# Curriculum and Syllabus

For

# MASTER OF COMPUTER APPLICATION (MCA)

Under

## Choice Based Credit System (CBCS)

[With effect from the Session 2020-22]

## USHA MARTIN UNIVERSITY
### Ranchi, Jharkhand

(Recognized by UGC under Sec. 2(f) of UGC Act 1956)

## Semester Wise Distribution of Credits and Marks

| Sl No. | Course Code | Title of the Course | Lecture Hours/ Weeks | | | Total Credits | End Term Examination (ETE) | Continuous Assessment (CA) | | Total Marks (ETE + CA) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | | Mid Term Evaluation | Internal Assessment | |
| **Semester I** | | | | | | | | | | |
| 1 | MCA-CC101 | Operating System | 3 | 0 | 0 | 03 | 60 | 25 | 15 | 100 |
| 2 | MCA-CC102 | Unix and Shell Programming | 3 | 0 | 0 | 03 | 60 | 25 | 15 | 100 |
| 3 | MCA-CC103 | Artificial Intelligence | 3 | 0 | 0 | 03 | 60 | 25 | 15 | 100 |
| 4 | MCA-CC104 | Programming in Java | 3 | 1 | 0 | 04 | 60 | 25 | 15 | 100 |
| 5 | MCA-CC105 | Accountancy and Financial Management | 3 | 0 | 0 | 03 | 60 | 25 | 15 | 100 |
| 6 | MCA-CP101 | Unix Lab | 0 | 0 | 4 | 02 | 60 | 40 | | 100 |
| 7 | MCA-CP102 | Programming in Java Lab | 0 | 0 | 4 | 02 | 60 | 40 | | 100 |
| 8 | MCA-CP103 | Accountancy System Lab | 0 | 0 | 4 | 02 | 60 | 40 | | 100 |
| **Credits- Sem I** | | | | | | **22** | **Total Marks - i** | | | **800** |
| **Semester II** | | | | | | | | | | |
| 1 | MCA-CC201 | Software Engineering | 3 | 1 | 0 | 04 | 60 | 25 | 15 | 100 |
| 2 | MCA-CC202 | Data Analytics | 3 | 0 | 0 | 03 | 60 | 25 | 15 | 100 |
| 3 | MCA-CC203 | Database Management System | 3 | 0 | 0 | 03 | 60 | 25 | 15 | 100 |
| 4 | MCA-CC204 | Operation Research and Optimization Techniques | 3 | 1 | 0 | 04 | 60 | 25 | 15 | 100 |
| 5 | MCA-CC205 | Data Communication and Computer Networks | 3 | 0 | 0 | 03 | 60 | 25 | 15 | 100 |
| 6 | MCA-CP201 | Data Communication and Computer Networks Lab | 0 | 0 | 4 | 02 | 60 | 40 | | 100 |
| 7 | MCA-CP202 | Data Analytics Lab | 0 | 0 | 4 | 02 | 60 | 40 | | 100 |
| 8 | MCA-CP203 | Software Project Management Lab | 0 | 0 | 4 | 02 | 60 | 40 | | 100 |
| **Credits- Sem II** | | | | | | **23** | **Total Marks - ii** | | | **800** |
| **Semester III** | | | | | | | | | | |
| 1 | | Elective1 (Set A) | 3 | 1 | 0 | 04 | 60 | 25 | 15 | 100 |
| 2 | | Elective2 (Set A) | 3 | 1 | 0 | 04 | 60 | 25 | 15 | 100 |
| 3 | | Elective3 (Set A) | 3 | 1 | 0 | 04 | 60 | 25 | 15 | 100 |
| 4 | | Elective4 (Set B) | 3 | 0 | 0 | 03 | 60 | 25 | 15 | 100 |
| 5 | MCA-CC301 | Values and Ethics of Profession | 3 | 0 | 0 | 03 | 60 | 25 | 15 | 100 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6 | | Elective Lab1 (Set B) | 0 | 0 | 4 | 02 | 60 | 40 | 100 |
| 7 | MCA-CP301 | Minor Project and Viva-Voce and Seminar | | | | 06 | | | 100* |
| **Credits- Sem III** | | | | | | **26** | **Total Marks - iii** | | **700** |
| **Semester IV** | | | | | | | | | |
| 1 | MCA-CP401 | Major Project and Viva-Voce | | | | 15 | | | 100** |
| **Credits- Sem IV** | | | | | | **15** | **Total Marks - iv** | | **100** |
| **Total Credits** (Sem I+Sem II+Sem III+Sem IV) | | | | | | **86** | **Total Marks** (i + ii + iii + iv) | | **2400** |

## List of Elective Courses (Set A)

MCA-ECA301- Cryptography (4)
MCA-ECA302- Compiler Design (4)
MCA-ECA303- E-Commerce (4)
MCA-ECA304- Distributed Database Management System (4)
MCA-ECA305- Image Processing (4)
MCA-ECA306- Parallel Computing (4)
MCA-ECA307- Cloud Computing (4)
MCA-ECA308- Bio-Informatics (4)
MCA-ECA309- Internet of Things (4)
MCA-ECA310- Theory of Computation (4)
MCA-ECA311- Data Mining and Data Warehousing (4)
MCA-ECA312- Deep Learning (4)

## List of Elective Courses with Laboratory (Set B)

MCA-ECB301- Mobile Computing (3)
MCA-EPB301- Mobile Computing Lab (2)
MCA-ECB302- Windows Programming With Visual Basic.Net (3)
MCA-EPB302- Windows Programming With Visual Basic.Net Lab (2)
MCA-ECB303- Pattern Recognition (3)
MCA-EPB303- Pattern Recognition Lab (2)
MCA-ECB304- System Administration and Linux (3)
MCA-EPB304- System Administration and Linux Lab (2)

## Naming Conventions

1. **CC –** Core Course
2. **CP –** Core Pracical
3. **ECA –** Elective Course Set A
4. **ECB –** Elective Course Set B
5. **EPB –** Elective Practical Set B

# SYLLABUS OF 1st SEMESTER

## MCA-CC101 Operating System and System Software Cr 3

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Understand the difference between different types of modern operating systems, virtual machines and their structure of implementation and applications.

CO2. Understand the difference between process & thread, issues of scheduling of user-level processes / threads and their issues & use of locks, semaphores, monitors for synchronizing multiprogramming with multithreaded systems and implement them in multithreaded programs.

CO3. Understand the concepts of deadlock in operating systems and how they can be managed / avoided and implement them in multiprogramming system.

CO4. Understand the design and management concepts along with issues and challenges of main memory, virtual memory and file system.

CO5. Understand the types of I/O management, disk scheduling, protection and security problems faced by operating systems and how to minimize these problems.

OS and the Computer System, Importance of OS, Basic concepts and terminology, types of OS: Batch Processing Systems, Multiprogramming Systems, Time Sharing Systems, Real Time Operating Systems, Distributed Operating Systems, Modern Operating Systems.

Design and implementation of OS Process: Concept and views, OS view of processes, Threads, Scheduling algorithms, performance evaluation

Inter process communication and synchronization, mutual exclusion, semaphores, hardware support for mutual exclusion, queuing implementation of semaphores, classical problem for concurrent programming, critical region and conditional critical region, monitors,messages, deadlocks.

Resource manager, file management, processor management, device management, Memory Management-paging, swapping, design issues for paging system, segmentation, Virtual memory concept, demand paging, page replacement algorithm.

Security and protection, policies and mechanism, authentication, protection and access control, formal models of protection, cryptography, worms and viruses. In- process communication & synchronization, File systems, security and protection mechanism, Input/out systems, processes and processors in distributed system. Performance measurement, monitoring and evaluation. Multiprocessor system, classification and types, OS function and requirements.

**Text Book and References:**


1. Operating System Concepts, A. Silverschwatz, P. Galvin & G.Gange , Willey
2. Operating System Concepts, Milenekovic, McGraw Hill
3. Modern Operating Systems, A.S. Tanenbaum, Pearson Education
4. Operating Systems & Systems Programming, P. Balakrishna Prasad, Scitech Publications Pvt. Ltd.

## MCA-CC102 Unix and Shell Programming Cr 3

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Understand the architecture, networking and basic commands of UNIX.

CO2. Implement various file processing commands used in UNIX.

CO3. Apply Regular expression to perform pattern matching using utilities like grep, sed and awk.

CO4. Construct various shell scripts for simple applications.

CO5. Understand the process management using system calls UNIX environment.

Overview of the UNIX Operating System, General purpose Utilities Command.

Vi editor, advance Vi Editor, Shell commands & Shell Programming (Bourne Shell).

Simple filters and grep Command, File System & Handing Ordinary Files, Basic & more File attributes.

Concept of I –Node, Overview of Process, Overview of Sed & awk.

Overview of TCP/IP networking- Basic Concept of 4 Layers, Network Class, Basic Concept of the Applications, Subnet.

**Text Book and References:**


1. UNIX: Concepts & Applications, Sumitava Das, TMH.
2. Your UNIX –The Ultimate Guide, Sumitava Das, TMH.
3. Design of UNIX Operating system, Maurice Bach, PHI.
4. Learning the UNIX operating system, peek, SPD/O'REILLY.
5. Mastering UNIX/LINUX/ Solaris shell scripting, Randal k: Michael, Wiley Dreamtech.


## MCA-CC103 Artificial Intelligence Cr 3

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Understand the modern view of AI as the study of agents that receive percepts from the environment and perform actions.

CO2. Demonstrate awareness of the major challenges facing AI and the complex of typical problems within the field.

CO3. Exhibit strong familiarity with a number of important AI techniques, including in particular search, knowledge representation, planning and constraint management.

CO4. Asses critically the techniques presented and to apply them to real world problems.

What is Artificial Intelligence? The AI problems, the underlying assumptions, what is an AI technique? Problems, Problem Spaces and search, defining the problem as a State Space Search, Production Systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Tic-

Tae-Toe problem. Heuristic Search Technique, Generate and Test, Hill climbing, Best-First search, Problem reduction, constraint Satisfaction, Means ends Analysis.

Knowledge Representation Issues, representations and Mapping, Approaches to knowledge Representation, Issues in Knowledge Representation, The Frame Problem. Representing Simple facts in Logic, Representing Instance and IS a Relationship, computable Functions and Predicates, Resolutions. Representing knowledge using rules, Procedural v/s declarative knowledge, Logic Programming, Forward v/s backward reasoning, matching control knowledge. Symbolic Reasoning under uncertainty, introduction to non monotonic reasoning, logics for non monotonic reasoning, depth first search, breadth first search. Statistical Reasoning, probability and Bayer's theorem, certainty factor and rule based systems. Bayesian Networks. Weak slot and filler structures, semantic nets, frames. Strong slot and filler structures, conceptual dependency.

Game Playing, overview. The minimax search procedure, adding alpha beta cut offs. Natural Language Processing. Introduction, syntactic Processing, Semantic analysis. Learning, What is learning? Role of learning, learning by taking advice, learning in problem solving. Expert systems, representing and using domain knowledge, explanation, knowledge acquisition. Lisp; introduction, Lisp a brief overview, higher order functions, search strategies, pattern matching. Prolog: introduction, syntax for predicate calculus programming, ADT.

**Text Book and References:**


1. DAN.W. Patterson, Introduction to A.I and Expert Systems – PHI, 2007.
2. Russell &Norvig, Artificial Intelligence-A Modern Approach**,** LPE, Pearson Prentice Hall, 2nd edition, 2005.
3. Rich & Knight, Artificial Intelligence – Tata McGraw Hill, 2nd edition, 1991.
4. W.F. Clocksin and Mellish, Programming in PROLOG, Narosa Publishing House, 3rd edition, 2001.
5. Ivan Bratko, Prolog Programming for Artificial Intelligence, Addison-Wesley, Pearson Education, 3rd edition, 2000.


## MCA-CC105 Accountancy and Financial Management Cr 3

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Acquaint the students with the broad framework of financial decision making in a business unit.

CO2. State the uses and users of accounting information;

CO3. Explain and apply accounting concepts, principles and conventions;

CO4. Record basic accounting transactions and prepare annual financial statements; and

CO5. Analyze, interpret and communicate the information contained in basic financial statements and explain the limitations of such statements.

**Fundamentals of Accounting**

Accounting Framework, Accounting and its functions, Accounting Concepts and Standards, Accounting Information and its Accounting, Understanding Financial Statement, Construction and Analysis of Balance Sheet and Profit and Loss account.

Construction and Analysis of Cash Flow Statement, Cost Management, Concept of Costs Accounting and Marginal Costing , Cost-Volume–Profit Analysis.

Financial and investment analysis, Ratio analysis, Budgeting and Budgetary control, Variance Analysis.

Financial Decisions, management of Working Capital, Managing Cash Needs, Capital Structure, Dividend Decisions. Introduction to financial accounting computer packages (TALLY).

## MCA-CP101 Unix Lab Cr 2

1. UNIX Utilities Command
2. Shell Command
3. VI Editor
4. Shell Programming
5. SED and AWK Programming

## MCA-CC104 Programming in Java Cr 4

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Design good web pages using different tags, tables, forms, frames and style sheets supported by HTML.

CO2. Implement, compile, test and run Java programs, comprising more than one class, to address a particular software problem.

CO3. Demonstrate the ability to employ various types of selection statements and iteration statements in a Java program.

CO4. Be able to leverage the object-oriented features of Java language using abstract class and interface.

CO5. Be able to handle errors in the program using exception handling techniques of Java.

CO6. Design applets as per the requirements with event handling facility.

**Introduction to Java**
Features of Java, Java Program Structure, Understanding the semantic and syntax differences between C++ and Java, Java Tokens, Java Virtual Machine (Bytecodes), Compiling and Executing a Java Program, Variables, Constants, Data Types, Scope of Variables, Type Casting, Operators, Expressions, Decision Making and Branching, Looping (While, Do, For, Jumps in Loops, Labelled Loops).

**Arrays, Strings and I/O**
Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Methods of String class, Manipulating Strings, String Buffer Classes, Methods of String Buffer class, String Tokenizer class, the Scanner class.

**Classes, Objects and Methods**
Class, Object, Constructors, Method Overloading, Inheritance, Method Overriding, This and Super, Final Variables and Methods, Final Classes, Finalize method, Abstract Methods and Classes, Visibility Control

**Interfaces and Packages**

Defining, Extending and Implementing Interfaces, Java API packages, Using Standard Java Packages (util, lang, io, net), Creating a package, Accessing and using a Package.

**Multithreading and Exception Handling**
Creating Threads, Extending the Thread Class, Stopping and Blocking a Thread, Life Cycle of a Thread, Thread Priority, Thread Synchronization, Runnable Interface Types of Errors, Exceptions, Built-in exceptions, Exception handling code (Try, Catch and Finally), Throwing our own Exception.

**Applets and AWT Programming**
**Applet :** Java Applets, Applet Life Cycle, Passing Parameters to Applets, Applet Tag, Embedding applets to HTML file, Running the applet

**AWT(Abstract Window Toolkit)**
Introduction to AWT, Graphics classes and its methods, Drawing Lines, rectangles, circles, ellipses and arcs using Graphics Class, Color class, ActionListener, ItemListener, KeyListener and MouseListener Interfaces, Component Class, Container Class, Button, Label, Checkbox, Radio Buttons, List Box, Choice Box, Text Area, Border Layout and Grid Layout

**Swing**
Introduction to Swing, Difference between AWT and Swing, Basics of JOptionPane, JApplet, JButton, JFrame, under javax.swing package.

## Text Book and References:


1. E. Balaguruswamy, Programming with Java, 5th Edition, McGraw Hill, 2014.
2. Herbert Schildt, JAVA The Complete Reference, 8th Edition, Mcgraw Higher Education, 2011
3. Cay S. Horstmann, Gary Corness, Core Java Volume II - Advanced Features, 9th Edition, Pearson Education, 2006.
4. Ken Arnold, James Gosling, David Homes, The Java Programming Language, Addison-Wesley Professional, 4th Edition, 2005.


## MCA-CP102 Programming in JAVA Lab Cr 2

1. To find the sum of any number of integers entered as command line arguments
2. To find the factorial of a given number
3. To learn use of single dimensional array by defining the array dynamically.
4. To learn use of .lenth in case of a two dimensional array
5. To convert a decimal to binary number
6. To check if a number is prime or not, by taking the number as input from the keyboard
7. To find the sum of any number of integers interactively, i.e., entering every number from the keyboard, whereas the total number of integers is given as a command line argument
8. Write a program that show working of different functions of String and StringBufferclasss like setCharAt(, setLength(), append(), insert(), concat()and equals().
9. Write a program to create a ―distance‖ class with methods where distance is computed in terms of feet and inches, how to create objects of a class and to see the use of this pointer
10. Modify the ―distance‖ class by creating constructor for assigning values (feet and inches) to the distance object. Create another object and assign second object as reference variable to another object reference variable. Further create a third object which is a clone of the first object.
11. Write a program to show that during function overloading, if no matching argument is found, then java will apply automatic type conversions(from lower to higher data type)

12. Write a program to show the difference between public and private access specifiers. The program should also show that primitive data types are passed by value and objects are passed by reference and to learn use of final keyword
13. Write a program to show the use of static functions and to pass variable length arguments in a function.
14. Write a program to demonstrate the concept of boxing and unboxing.
15. Create a multi-file program where in one file a string message is taken as input from the user and the function to display the message on the screen is given in another file (make use of Scanner package in this program).
16. Write a program to create a multilevel package and also creates a reusable class to generate Fibonacci series, where the function to generate fibonacii series is given in a different file belonging to the same package.
17. Write a program that creates illustrates different levels of protection in classes/subclasses belonging to same package or different packages
18. Write a program ―DivideByZero‖ that takes two numbers a and b as input, computes a/b, and invokes Arithmetic Exception to generate a message when the denominator is zero.
19. Write a program to show the use of nested try statements that emphasizes the sequence of checking for catch handler statements.
20. Write a program to create your own exception types to handle situation specific to your application (Hint: Define a subclass of Exception which itself is a subclass of Throwable).
21. Write a program to demonstrate priorities among multiple threads.
22. Write a program to demonstrate multithread communication by implementing synchronization among threads (Hint: you can implement a simple producer and consumer problem).
23. Write a program to create URL object, create a URLConnection using the openConnection() method and then use it examine the different components of the URLand content.
24. Write a program to implement a simple datagram client and server in which a message that is typed into the server window is sent to the client side where it is displayed.
25. Write a program that creates a Banner and then creates a thread to scrolls the message in the banner from left to right across the applet‘s window.
26. Write a program to get the URL/location of code (i.e. java code) and document (i.e. html file).
27. Write a program to demonstrate different mouse handling events like mouseClicked(), mouseEntered(), mouseExited(), mousePressed, mouseReleased() and mouseDragged().
28. Write a program to demonstrate different keyboard handling events.
29. Write a program to generate a window without an applet window using main() function.
30. Write a program to demonstrate the use of push buttons.

## MCA-CP103 Accountancy System Lab Cr 2

Software package used for Accountancy: Tally accounting package

1. Accounts Creation
2. Inventory Creation
3. Transactions
    a. Accounting vouchers
    b. Inventory vouchers
4. Importing of data

5. Reports
6. Introduction to Payroll system

# SYLLABUS OF 2nd SEMESTER

## MCA-CC201 Software Engineering Cr 4

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Gather and specify requirements of the software projects.

CO2. Analyze software requirements with existing tools.

CO3. Differentiate different testing methodologies.

CO4. Understand and apply the basic project management practices in real life projects.

CO5. Work in a team as well as independently on software projects.

**Introduction to SE**
S/W myths, Definitions and components of SE, Software processes and S/W characteristics, S/W applications. Software Process Models: Waterfall, Spiral, Prototype, RAD, 4 GT, Incremental, Evolutionary development, Iterative enhancement, Selection of a model.

**Software Metrics**
Definitions, Types of S/W metrics, products and processes S/W size and effort estimations: LOC, KLOC etc. Function point estimations COCOMO: basic, intermediate, detailed modes for organic, semidetached and embedded S/W.

**Software Requirements Analysis and Specification**
Requirement engineering, requirement elicitation, DFD, ER diagrams, Charts, requirement analysis, requirement documentations.

**Software Design**
Definitions, concepts and principles of S/W design, Structured design: modularity, coupling, cohesion, OO design principles.

**S/W Testing**
Objective, principles, types of S/W testing S/w quality assurance: concepts of S/W quality, S/W reliability, S/W safety.

**Text Book and References**


1. Rogers G. Pressman, Software Engineering: A Practitioner‘s Approach (7th Edition), McGraw-Hill, 2009.
2. Rajib Mall, Fundamentals of Software Engineering, PHI, 2014.
3. I. Sommerville, Software Engineering (8th edition), Addison Wesley, 2006.

## MCA-CC202 Data Analytics Cr 3

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Carry out data analysis/statistical analysis

CO2. Effectively visualize the data

CO3. Ability to think critically in making decisions based on data and deep analytics.

CO4. Ability to use technical skills in predicative and prescriptive modeling to support business decision-making.

CO5. Ability to translate data into clear, actionable insights.

CO6. Demonstrate effective communication skills that facilitate the effective presentation of analysis result

**Basics of Mathematics and Statistics**
Introduction to the course, Descriptive Statistics, Introduction to probability and probability distributions (discrete and continuous), Inferential Statistics through hypothesis tests

**Machine Learning: Introduction and Concepts**
Introduction to machine learning, Regression: Linear Regression, Logistic Regression, Ridge Regression, Lasso Regression, KNN (K- Nearest Neighbors)

**Basic & Advanced machine learning tools**
Decision Trees, K-Means, Naïve Bayes, Random Forests, Neural Networks, Dimensionality Reduction Techniques, Support Vector Machines, Clustering, Statistical mixture models

**Text Book and References**


1. An Introduction to Statistical Learning: with Applications in R, James, Springer
2. Pattern Recognition and Machine Learning, Bishop, Springer
3. Machine Learning (in Python and R) For Dummies, John Paul Mueller, Wiley


## MCA-CC203 Database Management System – II Cr 3

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Apply database transaction management and database recovery.

CO2. Construct queries and maintain database using SQL and PL/SQL.

CO3. Understand the basic knowledge of database security.

CO4. Understand the concept of object-oriented database and parallel database.

**Transaction Processing Concepts**
Transaction, Transaction execution, transaction processing and transaction properties, Concurrency control: Concurrency control, problems of concurrency control i.e., Lost update, dirty read (uncommitted data), unrepeatable (read), schedules, Lock types i.e. Shared, exclusive, two phase (2PL)), dead-locks, timestamp, methods.

**Database Security (DS)**

Goals of DS, Threats to DS, Authorization and authentication, data security issues, discretionary Access control (i.e. granting / revoking privileges, Audit trails).

**Database recovery system**
Database Backup, and Types of DB failures, types of Database recovery i.e. Forward and backward, recovery, Recovery technique i.e. Deferred update, immediate update and checkpoints.

**Object oriented databases**
Object oriented data model, concepts of object oriented databases (i.e. Objects, classes, polymorphism), Object Oriented DBMS i.e. OODBMS (Features, advantages and disadvantages).

**Parallel Database System:** Advantages, disadvantages and architecture of Parallel DBS.

**PL/SQL**
Basics of PL/SQL, Cursors, Triggers, Procedures and Functions.

**Decision Support System (DSS):** Evolution of DSS, Definition of DSS,
Characteristics of DSS, Benefits of DSS, Components of DSS.

**Data Warehousing**
Evolution, Components, Characteristics, Benefits, Limitation, Architecture of Data Warehouses(Data marts and Online Analytical Processing(OLAP)).

**Data Mining**
Data Mining Process, Data Mining Knowledge discovery, Goals of Data Mining, Data Mining Tools, Data Mining Application.

## MCA-CC204 Operation Research and Optimization Techniques Cr 4

**Course Outcome:** At the end of the course, the students will be able to:

**Linear Programming Problem**
Graphical Method, Algebraic Method, Simplex Method, Big-M Method, Two-Phase Method. Duality Method: Duality of Simplex Method, Dual-Simplex Method. Integer Programming Problem: Cutting Plane Method, Branch and Bound Method.

**Transportation Problem**
Determination of the Starting Solution:-North-West corner rule, Least Cost Method, Vogel's Approximation Method, Optimum Solution:- Stepping Stone Method, MODI-Method, and Assignment Problem: Hungarian Method, Unbalanced Assignment Problem, and Maximization Problem.

**Game Theory**
Two Person Zero Sum, Maximin-Minimax Principle, Games with Saddle Point, Games without Saddle Point Mixed Strategies:- 2×2 Games without Saddle Point, Graphical Method for 2×n or m×2 Games, Dominance Property, Sequencing Theory: N jobs through Two Machines, N jobs through three machines.

**Inventory Control**
Determination of EOQ, Components, Deterministic Inventory Model: - Purchasing Problem without Shortage, Purchasing problem with shortage, production problem without shortage, production problem with shortage. Queuing Theory: Basic Structure, Exponential distribution, Birth and Death model, M/M/I.

**Network Optimization Mode**

Minimal spanning tree: - Kruskal's and Prim's Algorithm, Shortest Path Problem:- Dijkstra's and Floyd's Algorithm, CPM/PERT:- Network Diagram, Forward Pass Computation, Backward Pass Computation, Determination of Total Float & Free Float Time.

## MCA-CC205 Data Communication and Computer Networks Cr 3

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Independently understand basic computer network technology.

CO2. Understand and explain Data Communications System and its components.

CO3. Identify the different types of network topologies and protocols.

CO4. To master the terminology and concepts of the OSI reference model and the TCP-IP reference model.

CO5. Identify the different types of network devices and their functions within a network

CO6. Understand and building the skills of IP addressing and routing mechanisms.

CO7. Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

**Introduction to computer network**
Topologies: STAR,BUS,RING,MESH,TREE & HYBRID Topologies, Base Band & Broad Band Communication, Guided & Unguided Transmission Media: Types of Guided and Unguided Media an Comparison, Overview of Data & Signal Bits, Baud Rate & Bit Rate, Modulation Techniques (AMPLITUDE MODULATION, PHASE MODULATION,FREQUENCY M)ODULATION, Multiplexing (TDM, FDM,STDM),Line coding (RZ, NRZ, MANCHESTER ENCODING, DIFFERENTIAL MANCHESTER ENCODING), Digital To Analog CONVERSION- ASK, PSK, FSK, QPSK.

**Transmission methods**
Synchronous & Asynchronous Transmission, Flow Control & Error Control: For noiseless channels: Simplest, Stop & Wait. For Noisy Channels: Stop and wait ARQ, Go-BACK-N ARQ, Selective Repeat ARQ, Error Detection methods. Goals of Layered protocols- Introduction to OSI, TCP/IP, SNA, UDP, ATM, FTP, Bit oriented (BSC) and Character oriented Protocols, High Level Data Link Control (HDLC).

**LAN Topology**
Ethernet, Token Bus, Token Ring (IEEE 802.5), Introduction to WAN & MAN,DQDM and FDDI. Switching Technologies- Circuit Switching, Message Switching and packet Switching. X.25, channelization and frames concepts, ISDN: International standards NTI, NT2, TA TE devices. Introduction to leased lines, DSL, Bridging &Routing: Types of Routing, static & Dynamic Routing, IP addressing concepts:IPV4 & IPV6, ICMP, Arp, Rarp, Congestion Control, Introduction to data security and Cryptography, private key, public key, ISO standards).introduction to Mobile technology (Topology, FDM, TDM, CDMA) satellite communication (LEO,GEO, TDM).

**Text Books and References**


1. Data communication & Networking, Fourozan, THM.
2. Computer Network. Tannenbaum, PHI.
3. Data and Computer Communications, Stallings, PHI.
4. Data Communication and Network, Dr. Prasad, Wiley, Dreamtech.

## MCA-CP202 Data Analytics Lab Cr 2

1. **Python Introduction**
   Why Python for data science, Installation and running, Python basic data structures, List, String, Tuples, Python iteration and conditional constructs, Python packages: how to import.

2. **Exploration and Visualization**
   Introduction to numpy, matplotlib. Pandas and Seaborn packages, Load data files, convert variables to different data types, transpose a table, sort data, plotting tools, using Pandas, Dataframe, Feature engineering using Pandas.

## MCA-CP203 Software Project Management Lab Cr 2

- Problem Statement,
- Process Model

1. Requirement Analysis:
   - Creating a Data Flow
   - Data Dictionary, Use Cases
2. Project Management:
   - Computing FP
   - Effort
   - Schedule, Risk Table, Timeline chart
3. Design Engineering:
   - Architectural Design
   - Data Design, Component Level Design
4. Testing:
   - Basis Path Testing

**Sample Projects:**

1. **Banking System**: Implement banking system for cash with drawl, cash deposit, check balance.
2. **Criminal Record Management**: Implement a criminal record management system for jailers, police officers and CBI officers
3. Organized Retail Shopping Management Software
4. Online Hotel Reservation Service System
5. Examination and Result computation system
6. Automatic Internal Assessment System

# SYLLABUS OF 3rd SEMESTER

## MCA-CC301 Values and Ethics of Profession Cr 3

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Understood the core values that shape the ethical behavior of an engineer

CO2. Exposed awareness on professional ethics and human values.

CO3. Known their role in technological development

Ethics of Profession: Engineering profession: Ethical issues in engineering practice. Conflicts between business demands and professional ideals. Social and ethical Responsibilities of Technologists. Codes of professional ethics Whistle blowing and beyond. Case studies.

Profession and Human values. Value Crisis in contemporary society. Nature of values: Value Spectrum of a 'good' life. Psychological values: Integrated personality; mental health. Societal values: the modern search for a 'good' society, justice, democracy, secularism, rule of law; values in Indian Constitution. Aesthetic Values: Perception and enjoyment of beauty, simplicity clarity. Moral and ethical values; Nature of moral judgments; canons of ethics; Ethics of virtue; ethics of duty; ethics of responsibility.

Information Technology Act 2000

- Rationale behind the Act.
- Scheme of the Act.
- Digital signature- Authentication of electronic records.
- Electronic governance- Legal recognition of electronic records and Digital signature
- use of electronic records and Digital signature in govt. and its agencies, Retention of
- electronic records, publication of rules and regulations in e-gazette, sec 9 and sec 10.
- Attribution, acknowledgement and dispatch of e-records – sec 11, 12, 13.
- Secure electronic records and digital signatures – sec 14, 15, and 16.
- Regulation of certifying authorities –sec 17 to sec 34.
- Digital signature certificates- 35-38.
- Duties of subscribers.
- Penalties and adjudication.
- The Cyber Regulations Appellate Tribunal.
- Offences.

## Text Book and References:


1. Blending the best of the East &West, Dr.Subir Chowdhury, EXCEL.
2. Ethics & Management. & Indian Ethos, ghosh, VIKAS.
3. Business Ethics, Pherwani, EPH.
4. Ethics, Indian Ethos &Management, Balachandran,Raja, Nair, Shroff Publishers.


## ELECTIVE LIST COURSE (SET A)

### MCA-ECA301 Cryptography Cr 4

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Understand the basic concepts and goals of Information security such as Confidentiality, Integrity, authentication, Non-Repudiation, Authorization, and Availability and their relevance in various Contexts.

CO2. Understand the mathematics related to Classical cryptosystems.

CO3. Understand the classical cryptosystems and techniques used to break them.

CO4. Understand the ideas of public key cryptosystems and digital signature schemes.

CO5. Understand different network issues and the solutions for them through firewall, intrusion detection system.

CO6. Understand and critically evaluate a range of access control and authentication mechanisms

**Introduction**
Basic Objectives of Cryptography, Secret-key and Public-key cryptography, Security Goals and Principles, Cryptographic Attacks, Substitution Ciphers, Transpositions, Stream and Block Ciphers, Algorithm Modes.

**Mathematics of Symmetric Key Cryptography**
Modular Arithmetic, Linear Congruence, GF($2^n$) Fields.

**Symmetric Key Cryptography**
Modern Block Ciphers, Modern Stream Ciphers, Diffie-Hellman Key Exchange Algorithm, Data Encryption Standard (DES), Blowfish, Advanced Encryption Standard (AES).

**Mathematics of Asymmetric Key Cryptography**
Primes, Primality Testing, Factorization, Chinese Remainder Theorem.

**Asymmetric Key Cryptography**
Overview, RSA, Cryptographic Hash function: MD5, SHA, MAC, HMAC, Digital Envelope, Digital Signature.

**Entity Authentication and Key Management**
Passwords, Challenge-Response, Zero-Knowledge, Kerberos, PKI.

**Network Security**
Threats in Network, Network Security Controls, Firewalls, Intrusion Detection Systems, Secure E-mail, Malicious Programs.

## Text Book and References:


1. Cryptography and Network Security: Second Edition, Behrouz A. Forouzan, McGraw Hill Education
2. Network Security Essentials : Applications and Standards: Fourth Edition, William Stalling, Pearson Education
3. Cryptography and Network Security: Atul Kahate, 2nd Edition, Tata McGraw-Hill
4. Applied Cryptography: Bruce Schneier, John Wiley & Sons
5. Security in Computing: P. Pfleeger, , PHI


## MCA-ECA302 Compiler Design Cr 4

**Course Outcome:** At the end of the course, the students will be able to

CO1. Describe the design of a compiler and the phases of program translation from source code to executable code and the files produced by these phases.

CO2. Explain lexical analysis phase and its underlying formal models such as finite state automata, push-down automata and their connection to language definition through regular expressions and grammars.

CO3. Explain the syntax analysis phase and identify the similarities and differences among various parsing techniques and grammar transformation techniques.

CO4. Formal attributed grammars for specifying the syntax and semantics of programming languages.

CO5. Identify the effectiveness of optimization and explain the differences between machine-dependent and machine-independent translation.

Classification of grammars. Context free grammars. Deterministic finite state automata (DFA). Non – DFA scanners. Top down parsing, LL grammars. Bottom up parsing. Polishing expressions Operator precedence grammar. IR comparison of parsing methods. Error handling. Symbol table handling techniques. Organization for non -block and block structured languages.

Run time strange Administration. Static and dynamic allocation. Intermediate froms of source program. Polish N-tuple and syntax trees. semantic analysis and code generation. Code optimization, folding, and redundant sub-expression evaluation. Optimization within iterative loops.

## Text Book and References:


1. Compiler Design, Aho& Ullman.
2. Compiler Design in C, Holub, PHI.


## MCA-ECA303 E-Commerce Cr 4

**Course Outcome:** At the end of the course, the students will be able to

CO1. Gain a comprehensive understanding of the E-Commerce landscape, current and emerging business models, and the technology and infrastructure underpinnings of the business.

CO2. Leverage the E-Commerce platforms to enhance current business or incubate new businesses.

CO3. Gain an understanding on how innovative use of the E-Commerce can help developing competitive advantage.

CO4. Develop an understanding on how internet can help business grow

CO5. Gain an understanding on the importance of security, privacy, and ethical issues as they relate to E-Commerce.

**Introduction to E-Commerce**

Information Technology. What is E-Commerce. Framework of Ecommerce. Categories of E-Commerce applications. Adoption of ECommerce. Advantages of E-Commerce .Business Models of E-Commerce: Different types of business models ie. B2B, B2C, C2C, C2B, B2G . Models of B2C E-Commerce. Major challenges of B2C E-Commerce. Development of B2B E-Commerce. Types of B2B markets. Impact and benefits of B2B E-commerce on business models.

**Technology for Online Business**

IT Infrastructure (Characteristics and Elements). Networks (Types and Topologies). Internet (Characteristics, Architecture, WWW, Domain Name, Client, Server, TCP/IP). Email. Intranet. Digital Signature. HTML. HTTP. Electronic Data Interchange (EDI) : Introduction to EDI. Components of EDI. Features of EDI. Cost of EDI. Electronic Funds Transfer. Business Applications of E-Commerce: Trade Cycle. Supply Chain. Competitive Advantage. Ecommerce Application (in Manufacturing, Wholesale, Retail, Service Sector.

**Electronic Payment Systems (EPS)**

Introduction to EPS. Online banking. Types of EPS (Electronic Tokens, E-Cash, E-Cheque, Smart Card, Credit Card, Debit Card, Proximity). Features and Advantages of Electronic Payment Systems. Cryptography. Security Issues in Ecommerce: Security issues related to Ecommerce. Threats and Risks involved in Ecommerce. Common Ecommerce security tools(Authentication, Access control, Encryption, Firewall). Biometric. Client Server N/W security. Data and message security (Encryption and Digital Signature).

## Text Book and References:


1. Bharat Bhaskar, Electronic Commerce—Framework Technologies and Applications, Tata McGraw Hill.
2. Ravi Kalakota & A.B. Winston, Frontiers of Electronic Commerce, Pearson Education.
3. Ravi kalakota & A.B. Winston, Electronic Commerce- A Manager's Guide, Pearson Education.
4. AgarwalaK amlesh, N and Agarwala Deeksha, Business on the Net Introduction to the E-Com, Macmillan India.
5. P.T. Joseph, E-Commerce: A Managerial Perspective, PHI, 2002.


## MCA-ECA304 Distributed Database Management System Cr 4

**Course Outcome:** At the end of the course, the students will be able to:

CO1. To know the design and system issues related to distributed database systems.

CO2. To learn the usage of different design strategies for distributed databases.

CO3. To study and implement the query processing techniques and algorithms as well as transaction management and concurrency control concepts used in such systems and in real world applications.

CO4. To know the Design and implementation issues related to multi-database systems (MDBS) and applications as well.

Distributed DBMS features and needs. Reference architecture, Levels of distribution transparency, replication, Distributed database design—fragmentation, allocation criteria. Storage mechanisms. Translation of global queries. Global query optimization.

Query execution and access plan. Concurrency control-2 phases locks. Distributed deadlocks. Time based and quorum based protocols. Comparison. Reliability –non-blocking commitment protocols. Partitioned networks. Checkpoints and cold starts.

Management of distributed transactions-2 phase unit protocols. Architectural aspects. Node and link failure recoveries. Distributed data dictionary management . Distributed database administration.

Heterogeneous databases- federated database, reference architecture loosely and tightly coupled. Alternative architecture, Development tasks, Operation- global task management.

Client server database–SQL server, open database connectivity. Constructing an application.

## Text Book and References:


1. Database System Concepts, Silberschatz, Korth, Sudarshan, TMH.
2. Database Management System, Ramakrishna, TMH.

3. Beginning SQL Server 2000 programming, Dew son, SPD/WROX.
4. Database Management System, Leon, VIKAS.
5. My SQL: Enterprise Solutions, Alexander Pachev, Wiley Dreamtech.

## MCA-ECA305 Image Processing Cr 4

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Analyze different image processing technique to retrieve image information.

CO2. Differentiate between different image transformation techniques.

CO3. Analyze different image enhancement techniques.

CO4. Analyze the concept of color image processing.

CO5. Analyze the concept of image restoration.

CO6. Differentiate between different image compression and segmentation techniques.

**Image**
Digital Representation. Elements Of Visual Perception. Sampling And Quantization. Image Processing System Elements, Fourier Transforms. Extension To 2-D, DCT, Walsh Transform, Hadamard Transforms. Enhancement And Segmentation. Point And Region Dependent Techniques.

**Image Encoding**
Fidelity Criteria. Transform Compression. KL, Fourier, DCT, Spatial Compression, Run Length Coding. Huffman and Contour Coding. Restoration Models: Constrained And Unconstrained, Inverse Filtering, Recursive Filtering.

## Text Book and References:

1. Digital image Processing &Analysis, Chanda&Magumde, PHI.
2. Fundamentals of Digital Image Processing, Jain, PHI.
3. Image Processing, Analysis & Machine Vision, Sonka, VIKAS.

## MCA-ECA306 Parallel Computing Cr 4

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Learn the basics and need for parallel computing environment
CO2. Learn about parallel random access machine and constituting algorithms
CO3. Learn parallel matrix multiplication algorithms and algorithms for Processor Array and Multiprocessors
CO4. Learn to solve Linear Systems using algorithms like Back Substitution, ODD-EVEN Reduction, Guassian Elimination and etc.
CO5. Explain how large-scale parallel systems are architectured and how massive parallelism are implemented in accelerator architectures
CO6. Write parallel programs for large-scale parallel systems, shared address space platforms, and heterogeneous platforms
CO7. Design efficient parallel algorithms and applications
CO8. Be conversant with performance analyze and modeling of parallel programs

**Introduction**

Computational Demand of Modern Science, Advent of Practical Processing, Parallel Processing Terminology- Contrasting Pipelining and Data Parallelism, Control Parallelism, Scalability, Control-Parallel Approach, Data-Parallel Approach with I/O.

**PRAM Algorithm**
A Model of Serial Computation, The PARAM Model of Parallel Computation, PARAM Algorithm-Parallel Reduction, Prefix Sums, List Ranking, Preorder Tree Traversal, Merging Two Sorted Lists, Graph Colouring, Problem defining Fast Solutions on PRAMS.

**Elementary Parallel Algorithm**
Classifying MIMD Algorithm, Reduction.
**Matrix Multiplication**
Sequential Matrix Multiplication, Algorithms for Processor Array, Algorithms for Multiprocessors.

**Solving Linear Systems**
Terminology, Back Substitution, ODD-EVEN Reduction, Gaussian Elimination, The JACOBI Algorithm, The Gauss-Seidel Algorithm, Jacobi Overrelaxation and Successive Overrelaxation, Mulyigrid Methods, Conjugate Gradient.

## Text Book and References:


1. H.Attiya & J. Welch- Distributed Computing- Fundamentals, Simulations and Advanced Topics, 2nd Edn., Wiley India Publication, New Delhi, 2006.
2. M.J. Quinn-Parallel Computing-Theory and Practice, 2nd Edn. McGraw Hill Inc., New York.


## MCA-ECA307 Cloud Computing Cr 4

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Understanding the systems, protocols and mechanisms to support cloud computing.

CO2. Develop applications for cloud computing.

CO3. Understanding the hardware necessary for cloud computing.

CO4. Design and implement a novel cloud computing application.

**Introduction**
Introduction to Cloud Computing, Roots of Cloud Computing: Fundamental concepts of Distributed Systems, Cluster Computing, Grid Computing, and Mobile Computing.

**Cloud Models**
Basics of Cloud Computing Concepts, Characteristics of Cloud Computing, Need for Cloud, Cloud Deployment models: private, public, hybrid and community cloud, Cloud Services: Resource-as-a-Service (RaaS), Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (PaaS), Examples of each services.

**Cloud Services**
RaaS: Usage of Physical resources like servers, networks, data centered, IaaS: Virtualization, Virtual Machine provisioning and Migration Services, Scheduling techniques of Virtual machines for resource reservation. PaaS: Integrated lifecycle platform: Google App Engine, Microsoft Azure, Anchored life cycle platform: Salesforce platform, SaaS: Characterizing SaaS, Salesforce's software environment.

**Cloud Application**
Cloud Application, Cloud challenges, Cloud Security and privacy issues, Mobile Cloud, Integration of Cloud with Wireless Sensor Network and its application.

## Text Book and References:


1. "Cloud Computing Principles and Paradigms", edited by Rajkumar Buyya, James Broberg and Andrzej Goscinski, Wiley Publication.
2. "Fundamentals of Cloud Computing", P.K. Pattnaik, M.R. Kabat, S. Pal, Vikas Publishing, 2014.
3. "Cloud Computing for Dummies", Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper, Wiley Publication.
4. "New frontiers in information and software as a service", Divyakant Agrawal, K. SelcukCandan, WenSyan Li (Eds.), Springer Proceedings.


## MCA-ECA308 Bio-informatics Cr 4

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Able to describe the contents and properties of the most important bioinformatics databases, perform text- and sequence-based searches, and analyze and discuss the results in light of molecular biological knowledge

CO2. Able to explain the major steps in pairwise and multiple sequence alignment, explain the principle for, and execute pairwise sequence alignment by dynamic programming

CO3. Knowledge to identify, adapt and develop in silico models appropriate to the specific study of different biological projects.

CO4. Able to use bioinformatics software, tools in their area of research.

**Introduction**
Biomedical data,-Clinical and life sciences -standards and databases. Principles and its uses Electronic health records (EMR) and health Information exchanges—including information retrieval, medical decision making, evaluation and evidence. Patient monitoring systems-ethics in informatics - bayesian networks-learning and decision-data structure in algorithm design and analysis.

**Networking**
TCP/IP Sockets and DNS clinical database concepts-design of the clinical information systems/Clinical Decision support systems--Synchornization, concurrency, deadlock, full-text databases, distributed database services and architexture on one of the database.any clinical database structure as one example.

**Methods and Evaluation**
Sampling, appropriate use of controls, data collection including human-testing of statiscal significance, sensitivity and specificity.ROC plots. Methods and issues specific to healthcare.

**Healthcare informatics**
Understanding and interaction Health organization especially academic health centers, understanding the health care environment, understanding the organization informatics- Interaction between these three units-machine learning approaches to make decision making and discovery. Human factors in clinical systems –use of machine learning to make modeling, datamining, policy design and law. Translation research and its uses and implications Evidence based medicines.

## Text Book and References:


1. Biomedical Informatics: First edition, - By Jules J. Berman. Jones & Bartlett, 2010
2. Biomedical Informatics: computer applications in Health care and Biomedicine (3rd ed), by Shortliffe EH, Ciminio JJ., New York Springer-Verlag. 2000
3. Evaluation methods in medical Informatics by Friedman CP. Wyatt JC, New York Springer-Verlag-1996.


## MCA-ECA309 Internet of Things Cr 4

**Course Outcome:** At the end of the course, the students will be able to :

CO1. Understand the application areas of IOT.

CO2. Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.

CO3. Understand building blocks of Internet of Things and characteristics.

**Introduction**

**The Internet of Things: an Overview**
The flavour of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?
**Design Principles for Connected Devices**
Calm and Ambient Technology, Magic as Metaphor, Privacy, Web Thinking for Connected Devices, Affordances.
**Internet Principles**
Internet Communications: An Overview (IP, TCP, The IP Protocol Suite (TCP/IP), UDP), IP Addresses (DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6), MAC Addresses, TCP and UDP Ports, Application Layer Protocols.

**Prototyping:**

**Thinking About Prototyping:** Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Open Source versus Closed Source, Tapping into the Community.
**Prototyping Embedded Devices:**
Electronics, Embedded Computing Basics, Developing on the Arduino, Raspberry Pi, Beaglebone Black, Electric Imp, Mobile Phone and Tablets, Plug Computing: Always-on Internet of Things.
**Prototyping the Physical Design:**
Preparation, Sketch, Iterate, and Explore, Non-digital Methods, Laser Cutting, 3D Printing, CNC Milling, Repurposing/Recycling.
**Prototyping Online Components:**
Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols.
**Techniques for Writing Embedded Code:**
Memory Management, Performance and Battery Life, Libraries, Debugging.

**Prototype to Reality:**

**Business Models**
A Short History of Business Models, The Business Model Canvas, Who Is The Business Model For Models, Funding an Internet of Things Startup, Lean Startups.
**Moving to Manufacture**
What Are You Producing?, Designing Kits, Designing Printed Circuit Boards, Manufacturing Printed Circuit Boards, Mass-Producing the Case and Other Fixtures, Certification, Costs, Scaling Up Software,

**Ethics**
Characterizing the Internet of Things, Privacy, Control, Environment, Solutions.

## Text Book and References:


1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley publication, 1st Edition, November 2013.


## MCA-ECA310 Theory of Computation Cr 4

**Course Outcome:** At the end of the course, the students will be able to :

CO1. Model, compare and analyze different computational models using combinatorial methods.
CO2. Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.
CO3. Construct algorithms for different problems and argue formally about correctness on different restricted machine models of computation.
CO4. Identify limitations of some computational models and possible methods of proving them.
CO5. Have an overview of how the theoretical study in this course is applicable to and engineering application like designing the compilers.

**Basic Mathematical Objects and Mathematical Induction**
Sets, logic, Functions, Relations, Alphabets, Strings, Languages, Principle of mathematical induction, Recursive definition.

**Regular Expressions and Finite Automata**
Regular languages and Regular Expressions, Memory required to recognize a language, Finite Automata, capability & limitations of FSM, Deterministic Finite Automata , Non-Deterministic Finite Automata, NFA with e-moves, regular sets & regular expressions, Equivalence of DFA and NDFA, NFA from regular expressions, regular expressions from DFA, Moore versus Mealy m/c, two way finite automata equivalence with one way , Kleen's Theorem, applications of finite automata.

**Regular and Non-regular languages**
Criterion for Regularity, Minimal Finite Automata, Pumping Lemma for Regular Languages, Decision problems, Regular Languages and Computers.

**Context Free Grammars**
Introduction, definition, Regular Grammar, Derivation trees, Ambiguity, Simplified forms and Normal Forms, Applications.

**Pushdown Automata**
Definition, Moves, Instantaneous Descriptions, Language recognised by PDA, Deterministic PDA, Acceptance by final state & empty stack, Equivalence of PDA , Pumping lemma for CFL, Interaction and Complements of CFL,Decision algorithms.

**Turing Machines**
Definition and examples, Computing Partial Functions with Turing Machine(TM), Combining TMs, Variations of TMs, Multi-tape TMs, Non-deterministic TM, Universal TM, Church Thesis.

**Recursively Enumerable Languages**
Recursively Enumerable and Recursive, Enumerating Language, Context Sensitive and Chomosky Hierarchy.

**Unsolvable Problems and Computable Functions**

Nonrecursive Language and unsolvable Problems, Halting Problem, Rice Theorem, Post Correspondence Problem.

**Computational Complexity**
Discussion on P, NP, NPC and NP-Hard Problems.

## Text Book and References:


1. John Martin -"Introduction to Languages and the Theory of Computation", 3rd edition, TMH.
2. K.L.P Mishra & N. Chandrasekharan -"Theory of Computer Science", PHI
3. Hopcroft JE. And Ullman JD -"Introduction to Automata Theory, Languages & Computation", Narosa.
4. Lewis H. R. and Papadimitrou C. H -"Elements of the theory of Computation", PHI.


## MCA-ECA311 Data Mining and Data Warehousing Cr 4

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Understand the functionality of the various data mining and data warehousing component. Appreciate the strengths and limitations of various data mining and data warehousing models
CO2. Explain the analyzing techniques of various data
CO3. Describe different methodologies used in data mining and data ware housing
CO4. Compare different approaches of data ware housing and data mining with various technologies.

**Introduction**
Introduction, Data Mining as subject, What motivated Data mining, Why is it important.

**Data warehousing**
Introduction, What is a Data Warehousing Definition, Multidimensional Data Model, OLAP Operation, warehouse Scheme, Data Warehousing, Architecture, Metadata, OLAP ENGINE, Data warehouse Backend Process.

**Data Mining**
Introduction, What is Data Mining, Data Mining Definition, KDD Vs, Data Mining, DBMS Vs. DM, Other related area, DM Technique, Other Mining Problem, Issue and challenge is in DM, DM Application area, DM Application, Case Sturdy.

**Mining Association Rule in Large Database**
Introduction, what is an Association Rule, Method to discover association Rule, A Priori Algorithm, Partition Algorithm, Pinear- Search algorithm, Dynamic item set Counting Algorithm, FP – Tree Growth Algorithm, Discussion and Different Algorithm, Generalized, Association Rule, Association Rules with Item Constraints.

**Clustering Techniques**
Introduction , Clustering Paradigram, Partition Algorithm, K- Medoid Algorithm, CLARA, CLARANS, Heirer Chial Clustering, DBSCAN, BIRCH, CURE, Categorical Chastereing Algorithms, STIRR, ROCK, CACTUS.

**Data Mining Primitives, Language and System Architecture**
Data Mining Primitives, what defines a Data Mining task, Task relevant Data, The Kind of Knowledge to Mined, Concept Hicrechings, Interestingness Measwce, presenation and visualization of Discovered Patterns, Data Mining Query Language.

**Decision Trees**

Introductions, What is decision Tree, Tree Construction Principle, Best split splitting Indices, Splitting criteria, Decision Tree Construction with Presenting, Prunesing Technique, Integration of Pruning Technique and Construction.

**Temporal and Spatial Data Mining**
Introduction, What is Temporal Data Mining emporal Association Rules, Sequence Mining, The GSP Algorithm, SPIRIT, Spafial Mining, Spatial Clustering, Spatial Trends.

## Text Book and References:


1. A.K. Pujari, "A Data Mining Technique", University press (India) Limited, 2001
2. A Hand and M. Kamber, "Data Mining Concept and Technique", Morgan Kauffmann Publishers, Else river India, New Delhi, 2003.
3. Recherd J, Roiger and Michance W. Creatz, Data Mining: a tutorial Based Primer, Addision Wesley, 2003.
4. M.H. Dienham, Data Mining : Introductory and Advanced Topics, Pentice Hall 2003.


## MCA-ECA312 Deep Learning Cr 4

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems
CO2. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains
CO3. Implement deep learning algorithms and solve real-world problems

**Introduction**
Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.

**Feedforward neural network**
Artificial Neural Network, activation function, multi-layer neural network

**Training Neural Network**
Risk minimization, loss function, backpropagation, regularization, model selection, and optimization

**Conditional Random Fields**
Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy

**Deep Learning**
Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network

**Probabilistic Neural Network**
Hopfield Net, Boltzman machine, RBMs, Sigmoid net, Autoencoders

**Deep Learning research**
Object recognition, sparse coding, computer vision, natural language processing

**Deep Learning Tools**
Caffe, Theano, Torch

## Text Book and References:


1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009
4. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013


# ELECTIVE LIST COURSE (SET B)

## MCA-ECB301 Mobile Computing Cr 3

**Course Outcome:** At the end of the course, the student should be able to:

CO1. Explain the basics of mobile telecommunication system

CO2. Choose the required functionality at each layer for given application

CO3. Identify solution for each functionality at each layer

CO4. Use simulator tools and design Ad hoc networks

CO5. Develop a mobile application.

**Introduction**
Mobile Computing – Mobile Computing vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

**Mobile internet protocol and transport layer**
Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance.

**Mobile telecommunication system**
Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).

**Mobile ad-hoc networks**
Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Popular Routing Protocols – Vehicular Ad Hoc networks ( VANET) – MANET Vs VANET – Security.

**Mobile platforms and applications**
Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – M Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

## Text Book and References:


1. Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt. Ltd, New Delhi – 2016, second edition.
2. C.K.Toh, “AdHoc Mobile Wireless Networks”, First Edition, Pearson Education, 2002.

3. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.

## MCA-ECB302 Windows Programming with Visual Basic.Net Cr 3

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Design, formulate, and construct applications with VB.NET

CO2. Integrate variables and constants into calculations applying VB.NET

CO3. Determine logical alternatives with VB.NET decision structures

CO4. Implement lists and loops with VB.NET controls and iteration

CO5. Separate operations into appropriate VB.NET procedures and functions

CO6. Assemble multiple forms, modules, and menus into working VB.NET solutions

CO7. Create VB.NET programs using multiple array techniques

CO8. Build integrated VB.NET solutions using files and structures with printing capabilities

CO9. Translate general requirements into data-related solutions using database concepts

Introduction to Visual Studio. NET, IDE to develop VB. NET ,Control Classes, Different type of applications., creating Windows form, Data types, Variables, Literals, decision making, Looping constructs, Object- oriented Programming through VB. NET, Creating procedures, Using Common dialogue classes, Retrieving and manipulating data to store in data base by ADO. NET..

Creating MDI applications, Creating Menus, Performing File Input/ Output. Creating multi- threaded applications.

Handling exception, debugging application, creating application assistant from help

System, creating and using components, creating user control.

Generating a report using crystal report.

Creating and using web-service, deploying an application.

### Text Book and References:

1. Visual Basic.Net Programming Black Book, Steven Holzner, Dreamtech Press.
2. Professional Visual Basic.Net 2003, Bill Evjen, Willey Dreamtech Press.

## MCA-ECB303 Pattern Recognition Cr 3

**Course Outcome:** At the end of the course, the students will be able to:

CO1. Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.

CO2. Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.

CO3. Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.

CO4. Apply pattern recognition techniques to real-world problems such as document analysis and recognition.

CO5. Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

Introduction to Pattern Recognition, Tree Classifiers (a) Decision Trees: CART, C4.5, ID3. (b) Random Forests

Bayesian Decision Theory, Linear Discriminants (a) Separability (b) Perceptrons (c) Support Vector Machines

Parametric Techniques (a) Maximum Likelihood Estimation (b) Bayesian Parameter Estimation (c) Sufficient Statistics, Non-Parametric Techniques (a) Kernel Density Estimators (b) Parzen Window (c) Nearest Neighbor Methods

Unsupervised Methods , Component Analysis and Dimension Reduction, The Curse of Dimensionality, Principal Component Analysis, Fisher Linear Discriminant, Locally Linear Embedding (b) Clustering, K-Means, Expectation Maximization, Mean Shift

Classifier Ensembles (a) Bagging (b) Boosting / AdaBoost

Graphical Models (a) Introductory ideas and relation back to earlier topics (b) Bayesian Networks (c) Sequential Models, State-Space Models, Hidden Markov Models, Dynamic Bayesian Networks

Algorithm Independent Topics (a) No Free Lunch Theorem (b) Ugly Duckling Theorem (c) Bias-Variance Dilemma (d) Jacknife and Bootstrap Methods (e) Syntactic Methods (f) Neural Networks

## Text Book and References:


1. L. Kuncheva. (2004) Combining Pattern Classifiers, Methods and Algorithms, Wiley
2. R.O. Duda, P.E. Hart and D. Stork. (2001) Pattern Classification (2nd edition), Wiley.
3. C. Bishop. (2006) Pattern Recognition and Machine Learning, Springer.
4. C. Bishop. (1995) Neural Networks for Pattern Recognition, Oxford University Press.
5. S. Theodoridis and K. Koutroumbas. (2009). Pattern Recognition (4th edition), Academic Press.


## MCA-ECB304 System Administration and Linux Cr 3

CO1. Understand the role and responsibilities of a Linux system administrator

CO2. Install and configure the Linux operating system

CO3. Manage the resources and security of a computer running Linux at a basic level

CO4. Make effective use of Linux utilities, and scripting languages

CO5. Configure and mange simple TCP/IP network services on a Linux system

Introduction to System Administration. Essential administrative Tools. Starting and Shutdown User Accounts. Security.

TCP/IP Network Management Getting started in LINUX. Linux Data Management POSIX Threads Pipes, FIFO, semaphores, Message Queues, Shared Memory, Sockets Tool Command Language PERL & CGI.

## Text Book and References:


1. Linux Administration: A Beginner's Guide, Shah, TMH.
2. LINUX: The Complete Reference, Petersen, TMH.
3. Guide to LINUX installations & administration, Wealls, VIKAS.
4. Red Hat LINUX- Administrator's Guide, Cox, PHI.
5. LINUX Network Administrator's Guide, Kirch, SPD/O'REILLY.


## MCA-EPB301 Mobile Computing Lab Cr 2

1. Installation
2. NS-2 structure
3. How to start
4. Creating topology
5. Sending data
6. Wired lab
    i. Node creation
    ii. UDP data traffic
    iii. Trace file analysis
    iv. TCP data traffic
7. Wireless lab
    i. Node creation
    ii. Mobile node position
    iii. UDP data traffic
    iv. Movement generation
    v. Trace file analysis

## MCA-EPB302 Windows Programming with Visual Basic.Net Cr 2

1. Introduction to Visual Basic .NET.
2. User Interface Design.
3. Variables, Constants and Calculations
4. Decisions making, Looping.
5. Arrays
6. Forms and Controls, MDI Forms, Common Dialog Boxes.
7. Sub Procedures, Functions.
8. Parameter passing by value and by reference.
9. Thread/Time slicing related programs.
10. Class /Interface based programming (Object Oriented Programs).
11. Inheritance / Polymorphism.
12. Database connectivity.
13. Saving Data and Objects in Files.
14. Web Forms.

**MCA-EPB303 Pattern Recognition Lab Cr 2**

**MCA-EPB304 System Administration and Linux Lab Cr 2**

1. The boot sequence
2. The essential Linux commands such as installation, searches and manipulation
3. The Grand Unified Boot Loader
4. GRUB Configuration Files
5. System Configuration Files
6. Manage users and groups by adding/deleting/modifying, configuring LDAP and PAM, modifying user processes and resources
7. Manage system storage by using partitions, logical volumes, physical volumes etc.