and Virtualization, Cloud OS.
Cloud Computing Platforms, Cloud service Platforms- storage service, database service, analytical service and application service, Cloud Data center management, Distributed Storage Systems, Cloud usage scenarios, Cloud Security
Amazon Web Services (AWS), Amazon Elastic Cloud, AWS Architecture, Microsoft Azure, Google App Engine, DevOps Services, Open Stack and Open Nebula Private Cloud setup and usage.

TEXT BOOKS/ REFERENCES:

1. Thomas Erl, "Service Oriented Architecture", Concepts, Technology and Design", Prentice Hall of India, 2005.
2. Thomas Erl, "Service oriented Architecture: A field guide to integrating XML and web services.
3. Toby Velte, Anthony Velte and Robert Elsenpeter,"Cloud Computing A Practical Approach", Tata McGraw hills, 2009
4. Thomas Erl, Cloud Computing: Concepts, Technology & Architecture and Cloud Computing Design Patterns., Prentice Hall of service technology series, 2013.
5. ArshdeepBahga and Vijay Madisetti, Cloud Computing: A Hands-On Approach, AWS Basics: Beginners Guide, by Gordon WonG, 2013

18CA314   **CRYPTOGRAPHY AND NETWORK SECURITY**   **3-1-0-4**

Introduction:- Goals of Security, types of attacks, services and mechanism, different techniques. Mathematics involved – integer arithmetic, modular arithmetic, matrices, linear congruence, algebraic structures,GF(2n) fields. Symmetric key ciphers – Kerckhoff's principle, substituition ciphers, transposition ciphers, stream and block ciphers,modern block ciphers, modern stream ciphers, DES structure and analysis, multiple DES, security, AES- transformations, key expansion, ciphers, analysis.
Asymetric key cryptography – RSA cryptosystem, RABIN cryptosystem, ELGAMAL cryptosystem, elliptic curve cryptosystem. Message integrity, Random oracle model, message authentication, hash functions, digital signature, entity authentication, Key management.
Network security: At application layer – Email, PGP, S/MIME. At transport layer – SSL architecture, handshake protocol, changecipherspec protocol, Alert protocol, Record protocol, SSL message format, Transport layer security. At network layer – modes, security protocols, security associations, security policy, Internet key exchange, ISAKMP.

TEXT BOOKS/ REFERENCES:
1. Behrouz A. Forouzan, "Cryptography and Network Security", Tata McGraw-Hill Publishing.
2. Manuel Mogollon, "Cryptography and Security Services – Mechanisms and Applications", Cybertech Publishing.
3. William R. Cheswick, Steven M. Bellovin, Aviel D. Rubin, "Firewalls and Internet Security", Addison-Wesley.

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 andSAS Businessm.Series, 2012.
2. The Data Modeling Handbook: A Best-Practice Approach to Building Quality DataModels 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 andCrime Analysis",Elsevier, 2007
1. Correlation and Regression: Applications for Industrial Organizational Psychologyand Management (Organizational Research Methods) 1st Edition, by Philip BobkoMultiple Regression and Beyond 1st Edition by Timothy Z. Keith.

18CA332   **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.

18CA333   **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, MichelineKamber 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-WesleyLongman Publishing Co., Inc. 2003.

18CA334   **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.

18CA335 **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 Surface Detection 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.

18CA336 **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 andProcedures*", 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.

18CA338   **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 BasicRelationships between Pixels - Linear and Nonlinear Operations - Connectivity and Relationsbetween Pixels.Simple Operations- Arithmetic, Logical, Geometric Operations. Image Enhancement in theSpatial Domain and Frequency Domain: Some Basic Gray Level Transformations -Histogram Processing – Basics of Spatial Filtering - Smoothing Filters-Mean, Median, ModeFilters - Edge Enhancement Filters – Sobel, Laplacian, Robert, Prewitt filter, Contrast BasedEdge Enhancement Techniques.Design of Low Pass Filters - High Pass Filters- Edge Enhancement - Smoothening Filters inFrequency 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 ImageDegradation/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 – Connected26Components Labeling - Region Growing and Region Adjacency Graph (RAG), Split andMerge 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.

18CA339   **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 anSynchronous 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.

18CA380   **ALGORITHMS LAB**   0-0-1-1

Implementation of sorting algorithms – Bubble sort, Insertion Sort, Selection Sort, QuickSort- Merge Sort, Heap implementation using array, Heap 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. Divide and conquer implementation of Maximum subarray sum
Dynamic Programming based solution for 0-1 Knapsack problem, Recursive matrix chainMultiplication, Longest common substring,

18CA381DATA STRUCTURES AND DBMS LAB   0 -0-1-1

Linear data structure implementation: Singly Linked list,Doubly linked list, Stack, Queue, and applications. Non linear data structure implementation: Binary search tree, AVL tree, Adjacency matrix and adjacency list representations, skip list, dictionary, suffix tree. 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

18CA382   **COMPETITIVE PROGRAMMING LAB**   0-0-1-4

Sorting - Greedy algorithms – Backtracking - Dynamic programming - Basic graph algorithms - Advanced graph algorithms – Trees - Basic geometry - Computational geometry – Strings - Basic heuristic search - Advanced search - Simulation problems – Number theory – Discrete structures
Any of the online platforms likeCodeChef / CodeForces / Hackerrank can be used.

18CA386   **ANDROID APPLICATION DEVELOPMENT**   0-0-1-1

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. Mobile Apps Development, Anubhav Pradhan, Anil V Deshpande, Edition: I.
2. Android Application Development All in one for Dummies, Barry Burd, Edition: I
3. Teach Yourself Android Application Development in 24 Hours, SAMS Publication, Edition I

18CA391   RESEARCH LEARNING AND PROBLEM FORMULATION 1-0-1-2

Research: Meaning, Purpose, Types of Research, Steps in Research, Identification, Selection and
Formulation of Research Problem, Research Questions, Research Design, Formulation of
Hypothesis, Review of Literature.Internet as a source in identifying gap areas from literature
reviews and emerging trends.Sampling Technique: Types of Sampling, Steps in Sampling,
Sample Size, Advantages and Limitations of Sampling.
Data for Research: Primary Data, Collection Methods, Observation, Interview, Questionnaire,
Pretest-Pilot test, Experimental and Case Studies, Secondary Data, Relevance, Limitations and
Cautions. Processing Data: Checking, Editing, Coding, Transcriptions and Tabulation. Data
Analysis- Meaning and Methods- Quantitative and Qualitative Analysis. Statistical Tables,
Diagrams and Graphs, Measures of Averages, Measures of Dispersion, Correlation Analysis and
Regression Analysis.
Familiarization of Spreadsheet Tools, Presentation Tools and Writing Tools, Structuring the
Report, Pagination, Identification, Presenting Footnotes, Abbreviations, Presentation of Tables
and Figures- Referencing- Use and Format of Appendices, Indexing.
Research Report: Types of Reports- Styles of Reporting- Steps in Drafting Reports-Editing and
Evaluating the Final Draft.Developing a Proposal and Working in a Research Team.Critical
Appraisal of Published Research: Guidelines for Appraisal.
Ethical Issues, Copyright, Royalty, Intellectual Property Rights and Patent Law, Reproduction of
Published Material, Citation and Acknowledgement.

TEXT BOOKS/ REFERENCES:

1. *CR Kothari: "Research Methodology-Methods and Techniques", New Age International
   Publishers,* 2004
2. *Jacques Barzun, Henry F. Graff: "The Modern Researcher" Edition 6, Wadsworth Inc
   Fulfillment,* 2003
3. *Carlo Lastrucci, The Scientific Approach: Basic Principles of the Scientific Method
   (Cambridge, Mass.: Schenkman, 1967)*

18CA403   **MOBILE APPLICATION DEVELOPMENT**   **3-1-0-4**

Introduction: About Android, Pre-requisites to learn Android, Dalvik Virtual Machine & .apk file extension, Android API levels (versions & version names)

Android Java Basics: Getting started with Android development, project folder structure, simple programming, running project, generating build/APK of the app from Android Studio

First application: Creating Android Project, Android Virtual Device Creation, Set up debugging environment, Workspace set up for development, Launching emulator, debugging on mobile devices.

Basic UI design: Basics about Views, Layouts, Drawable Resources, Input controls, Input Events, Toasts.

More UI Components: Layouts - GridView and ListView, Action bar, Adapters, Menus: Option menu, context menu, sub menu, Pickers - Date and Time, Spinners.

Activity and Fragment: Activity, Fragment, Activity Lifecycle and Fragment Lifecycle.

Intents: Implicit Intents, Explicit intents, communicating data among Activities.

Navigation Drawer: Panel that displays the app's main navigation screens on the left edge of the screen

Android Notifications – Toast, Dialogs (TimePicker, DatePicker, Progress, Alert), Notification Manager and Push Notification

Introducing SQLite - SQLiteOpenHelper and creating a database - Opening and closing a database, Working with cursors Inserts, updates, and deletes.

TEXT BOOKS/ REFERENCES:
1. Erik Hellman, Android Programming: Pushing the Limits, Wiley
2. Pradeep Kothari,Android Application Development Black Book, Dreamtech Press, KLSI
3. Head first Android Development.

18CA404   **COMPILER DESIGN**   **3-1-0-4**

Automata and Language: Chomsky hierarchy of languages, Introduction to Finite Automata – Non-Deterministic Finite Automata- equivalence of NFAs and DFAs- minimization of DFA-Regular Expressions. Context-free Grammar - Parse tree derivations (Top-down, Bottom-up), Context-free languages – Chomsky normal form, GNF.

Introduction to Compilers: Compiler structure – Overview of Translation. Lexical Analysis: From regular expression to Scanner. Implementation of scanner: Lex - Parsers: Expressing syntax – Top-down parsing: Recursive descent parsing, Non-recursive predictive parsing. Bottom-up parsing: LR(0), LR(1) and LALR(1) – Implementation of Parser - YACC

Context-Sensitive Analysis: Type Systems – Attribute – Grammar – Syntax Directed Translation. Intermediate Representations: Graphical and Linear Intermediate Representations – Symbol tables. Procedure Abstraction: Procedure calls – Name Spaces – Communicating Values between Procedures.

Iterative Data Flow Analysis – Instruction selection via Tree Pattern Matching – Register allocation: Local and Global – Introduction to Optimization.

TEXT BOOKS/ REFERENCES:
1. *Peter Linz,* "*An Introduction to Formal Languages and Automata*", Fifth Edition, 2012.

2. *Keith Cooper and Linda Torczon*, "*Engineering a Compiler*", Second Edition, Morgan Kauffmann, 2011.
3. *Alfred V.Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman*, "*Compilers: Principles, Techniques and Tools*", Prentice Hall, Second Edition, 2006.
4. *Andrew W. Appel and Jens Palsberg*, "*Modern Compiler Implementation in Java*", Cambridge University Press, Second Edition, 2002.

18CA431   **INFORMATION RETRIEVAL**   **3-0-0-3**

Introduction to Information retrieval - Information Need and User Query - IR domains - 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 OphirFrieder "*Information Retrieval: Algorithms and Heuristics*", Second Edition, Springer 2004.

18CA433 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.

TEXT BOOKS/ REFERENCES:

1. Simon Holmes , "Getting MEAN with Mongo, Express, Angular, and Node, Second Edition, Manning Publications; 1 edition (31 October 2015)
2. Jeff Dickey, "Write Modern Web Apps with Mean Stack , Peachpit press, 2015
3. Ken Williamson, "Learning Angular JS", O′Reilly; 1 edition (24 March 2015)
4. MithunSatheesh, "Web development with MongoDB and Node JS", Packt Publishing Limited; 2nd Revised edition (30 October 2015).

18CA434   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. 27 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* (MicrosoftCorporation)", Wiley, 2011.
2.   98-367:   "*MTA   Security   Fundamentals,   Microsoft   Official   Academic Course*(MicrosoftCorporation)", Wiley, 2011.
3. 98-365: "*Windows Server Administration Fundamentals, Microsoft Official AcademicCourse* (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.

18CA436   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:
  1. Joseph Feller, Brian Fitzgerald and Eric S. Raymond, "*Understanding Open Source Software Development*", Addison Wesley Professional, 2000.

18CA437   **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.

18CA438   **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.

18CA439   **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*", Tenth 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.

18CA440   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, ProActivevs.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. Wireless Communications: Principles and Practice by Rappaport, Pearson, Second Edition.

18CA451   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.

18CA452   **DEEP LEARNING**   **3-0-0-3**

Historical Trends in Deep Learning, Linear Algebra, Probability and Information theory, Numerical Computation, Machine learning basics
Deep Networks: Deep feedforward networks, Regularization for deep learning, Optimization for training deep models, Convolutional Networks, Sequence modelling: Recurrent and recursive nets, Practical methodology, Applications
Deep Learning Research: Linear factor models, autoencoders, Representation learning, Structured probabilistic models, Monte-Carlo models,
Intro to NLP and Deep Learning, Simple Word Vector representations
Introduction to Tensorflow
Convolutional neural networks- Dynamic Memory Networks.

TEXT BOOKS/ REFERENCES:
2. Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press, 2016
3. Yoav Goldberg, A Primer on Neural Network Models for Natural Language Processing, 2015
4. Jurafsky, James H. Martin, Speech and Language Processing, 3rd edition, 2017

18CA453   **GRAPH THEORY**   **3-0-0-3**

Graph Terminology and Data Structures: Graphs, Graph Models, Adjacency and Incidence, Degree, Computer representation of graphs: Adjacency matrix, Incidence matrix, circuit matrix, adjacency list, Isomorphism, Permutation algorithm for graph isomorphism, Sub graphs, Walks, Paths, Circuits, Connected graphs, Components, Adjacency matrix algorithm for connectedness, Fusion algorithm for the connectedness and components, Operations on graphs: Union, Ring-Sum, Fusion, Join and Product, Algorithm for the graph operations, Complete graphs, Bipartite graphs, Directed Graphs, in-degree, out-degree, directed paths, directed cycles, DFS & BFS traversals for graphs and digraphs, Strong and weak connectivity in digraphs, Algorithm for the strong components of a digraph, Matrices and adjacency lists of digraphs.
Shortest Path Algorithms &Traversability: Shortest Path, distances, eccentricity, shortest path algorithms, Dijkstra's algorithm for the single source shortest paths, Application of the Dijkstra's algorithm to the shortest path routing in the Computer Networks, Floyd's algorithm for all pair shortest paths and eccentricities, Euler graphs, Characterization of Euler graphs, Chinese Postman problem, Randomly Euler graphs and Exhibition hall design problem, Algorithm for Euler tours, Euler digraphs, Teleprinter's problem, Hamiltonian paths and circuits, Traveling salesman problem, Grey Codes and Hamilton cycles of Hyper Cubes, Matricial Product algorithm for all Hamilton cycles.
Trees & Applications: Trees, Properties, Rooted trees, Rooted & Binary Trees, Prefix codes, Binary codes, Huffman's Algorithm, Spanning trees, Kruskal's& Prim's algorithms for the optimal spanning tree, Activity Networks in Project management, Topological sorting, CPM Algorithm for Activity Networks, Arborescence, Prefix, in-fix and postfix Tree traversals, Expression trees, Polish notation, Matrices of digraphs, Acyclic digraphs, decyclization, Graphs in Computer Programming,

Fundamental cycles, algorithm for the fundamental cycles, Fundamental cut sets, algorithm for the fundamental cut sets, Vectors & Vector spaces of a graph, cycle & cut-set vector spaces of a graph. Connectivity, Networks & Combinatorial Optimization: Cut vertices, Bi-connected graphs, algorithm for cut vertices and biconnected graphs, Vertex & Edge connectivity, Menger's Theorem (Statement only), Network flows, Ford and Fulkerson's Theorem (Statement only), Edmonds-Karp Algorithm for the maximal network flow, Network Simplex algorithm for the minimum cost flow, Matching, Perfect matching, Hall's marriage theorem, Edmond's Algorithm for the maximum cardinality matching, Independent set, Covering, Clique, Dominating Set.

Planarity, Coloring & Intractable graph problems: Planar graphs, Kuratowski graphs, Different representations of planar graphs, DMP Algorithm for the Planarity detection, Geometric dual, Coloring, chromatic number, Four color theorem (Statement only), Grundy coloring, time table scheduling problem, chromatic polynomials, Algorithmic complexity, growth rates, P, NP, NPC classes, Cook's theorem (Statement only), NPC reduction, NPC Graph problems.

TEXT BOOKS/ REFERENCES:
1. NarsinghDeo, Graph theory with Applications to Engineering & CS, PHI
2. Alan Gibbons, Algorithmic Graph theory, Cambridge University Press
3. Jeffrey J. McConnell, Analysis of algorithms, Narosa, 2004
4. Humdy A Taha, Operation Research, TMH, 2003.
5. Harary F, Graph Theory, Narosa, 1993.

18CA454   **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.

18CA455   **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

18CA456   **INTERNET OF THINGS**   **3-0-0-3**

Introduction to IoT- Definition of IoT - Evolution of IoT - IoT and related terms - Business Scope - Elements of IoT - Introduction to Elements of IoT - Basic Architecture of an IoT Application Sensors & Actuators - Edge Networking (WSN) – Gateways - IoT Communication Model – WPAN & LPWA- Communication and Connectivity Technologies - Cloud Computing in IoT - IoT Communication Model – Cloud Connectivity - Data Analytics and IoT Platforms - Big Data Analytics - Data Visualization - IoT Platforms -Concerns and Future Trends - Different Players of IoT - Security Concerns and Challenges - Future Trends – Standards-Hands-On Projects-DIY Kits - IFTTT and other apps

TEXT BOOKS/ REFERENCES:

1. The Internet of Things: Applications and Protocols, Wiley publications. Author(s): Oliver Hersent, David Boswarthick, Omar Elloumi
2. Architecting the Internet of Things, Springer publications. Author(s): Dieter Uckelmann, Mark Harrison, Florian Michahelles
3. Internet of Things with Arduino Cookbook, Packt Publications. Author(s): Marco Schwatrz.

18CA457   **MACHINE LEARNING**   **3-0-0-3**

Introduction, linear classification, perceptron update rule, Perceptron convergence, generalization, Maximum margin classification,Classification errors, regularization, logistic regression,Linear regression, estimator bias and variance, active learning

Non-linear predictions, kernels, Kernel regression, kernels, Support vector machine (SVM) and kernels, kernel optimization.

Model selection, Model selection criteria, Description length, feature selection, Combining classifiers, boosting, Boosting, margin, and complexity, Margin and generalization (EM) algorithm, EM, regularization, clustering, Clustering, Spectral clustering, Markov models, Hidden Markov models (HMMs), Bayesian networks, Learning Bayesian networks, Probabilistic inference, Current problems in machine learning.

TEXTBOOKS / REFERENCES:

1. Machine Learning, Tom Mitchell, McGraw Hill, 1997
2. Christopher, M. Bishop. Pattern Recognition and Machine Learning, Springer-Verlag New York, 2016.
3. Duda, Richard, Peter Hart, and David Stork, "Pattern Classification" Second Edition, New York, NY: Wiley-Interscience, 2000.

4. Hastie, T., R. Tibshirani, and J. H. Friedman, "The Elements of Statistical Learning: DataMining, Inference and Prediction", New York, Springer, 2001.

18CA458   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).

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.

18CA459   SECURE APPLICATIONS FOR MOBILE DEVICES   3-0-0-3

OS refresher; TCP/IP Refresher; Mobile Systems Characteristics; Design of Mobile OS, Android Internals, API - Application Software Design for Android - Tour of: Android Open Source Project (AOSP), CyanogenMod; Building a ROM; Linaro - Network Security; Linux Security; Android Security; Location Based Services; Pocket Spy - Android Permissions System - Mobile Malware - Privacy Violations – cyber security - Mobile-, Cloud-, Ubiquitous-, Pervasive-Computing

Apache cordova - Cross site request forgery- cross site - browser security model and policies - same origin policy - CORS - Android security model.

TEXT BOOKS/ REFERENCES:
1. PrabhakerMateti, Lecture Notes on Android Internals and Security, http://www.cs.wright.edu/~pmateti/Courses/4440/Top/
2. Nikolay Elenkov, "An In-Depth Guide to Android's Security Architecture", https://www.nostarch.com/androidsecurity . October 2014, 432 pp. ISBN: 978-1-59327-581-5; WSU safaribooksonline
3. Karim Yaghmour, Embedded Android, O'Reilly Media, Inc., 2013, 412 pp, ISBN: 9781449327958; WSU safaribooksonline
4. Joseph Annuzzi, Jr., Lauren Darcey, Shane Conder, Introduction to Android Application Development: Android Essentials, 5th Edition, Addison-Wesley Professional, 2015, 672pp, ISBN: 9780134389653; WSU safaribooksonline
5. Adapted Materials from Android security sites.

18CA460   SOFTWARE TESTING   3-0-0-3

Introduction: Introduction to software testing and analysis, Error, Fault, Failure, Incident, Test Cases, Testing Process, Limitations of Testing, No absolute proof of correctness, Overview of Graph Theory.

Specification-based testing techniques, code-based testing techniques, Model-based testing,

Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.

Structural Testing: Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing,

Static Analysis, Dynamic Analysis

Reducing the number of test cases: Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, Slice-based testing

Testing Activities: Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging, Domain Testing, Regression Testing, Acceptance testing

Object Oriented Testing: Issues in Object Oriented Testing, Class Testing, GUI Testing, Object Oriented Integration and System Testing, Methods of test data generation and validation.

Program slicing and its application, Reliability analysis, Formal methods; verification methods; oracles.

Testing Tools: Static Testing Tools, Dynamic Testing Tools, and Characteristics of Modern Tools.

TEXT BOOKS/REFERENCES:

1. William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York, 2007.
2. CemKaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van Nostrand Reinhold, New York, 2000.
3. Boris Beizer, "Software Testing Techniques", Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.
4. Louise Tamres, "Software Testing", Pearson Education Asia, 2002
5. "Software Testing: A Craftsman's Approach, Second Edition," by Paul C Jorgensen, CRC Press, June 26, 2002. (required)
6. "The Art of Software Testing," 2nd ed., Glenford J. Myers, John Wiley & Sons, Inc., Hoboken, New Jersey, 2004. (optional)
7. "Lessons Learned in Software Testing: a Context-Driven Approach," CemKaner, James Bach, and Bret Pettichord, John Wiley & Sons, Inc., New York, 2002. (optional).

18CA480   **PYTHON LAB 0-0-1-1**

Introduction To Python -Understanding Python variables -Python basic Operators - Understanding python blocks -Python Data Types -Declaring and using Numeric data types: int, float, complex - Using string data type and string operations - Defining list and list slicing

Use of Tuple data type - Python Program Flow Control - Conditional blocks using if, else and elif Simple for loops in python - For loop using ranges, string, list and dictionaries - Use of while loops in python - Loop manipulation using pass, continue, break and else - Programming using Python conditional and loops block Python Functions, Modules And Packages- Python String, List And Dictionary Manipulations - Building blocks of python programs -Understanding string in build methods -List manipulation using in build methods - Dictionary manipulation - Programming using string, list and dictionary in build functions - Python File Operation- Reading config files in python

Writing log files in python - Understanding read functions, read(), readline() and readlines()

Understanding write functions, write() and writelines() - Manipulating file pointer using seek

Programming using file operations - Python Object Oriented Programming – Python Regular Expression - Powerful pattern matching and searching -Power of pattern searching using regex in python - Python Exception Handling - Python Database Interaction

Python packages - Numpy, Scipy, NLTK, Pandas, Matplotlib, Scikit-Learn, Tensorflow, NetworkX

18CA485   COMPUTER ORGANIZATION AND ARCHITECTURE LAB0-0-1-1

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

18CA486   C# and .NET LAB   0-0-1-1

.Net Framework Overview- Architecture-.Net Framework class Libraries-CLR-Metadata-Interoperability-Assemblies-the .net Packaging system-CLR-MSIL , Introduction to Visual Studio.Net-C# Programming Concepts-Predefined Types- Value types and reference type, Classes and Objects, Constructors and methods , Conditional statements, loops, arrays , Collection classes: ArrayList , HashTable, Stack ,Queue, indexers and properties.
String class: methods and properties of string class, enumerations, boxing and unboxing, OOPS concepts: Encapsulation, data hiding, inheritance, interfaces, polymorphism, operator overloading, overriding Methods, Static Class members, Delegates and events. Exception Handling, garbage collector, generics and collection
Basics of Windows Programming- Event Driven Programming, Windows Forms, Using common controls-Labels, textboxes, buttons, check boxes, radio button, progress bar, combo box, list box. Components-timer, imagelist, Menus, Modal and Modeless Dialog Boxes, MDI, Mouse and keyboard event handling.
Introduction to ADO.Net-Object Model- System. Data Namespace- Data Bound controls- Connected Mechanism-Disconnected mechanism-.Net Data Providers.
Files: System.IO, directory and file types, Stream readers and stream writers, working with binary data.

18CA487   FUNCTIONAL PROGRAMMING LAB0-0-1-1

Introduction Imperative Vs Functional programming Clojure& Functional Basics Scalar Data Types, Composite types, Lazy evaluation Functional forms, recursion Lambdas, Closures, Macros Namespaces, Multi-methods Lazy evaluation, Immutability Pure functions, first-class functions Currying, memorization, high order functions List compressions, restructuring Collection pipelines Testing, Clojure - Java interoperation Concurrency & Mutation Software Transactional memory Vars, Refs, Agents, Atoms, promises, futures Functional programming, Web Apps, Databases Functional programming patterns and practices
Introduction to Haskell, Scala

18CA488   LINUX AND SHELL PROGRAMMING LAB0-0-1-1

Introduction to Linux - History, Architecture, Comparison with UNIX, Features and Facilities of Linux, Basic commands in Linux, Files and File Structure - Linux File System, Boot block, Super block, Inode table, Data blocks, Linux standard directories. File naming Conventions, Path, Types of file names and Users, File Commands in Linux, file comparisons, Directory Commands, Text Editors- Functions of a Text Editor, vi Editor, Locating Files, File Access Permissions [FAP], Viewing and Changing FAPs. Linux Shell – Session, Standard streams, Redirection, pipes, tee, command execution, command line editing, command substitution, job control, aliases. Shell variables, exporting, output, input, shell environment variables and customization, startup scripts, command history.
Common administrative tasks, identifying administrative files configuration and log files, Role of system administrator, Managing user accounts-adding & deleting users, changing permissions and ownerships, Creating and managing groups, modifying group attributes, Temporary disabling of users accounts, creating and mounting file system.

Checking and monitoring system performance - file security & Permissions, becoming super user using su. Getting system information with uname, host name, disk partitions & sizes, users, kernel. Installing and removing packages. Backup, restore and Compress utilities - tar, cpio, dump,rsync and restore utilities.

Bash shell programming – basic concepts, expressions, decision making selections, repetition, special parameters - positional parameters, shift, argument validation, script examples.

Communication in Linux - mesg, who- T, talk, write, wall, finger, chfn, ping, traceroute utilities, email facilities . Configuration of servers- Telnet, FTP, DHCP,NFS, SSH, Proxy Server(Squid), Web server (Apache), Samba. Daemons- init, crond, atd, xinetd, inetd, the services file. named, sshd, httpd.

18CA489   MEAN STACK LAB 0-0-1-1

Introduction to MongoDB -MongoDB Environment - MongoDB Create Database- MongoDB Drop Database - MongoDB Create Collection- MongoDB Drop Collection -MongoDB Read Operations - MongoDB Write Operations - MongoDB Data Modelling - MongoDB Administration - MongoDB Security - MongoDB Aggregation - MongoDB Indexes - MongoDB Storage - MongoDB Replication

Introduction to Express Framework -Introduction to Nodejs - What is Nodejs -Getting Started with Express - Your first Express App - Express Routing -Implementing MVC in Express - Middleware - Using Template Engines -Error Handling - API Handling - Debugging -Developing Template Engines -Using Process Managers - Security & Deployment

Introduction to AngularJS - AngularJS Expressions - AngularJS Modules - AngularJS Data Binding - AngularJS Scopes -AngularJS Directives & Events - AngularJS Controllers -AngularJS Filters - AngularJS Services -AngularJS HTTP -AngularJS Tables - AngularJS Select - Fetching Data from MySQL -AngularJS Validation - AngularJS API -AngularJS Animations - AngularJS i18n and i10n Node.JS

18CA496   DISSERTATION Phase I   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.

18CA497   DISSERTATION Phase II   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.

18HU211   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.

18HU431   MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR   3-0-0-3

Managers and Management – Meaning – Role of managers – Processes of management – Historical roots of contemporary management practices.

Organizational behavior – Nature and levels of organizational behavior – Individuals in organization – individual differences – Personality and ability – The Big 5 Model of personality – organizationally relevant personality traits. The nature of perception – characteristics of the perceiver, target and situation – perceptual problems.

Foundations of planning – Types of plans–Approaches to planning – Planning in dynamic environment. Organizational designs and structures – traditional and contemporary organizational designs. Organizational culture and ethical behavior – factors shaping organizational culture–creating an ethical culture.

Motivation–early and contemporary theories of motivation. Leadership – early and contemporary approaches to leadership. Groups and group development – turning groups into effective teams. Managing change – process, types and challenges.

Power, Politics, Conflict and Negotiations–Sources of individual, functional and divisional Power. Organizational politics. Conflict – causes and consequences – Pondy's model of organizational conflict–conflict resolution strategies. Communicating effectively in organizations – communication process–barriers to communication–overcoming barriers to communication–persuasive communication–communication in crisis situations.

TEXTBOOK / REFERENCES:
1. Jennifer George and Gareth Jones "Understanding and Managing Organizational Behavior",Published by Pearson Education Inc.
2. Jon L Pierce and Donald G. Gardner, "Management and Organizational behavior", Cengage Learning India (P) Limited.
3. Richard Pettinger, "Organizational Behaviour", 2010 Routledge.
4. Dipak Kumar Bhattacharya, "Organizational Behavior, Concepts and Applications", Oxford
5. K. Aswathappa, "Organizational behavior", Himalaya Publishing House.

18HU432   MANAGEMENT INFORMATION SYSTEMS   3-0-0-3

Introduction to Information System Concepts - Definition to MIS, Role and Impact- Role of Computers in MIS

Management Practices - Strategic Management of Business - The Concept of Corporate Planning -Essentiality of Strategic Planning -Development of Business Strategies and Types of Strategies

Decision Making - Information Concepts - Systems – Concepts – Controls – Types of System

Business Process Re-engineering – Introduction – Business Process – Process Model of the Organization

Decision Support System – Concepts And Philosophy – DSS Deterministic System – MIS and Role of DSS.

TEXTBOOK / REFERENCES:
1. W.S. Jawadekar, Management Information System Second Edition: Tata McGraw-Hill
2. Ashok Arora, AkshayaBhatiya, Management Information System,Excel Books.

18HU433   PRINCIPLES OF ECONOMICS AND MANAGEMENT   3-0-0-3

Introduction to Management**:** Managers and Management - History Module - The HistoricalRoots of Contemporary Management Practices, The Management Environment. Planning:Foundations of Planning - Foundations of Decision Making - Quantitative ModuleQuantitative Decision-Making Aids. Organizing: Basic Organization Designs - Staffing andHuman Resource Management - Career Module Building Your Career - Managing Change,Stress, and Innovation .Leading-Foundations of Individual and Group Behavior - Understanding Work Teams – Motivatingand Rewarding Employees - Leadership and Trust - Communication and Interpersonal Skills.Introduction to Economics**:** The Firm and Its Goals - Review of Mathematical Concepts usedin Managerial Economics, Supply and Demand - The Mathematics of Supply and Demand,Demand Elasticity - Applications of Supply and Demand, Demand Estimation andForecasting, The Theory and Estimation of Production - The Multiple-Input Case -Expressing the Production Function with the Use of Calculus, The Theory and Estimation ofCost - A Mathematical Restatement of the Short-Run Cost Function - The Estimation of Cost.29Pricing and Output Decisions: Perfect Competition and Monopoly - The Use of Calculus in

Pricing and Output Decisions - Break-Even Analysis (Volume-Cost-Profit), MonopolisticCompetition 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.

18HU434   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 andScheduling Projects - Network Planning Models – AOA – AON - CPM - Shortening ProjectDuration – 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 inSW Environments: Organizational Behavior – Motivation. Working in Teams: OrganizingTeams.Software Quality Management: Defining Software Quality – Metrics – Process CapabilityModels – Software Reliability.Case Study: 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.

18EN281   **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.

18MA201   **DISCRETE STRUCTURES**   **3-1-0-4**

Logic: Logic- Prepositional - Predicates and Quantifiers. Sets – Functions - Counting: Basics of Counting- The Pigeonhole Principle- Inclusion-Exclusion Principle, Permutations and Combinations. Relations: Relations and their Properties- Representing Relations- Closure of Relations- Equivalence and partial order 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.
Introduction to Vector Space - Subspaces, Linear Independence, Basis and Dimension
Graph Theory: Definition, walk, path, trails, connected graphs, regular and bipartite graphs, cycle and circuits. Tree and rooted tree. Spanning trees – Eccentricity of a vertex radius and diameter of a graph. Central graphs – Centre (s) of a tree. Hamiltonian and Eulerian graph, planar graphs
Groups: Finite fields and Error correcting/detecting codes

TEXT BOOKS/ REFERENCES:
1. Rosen K. H., "*Discrete Mathematics and its Applications*", Seventh Edition, Tata McGraw-Hill, New Delhi, 2007.
2. Grimaldi R. P., "*Discrete and Combinatorial Mathematics*", Fifth Edition, Pearson Education Asia, New Delhi, 2008.
3. E Kreyszig, "Advanced Engineering Mathematics", Tenth Edition, John Wiley and Sons, 2010.
4. Carl D. Meyer, "Matrix Analysis and Applied Linear Algebra, SIAM, 2000.

18MA301   **PROBABILITY AND STATISTICS**   **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. Discrete and continuous distributions - Binomial- Poisson, hyper geometric - uniform and Normal Distributions – mean, variance central moments- Moment generating function - Two dimensional random variables – joint probability density-cumulative distribution – marginal probability –
Statistics: Linear Correlation –correlation coefficient – properties of correlation coefficient – rank correlation coefficient – Regression – equation of linear regression – Tchebyshev's inequality - Central Limit Theorem.
 Testing of Hypothesis. Parameter and statistic – sampling distribution – Estimation and testing of hypothesis – critical region and level of significance – errors in testing of hypothesis – one-tailed and two-tailed tests – procedure for testing hypothesis – confidence interval – test of significance of large and small samples – Student's t-distribution – Sndecor's F distribution
Chi-Square Test for Goodness of fit and Independence.

TEXT BOOKS/ REFERENCES:
1. Ravichandran. J, "*Probability and Statistics for Engineers*", First Edition, Wiley India, 2012.
2. Douglas C. Montgomery and George C. Runger, "*Applied Statistics and Probability for Engineers*", Third Edition, John Wiley and Sons Inc., 2003.
3. Ronald E. Walpole, "*Probability and Statistics for Engineers and Scientists*", Seventh Edition, Pearson Education, Asia, 2002.

18MA311   NUMERICAL ANALYSIS AND OPTIMIZATION TECHNIQUES   3-1-0-4

Errors In Numerical Calculations Types Of Errors-Significant Digits-Programming Errors-Numerical Solution Of Non Linear Equations-Bisection Method-RegulaFalsi Method-Newton Raphson Method –Fixed Point Method Of Iteration – Rates Of Convergence Of These Methods-Solutions Of Algebraic Equations-Guass Elimination Method-Relaxation Method-Gauss Seidel Iteration Method-Gauss Jordan Method-Polynomial Interpolation – Lagrange's Interpolation Polynomial-Divided Differences-Newton's Divided Difference Interpolation-finite Differences-Operators (Δ, ∇ and E)-Gregory-Newton ForwardAnd Backward Difference Interpolation Polynomials-Central Differences.Mathematical Formulation Of Linear Programming problem-Formulation Of LPP-Graphical Solution Of LPP – Canonical And Standard Form Of LPP-Simplex Method-Big M Method- Two Phase Method-Principle Of duality-Dual Simplex Method.Transportation Problem-Initial Basic Feasible Solution-North West Corner Rule-Vogel's. Approximation Method –Tests For Optimality-Unbalanced Transportation Problem-Assignment Problem-Travelling Salesman Problem.

TEXT BOOKS/ REFERENCES:
1. Sastry S.S., Numerical Analysis, Prentice-Hall India (module I), 4th edition
2. KanthiSwarup, P.K.Gupta,Man Mohan, Operations research, Sultan Chand & Sons.(module II), 5th edition.
3. R Panneerselvam – Operations research, 2nd edition, PHI
4. Froberg, Introduction to Numerical Analysis-Second Edition, Addition Wesley
5. Gerald and Wheatley, Applied Numerical Analysis, Pearson Education Asia, Sixth Edition
6. S.S Rao, Optimization Theory and Applications, Wiley Eastern
7. Grawin W. W, Introduction of Linear Programming, McGraw Hill.