

**Course Structure & Syllabus**

**for**

**Master of Computer Applications (MCA)**

**2016**

**Affiliated to  
Maulana Abul Kalam Azad University of Technology  
(Formerly known as WBUT)**

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

<b>First Semester</b>							
SN	Course Code	Course Name	Contact Hours/Week				Credits
			L	T	P	Total	
<b>THEORY</b>							
1	MCA 101	Computer Organization & Architecture	3	1	-	4	4
2	MCA 102	System Analysis & System Programming	3	1	-	4	4
3	MCA 103	Programming with C	3	1	-	4	4
4	MCA 104	Discrete Mathematical Structures & Graph Theory	3	1	-	4	4
5	HU 101	Business English & Communication	3	1	-	4	4
<b>PRACTICAL</b>							
6	MCA 191	Computer Architecture & Microprogramming Lab	-	-	4	4	3
7	MCA 193	C Language Lab	-	-	4	4	3
8	HU 191	Business English & Communication Lab	-	-	4	4	3
Total						32	29

<b>Second Semester</b>							
SN	Course Code	Course Name	Contact Hours/Week				Credits
			L	T	P	Total	
<b>THEORY</b>							
1	MCA 201	Data Communication & Computer Networks	3	1	-	4	4
2	MCA 202	Software Engineering & TQM	3	1	-	4	4
3	MCA 203	Data Structures & Algorithms	3	1	-	4	4
4	MCA 204	Operating Systems	3	1	-	4	4
5	MCA 205	Statistical & Numerical Methods	3	1	-	4	4
<b>PRACTICAL</b>							
6	MCA 293	Data Structure & Algorithm Lab	-	-	4	4	3
7	MCA 294	Operating Systems Lab	-	-	4	4	3
8	MCA 295	Statistical & Numerical Computing Lab	-	-	4	4	3
<b>SESSIONAL</b>							
9	MCA 280 *	Technical Communication	-	-	-	-	0
Total						32	29

\* Qualifying/Mandatory Paper

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

<b>Third Semester</b>							
SN	Course Code	Course Name	Contact Hours/Week				Credits
			L	T	P	Total	
<b>THEORY</b>							
1	MCA 301	UNIX & Shell Programming	3	1	-	4	4
2	MCA 302	Database Management System	3	1	-	4	4
3	MCA 303	Object Oriented Programming Using C++	3	1	-	4	4
4	MCA 304	Operation Research & Optimization Techniques	3	1	-	4	4
5	MBA 301	Management & Accountancy	3	1	-	4	4
<b>PRACTICAL</b>							
6	MCA 391	UNIX & Shell Programming Lab	-	-	4	4	3
7	MCA 392	Database Management System Lab	-	-	4	4	3
8	MCA 393	Object Oriented Programming Using C++ Lab	-	-	4	4	3
<b>SESSIONAL</b>							
	MCA 380*	Technical Seminar	-	-	-	-	0
Total						32	29

\* Qualifying/Mandatory Paper

<b>Fourth Semester</b>							
SN	Course Code	Course Name	Contact Hours/Week				Credits
			L	T	P	Total	
<b>THEORY</b>							
1	MCA 401	Formal Language and Automata Theory	3	1	-	4	4
2	MCA 402	Computer Graphics & Multimedia	3	1	-	4	4
3	MCA 403	Programming with Java	3	1	-	4	4
4	MCA 404	Artificial Intelligence	3	1	-	4	4
5	HU 401	Values & Ethics	3	1	-	4	4
<b>PRACTICAL</b>							
6	MCA 492	Computer Graphics & Multimedia Lab	-	-	4	4	3
7	MCA 493	Java Lab	-	-	4	4	3
8	MCA 495	Visual Basic Lab	-	-	8	8	4
Total						36	30

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

<b>Fifth Semester</b>							
SN	Course Code	Course Name	Contact Hours/Week			Credits	
			L	T	P	Total	
<b>THEORY</b>							
1	MCA 501	Distributed System	3	1	-	4	4
2	MCA E 502 A/B/C	Elective – 1	3	1	-	4	4
3	MCA E 503 A/B/C	Elective – 2	3	1	-	4	4
4	MCA E 504 A/B/C	Elective – 3	3	1	-	4	4
5	MCA E 505 A/B/C	Elective – 4	3	1	-	4	4
<b>PRACTICAL</b>							
6	MCA E 592 A/B/C	Elective – 1 Lab	-	-	4	4	3
7	MCA 596	Minor Project	-	-	8	8	6
8	MCA 580*	Group Discussion	-	-	-	-	0
Total						32	29

\* Qualifying/Mandatory Paper

<b>Sixth Semester</b>							
SN	Course Code	Course Name	Contact Hours/Week				Credits
			L	T	P	Total	
1	MCA 691	Major Project	-	-	30	30	30
2	MCA 692	Grand Viva	-	-	-	-	4
Total						30	34

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

<b>Elective Courses</b>		
<b>Elective Number</b>	<b>Course Code</b>	<b>Course Name</b>
1	MCAE 502A	Advanced Java Technologies
	MCAE 502B	Python Programming
	MCAE 502C	Linux System Administration
2	MCAE 503A	Computational Intelligence
	MCAE 503B	Mobile Computing
	MCAE 503C	Compiler Design
3	MCAE 504A	E-commerce & Cyber-Law
	MCAE 504B	Big Data
	MCAE 504C	Image Processing
4	MCAE 505A	Network Security & Cryptography
	MCAE 505B	Cloud Computing
	MCAE 505C	Internet of Things

<b>Elective - 1 Lab</b>		
<b>Elective Number</b>	<b>Course Code</b>	<b>Course Name</b>
1	MCAE 592A	Advanced Java Technologies Lab
	MCAE 592B	Python Programming Lab
	MCAE 592C	Linux System Administration Lab

<b>Semester</b>	<b>Credits</b>
Semester-I	29
Semester-II	29
Semester-III	29
Semester-IV	30
Semester-V	29
Semester-VI	34
<b>Total</b>	<b>180</b>

## MCA 1<sup>st</sup> Semester

### THEORY

**Paper Name: COMPUTER ORGANIZATION AND ARCHITECTURE**

**Paper Code: MCA 101**

**Credits: 4**

**Total Contact: 42L**

#### Course Objectives

1. The objective of this course is to introduce the organization of a computer and its principal components, viz, ALU, Control, Memory and Input/output, etc.
2. The course will also enable the student to understand the design components of a digital subsystem that required realizing various components such as ALU, Control, etc.

#### Course Outcomes

Upon successful completion of the course, a student will be able to:

1. An ability to understand theory of Digital Design and Computer Organization to provide an insight of how basic computer components are specified.
2. An ability to understand the functions of various hardware components and their building blocks.
3. An ability to understand and appreciate Boolean algebraic expressions to digital design
4. An in depth understanding of realization of different combinational / sequential circuits.
5. An ability to understand memory hierarchy and design of primary memory

#### Syllabus:

##### Module 1: Data and numbers [5L]

Data and number representation- binary-complement representation, BCD-ASCII, conversion of numbers from one Number system to the other, (r-1)'s & r's complement representation. Weighted and Unweighted Codes – Gray Code, Excess 3 Code, Binary Arithmetic, Floating Point Numbers.

##### Module 2: Boolean Algebra and Logic Gates [5L]

Fundamentals of Boolean Algebra, Logic gates (AND, OR, NOT, XOR, NAND, NOR) MINTERM, MAXTERM, truth table, Boolean expression, simplification, Boolean Algebra, K-map up-to 4 variable, Canonical Forms.

##### Module 3: Combinational Circuits [6L]

Adder, subtractor, BCD adder, multiplexer, De-multiplexer, encoder, decoder

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Module 4: Sequential Circuits [8L]

Flip-Flop (SR, JK, D, T, Master-slave), Application of flip-flop-- Asynchronous counter up-to 4 bit, decade counter, mod-n-counter, Synchronous counter—ring counter, Johnson's count, Up down counter, Register.

### Module 5: Memory Organization [4L]

Types of memory RAM ROM, EPROM, DRAM, SRAM, Addressing Modes, Associative memory, main memory, virtual memory, secondary memory

### Module 6: I/O Interface [4L]

I/O: I/O interface, polling, interrupts, DMA, mode of data transfer

### Module 7: CPU Organization [6L]

CPU organization, instruction format, addressing mode, RISC, CISC, Von- Neumann- Architecture Pipeline & vector processing, Pipeline structure, speedup, efficiency, throughput and bottlenecks. Arithmetic pipeline and Instruction pipeline.

### Module 8: Computer Arithmetic [4L]

Computer arithmetic: addition, subtraction, multiplication & division. Booth'. Dual core, C2D, I3, I5.

#### Text Books:

1. "Computer System Architecture" by Morris Mano, PHI
2. "Computer Architecture" by Carter, Schaum Outline Series, TMH

#### Reference Books:

1. "Computer Organization" by Hamacher, MGH
2. "System Architecture" by Buad, VIKAS
3. "The Fundamentals of Computer Organization" by Raja Rao, Scitech

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**Paper Name: SYSTEM ANALYSIS & SYSTEM PROGRAMING**

**Paper Code: MCA 102**

**Credits: 4**

**Total Contact: 40L**

#### Course Objectives:

1. To provide foundation for understanding the software development process in a defined way according to industrial standards.
2. To understand the complete software development life cycle and the different methodologies
3. System Software concept.

#### Course Outcomes:

After this course, the students will be able to

1. Understanding the requirements to develop the software projects or prototypes.
2. Concept of fundamental outcomes of cost-benefit analysis.
3. Develop the software workflow by different types of models and

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

diagrams like ERD, DFD etc

4. Working with different types of testing tools and terminologies.
5. Concepts of System Softwares and their applications

### Syllabus:

#### Module 1: Introduction [4L]

System : Definition, Characteristics, elements and types of system.

#### Module 2: System Development Life Cycle[8L]

System Development Life Cycle, Role of system analyst, Initial investigation, Feasibility study -Technical, economic and behavioral feasibility, Cost and Benefit analysis.

#### Module 3: System Analysis [10L]

Problem Definition, Information requirements, Information gathering tools, Tools of structured Analysis –Data Flow Diagrams, Data Dictionary, Decision Tree, Decision tables and structured English. ER Diagram

#### Module 4: Testing [8L]

System Testing, Importance of testing, Types of system testing, Handling Errors

#### Module 5: System Programming[10L]

**Assembler:** macro processor, macros, calls, parameters, expansion, design of two-pass assembler.

**Loaders and Linkers:** Loading schemes, design of absolute and direct linking loaders.

#### Text Books:

1. “System Analysis and Design” by Awad, EM, Galgotia Publications Pvt. Ltd
2. “Fundamentals of Software Engineering” by Rajib Mall; PHI Learning Pvt. Ltd.
3. “Systems Programming” by Donovan; TMH

#### Reference Books:

4. Gane and Sarson: Structured System Analysis and Design.
5. Silver, GA, Silver, ML: System Analysis and Design, Addison-Wesley Publishing Co
6. Dhamdhare, Systems Programming & Operating Systems, TMH
7. S. Chattopadhyay, System Software, Prentice-Hall of India, 2007

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**Paper Name: PROGRAMMING WITH C**

**Paper Code: MCA 103**

**Credits: 4**

**Total Contact: 42L**

### COURSE OBJECTIVES

1. To write, compile and debug programs in C language.
2. To formulate problems and implement algorithms in C.
3. To effectively choose programming components that efficiently solves computing problems in real-world.

### COURSE OUTCOMES

Upon successful completion of this course, students will be able to

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

1. Understand the basic concept of C Programming, and its different modules that includes decision and loop control structures
2. Acquire knowledge about the basic concept of writing a program.
3. Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.
4. Application of Arrays, Strings, Functions, Pointers, Recursive Functions
5. Role of Functions involving the idea of modularity, User defined datatypes, FILE handling

### Syllabus:

#### Module 1: Introduction[4L]

C character set- Delimiters-The C Keywords-Identifiers- Constants-Variables-Rules for Defining Variables

#### Module 2: Data Types and Variables[4L]

Data Types-Declaring Variables- Initializing Variables –Type Conversion, storage classes.

#### Module 2: Operators and Operations[6L]

Operators, types of operators, Priority of Operators and their Clubbing- Comma and Conditional Operator-Arithmetic Operators-Relational Operators –Logical Operators-Bitwise Operators, Shift operator-Input and

#### Module 3: Output[2L]

Output in C-Formatted and Unformatted Functions -Library Functions.

#### Module 4: Decision Control Structures[4L]

if statement- if...else – various statement forms of if-nested if -break statement-continue statement –go to statement - switch statement - nested switch statement

#### Module 5: Loop Control Structures[6L]

for statement -while statement, do-while statement - nested loops, infinite loops

#### Module 6: Array, String and Pointer[4L]

Arrays - working with string and standard functions. Introduction to pointers –pointer declaration –Arithmetic Operations with pointers – pointers and arrays –pointers and two-dimensional arrays –array of pointers –pointers to pointers –pointers and strings –void pointers

#### Module 7: Function[4L]

Function definition and declaration –prototypes - types of functions –call by value and reference –function as an argument –function with operators –function and decision statements –function and loop statements –function with arrays and pointers –recursion –pointer to function

#### Module 8: User Defined Data Types, Dynamic Memory Allocation[3L]

Structures and unions, dynamic memory allocation.

#### Module 9: Pre-Processor Directive, FILE[5L]

Pre-processor directives – Macro, command line arguments, FILE handling.

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Text Books:

1. "Programming with C" by - Byron S Gottfried, Schaum's Outline series
2. "C The Complete Reference" by - Schildt, TMH

### Reference Books:

3. "Practical C Programming", 3rd Ed, Oualline, SPD/O' REILLY
  4. C Programming Made Easy, Raja Ram, SCITECH
  5. Projects Using C, Varalaxmi, SCITECH
  6. Mastering Algorithms with C, Loudan, SPD/O'REILLY
  7. Kanithkar; "Let us C". BPB publication
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### Paper Name: DISCRETE MATHEMATICAL STRUCTURES AND GRAPH THEORY

**Paper Code: MCA 104**

**Credits: 4**

**Total Contact: 40L**

**Prerequisites:** An introductory course on Relation and Function, knowledge of basic graph theory.

### Course Objectives:

The purpose of this course is to provide fundamental concepts of Basics of Probability and its Distribution, Discrete Mathematics, Algebraic Structures and Advanced Graph Theory.

### Course Outcomes :

On successful completion of the learning sessions of the course, the learners will be able to:

1. Recall the distinctive characteristics of Basics of Discrete Mathematics, Algebraic Structures and Advanced graph Theory.
2. Understand the theoretical workings of Discrete Mathematics, Algebraic Structures and Advanced graph Theory to evaluate the various measures and forms in related field.
3. Apply various principles of Discrete Mathematics, Algebraic Structures and Advanced graph Theory and solve the same.

### Syllabus :

#### Module 1: Mathematical Logic[4L]

Mathematical Logic: Statements and Notation, Connectives, Normal Forms, Predicate Calculus.

#### Module 2: Set Theory[8L]

Sets and Operations on Sets, Relations and Ordering, Posets and Lattices, Functions (Injective, Surjective, Bijective, Inverse)

#### Module 3: Mathematical Induction [2L]

Mathematical Induction, Problem solving using method of Mathematical Induction

#### Module 4: Counting Principle[8L]

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

Counting: Factorial Notation, Binomial Coefficients, Permutation and Combinations, Pigeonhole Principle, Principle of Inclusion-Exclusion.

### Module 5: Generating Function and Recurrence Relation[6L]

Generating Functions, Recurrence Relations and its solutions.

### Module 7: Graph Theory[12L]

Basic concepts; Complete, Regular and Bipartite Graphs; Subgraphs and Isomorphism; Paths and connectivity; Trees and Planar graphs; Euler and Hamiltonian Graphs; Graph Algorithms.

#### Text Books:

1. “Discrete Mathematics for Computer Scientists & Mathematicians” by - Mott, Kandel & Baker; PHI
2. “Discrete Mathematical Structures with Applications to Computer Science” by - Tremblay & Manohar; TMH

#### Reference Books:

3. “Elements of Discrete Mathematics” by - C.L.Liu; TMH
4. “Discrete Mathematics & Its Applications” by - Kenneth H Rosen, TMH
5. “Discrete Mathematics (SCHAUM'S outlines)” by - Lipschutz & Lipson; TMH

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**Paper Name: BUSINESS ENGLISH AND COMMUNICATION**

**Paper Code: HU 101**

**Credits: 4**

**Total Contact: 42L**

#### Course Objectives:

1. Understand the communication concepts.
2. Practically apply various components of business communication
3. Identify and analyze essentials of communication
4. Understand the concept of effective communication in a corporate world

#### Course Outcomes :

On successful completion of the learning sessions of the course, the learners will be able to:

1. Mastering the art of a professional business presentation
2. Distinguishing different communication processes and their practical applications
3. More effective written communication strategies.

#### Syllabus :

##### Module 1: Introduction[6L]

This should cover general and technical writing, oral communications and listening skills: letter writing, technical report writing, and business communication.

##### Module 2: Communication Skill Development[10L]

Expression: Practical communication skill development, business presentation with multimedia, speaking skill, prepared speech, extempore speech

##### Module 3: Reading Skill Development[8L]

Reading skill: comprehension test

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Module 4: Writing Skill Development[10L]

Writing: precise, technical/business letter, organization of writing material

### Module 5: Technical Documents Preparation[8L]

Poster presentation, writing technical document, preparing software user manual, preparing project documentation.

#### Text Books:

1. "Business Correspondence & Report Writing" by - Sharma, TMH
2. "Business Communication Strategies" by -Monipally, TMH

#### Reference Books:

3. "English for Technical communication" by -Laxminarayanan, Scitech
4. "Business Communication" by - Kaul, PHI
5. "Communication Skill for Effective Management" by - Ghanekar, EPH

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## PRACTICAL

### Paper Name: Computer Architecture and Microprogramming Lab

Paper Code: MCA 191

Credits: 3

Total Contact: 40P

#### Course Objectives:

1. To study the basic organization and architecture of digital computers (CPU, memory, I/O, software).microprocessors.
2. To get an exposure of digital logic and microprogramming.
3. Clear understanding and utilization of digital computers and Microprocessor

#### Course Outcomes:

After successful completion of this course, the students will be able to

1. Analyze and design digital logic circuits and optimize that.
2. Implement standard Combinational and Sequential circuits.
3. Learn about Microprocessor components, registers and pin details
4. Microprocessor programming

#### Syllabus :

All laboratory assignments are based on Hardware Description Language (VHDL or Verilog) Simulation.

1. HDL introduction
2. Realization of a Boolean Function. Minimize using K map and realize the same using truth table
3. Realize NAND and NOR Gate as universal gate
4. Design Half Adder and Full Adder
5. Design a Full Adder/ Subtractor using 2 half adder/ subtractor

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

6. Design Half Subtractor and Full Subtractor
7. Design 4 bit parallel Adder Subtractor Composite unit using IC7483 and 7486
8. Design 8:1 Multiplexer using two 4:1 Multiplexer
9. Implement logic function using Multiplexer.
10. 8-bit Addition, Multiplication, Division
11. 8-bit Register design
12. Memory unit design and perform memory operations.
13. 8-bit simple ALU design
14. 8-bit simple CPU design
15. Interfacing of CPU and Memory

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### Paper Name: C Programming Lab

Paper Code: MCA 193

Credits: 3

Total Contact: 40P

#### Course Objectives:

1. To introduce the students in the field of programming using C language
2. To give a clear exposure of Custom based programming
3. To develop the concept of logic application.

#### Course Outcomes:

After successful completion of this course, the students will be able to

1. Clearly formulate a problem for solving using Programming
2. Perfectly apply Data types, operations and control structures available in C
3. Solve real life problems using C programming
4. Efficiently utilize computer memory to deal with complex problems
5. Create own data type and handle files, create own library.

#### Syllabus :

1. Introduction about the way of programming, Programming to implement input and output statement, *scanf()*, *printf()*, Other preliminary function, like *getch()*, *clrscr()*.
2. Control Statement: if, if – else, if – else – else if. switch case.
3. Loop: for, while, do – while.
4. Array: single, double, multidimensional array
5. Teach how to write a programming depending on algorithm.

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### Paper Name: Business English and Communication Lab

Paper Code: HU 191

Credits: 3

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

**Total Contact: 40P**

### **Course Objectives :**

1. Understand the concept of technical communication.
2. Practical approach of business communication
3. Learning various components of communication
4. Learning effective communication in a corporate world

### **Course Outcomes :**

1. Mastering the templates and application tools available for business presentations
2. Learning the art of a professional communication
3. Learning use of media and modes of communication in workplace context
4. Distinguishing different communication processes and their practical applications
3. Analyzing effectiveness of written and verbal communication strategies.

### **Syllabus :**

#### **Module 1: Learning Tools & Templates [12P]**

Windows Overview, Office features, Templates and Wizards, MS Word, PowerPoint, Outlook, MS Excel, MS Access.

#### **Module 2: Preparing Business Presentations [8P]**

Preparing business presentation with computers using PowerPoint

#### **Module 3: Structured report Generation [8P]**

Developing structured project report with Word and Excel

#### **Module 1: Communication Skill Development [12P]**

practicing English and communication skills.

## MCA 2<sup>nd</sup> Semester

### THEORY

**Paper Name: DATA COMMUNICATION AND COMPUTER NETWORKS**

**Paper Code: MCA 201**

**CREDITS: 4**

**TOTAL: 40L**

#### **Course Objective:**

The objective of the course is to

1. Develop understanding regarding networking
2. Introduce students regarding different network related problems and their solutions
3. Clarify different network terminologies

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

1. Understand the basic concepts of data communication and networking
2. Analysis the different problems in the field of networking
3. Evaluate different solution to the networking related problem.
4. Apply the knowledge of networking in development optimal solution.

#### **Syllabus**

##### **Module 1: Introduction to computer network [8L]**

Topology; Baseband & Broadband Topology; Guided & Unguided Media. Overview of Data & Signal Bits. Baud & Bit Rate. Modulation (AM, PM, FM); Multiplexing (TDM, FDM, STDM). Encoding (RZ, NRZ, BIPOLAR, MANCHESTER, DIFF. MANCHESTER). Digital To Analog –ASK, PSK, FSK, QPSK.

##### **Module 2: Transmission methods[10L]**

Synchronous & Asynchronous, Flow Control, Error Control, Error Detection methods. Goals of Layered protocols- Introduction to OSI, TCP/IP, IBM, SNA, ATM. Bit oriented (BSC) & Character oriented Protocol (SDLC, LAPB,

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

LAPD, LLC) HDLC- frame format, station, states, configuration, access control. LAN Topology Ethernet (IEEE 802.3), Token Bus (IEEE 802.4), Token Ring (IEEE 802.5)

### Module 3: Introduction to WAN[10L]

DQDB (IEEE 802.6) & FDDI. Switching Technologies –Circuit, Message, and Packet. X.25, X.21, RS-232 C –frame format, channel, packet frames, facilities (In brief only). ISDN- D channel, B-Channel Introduction to leased lines, DSL, Digital Carriers.

### Module 4: Bridging & Routing [12L]

Static & Dynamic (In Brief), IP, IP addressing, ICMP, Congestion Control, TCP, UDP. HTTP, FTP, Telnet, SMTP. Introduction to data security (private key, public key, ISO standards). Introduction to Mobile technology (Topology, FDM, TDM, CDMA), Satellite Communication (LEO, GEO, TDM).

#### Text Books:

1. Data Communication & Networking, Forouzan, TMH
2. Computer Networks, Tanenbaum, PHI

#### Reference Books:

3. Data & Computer Communications, Stallings, PHI
4. Communication Networks, Walrand, TMH
5. Computer Communication Networks, Shanmugam & Rajeev, ISTE/EXCEL
6. Data Communications, Prakash C. Gupta, PHI
7. Computer Networking, Tittel, Schaum Outline Series, TMH
8. Data & Network Communications, Miller, VIKAS

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**Paper Name: SOFTWARE ENGINEERING AND TQM**

**Paper Code: MCA 202**

**CREDITS: 4**

**TOTAL: 40L**

#### Course Objectives:

1. Analysis and design of complex systems and meet ethical standards, legal responsibilities
2. To apply software engineering principles, techniques and develop, maintain, evaluate large-scale software systems.
3. To produce efficient, reliable, robust and cost-effective software solutions and perform independent research and analysis.
4. To work as an effective member or leader of software engineering teams and manage time, processes and resources effectively by prioritizing competing demands to achieve personal and team goals.

#### Course Outcome (CO):

1. Ability to analysis and design of complex systems and meet ethical standards, legal responsibilities
2. Ability to apply software engineering principles, techniques and develop, maintain, evaluate large-scale software systems.
3. To produce efficient, reliable, robust and cost-effective software solutions and perform independent research and analysis.
4. Ability to work as an effective member or leader of software engineering teams and manage time, processes and resources effectively by prioritizing competing demands to achieve personal and team goals.

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Syllabus :

#### Module 1 : Introduction [3L]

Definition of SE, Software crisis, Evolution of technology- Hype curve, Exploratory style of Software development vs SE, Human cognition mechanism, SE principle- abstraction and decomposition.

#### Module 2 : Software life-cycle models [4L]

Waterfall model, V Model, Prototyping Model, Spiral Model, RAD Agile Model

#### Module 3 : Software Project Management [8L]

Responsibility of a project manager, Project planning, Metrics for project size estimation, Project estimation techniques, COCOMO model, Halstead's Software Science, Scheduling- CPM, PERT, Gantt chart, Risk management, Software configuration management, Staffing and team leader project and planning

#### Module 4 : Requirement analysis and specification [4L]

SRS, Requirement gathering and specification, Functional requirement, Traceability, 4GL.

#### Module 5 : Software Design [6L]

Characteristics of a good software, Cohesion and coupling, Function oriented design- DFD, Structure chart. Object oriented design- class and relationship, Design phase in life cycle, System Design Definitions, Concept and methodologies, data flow oriented Design, Program Design and the requirements

#### Module 6 : Coding and Testing [8L]

Coding Standard, software documentation, Testing- unit testing, black box testing- equivalence class partitioning, boundary value analysis, white box testing- McCabe's Cyclomatic Complexity, Mutation Testing, Debugging, Program analysis tool, Integration Testing, Grey box testing, System testing- Smoke and performance testing.

#### Module 7 : Software Reliability and Quality Management [4L]

Reliability, Hazard, MTTF, Repair and Availability, Software quality, SEI CMM and ISO-9001. Software reliability and fault-tolerance, Six sigma

#### Module 8 : Computer-aided software engineering [3L]

**Computer-aided software engineering (CASE)**-environment and benefit. Function point methods (FSM, ISO, OMG) & Metrics. Standards: Capability Maturity Model Integration, ISO 9001

### Text Book:

1. Rajib Mall: Software Engineering, PHI

### Reference Books:

2. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, Mc Graw-Hill International Edition.
3. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
4. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.

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**Paper Name: DATA STRUCTURES AND ALGORITHMS**

**Paper Code: MCA 203**

**CREDITS: 4**

**Total: 40L**

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Course Objective(s):

1. To provide knowledge in various data structures and algorithms to introduce techniques for analyzing the efficiency of computer algorithms.
2. To provide efficient methods for storage, retrieval and accessing data in a systematic manner and explore the world of searching, sorting, traversal and graph algorithm.
3. To demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists and trees.
4. To compare different implementations of data structures and to recognize the advantages and disadvantages of the different implementations.
5. To demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.
6. To compare the efficiency of various sorting algorithms in terms of both time and space.
7. To trace and code recursive functions.

### Course Outcome (CO):

1. Use different kinds of data structures which are suited to different kinds of applications, and some are highly specialized to specific tasks.
2. Manage large amounts of data efficiently, such as large databases and internet indexing services.
3. Use efficient data structures which are a key to designing efficient algorithms.
4. Use some formal design methods and programming languages which emphasize on data structures, rather than algorithms, as the key organizing factor in software design.
5. Store and retrieve data stored in both main memory and in secondary memory.

### Syllabus:

#### MODULE 1: [8L]

Linear Data Structure Introduction : Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code. Algorithm efficiency and analysis, time and space analysis of algorithms – order notations. Array : Different representations – row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials. Linked List : Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

#### MODULE 2 : [7L]

Linear Data Structure [Stack and Queue] : Stack and its implementations (using array, using linked list), applications. Queue, circular queue, dequeue. Implementation of queue- both linear and circular (using array, using linked list), applications. Recursion : Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi, Eight Queens Puzzle.

#### MODULE 3 :[15L]

Nonlinear Data structures Trees : Basic terminologies, forest, tree representation (using array, using linked list). Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-recursive traversal algorithms using threaded binary tree, expression tree. Binary search tree- operations (creation, insertion, deletion, searching). Height balanced binary tree – AVL tree (insertion, deletion with examples only). B- Trees – operations (insertion, deletion with examples only). Huffman tree. Graphs : Graph definitions and Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi-list. Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross edge, forward-edge), applications.

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

Minimal spanning tree – Prim's algorithm

### MODULE 4:[10L]

Sorting Algorithms : Internal sorting and external sorting Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap), radix sort. Tree Sort technique. Searching : Sequential search, binary search, interpolation search. Hashing : Hashing functions, collision resolution techniques

#### Books:

1. Fundamentals of Data Structures in C, E. Horowitz, Sartaj Sahni and Susan Anderson, W. H. Freeman and Company
2. Data Structure Using C & C++, Tanenbaum, PHI

#### Reference Books:

1. Data Structures & Program Design in C, 2nd Ed, Kruse, Tondo & Leung, PHI
2. Mastering Algorithms with C. Loudon, SPD/O'REILLY
3. Data Structures and Algorithm, R. S. Salaria, Khanna Publishing

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**Paper Name: OPERATING SYSTEMS**

**Paper Code: MCA 204**

**CREDITS: 4**

**TOTAL: 44L**

#### Course Objective:

1. To understand the services provided by and the design of an operating system.
2. To understand the structure and organization of the file system.
3. To understand what a process is and how processes are synchronized and scheduled.
4. To understand different approaches to memory management.
5. To able to use system calls for managing processes, memory and the file system.
6. To understand the data structures and algorithms used to implement an OS.

#### Course Outcome:

1. Analyze the structure and basic architectural components involved in OS.
2. Demonstrate competence in recognizing and using operating system features
3. Understand and analyze theory and implementation of different operating system aspect.
4. Apply knowledge of different operating system algorithms.

#### Syllabus :

##### Module I :[2L]

Importance of OS, Basic concepts and terminology, types of OS, different views, journey of a command execution, design and implementation of OS.

##### Module 2: [16L]

Process: Concept and views, OS view of processes, OS services for process management, scheduling algorithms, performance evaluation; Inter-process communication and synchronization, mutual exclusion, semaphores, hardware support for mutual exclusion, queuing implementation of semaphores, classical problem of concurrent programming, critical region and conditional critical region, monitors, messages, deadlocks.

##### Module 3 :[10L]

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

Resource manager, file management, processor management, device management, Memory management –paging, swapping, page replacement algorithm, design issues for paging system, segmentation, Scheduling algorithm and performance evaluation. Security and protection, policies and mechanism, authentication, protection and access control, formal models of protection, cryptography, worms and viruses.

### Module 4: [6L]

In-process communication & synchronization, File systems, security and protection mechanism, Input/output systems, processes and processors in distributed system Performance measurement, monitoring and evaluation .

### Module 5: [10L]

Multiprocessor system, classification and types, OS functions and requirements, introduction to parallel computing, multiprocessor interconnection synchronization. Distributed OS - rationales, algorithms for distributed processing.

OS services and kernel, Multiprogramming and time sharing, Processor scheduling. Performance measurement and monitoring –measures, evaluation techniques, bottlenecks and saturation, feedback loops.

### Books:

1. Operating Systems, Galvin & Silberschatz, John Wiley
  2. Modern Operating System, 2nd Ed, Tanenbaum, PHI
  3. Systems Programming & Operating Systems, Dhamdhare, TMH
  4. Systems Programming, Donovan, TMH
  5. UNIX and Shell Programming, Yashavant P. Kanetkar, BPB Publications
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**Paper Name: STATISTICAL AND NUMERICAL METHODS**

**Paper Code: MCA 205**

**CREDITS: 4**

**TOTAL: 42L**

**Course Objective:** The purpose of this course is to

1. provide basic understanding of the derivation and the use of the numerical methods
2. along with the knowledge of finite precision arithmetic and fundamental concepts of statistics and probability.

### Course Outcomes :

On successful completion of the learning sessions of the course, the learner will be able to:

1. Recall the distinctive characteristics of various numerical techniques and the associated error measures, statistics and probability.
2. Understand the theoretical workings of various numerical techniques, statistics and probability to solve the engineering problems and demonstrate error.
3. Apply the principles of various numerical techniques, statistics and probability to solve various problems.
4. Examine the nature of system using the concept of numerical techniques, statistics and probability.

### Syllabus:

#### Module 1: Statistics & Probability [12L]

Measures of Central Tendency, Measures of Dispersion, Correlation and Regression, Theory of Probability, Theoretical Distributions - Binomial, Poisson and Normal distributions.

#### Module 2: Numerical Methods-I [10L]

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

Approximations and Errors in Computing, Error propagation.

Roots of Nonlinear equations: Concept of root, Methods of solution –Bisection method, False Position method, Newton-Raphson method, Secant method and Fixed-Point method.

Solution of a system of Linear Equations: Basic Gauss Elimination method, Gauss Elimination with Pivoting, Gauss-Jordan method, Matrix Inversion method, LU factorization method, Jacobi method, Gauss-Seidel method.

### Module 3: Numerical Methods-II [10L]

Interpolation: Basic concepts, Lagrange Interpolation, Newton's Divided Difference Interpolation, Interpolation with equidistant points –Gregory-Newton Forward difference and Backward difference formula. Inverse Interpolation.

### Module 4: Numerical Methods-III [10L]

Numerical Integration: Newton-Cotes methods –Trapezoidal rule, Simpson's 1/3 rule, Sim Weddel's Rule. Numerical Solution of Ordinary Differential Equations: Taylor Series method, Euler's method, Modified Euler's method, Runge-Kutta method.

#### Text Books:

1. Shishir Gupta & S. Dey, Numerical Methods, McGraw Hill Education Pvt. Ltd.
2. Dutta & Jana: Introductory Numerical Analysis. PHI Learning
3. Jain, Iyengar, & Jain: Numerical Methods (Problems and Solution). New age International Publisher.
4. N. G. Das: Statistical Methods, TMH.
5. D. S. Sancheti & V. K. Kapoor: Statistics Theory, Method & Application, Sultan chand & sons, New Delhi.

#### Reference Books:

1. Balagurusamy: Numerical Methods, Scitech. TMH
2. Soumen Guha & Rajesh Srivastava: Numerical Methods, Oxford Universities Press.
3. Numerical Analysis, Sastry, PHI
4. Numerical Analysis, S. Ali Mollah. New Central Book Agency.
5. Numerical Methods in Computer Application, Wayse, EPH
6. Programmed Statistics (Questions – Answers), G. S. Rao, New Age International
7. Probability and Statistics for Engineers, Rao, Scitech.

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## PRACTICAL

**Paper Name: DATA STRUCTURE AND ALGORITHM LAB**

**Paper Code: MCA 293**

**CREDITS: 3**

**Total: 40P**

#### Course Objectives:

1. To assess how the choice of data structures and algorithm design methods impacts the performance of programs.
2. To choose the appropriate data structure and algorithm design method for a specified application.
3. To solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions.

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Course Outcomes:

Graduates will be able to

1. Write well-structured procedure-oriented programs of up to large lines of code.
2. Analyze run-time execution of previous learned sorting methods, including selection, merge sort, heap sort and Quicksort.
3. To implement the Stack ADT using both array based and linked-list based data structures.
4. To implement the Queue ADT using both array based circular queue and linked list based implementations.

### Syllabus:

Following Programs to be covered:

1. Array: Conversion of Array from higher dimension to one dimension. [4P]
2. Search: Linear & Binary [4P]
3. Sorting: bubble, merge, quick, selection, insertion, shell, tournament, radix, heap [4P]
4. Linked List: Singly, circular, doubly, doubly & circular [4P]
5. Stack: Implementation using Array and linked list, Conversion from infix – to postfix, evaluation of postfix expression. [4P]
6. Queue: Implementation using array & linked list, circular queue, dequeue, priority queue-Both iterative & recursive implementation. [4P]
7. Tree: Binary Search Tree, traversal algorithms (pre, post, in) both recursive and non recursive, deletion of a node from the BST. Threaded tree, AVL tree. [4P]
8. File Handling: Sequential file, random access file, indexed sequential. [4P]
9. Miscellaneous Problems. [8P]

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**Paper Name: OPERATING SYSTEMS LAB**

**Paper Code: MCA 294**

**CREDITS: 3**

**TOTAL: 40P**

### Course Objectives:

- Introduce the basic principles in Operating System.
- The management modules present in the OS like process management, Memory management, File management, Disk management, Network management, I/O management

**Course Outcomes:** After completion of this course students will be able to

- Understand gcc compiler, and Makefiles
- Understand the high-level structure of the Linux kernel both in concept and source code
- Acquire a detailed understanding of one aspect (the scheduler) of the Linux kernel

### Syllabus :

Following experiment may be covered

1. Implement the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority [4P]
2. Implement all file allocation strategies : Sequential ,Indexed ,Linked [4P]
3. Implement Semaphores [4P]

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

4. Implement File Organization Techniques : Single level directory, Two level, Hierarchical, DAG [4P]
5. Implement Banker's Algorithm for Deadlock Avoidance [4P]
6. Implement an Algorithm for Deadlock Detection [4P]
7. Implement all page replacement algorithms: FIFO, LRU, LFU [4P]
8. Implement Shared memory and IPC [4P]
9. Implement Paging Technique of memory management. [4P]
10. Implement Threading & Synchronization Applications [4P]

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**Paper Name: NUMERICAL AND STATISTICAL COMPUTING LAB**

**Paper Code: MCA 295**

**CONTACTS: 4P**

**CREDITS: 3**

**TOTAL: 40P**

**Course Objective:** The purpose of this course is to

1. provide basic programming skills for solving the problems in
  - a. numerical methods and
  - b. statistics.

**Course Outcomes (COs):**

On successful completion of the learning sessions of the course, the learner will be able to:

1. Apply the programming skills to solve the problems using multiple numerical approaches and statistics.
2. Analyze the results to design reports by effective presentation.

**Course Content:**

1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Gauss Jacobi and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsi, Newton-Raphson method.
5. Assignments on ordinary differential equation: Euler's method, Euler's modified method, Runge-Kutta methods.
6. Simple problems as assignment on Measures of Central Tendency- mean, median, mode, Measures of Dispersion- variance, standard deviation. Problems related to engineering field.

**Text Books:**

1. Numerical Methods in Computer Application, Wayse, EPH
2. Programmed Statistics (Questions – Answers), G. S. Rao, New Age International

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### SESSIONAL

**Paper Name: Technical Communication**

**Paper Code: MCA 280\***

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

**CREDITS: 0**

**TOTAL: 12L**

**Course Objective:** The purpose of this course is to

1. To prepare students with the individual and collaborative technical writing, presentation, and research skills necessary to be effective technical communicators in academic and professional environments.
2. To increase vocabulary beyond the subject, improve pronunciation, listening comprehension skills.
3. paraphrasing and elaboration skills, interactive skills to enhance comprehension.

**Course Outcomes (COs):**

On successful completion of the learning sessions of the course, the learner will be able to:

- Prepare and deliver professional technical presentations through applying principles of effective oral communication and design by applying principles for the visual display of quantitative information.
- Researching, analyzing, synthesizing, and applying information to create technical reports.
- Recognizing ethical implications of technical communication in professional contexts.
- Understanding the contemporary issues in engineering from an environmental, societal, economic, and global perspective.

Module	Content
One	Technical Communication Training
Two	Business Etiquette (Meeting / E-Mail / Phone)
Three	Corporate Life and Protocols
Four	Group Discussion
Five	Team Work
Six	Interview Skills

### **MODULE 1 : TECHNICAL COMMUNICATION TRAINING [2L]**

1. Organisational Communication and Structure.
2. Vocabulary related to Corporate Operation.
3. Modes of Communication (Telephone, Conference Call, Team Huddle, Public Relation etc.)
4. Communication with Clients, Customers, Suppliers etc.
5. Verbal and Non-Verbal Communication, Proxemics and Para Language.
6. Vocabulary Building (Synonym / Antonym / One word Substitution / Portmanteau etc.)

### **MODULE 2 : BUSINESS ETIQUETTE [2L]**

7. Presenting oneself in the Business Environment.
8. Corporate Dressing and Mannerism.
9. Table Etiquette (Corporate Acculturation, Office parties, Client/Customer invitations etc.)
10. Professional Phone Call.
11. Cultural Difference.
12. E-mail Etiquette.

## **Course Curriculum & Syllabus of Master of Computer Application (MCA) Program**

### **MODULE 3 : CORPORATE LIFE AND PROTOCOLS [2L]**

13. Introduction of Companies (Domain Specific)
14. Opportunities and Growth Plan.
15. Performance and Corporate Behaviour.
16. Service Level Agreement and Corporate Jargon.
17. Networking and Adapting to Culture, Technology and Environment.

### **MODULE 4 : GROUP DISCUSSION [2L]**

18. Introduction, Definition and Purpose.
19. Types of Group Discussion.
20. Strategies and Protocols of Group Discussion.
21. Skills and Parameters of Evaluation.
22. Practice Session and Video Viewing Task.

### **MODULE 5 : TEAMWORK [2L]**

23. Concept of Team Culture.
24. Stages of Team Development (Forming, Storming, Norming, Performing, Adjourning)
25. Team Working Agreement (Participation, Decision Making, Problem Solving.
26. Conflict Management, Flexibility, Negotiation Skill.
27. Team Building (Assess, Plan, Execute and Evaluate)

### **MODULE 6 : INTERVIEW SKILLS [2L]**

28. Types of Interview (One-on-One, Panel or Group, On-site Interview, Telephonic etc.)
29. Stages of Interview.
30. Pre-Interview Preparation.
31. Interview Questions and Answers (HR and Technical).
32. Questions for Interviewer/s.
33. Dressing and Behavioural Etiquette.

## **MCA 3<sup>rd</sup> Semester**

### **THEORY**

**Paper Name: UNIX & Shell Programming**

**Paper Code: MCA 301**

**Credit: 4**

**Total: 40 Lectures**

### **COURSE OBJECTIVES:**

1. To familiarize the students with the Linux/UNIX environment.

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

2. To explore the Basic Shell Commands
3. To learn the fundamentals of shell scripting/programming
4. To familiarize students with basic Linux administration

### COURSE OUTCOMES:

Upon successful completion of this course, students will be able to

1. Work confidently in Unix/Linux environment
2. Write shell scripts to automate various tasks
3. Master the basics of Linux administration
4. Implement and innovate commands using the basic programming tool kit.

### Syllabus:

#### Module 1: Introduction to UNIX [4L]

Architecture of UNIX, Features of UNIX , UNIX Commands – *man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, env.*

#### Module 2: Environment Variables [2L]

PATH, LOGNAME, SHELL, USER

#### Module 3: UNIX Utilities [4L]

Introduction to UNIX file system, vi editor, file handling utilities, security by file permissions, process utilities, disk utilities

#### Module 4: Linux Networking [2L]

Networking commands - *unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin*

#### Module 5: Text processing utilities and backup utilities [2L]

*tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio*

#### Module 6: Introduction to Shell [4L]

UNIX Session, Standard Streams, Redirection, Pipes, *tee* Command, Command Execution, Command Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Shell/Environment Customization

#### Module 7: Filters [4L]

Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count characters, Words or Lines, Comparing Files

#### Module 8: Advanced Filters grep [2L]

Operations using grep Family filters, Searching for File Contents

#### Module 9: Advanced Filters: sed [2L]

Scripts, Operations, Addresses, commands, Applications

#### Module 10: Advanced Filters: awk [4L] Execution, Fields and Records, Scripts, Operations, Patterns,

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

Actions, Associative Arrays, String Functions, String Functions, Mathematical Functions, User – Defined Functions, Using System commands in awk, Applications, awk and grep, sed and awk

**Module 11: Perl [2L]** Scripting, Difference of Programming Language and Scripting Language, Basic scripting using PERL

### **Module 12: File Management [4L]**

File Structures, System Calls for File Management – *create, open, close, read, write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown*, Directory API – *opendir, readdir, closedir, mkdir, rmdir, umask*

### **Module 13: Process Management [4L]**

Categories of process, Parent & Child process, Zombie and Orphan process, mechanism of `init()`, termination of a process, process control mechanism

### **Text Books:**

1. UNIX and Shell Programming; Behrouz A. Forouzan, Richard F. Gilberg; Thomson
2. UNIX: Concepts and Applications; Sumitava Das; TMH

### **Reference Books:**

1. UNIX for Programmers and Users; Graham Glass, King Ables; Pearson Education
2. UNIX Programming Environment; Kernighan and Pike; PHI/Pearson Education
3. The Complete Reference UNIX; Rosen, Host, Klee, Farber, Rosinski; TMH
4. Your UNIX – The Ultimate Guide; Sumitava Das; TMH
5. Design of UNIX Operating System; Maurice Bach; PHI

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## **Paper Name: Database Management System**

**Paper Code: MCA 302**

**Credits: 4**

**Total: 40 L**

### **COURSE OBJECTIVES**

To educate students with

1. Fundamental Concepts Of Database Management System,
2. Data Models
3. Different Database Languages.

### **COURSE OUTCOMES :**

Upon successful completion of this course, students will be able to

1. To analyze Database design methodology.
2. Acquire knowledge in fundamentals of Database Management System.
3. Be able to analyze the difference between traditional file system and DBMS.
4. Able to handle with different Database languages.

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

5. Draw various data models for Database and Write queries mathematically.

### Syllabus:

#### Module 1: Introduction to DBMS [4L]

Definition, applications, architecture, administration roles, data dictionary, abstraction and data integration, traditional models, three-level architecture-hierarchical model, network model and relational model.

#### Module 2: Relational model [4L]

Definitions and properties, keys, types of keys, integrity rules.

#### Module 3: Database design [5L]

Concept, logical and physical models, ER diagram, extended Entity Relationship model, application

#### Module 4: Relational Algebra [5L]

Set, Set operations, tuple relational calculus and domain relational calculus, joins-different types.

#### Module 5: SQL[4L]

SQL constructs, DDL, DML, views, Embedded SQL, Query & its optimisation techniques  
Singed valued functional dependencies

#### Module 6: Relational Database Design Concepts [5L]

Relation, tables, Functional Dependency, determining keys, anomalies, need for normalization, normalization -1NF, 2NF, 3NF, BCNF, 4NF, 5NF,DKNF, lossless join and dependency preserving decomposition

#### Module 7: File and Storage structure [2L]

Files and File Management, Sequential, Indexed Sequential. Random

#### Module 8: B+ tree[2L]

Creation, insertion & deletion

#### Module 9: Indexing[3L]

Primary and secondary indexes, dense and sparse indexes, B+tree indexes, Hash indexes-linear and extensible hash indexes

#### Module 10: Transaction [3L]

view, cursor, transaction, Transaction Management, security and recovery, Concurrency Control in databases

#### Module 11:Introduction to PL/SQL [3L]

Processing PL/SQL Block, Cursor Management.

### Text Books:

1. Data Base System Concepts, Silverchatz, Korth & Sudarshan, TMH.
2. Fundamentals of Database Systems, Elmasri & Navathe, 6<sup>th</sup> Ed, TMH

### Reference Books:

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

1. Data Base Management Systems, Majumder & Bhattacharyya, TMH.
  2. Data Base Management System, A.K. Pujari, ISTE/EXCEL.
  3. Data Base Processing: Fundamentals, Design & Implementation, Kroenke, PHI.
  4. SQL PL/SQL for Oracle 8 & 8i, P.S Deshpande, Wiley Dreamtech.
  5. Data Base Management Systems, V.K Jain, Wiley Dreamtech.
  6. Beginning SQL Programming, Kauffman, SPD/WROX.
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### **Paper Name: Object-Oriented Programming using C++**

**Paper Code: MCA 303**

**Credit: 4**

**Total: 40L**

### **COURSE OBJECTIVES**

1. To get a clear understanding of object-oriented concepts.
2. To understand object oriented programming through the constructs of C++.

### **COURSE OUTCOME**

Upon successful completion of this course, Student will be able to

1. Understanding of Object Oriented concepts with knowledge of differentiation between C++, ANSI & standard C. Also ability to develop program.
2. To demonstrate the concept of class, object, constructor, destructor, abstraction, inheritance, and polymorphism. And also different types of variables, functions and operators.
3. Gain knowledge of file, streams, Template and exception handling.

### **Syllabus:**

**Module 1:** Basics of Object Oriented Programming and C++, C++ & ANSI standard C [2L]

**Module 2:** Predefined classes, building objects with classes, access specifiers, Constructor and Destructor, static member variable and static member functions, Defining operations on objects. Inheritance, aggregation [8 L]

**Module 3:** Polymorphism, Function overloading, Operator Overloading, Constructor overloading, Friend Function, Inline function , Abstract class and Virtual functions [17 L]

**Module 4:** Overview of File, Use of different file handling functions, Overview of streams, Overview of Template (Class & Functions), Exception Handling [13 L]

### **Text Books:**

1. Object-Oriented Programming with C++, E Balagurusamy, TMH
2. C++ The Complete Reference, Schildt, 4th Ed, TMH

### **Reference Books:**

1. Object Oriented Programming & C++, R.Rajaram, New Age International

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

2. Programming in C++, Shah & Thaker, ISTE/EXCEL
  3. Beginning C++, The Complete Language, Horton,SPD/WROX
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### **Paper Name: Operation Research & Optimization Techniques**

**Paper Code: MCA 304**

**Credit: 4**

**Total: 40L**

### **COURSE OBJECTIVES**

1. The goal of this course is to teach you to formulate, analyze, and solve mathematical models that represent real-world problems.
2. To learn linear programming, network flow problems, integer programs, nonlinear programs, dynamic programming and queueing models.

### **COURSE OUTCOMES**

Upon completion of this course, Student will be able to:

1. Formulate a real-world problem as a mathematical programming model.
2. Understand the theoretical workings of the simple method for linear programming and perform iterations of it by hand.
3. Understand the relationship between a linear program and its dual, including strong duality and complementary slackness.
4. Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.
5. Solve specialized linear programming problems like the transportation and assignment Problems.
6. Solve network models like the shortest path, minimum spanning tree, and maximum flow problems.

### **Syllabus:**

#### **Module 1 : Linear Programming [10L]**

Concepts, General Mathematical Formulation/ (Matrix form) of LPP, Graphical Analysis, Simplex Method, Artificial Variables – Charne's Big M-Method, Duality Method, Transportation Problem, Assignment Problem.

#### **Module 2 : Integer Linear Programming [3L]**

Importance of ILP, Applications of ILP , Methods of ILP - Branch and bound algorithm.

#### **Module 3 : Network Optimization Models [6L]**

CPM / PERT (Arrow Network, Rules of Network Construction, Numbering the Events(Fulkerson's Rule), Time Analysis- Time estimates, earliest expected time, latest allowable occurrence time, latest allowable occurrence time and Determination of Various Floats and Slack Times, Calculation of CPM network. PERT – Probability of meeting scheduled date of completion of project.

#### **Module 4 : Dynamic Programming [3L]**

Concept, Bellman's Principle of Optimality, Characteristics of DPP, Applications of Dynamic Programming and Simple problem solving.

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Module 5 : Queuing Theory [5L]

Stochastic process, Queuing System(Basic Structure), Exponential distribution, Kendall's Notation for Representing Queuing Model, Birth-and-Death Model, Different name of Queuing Model , Classification of Queuing Model – [ Model-I:(M/M/1):(∞/FCFS)(Birth-and-Death Model), Model-II: (M/M/1):(N/FCFS)] (Infinite and Finite Population Queue).

### Module 6 : Game Theory [4L]

Pay-off, Two person Zero Sum game, Games with saddle point(s), Games without saddle point ( Mixed Strategies), Algebraic method, Graphical method, Dominance property.

### Module 7 : Inventory Control [6L]

Types of Inventory, Variables in Inventory problem, Factors Involved in Inventory Analysis. Deterministic Inventory Model – a) EOQ Models without Shortages, b) EOQ Models with Shortages (Determination of EOQ). Probabilistic Demand – Inventory Model: Discrete and Continuous.

### Module 8 : Sequencing [3L]

Two Jobs through Two Machines, Three Jobs through Two Machines.

### Text Books:

1. Operations Research by Kanti Swarup and P.K. Man Mohan, Sultan Chand and Sons.
2. Operations Research Problems and Solutions V.K. Kapoor, Sultan Chand and Sons.

### Reference Books:

1. Operations Research, Paneer Selvam, PHI.
2. Operations Research, Hillier & Lieberman, TMH.
3. Operations Research, Kalavati, VIKAS.
4. Operations Research, Humdy A Taha, PHI.
5. Operations Research Theory and Applications by J.K.Sharma, Macmillan India Limited.
6. Operations Research, Vijayakumar, Scitech.
7. Operations Research by S.D. Sharma, Kedar Nath Ram Nath Publishers.
8. Operations Research by A.P. Verma, S. K. Kataria & Sons.
9. Operations Research by P.K. Gupta & Hira, S.Chand
10. Operations Research : Principles and Practice 2<sup>nd</sup>. Edition Ravindran Wiley Production
11. Operations Research An Introduction by H.A.Taha , McMillan Publishing Company, NY

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### Paper Name: Management Accounting

Paper Code: MBA 301

Credit: 4

Total: 40L

### COURSE OBJECTIVES

1. Ability to prepare accounting statements and reports in accordance with accounting concepts and conventions.
2. Knowledge of types of accounting errors and the ways of rectifying them
3. To find how the financial position of a firm is represented in its financial statement

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

4. To find out arithmetic accuracy of balance sheet.
5. To find out arithmetic accuracy of trial balance.

### COURSE OUTCOMES

Upon successful completion of this course, the students will be able to

1. Understand the role of accounting and its limitations.
2. Prepare financial statements in accordance with Generally Accepted Accounting Principles.
3. Demonstrate knowledge of each step in the accounting cycle.
4. Support at a basic level the recording and reporting of financial information for business.
5. Demonstrate an understanding the tally in accounts

### Syllabus:

#### Module 1 : Overview [10L]

Accounting concepts, conventions and principles; Accounting Equation, International Accounting principles and standards; Matching of Indian Accounting Standards with International Accounting Standards.

#### Module 2 : Mechanics of Accounting [10L]

Double entry system of accounting, journalizing of transactions; preparation of final accounts, Profit & Loss Account, Profit & Loss Appropriation account and Balance Sheet, Policies related with depreciation, inventory and intangible assets like copyright, trademark, patents and goodwill.

#### Module 3 : Analysis Of Financial Statement [10L]

Ratio Analysis- solvency ratios, profitability ratios, activity ratios, liquidity ratios, market capitalization ratios ; Common Size Statement ; Comparative Balance Sheet and Trend Analysis of manufacturing, service & banking organizations.

#### Module 4 : Funds Flow Statement [10L]

Meaning, Concept of Gross and Net Working Capital, Preparation of Schedule of Changes in Working Capital, Preparation of Funds Flow Statement and its analysis; Cash Flow Statement: Various cash and non-cash transactions, flow of cash, preparation of Cash Flow Statement and its analysis.

### Text Books:

1. Narayanswami - Financial Accounting: A Managerial Perspective (PHI, 2nd Edition).
2. Mukherjee - Financial Accounting for Management (TMH, 1st Edition).

### Reference Books:

3. Ramachandran & Kakani - Financial Accounting for Management (TMH, 2nd Edition).
4. Ghosh T P - Accounting and Finance for Managers (Taxman, 1st Edition).
5. Maheshwari S.N & Maheshwari S K – An Introduction to Accountancy (Vikas, 9th Edition)
6. Ashish K. Bhattacharya- Essentials of Financial Accounting (PHI, New Delhi)
7. Ghosh T.P- Financial Accounting for Managers (Taxman, 3rd Edition)
8. Maheshwari S.N & Maheshwari S K – A text book of Accounting for Management (Vikas, 1st Edition)
9. Gupta Ambrish - Financial Accounting for Management (Pearson Education, 2nd Edition)
10. Chowdhary Anil - Fundamentals of Accounting and Financial Analysis (Pearson Education, 1st Edition).

# Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

## PRACTICAL

**Paper Name: UNIX & Shell Programming Lab**

**Paper Code: MCA 391**

**Credit: 3**

**Total: 40P**

### **COURSE OBJECTIVES:**

1. To familiarize the students with the Linux/UNIX environment.
2. To explore the Basic Shell Commands
3. To learn the fundamentals of shell scripting/programming
4. To familiarize students with basic Linux administration

### **COURSE OUTCOMES:**

Upon successful completion of this course, students will be able to

1. Work confidently in Unix/Linux environment
2. Write shell scripts to automate various tasks
3. Master the basics of Linux administration
4. Implement and innovate commands using the basic programming tool kit.

### **Syllabus:**

1. **UNIX Utilities:** Introduction to UNIX file system, vi editor, file handling utilities, security by file permissions, process utilities, disk utilities [4P]
  2. **Text processing and backup utilities:** *tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio* [4P]
  3. **Filters:** Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count characters, Words or Lines, Comparing Files [4P]
  4. **Linux Networking:** Networking commands - *unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin* [4P]
  5. **Introduction to Shell:** Command Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Shell/Environment Customization, Shell Scripting [4P]
  6. **Advanced Filters**  
**grep & sed:** Operations using grep Family filters, Searching for File Contents [4P]
  7. **Advanced Filters awk:** Execution, Fields and Records, Scripts, Operations, Patterns, Actions, Associative Arrays, String Functions, String Functions, Mathematical Functions, User Defined Functions, Using System commands in *awk*, Applications. [4P]
  8. **File Management:** File Structures, System Calls for File Management – *create, open, close, read, write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown*, Directory APIs – *opendir, readdir, closedir, mkdir, rmdir, umask* [4P]
  9. **Process Management:** Categories of process, Parent & Child process, Zombie and Orphan process, mechanism of *init()*, termination of a process, process control mechanism [4P]
  10. **Perl:** Scripting, Difference of Programming Language and Scripting Language, Basic scripting using PERL [4P]
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**Paper Name: Database Management System Lab**

**Paper Code: MCA 392**

**Credit: 3**

**Total: 40P**

**COURSE OBJECTIVES**

To educate students with

1. Practical Fundamental Concepts Of Database Management Systems
2. Implementing Data Models
3. Working with PL/SQL Database Languages.

**COURSE OUTCOME**

Upon successful completion of this course, students will be able to

1. To understand Database design methodology.
2. Acquire knowledge in fundamentals of Database Management System.
3. Be able to realise the difference between traditional file systems and DBMS.
4. Work with popular Database languages.
5. Realise various data models for Database and Write queries in SQL.

**Syllabus:**

1. **SQL:** SQL constructs, DDL, DML, DQL, Views and Different Data Constraints. [8P]
  2. **Built-in functions:** Group Functions, Scalar Functions, Aggregate functions, Numeric functions, Date functions, Conversion functions. [8P]
  3. **Join:** Joining multiple tables, Inner Join, outer Join, Cross Join, Self Join. [4P]
  4. **Sub-Queries:** Parallel Sub-Query, Nested Sub-Query, Correlated Sub-Query. [8P]
  5. **Introduction to PL/SQL:** Control structure, Construct PL/SQL block, Processing. [4P]
  6. **PL/SQL Database Objects:** Creation and execution of Functions/Procedures/Packages, Database Trigger constructs. [8P]
- 

**Paper Name: Object Oriented Programming using C++ Lab**

**Paper Code: MCA 393**

**Credit: 3**

**Total: 40P**

**COURSE OBJECTIVES**

1. To get a clear understanding of object-oriented programming concepts.
2. To learn problem solving using C++ programming language.

**COURSE OUTCOME**

Upon successful completion of this course, Student will be able to

1. Develop program using Object Oriented programming concepts.
2. To implement the concepts of Class, Object, Constructor, Destructor, Abstraction, Inheritance and Polymorphism.
3. Gain knowledge of Files, Streams, Templates and exception handling.

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Syllabus:

1. Creating class and object
2. Constructor and destructor – create, use different types of constructor
3. Function overloading, inline function, default arguments
4. Implementation of Multiple Inheritance
5. Implementation of Multilevel Inheritance
6. Using static function and static member variable
7. Implementation of aggregation
8. Constructor in aggregation
9. Concept of Friend function and Friend Class
10. Operator overloading - concept and implementation
11. Implementation of virtual function
12. Design of abstract class and pure virtual function
13. File handling programs

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### SESSIONAL

**Paper Name: Technical Seminar**

**Paper Code: MCA 380\***

**Credit: 0**

**COURSE OBJECTIVE:** The Aim of this Course is to develop different types of skills leading to the achievement of the following competency:

1. Acquire different learning abilities in cognitive, psychomotor and affective domains.
2. Gain knowledge of fast and rapid changing Information technology by self learning.
3. Prepare models/charts/reports based on collected information.
4. Prepare presentation in proper format.
5. Develop communication, interpersonal and presenting skills.
6. Handle questions after the presentation with confidence.

### **COURSE OUTCOMES :**

After this course the students will be able to

1. Acquire different learning outcomes in cognitive, psychomotor and affective domains.
2. Gain knowledge of fast and rapid changing Information technology by self learning.
3. Prepare models/charts/reports based on collected information.
4. Prepare presentation in proper format.
5. Show communication, interpersonal and presenting skills.
6. Handle questions after the presentation with confidence.

### **Execution Guidelines:**

There is no specific content in this course; however, teachers/students are supposed to follow the following guidelines for technical seminar/model making:

1. Students will select topics on their own, the topics may be on any aspect of the information technology but normally beyond the curriculum.
2. Student would organize preliminary presentations before faculty and other students, in which he/she would explain what is the topic or topics? Why they have chosen this? And what are they going to do

## **Course Curriculum & Syllabus of Master of Computer Application (MCA) Program**

in it? Based on this presentation, faculty would approve or help them in finalization of the topic and would give suggestions for further improvement. The presentation by one student/group and discussion on the presentation would also be a learning feat for other groups.

3. Faculty should ensure that though topic is challenging to students, it should be feasible and within capabilities of the group of the students.
4. It is mandatory that each student will present individually a seminar/model on agreed topic. Student can make working/ demonstrative models and give presentation/seminar on it.
5. In a session of three periods per week, Students are expected to present the progress of seminar/ model to the concerned faculty and take help of them if required.
6. These three periods per week may also be used by faculty for arranging presentation by each student on a small topic (but different than their main topic) for 5 to 10 minutes duration. This would give more chances to each student for learning and presenting.
7. During the final seminar sessions each student (In case of group, max. of 4) is expected to prepare and present a topic on engineering/ technology for a duration of not less than 15 minutes.
8. The student has to submit a hard copy of the technical report, in the form of a Title Page, Introduction, Chapters and a Conclusion with References, running not less than 20 pages; this will be evaluated by the faculty coordinator or the guide. Original references will be highly appreciated.
9. At the end of the semester students would have to submit the posters/charts/ model/presentations.
10. For every group of students a faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance.
11. Students are encouraged to use various teaching aids such as over head projectors, powerpoint presentation and demonstrative models.

### **Assessment Guidelines:**

The progressive assessment may be carried out based on the following criteria:

1. Innovativeness of the topic
2. Initiative and efforts taken in searching the topic
3. Amount and quality of material collected related to topic by searching library/internet/IT companies/society in general etc.
4. Creativity and innovativeness in preparing models/charts/presentations etc.
5. Planning the activities and then pursuing that plan.
6. Persistence in the efforts and resourcefulness.
7. Team work of the members and the team leader.
8. Communication skills.
9. Sharing of the load within the group.
10. Timely achievement of the targets.

**Note: -\*It is advisable to upload three best PPT Presentations in the Departmental Website for future references.**

## **MCA 4th Semester**

### **THEORY**

**Paper Name: Formal Languages and Automata Theory**

**Paper Code: MCA 401**

**Credit: 4**

**Total: 40L**

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### COURSE OBJECTIVES

1. The goal of this course is to teach you to formulate, analyze, and solve mathematical models that represent real-world problems.
2. To learn linear programming, network flow problems, integer programs, nonlinear programs, dynamic programming and queueing models.

### COURSE OUTCOMES

Upon completion of this course, Students will be able to:

1. Understand basics of Languages, Grammars and Finite Automata.
2. Learn Regular Expression, Regular Grammar, Context Free Languages, Pushdown Automata and Turing Recognizable Languages.
3. Be exposed to a broad overview of the theoretical foundation of computer science with analytical thinking for problem-solving in related areas.

### Syllabus:

**Module 1: Introduction:** Alphabets, strings, and languages. [4L]

**Module 2: Finite Automata and Regular Languages:** Deterministic and non-deterministic finite automata, regular expressions, regular languages and their relationship with finite automata, pumping lemma and closure properties of regular languages. [10L]

**Module 3: Context Free Grammars and Pushdown Automata:** Classification of grammars, Chomsky hierarchy, Context free grammars (CFG), parse trees, ambiguities in grammars and languages, pushdown automaton (PDA) and the language accepted by PDA, deterministic PDA, Non-deterministic PDA, properties of context free languages; normal forms. [12L]

**Module 4: Turing Machines:** Turing machine as a model of computation, programming with a Turing Machine, variants of Turing machine and their equivalence, universal Turing machine [6L]

**Module 5: Undecidability:** Recursively enumerable and recursive languages, undecidable problems about Turing machines: halting problem, Post Correspondence Problem, and undecidability problems about CFGs. [8L]

### Text Books:

1. J. E. Hopcroft, R. Motwani, and J. D. Ullman, Introduction to Automata Theory, Languages and Computation , 2<sup>nd</sup> Ed, Addison-Wesley, 2001
2. K.L.P Mishra & Chandrasekharan, Theory of Computer Science: Automata, Languages And Computation, PHI.

### Reference Books:

1. H.R. Lewis, C.H. Papadimitriou, C. Papadimitriou, Elements of the Theory of Computation (2<sup>nd</sup> Ed.), Prentice-Hall, NJ, 1997
2. J.A. Anderson, Automata Theory with Modern Applications, Cambridge University Press, 2006.

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### Paper Name: Computer Graphics & Multimedia

**Paper Code: MCA 402**

**Credits: 4**

**Total: 40L**

### COURSE OBJECTIVES

This course is designed to provide

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

1. a comprehensive introduction to computer graphics
2. the ability to understand
  - a. contemporary terminology
  - b. progress
  - c. issues
  - d. trends.

### COURSE OUTCOMES

Upon successful completion of this course, students will be able to -

1. Understand contemporary graphics hardware. Display mechanism, Input output mechanism.
2. Able to do scan-conversion and display objects on screen, fill regions, draw curves.
3. Able to transform objects in 2D and 3D, Clip object in 2D using different mechanisms.
4. Detect visible surfaces using algorithms, get working knowledge of multimedia.

### Syllabus:

**Module 1: Introduction:** Application of Computer Graphics, interactive input/output devices, display, colour display techniques, LCD & LED display, Raster Scanning, Raster Refresh [4L]

**Module 2: Points, lines and curves:** DDA & Bresenham Line drawing algorithms, circle and ellipse drawing, polygon filling anti aliasing, Scan conversion, [5L]

**Module 3: Two-dimensional viewing & Clipping:** Coordinate systems, line and polygon clipping Algorithms: Cohen- Sutherland Algorithm, Midpoint subdivision algorithm, Sutherland-Hodgman Polygon Clipping. Weiler-Atherton Algorithm [6L]

**Module 4: 2-D Transformations:** Scaling, Rotation, Translation, Reflection, Shear, Homogeneous coordinate system, Rotation about an arbitrary point, reflection in an arbitrary straight line [5L]

**Module 5: Curves and Surfaces:** Bezier curves and surfaces, B-Spline curves and surfaces. [4L]

**Module 6: 3-D Transformations:** Scaling, Rotation, Translation, Reflection, Rotation about an arbitrary straight line, reflection in an arbitrary plane, Parallel projections, Perspective projections [5L]

**Module 7: Hidden Surface Removal:** Z-Buffer Algorithm, Scan line Z Buffer Algorithm, Painter's Algorithm, Shading models and colour models. [3L]

**Module 8: Multimedia:** Evolution of Multimedia, Structure and Components of Multimedia. Multimedia platforms, Application domains, Multimedia & interactivity [3L]

**Module 9: Audio Compression Techniques:** Need for compression, DPCM, ADPCM, SBC, MPEG [2L]

**Module 10: Video Technology:** Analog Video and its Principles, Digital Video and its Principles. [2L]

**Module 11: Video Compression:** MPEG [1L]

### Text Books:

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

1. Computer Graphics, 2nd Ed., Hearn & Baker, PHI
2. Procedural & Mathematical Elements in Computer Graphics, Rogers, TMH

### Reference Books:

1. Fundamentals of Computer Graphics & Multimedia, Mukherjee, PHI
  2. Computer Graphics, Plastock, Schaum's Outline Series, TMH
  3. Computer Graphics, a programming approach, by S. Harrington, TMH publication.
  4. Computer Graphics, Multimedia Animation, Malay Pakhira, 2<sup>nd</sup> Ed, PHI
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### Paper Name: Programming with Java

**Paper Code: MCA 403**

**Credit: 4**

**Total: 40L**

### COURSE OBJECTIVE

1. To introduce students to the Java programming language.
2. To create Java programs that leverage the object-oriented features of the Java language, such as
  - a. encapsulation
  - b. inheritance
  - c. polymorphism;
  - d. use of data types, arrays and other data collections
3. To implement I/O functionality to read from and write to text files.

### COURSE OUTCOMES

Upon successful completion of this course, student will be able to

1. Understanding of the principles and practice of object oriented analysis and design in the construction of robust, maintainable programs which satisfy their requirements;
2. Ability to implement, compile, test and run Java programs comprising more than one class, to address a particular software problem.
3. Demonstrate the principles of object oriented programming;
4. Demonstrate the ability to use simple data structures like arrays in a Java program.
5. Understand the concept of package, interface, multithreading and File handling in java.
6. Ability to make use of members of classes found in the Java API (such as the Math class).

### Syllabus:

#### Module 1 : An introduction to Java [1L]

Brief History, Salient features

#### Module 2 : Java Programming Environment [2L]

Java Development Kit.

#### Module 3 : Fundamental Programming structures in Java [4L]

Data types, Variables and Constants, Operators, Strings & String Buffer, Input & Output, Control Flow, Arrays, Conversions

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Module 4 : Objects and Classes [3L]

Objects, Defining your own classes, Static fields & methods, Object Constructions

### Module 5 : Packages [2L]

Creating & accessing packages, adding a class to a package, hiding classes

### Module 6 : Inheritance [4L]

Classes, Superclasses & Subclasses, Object – The Universal Super class, Object Wrappers, vectors, Enumeration Classes.

### Module 7 : Interface and Inner Classes [3L]

Interface, Polymorphism & Interface, Cloning, Inner Classes.

### Module 8 : Graphics Programming [3L]

Introduction to AWT & SWING, Creating Frames, Working with D Shapes.

### Module 9 : Event Handling [2L]

Basics of event handling, The AWT event hierarchy.

### Module 10 : User- Interface Components with Swing [4L]

Model-View-Controller Design pattern, Layout Managers, Text Input, Choice components, Menus, Dialog boxes.

### Module 11 : Exception Handling [4L]

Classification of exceptions, declaring checked exceptions, How to throw an exception, creating exception classes, Catching exceptions, re throwing and chaining exceptions, The finally clause.

### Module 12 : Applets [3L]

Applets basics, Applets HTML tags and attributes, Inter-applet communication.

### Module 13 : Multithreading [2L]

Thread basics, Thread states, Thread properties, Synchronization, Thread & Swing.

### Module 14 : File and Object [3L]

I/O Streams & Stream Classes, Data streams, Text streams, ZIP file streams, String Tokenizer, Object streams.

### Text Books:

1. Programming with Java: A Primer, 5<sup>th</sup> Ed, E Balagurusamy, TMH
2. Object Oriented Programming with JAVA: Wu, TMH.

### Reference Books:

1. Core Java, Volume I & II: Cays Horstmann, Gary Cornell, Pearson Publication, 7th Edition.
2. Complete Reference for JAVA: Herbert Schildt.

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**Paper Name: Artificial Intelligence**

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

**Paper Code: MCA 404**

**Credit: 4**

**Total: 40L**

### **COURSE OBJECTIVE**

The goal of learning **Artificial Intelligence** is

1. to build software systems that behave "intelligently" like Human beings .
2. To present an overview of Artificial Intelligence (AI) principles and approaches.
3. To introduce core topics of knowledge representation, reasoning, and learning, all from the perspective of probabilistic methods, Natural Language Processing, etc.

### **COURSE OUTCOMES**

Upon successful completion of this course, students will be able to -

1. Understand basic concepts of Artificial intelligence, early developments in this field, basic knowledge representation, problem solving, and learning methods of Artificial Intelligence
2. Understand the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular problems, game playing as problem solving.
3. Representation of a game as a state space, state space search, heuristic search, blind and informed search.
4. Understand Natural language processing, expert system, modern developments in the field of AI , Soft Computing, Image processing, Robotics etc.

### **Syllabus:**

#### **Module 1: Introduction [5L]**

Artificial Intelligence: Definition, Foundation, History, Applications, Techniques, Early works Programming languages for AI, Soft Computing, Bio-Inspired Computing. Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents.

#### **Module 2: Problem Solving Using AI [8L]**

Defining a problem as a state space, Problem solving as state space search, production system, control strategies, characteristics of good control strategies, Reasoning - forward & backward chaining, Minimax and game trees, Alpha – Beta pruning, Constraints satisfaction Problem.

#### **Module 3: Search Algorithms [6L]**

Blind and Informed search techniques, Breadth First Search, Depth-first Search, Iterative Deepening, Uniform Cost Search, Hill-climbing, Best-First Search, Branch and Bound, Dynamic programming, A\*, AO\*, Simulated Annealing. Adversarial search - Game playing

#### **Module 4: Knowledge Representation [7L]**

Classification of Knowledge, Structured Knowledge Representation Techniques, Well formed formula, Predicate Calculus in AI, First order predicate logic, Method of Resolution using Refutation, Semantic networks, frames, conceptual dependency, Ontology, Expert systems. Basic knowledge of programming language - Prolog & Lisp

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Module 5: Reasoning under Uncertainty [4L]

Non Monotonic Reasoning Systems, Truth Maintenance System, Probabilistic Reasoning, Concept of Fuzzy Set, Conditional probability, Bayes Theorem.

### Module 6: Machine Learning [7L]

Decision Trees, Artificial Neural Networks, Learning theory, Supervised and Unsupervised learning, Reinforcement learning, Inductive learning, cognitive computing

### Module 7: Soft Computing [3L]

Introduction, Components of Soft Computing, Importance of Soft Computing, Applications, Genetic Algorithms, Artificial Neural Network.

#### Text Books:

1. *S. Russell and P. Norvig*, Artificial Intelligence: A Modern Approach 2<sup>nd</sup> Ed., Pearson Education, 2005.
2. *Elaine Rich and Kelvin Knight*, Artificial Intelligence, Tata McGraw Hill, 2002

#### Reference Books:

1. *Nils J Nilson*, Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers, Inc., San Francisco, California, 2000.
2. *R. Akerkar*, Introduction to Artificial Intelligence, Prentice-Hall of India, 2005
3. *Dan W. Patterson*, Introduction to Artificial Intelligence and Expert Systems, Prentice Hall of India, 2006.
4. *Nils J. Nilson*, Principles of Artificial Intelligence, Narosa Publishing House, 2001
5. *Clocksini and C.S. Mellish*, Programming in PROLOG, Narosa Publishing House, 2002.
6. *Saroj Kaushik*, Logic and Prolog Programming, New Age International Publisher, 2006

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### Paper Name: Values & Ethics

Paper Code: HU 401

Credit: 4

Total: 40L

#### COURSE OBJECTIVES

Prime objective of this course is

1. Creating awareness among technical students about the importance of professional ethics
2. The effect of technology on the societal issues
3. How to develop technologies that do not disturb the psychological well being of the society

#### COURSE OUTCOME

Upon successful completion of this course, students will be able to

1. Know the importance of ethics and methods of developing technologies
2. Describe the structure and function of an ethical society..
3. Identify the values and ethics of professional development.
4. Explain the causes, effects and control measures for various types of societal failures.
5. Select the appropriate methods for self management.

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

6. Get knowledge about various ethical management methods
7. Recall social issues and legal provisions.

### Syllabus:

#### Module 1 : Effects of Technological Growth [15L]

1. Science, Technology and Engineering as Knowledge and as Social and Professional Activities
2. Rapid Technological growth and depletion of resources. Reports of the Club of Rome. Limits of growth; sustainable development
3. Energy Crisis; Renewable Energy Resources
4. Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations. Environmental Ethics
5. Appropriate Technology Movement of Schumacher: later developments
6. Technology and developing nations. Problems of Technology transfer. Technology assessment, impact analysis
7. Human Operator in Engineering projects and industries. Problems of man machine interaction. Impact of assembly line and automation. Human centered Technology

#### Module 2 : Profession and Human Values [15L]

8. Nature of values: Value Spectrum of a 'good' life
9. Value Crisis in contemporary society
10. 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
11. Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity
12. Moral and ethical values: Nature of moral judgments; canons of ethics; Ethics of virtue; ethics of duty; ethics of responsibility

#### Module 3 : Ethics of Profession [6L]

13. 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

#### Module 4 : IPR [4L]

Introduction to IPR, IPR Laws in India

#### Text Books:

1. Blending the best of the East & West, Dr. Subir Chowdhury, EXCEL
2. Ethics & Mgmt. & Indian Ethos, Ghosh, VIKAS

#### Reference Books:

1. Business Ethics, Pherwani, EPH
2. Ethics, Indian Ethos & Mgmt., Balachandran, Raja, Nair, Shroff Publishers
3. Values & Ethics of Profession & Business, S.K. Sarangi, Asian Books Private Limited

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## PRACTICAL

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Paper Name: Computer Graphics & Multimedia Lab

Paper Code: MCA 492

Credit: 3

Total: 40P

### COURSE OBJECTIVES

This course is designed to provide

1. A hands-on introduction to computer graphics
2. The ability to understand
  - a. contemporary terminology
  - b. progress
  - c. issues
  - d. trends.

### COURSE OUTCOMES

Upon successful completion of this course, students will be able to -

1. Experience contemporary graphics hardware/software, Display mechanism, Input output mechanism.
2. Able to do scan-conversion and display objects on screen, fill regions, draw curves.
3. Able to transform objects in 2D and 3D, Clip object in 2D using different mechanisms.
4. Detect visible surfaces using algorithms, get working knowledge of multimedia.

### Syllabus :

1. Concept of text mode and graphics mode, switch from one mode to another [1P]
2. Introduction to useful library functions of **graphics.h**, *initgraph( )*, *closegraph( )*, *cleardevice( )*, *putpixel( )*, *getcolor( )*, *setcolor( )*, *setbkcolor( )*, *settextstyle( )*, *setlinestyle( )*, *setfillstyle( )*, *outtext( )*, *outtextxy( )*, *floodfill( )*, *moveto( )*, *lineto( )*, *line( )*, *circle( )*, *rectangle( )*, *arc( )*, *pieslice( )*, *putimage( )*, *getx( )*, *gety( )*, *getmaxx( )*, *getmaxy( )* etc. [3P]
3. Line drawing using DDA algorithm, Bresenham's algorithm [3P]
4. Circle drawing using Midpoint Circle Drawing algorithm, Bresenham's algorithm [3P]
5. Ellipse drawing using Midpoint Ellipse algorithm [3P]
6. 2D Transformation : Translation, Rotation, Scaling, Reflection, Shearing [3P]
7. 2D Transformation using Homogeneous Coordinates : Translation, Rotation, Scaling, Reflection [3P]
8. 2D Transformation with respect to some pivot point other than origin [3P]
9. A series of 2D Transformation applied on the same object [3P]
10. Area filling : Flood fill, Boundary fill [3P]
11. Line clipping : Using Cohen- Sutherland Algorithm, Mid-point subdivision algorithm, Cyrus-Beck line clipping algorithm [3P]
12. Polygon clipping : Using Sutherland-Hodgeman polygon clipping algorithm [3P]
13. Drawing Curves : Bezier Curve with 4 control points,  $3n + 1$  control points [3P]
14. Drawing Curves : B-Spline curve with 4 control points, n control points [3P]

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### Paper Name: Java Lab

Paper Code: MCA 493

Credit: 3

Total: 40P

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### COURSE OBJECTIVE

1. To introduce students to hands-on Java programming language.
2. To create Java programs that leverage the object-oriented features of the Java language, such as
  - a. encapsulation
  - b. inheritance
  - c. polymorphism;
  - d. use of data types, arrays and other data collections
3. To implement I/O functionality to read from and write to text files.

### COURSE OUTCOMES

Upon successful completion of this course, student will be able to

1. Understanding of the principles and practice of object oriented analysis and design in the construction of robust, maintainable programs which satisfy their requirements;
2. Ability to implement, compile, test and run Java programs comprising more than one class, to address a particular software problem.
3. Demonstrate the principles of object oriented programming;
4. Demonstrate the ability to use simple data structures like arrays in a Java program.
5. Understand the concept of package, interface, multithreading and File handling in java.
6. Ability to make use of members of classes found in the Java API (such as the Math class).

### Syllabus:

1. Creating and working with class and object [2P]
2. Constructor – create, use different types of constructor [2P]
3. String and StringBuffer [4P]
4. Package - create & access [4P]
5. Polymorphism [4P]
6. Frame Creation - AWT and Swing [4P]
7. Model view controller design pattern [4P]
8. Exception Handling [4P]
9. Creation of APPLETs [4P]
10. Implementation of Multithreading [4P]
11. File handling programs [4P]

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**Paper Name: Visual Basic Lab**

**Paper Code: MCA 495**

**Credit: 4**

**Total: 40P**

### COURSE OBJECTIVE

1. To introduce students to hands-on visual programming language
2. To create VB programs that leverage the visual and object-oriented features of the language,
3. To implement Form based project and database connectivity.

### COURSE OUTCOMES

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

Upon successful completion of this course, student will be able to

1. Design, create, build, and debug Visual Basic applications.
2. Explore VB IDE and implement syntax rules in VB programs.
3. Explain variables and data types, apply arithmetic operations in program development.
4. Apply decision control structures, loop control structures, write and apply procedures, sub-procedures, and functions to create manageable code.
5. Write VB programs using object-oriented programming techniques including classes, objects, methods, instance variables, composition, and inheritance, and polymorphism.
6. Write Windows applications using forms, controls, and events.
7. Develop VB applications with database connectivity and file handling.

### Syllabus:

**Module 1: Computer Programming with Visual Basic:** Presents Interface Features, Menus, Tools, Different Controls [8P]

**Module 2: Different Constructs and Applications:** Decision Structures (ifs and Select Case), Loops (While, for, etc.), Loop Applications, Creation of Array in Visual Basic [8P]

**Module 3: VB Functions and Procedures:** Creation and Execution of Sub Procedures (Val and Ref Parameters), Procedures and Functions and employment of them in different Applications [8P]

**Module 4: Connecting with SQL and Oracle Database using Data Controls:** Accessing Databases using the various Data Access Objects and Remote Data Objects, Accessing Databases in SQL Server using the various Data Access Objects and Remote Data Objects [8P]

**Module 5: Objects and Classes:** Implementation of Visual Basic in Object Oriented Paradigm, Building own Objects, Classes and Class Modules [8P]

### Sample Programs:

1. Comparison of two Numbers
2. Even or Odd Number
3. Prime or Non Prime Number
4. Simple and Compound Interest
5. Armstrong Number
6. Palindrome
7. Leap Year
8. Factorial
9. Fibonacci Series
10. Bubble Sort
11. Selection Sort
12. Insertion Sort
13. Binary Search
14. Linear Search
15. Simple Calculator



## MCA 5<sup>th</sup> Semester

### THEORY

**Paper Name: Distributed Systems**

**Paper Code: MCA 501**

**Credits: 4**

**Total Contact: 40L**

#### **COURSE OBJECTIVES:**

- This course provides an introduction to the fundamentals of distributed computation systems, assuming the availability of facilities for data transmission.
- The structure of distributed systems using multiple levels of software is emphasized. Specific topics include:
  - distributed algorithms
  - distributed file systems
  - distributed databases
  - security and protection
  - distributed services such as the world-wide web and
  - examples of research and commercial distributed systems

#### **COURSE OUTCOMES:**

- The student will explain various architectures used to design distributed systems, such as client-server and peer-to-peer.
- The student will build distributed systems using various interprocess communication techniques, such as remote method invocation, remote events, and tuple spaces.
- The student will build distributed systems using various techniques for tolerating partial failures, such as leasing and replication.
- The student will explain various distributed algorithms, such as logical clocks and leader election
- The student will analyze and explain current distributed systems research literature.

#### **Syllabus :**

##### **Module 1: Characterization of Distributed Systems [4L]**

Introduction, advantages and examples of distributed systems Models of distributed systems.

##### **Module 2: Communication Issues [4L]**

External data representation and marshalling, client-server communication, peer-to-peer communication, remote procedure calls.

##### **Module 3: Fundamental Issues in Distributed Systems [4L]**

Event ordering and logical clocks, global state collection, physical clock synchronization, mutual exclusion,

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

leader election, termination detection, spanning tree construction, routing.

### Module 4: Fault Tolerance [4L]

Fault models, types of tolerance, Agreement protocols, Reliable broadcast and multicast, Check pointing and recovery.

### Module 5: Distributed File Systems [4L]

File service architecture, case studies: Sun network file systems and Andrew file system.

### Module 6: Name Services [4L]

Name services and the Domain Name System, Directory and Discovery Services.

### Module 7: Distributed Transaction [4L]

Flat and Nested distributed Transaction, Atomic commit protocols, Concurrency control in distributed transactions, Distributed Deadlocks, Transaction recovery.

### Module 8: Replication [4L]

System model and group communication, Fault-tolerant services, highly available services, transactions with replicated data.

### Module 9: Distributed Shared Memory [4L]

Design and Implementation Issues, Sequential consistency and Ivy, Release consistency and Munin, Other consistency models.

### Module 10: Security in Distributed Systems [4L]

Models, Authentication protocols – Kerberos.

### Text Books:

1. “Distributed Systems: Concepts & Design”, by George Coulouris, 5<sup>th</sup> Edition, Addison Wesley Pvt. Ltd.
2. “Distributed Systems : Principles and Paradigms”, by Tanenbaum & Steen, 2<sup>nd</sup> Edition, Prentice Hall of India.

### Reference Books:

1. “Distributed Operating Systems : Concepts and Design”, Pradeep K. Sinha, 1<sup>st</sup> Edition, Prentice Hall of India.
2. “Distributed Systems & Networks”, William Buchanan, 1<sup>st</sup> Edition, Tata McGraw Hill.
3. “Distributed Systems: An Algorithmic Approach”, Sukumar Ghosh, 2<sup>nd</sup> Edition, Chapman & Hall/CRC, Computer and Information Science Series.
4. “Distributed Algorithms”, Nancy Lynch, Morgan Kaufmann Publishers Inc.

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## ELECTIVES

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

**Paper Name: Advanced Java Technologies**

**Paper Code: MCAE 502A**

**Credits: 4**

**Total : 40L**

### **COURSE OBJECTIVES:**

1. To provide the ability to design
  - a. console based, GUI based and web based advanced applications.
2. Students will also be able to understand integrated development environment to
  - a. create, debug and run multi-tier and enterprise-level applications

### **COURSE OUTCOMES:**

- Students will be able to review the basic concepts of Java.
- Students will be able to understand basic web application architecture protocol and specification.
- Students will be able to analyze different web application problems and optimize the solutions
- Students will be able to apply Java web technology for developing projects to help the industry and individuals
- Students will be able to contribute to different open source standards in this field.

### **Syllabus:**

#### **Module 1 : Review of Basic Java Concepts [5L]**

Class, Object, method overloading ,Inheritance, overriding, object cloning, IO.

#### **Module 2 : Multithreading and Exception Handling [4L]**

Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads. Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes.

#### **Module 3 : Swing Programming [4L]**

Swing Origins, Components and containers, Difference between AWT and swing, small swing programs, swing apps, concept of delegation event model and listener

#### **Module 4 : Applet Programming [4L]**

Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets, concept of delegation event model and listener, I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text fields.

#### **Module 5 : JDBC [3L]**

Need and different approaches of persistence of data, Connecting to databases using *jdbc:odbc* bridge and Type-4 drivers, Executing basic CRUD using JDBC: *Statement*, *PreparedStatement*, *ResultSet*. Execution of batch SQL, Stored Procedures using *CallableStatement*, Transaction Failure management:

#### **Module 6 : Servlet [6L]**

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Concept of Dynamic Web pages, Web server versus Application server, Role of threading in a Server, Servlet-2.x API conforming to Web 2.0: Role of *web.xml* as deployment descriptor, request and response, Basic request handling, parameter retrieval, multiple parameter retrieval, inter-Servlet collaboration: Dispatching the request, Concept of state of web: Sessions , tracking session, Using Cookies and *jsessionId*, Parameter passing to and from session, Servlet Filters and common uses of Filters and Cookies. Migration to Servlet 3.x plus and omission of web.xml and concept of WebSocket.

### Module 7 : JSP [6L]

Benefits of JSP over Servlets, JSP scriptlets, page directives, declarations, action tags: `<jsp:useBean/>`, `<jsp:include/>` `<jsp:forward/>`, introducing MVC architecture .

### Module 8 : Java Mail [4L]

Sending Email , Sending email through Gmail server , Receiving Email , Sending HTML content

### Module 9 : STRUTS Framework [4L]

Introduction to STRUTS

#### Text Book:

1. Java -The Complete Reference, Herbert Schildt, Tata McGraw-Hill, 7th Edition, 2008.

#### Reference Book:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, 2nd Edition, PHI Learning, New Delhi, 2014.
2. Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Kogent Learning Solutions Inc, Dreamtech, 2015.

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## Paper Name: Python Programming

Paper Code: MCA E502B

Credits: 4

Total : 40L

### COURSE OBJECTIVES:

1. To introduce Python programming language through its core language basics and program design techniques suitable for modern applications.
2. To understand the wide range of programming facilities available in Python covering graphics, GUI, data visualization and Databases.
3. To utilize high-performance programming constructs available in Python to develop solutions in real life scenarios.

### COURSE OUTCOMES:

1. Design real life situational problems and think creatively about solutions of them.
2. Apply a solution clearly and accurately in a program using Python.
3. Apply the best features of Python to program real life problems

### Syllabus:

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Module 1: Introduction to Python [4L]

Two modes of using Python Interpreter , Variables and Data Types, Operators and their Precedence, Python Strings & Slicing, Python Lists, Mutable and Immutable Types, Input from the Keyboard

### Module 2: Loops and Iterations [4L]

Iteration: *while* and *for* loops, Python Syntax, Colon & Indentation, Syntax of 'for loops' , Conditional Execution: *if, elif and else* , Modify loops : *break* and *continue*

### Module 3: Functions, Strings & Lists [4L]

Functions, Optional and Named Arguments , Strings & Lists experiments, Split and Join  
Manipulating Lists , Copying Lists

### Module 4: Modules and Packages [4L]

Python Modules and Packages, Different ways to import Packages, File Input/Output  
The pickle module, Formatted Printing, Exception Handling

### Module 5: Graphics, GUI and Object Oriented Programming [4L]

Turtle Graphics, Writing GUI Programs, Object Oriented Programming in Python,  
Inheritance, reusing code

### Module 6: Arrays and Matrices [4L]

The NumPy Module, Creating Arrays and Matrices, Copying, Arithmetic Operations,  
Cross product & Dot product , Saving and Restoring, Matrix inversion, Vectorized Functions

### Module 7: 2D & 3D Data Visualization [4L]

The Matplotlib Module, Multiple plots, Polar plots, Pie Charts, Plotting mathematical functions, Sine function and friends, Parametric plots, Astroid, Ellipse, Spirals of Archimedes and Fermat, Polar Rose, Power Series & Fourier Series, 2D plot using colors, Fractals, Meshgrids, 3D Plots, Surface Plots & Line Plots, Wire-frame Plots, Mayavi, 3D visualization

### Module 8: Files and Streams [4L]

File related modules in Python, File modes and permissions, Reading & Writing data from a file,  
Redirecting output streams to files, Working with directories, CSV files and Data Files

### Module 9: Python and Databases [4L]

ODBC and Python, Working with Databases in MySQL, Working with Tables in MySQL  
Managing users in MySQL, Accessing MySQL data from Python, Working with SQLite Database

### Module 10: Python Networking [4L]

Launching HTTP server in Python, Creating own TCP server in Python, Making HTTP requests,  
Working with TCP & UDP

### Text books:

1. Python for Education – Ajith Kumar B. P., Inter University Accelerator Center, New Delhi, 2010
2. Python Training Guide – Mercury Learning & Information USA, BPB Publications, 2015

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### References:

1. Learn to Program, University of Toronto: <https://www.coursera.org/learn/learn-to-program>
  2. Spoken Tutorial - IIT Bombay: <https://swayam.gov.in/course/4178-spoken-tutorial-python-english>
  3. Python Cookbook: Recipes for Mastering Python 3, 3rd Edition, David Beazley & Brian K. Jones, O'Reilly Media, Inc., 2013
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**Paper Name: Linux System Administration**

**Paper Code: Code: MCA E502C**

**Credits: 4**

**Total Contact: 40L**

### COURSE OBJECTIVES:

1. To introduce the concept of System & Network Administration in light of Linux.
2. To learn Advanced Administration concepts in the Linux Environment.
3. To introduce automation of system administrative tasks using shell/python scripts.
4. To enable the learner to become Linux System Administrator in the IT Industries

### COURSE OUTCOMES:

1. Make appropriate decisions during the configuration process to create a properly functioning Linux environment.
2. Use programs and utilities to administer a Linux machine.
3. Explain how a Linux server can be integrated within a multi-platform environment.
4. Analyze the need for security measures for a Linux environment.
5. Identify the different uses and advantages of Linux in a business environment

**Prerequisites:** Basic UNIX & Shell/Python Scripting Concepts

### Syllabus:

#### **Module 1 : [2L]**

Introduction to System Administration  
User Management in Linux

#### **Module 2 : [2L]**

Linux Booting Process  
Starting Up and Shutting Down  
Run level Management

#### **Module 3 : [6L]**

Linux Data Management

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*disk management*

*files management*

### **Module 4 : [4L]**

Essential System Administration Tools

### **Module 5 : [6L]**

TCP/IP Network Administration

Network Configuration

Telnet/SSH Configuration

NFS Configuration

FTP Configuration

### **Module 6 : [6L]**

TCP/IP Network Administration

HTTP Configuration

DNS Configuration

DHCP Configuration

### **Module 7 : [4L]**

System Security

Firewall Configuration

### **Module 8 : [4L]**

Shell/Python Scripting for Linux Administration

### **Module 9 : [6L]**

Case Studies

### **Text books:**

- Linux Administration: A Beginner's Guide, 6th Edition, Wale Soyinka, The McGraw-Hill Company, 2017
- Linux Administration, Kogent Learning Solutions, Dreamtech Press, 2012

### **References:**

- Red Hat Linux Networking and System Administration, 3rd Edition, Terry Collings and Kurt Wall, Wiley, 2005.
- Linux Web Tutorials: <http://www.yolinux.com/TUTORIALS/index.html>
- Linux System Administrator's Guide: <http://tldp.org/LDP/sag/html/sag.html>
- Python for Unix and Linux System Administration, Jeremy Jones & Noah Gift, O'Reilly Media, 2009
- Linux Admin - Shell Scripting :  
[https://www.tutorialspoint.com/linux\\_admin/linux\\_admin\\_shell\\_scripting.htm](https://www.tutorialspoint.com/linux_admin/linux_admin_shell_scripting.htm)

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Paper Name: Computational Intelligence

Paper Code: MCA E503A

Credits: 4

Total: 40L

#### COURSE OBJECTIVES :

- To promote learners to the concept of Intelligent Computing
- To understand the concepts of Soft Computing and its applications.
- Introduce cognitive problem solving techniques using Artificial Neural Networks, Fuzzy Logic, and Evolutionary Algorithms
- To build real life problem solving skills using Computational Intelligence Techniques

#### COURSE OUTCOMES :

- Understand the fundamental concepts of computational intelligence and machine learning.
- Demonstrate awareness of the major challenges and risks facing computational intelligence and the complexity of typical problems within the field.
- To be able to implement solutions to various problems in computational intelligence

#### Syllabus:

##### Module 1: [4L]

Introduction to Computational Intelligence  
Introduction to Soft Computing and fundamental concepts  
Computational Learning Theory

##### Module 2: [6L]

Fuzzy Sets and Relations  
Fuzzy Logic and Approximate Reasoning

##### Module 3 : [8L]

Artificial Neural Networks  
Feature Selection using Principal Component Analysis [PCA]  
Supervised Learning with Artificial Neural Networks  
Back Propagation Neural Networks [BPNN]  
Radial Basis Function Neural Networks [RBFN]

##### Module 4 : [6L]

Unsupervised learning using K-means Clustering  
Fuzzy Pattern Recognition using Fuzzy C-means Clustering  
Competitive Learning using Self-Organising Features Map [SOM]

##### Module 5 : [8L]

Introduction to Evolutionary Computing [EC]  
Introduction to Genetic Algorithms [GA]  
Application of GA in Optimization Problems  
Application of GA in Machine Learning

##### Module 6 : [8L]

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

Emerging areas of Computational Intelligence  
Artificial Life  
Particle Swarm Optimization  
Artificial Immune Systems  
Rough Sets

### Text Books :

1. Computational Intelligence: Principles, Techniques and Applications, *Amit Konar*, Springer, 2005.
2. Soft Computing: Fundamentals and Applications, Revised Edition, *D K Pratihari*, Narosa Publishing House, 2015

### References:

1. Neural Networks & Learning Machines, 3ed, *Simon Haykin*, Pearson India, 2016.
2. Fuzzy Logic with Engineering Applications, 3ed, Timothy J. Ross, Wiley India, 2011
3. Genetic Algorithms, *David E. Goldberg*, Pearson India, 2008.

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### Paper Name: Mobile Computing

Paper Code: MCA E503B

Credits: 4

Total: 40L

### COURSE OBJECTIVES:

1. Identify the basic problems, strengths and current trends of mobile computing.
2. Explain the current wireless networking mechanisms for mobile computing.
3. Create novel mechanisms and systems for supporting mobile computing.
4. Analyse the performance of different networks and algorithms for mobile computing.

### COURSE OUTCOMES:

1. Describe wireless and mobile communications systems and be able to choose an appropriate mobile system from a set of requirements.
2. Be able to work around the strengths and weaknesses of mobile computing.
3. Understanding the Interface of a mobile computing system to hardware and networks.
4. Design applications on a mobile computing system interacting with servers and database systems.

### Syllabus:

#### Module 1: Introduction [5L]

Mobile Communications, Mobile Computing – Paradigm. Promises/Novel Applications and impediments and Architecture; GSM — Services. System Architecture. Radio Interfaces, Protocols. Localization, Calling, Handover, Security, New Data Services, GPRS, CSHSD, DECT.

#### Module 2: [Wireless] Medium Access Control [MAC] [10L]

Motivation for a specialized MAC [Hidden and exposed terminals. Near and far terminals], SOMA, FDMA

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TOMA, COMA, Wireless LAN/[IEEE 802.11], Mobile Network Layer IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration. Tunneling and Encapsulation, Route Optimization, DHCP.

### Module 3: Mobile Transport Layer [10L]

Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.

Database Issues: Database Hoarding & Caching Techniques. Client-Server Computing a Adaptation, Transnational Models, Query processing, Data Recovery Process & QoS Issues.

### Module 4: Data Dissemination and Synchronization [10L]

Communications Asymmetry. Classification of Data Delivery Mechanisms. Data Dissemination, Broadcast Models. Selective Tuning and Indexing Methods. Data Synchronization – Introduction. Software, and Protocols.

### Module 5: Mobile Ad hoc Networks [MANETs] [5L]

Introduction, Applications a Challenges of a MANET Routing, Classification of Routing Algorithms. Algorithms such as DSR. AODV. DSDV. etc. , Mobile Agents. Service Discovery.

#### Text Book:

1. "Mobile Communications", Jochen Schiller, Pearson Education, 2nd Edition, 2002

#### Reference:

1. "Wireless Communications: Principles and Practices", Theodore S. Rappaport, Pearson Education, 2nd Ed, 2002

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### Paper Name: Compiler Design

Paper Code: MCAE 503C

Credits: 4

Total: 42L

#### COURSE OBJECTIVES:

1. To introduce the major concept areas of language translation and compiler design.
2. To enrich the knowledge in various phases of compiler and its use, code optimization techniques, machine code generation, and use of symbol table.
3. To extend the knowledge of parser by parsing LL parser and LR parser.
4. To provide practical programming skills necessary for constructing a compiler.

#### COURSE OUTCOMES:

1. Construct parse tree, given a BNF grammar and a string over the appropriate alphabet.
2. Compute the FIRST set for a BNF grammar.
3. fix simple violations of constraints that preclude single symbol-lookahead, top-down, lookahead parsing
4. design and implement a single-symbol-lookahead, top-down, lookahead parser from a BNF grammar
5. enhance the parser to perform semantic tests as it parses an input

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

6. Draw the dynamic structure of the run-time stack when target code containing procedure/function calls is executed.

### Syllabus:

#### Module 1: Introduction [2L]

Programs, interpreters, and translators; Analysis-Synthesis model of translation; Examples of translators; Structure of a compiler; Issues in compiler design.

#### Module 2: Programming Language Basics [5L]

Language and Syntax, Grammars, Semantics and Pragmatics; Problem of Compilation. [3L]

The static/dynamic distinction, Environments and states, Static scope and block structures, Explicit access control, Dynamic scope, Parameter passing mechanisms, Aliasing. [2L]

#### Module 3: Lexical Analysis [7L]

Role of a lexical analyzer; Input buffering, Specification of tokens,

Recognition of tokens; Languages, Regular expressions, Regular definitions; Finite automata, Nondeterministic and deterministic finite automata, Transitions tables, Acceptance of input strings by automata, Conversion of an NFA to DFA; State-machine driven lexical analyzers and their implementations.

#### Module 4: Syntax Analysis [12L]

Role of a parser, Representative grammars, Context-free grammars, Parse trees, derivations and sentential forms, Ambiguity [2L]

Top down parsing, Predictive and Recursive descent parsing, Elimination of left recursions, Left factoring, FIRST and FOLLOW sets and their computations, LL(1) grammars, Error recovery techniques [4L]

Bottom up parsing, Reductions, Handle pruning, Shift reduce parsing; LR parsing, Implementing the parser as a state machine, viable prefixes, Items and the LR(0) automaton; Constructing SLR parsing tables: LR(0) grammars, SLR(1) grammars; Canonical LR(1) items and constructing canonical LR(1) parsing tables; Constructing LALR parsing tables [5L]

Using Yacc and Lex [1L]

#### Module 5: Semantics and Semantic Analysis [4L]

Syntax-directed translation, Attribute grammars, Inherited and synthesized attributes, Dependency graphs, Evaluation orders of attributes, S-Attributed definitions, L-attributed definitions, Syntax-directed translation schemes. [2L]

Symbol tables and their relationship to semantic objects; Symbol table implementation: binary trees vs. hashing. [2L]

#### Module 6: Intermediate Code Generation [2L]

Intermediate languages – Declarations – Assignment Statements – Boolean Expressions – Case Statements – Back patching – Procedure calls

#### Module 7: Code Optimization [4L]

Overview of optimization; Data Flow Analysis; Peephole Optimizations; Constant Folding, Common Sub-expression Elimination, Copy Propagation, Strength Reduction. Global Optimization: Loop optimizations; Induction Variable elimination, Optimizing procedure calls – inline and closed procedures. Machine-Dependent Optimization: Pipelining and Scheduling

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Module 8: Code Generation [2L]

Issues in the design of code generator – The target machine, Construction of executable code and libraries.

### Module 9: Runtime Environment [4L]

Static versus dynamic storage allocation, Names, scopes and bindings; Object lifetimes; Stack allocation; Access to non-local data on the stack; Heap management; Garbage collection.

### Text Book:

1. Compilers – Principles, Techniques, and Tools, by - Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman; 2nd Edition, Pearson Education.

### References:

1. Compiler Design in C, Allen I. Holub, Prentice Hall (Software Series).
  2. Crafting a Compiler with C, C. N. Fischer and R. J. LeBlanc, Pearson Education.
  3. Compiler Construction: Principles and Practice, Kenneth C. Louden, 1st edition, Thomson Learning.
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## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### **Paper Name: E-Commerce & Cyber Law**

**Paper Code: MCAE 504A**

**Credits: 4**

**Total: 40L**

#### **COURSE OBJECTIVES:**

1. To impart knowledge on E-Commerce, Various applications connected with E-Commerce and legal issues of e-commerce.
2. To enable the learner for aiming careers in special software development involving E-Commerce and M-Commerce technologies.

#### **COURSE OUTCOMES:**

1. Analyze the impact of E-commerce on business models and strategy
2. Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational structures.
3. Discuss legal issues and privacy in E-Commerce
4. Assess electronic payment systems and its securities.
5. Recognize and discuss global E-commerce issues

#### **Syllabus:**

##### **Module 1: Introduction to E-Commerce [5L]**

Definition, Scope of E-Commerce, Hardware requirements, E-Commerce and Trade Cycle, Electronic Markets, Electronic Data Interchange and Internet Commerce.

##### **Module 2: Business to Business E-Commerce [5L]**

Electronic Markets, Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, Implementations, Agreements, Security, EDI and Business, Inter-Organizational E-commerce. Business models for E-commerce, Business Process Re-Engineering.

##### **Module 3: Business to Consumer E-Commerce and E-Business [5L]**

Consumer trade transaction, Web metrics, Elements of E-Commerce, Industry impacts of E-business. Integrating Intranet and internet web applications across multiple networks. Internet bookshops, Software supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the net, E-Diversity, Case studies through internet.

##### **Module 4: Legal Issues [5L]**

What is cybercrime? Forgery, Hacking, Software Piracy, Computer Network intrusion  
Legal aspects, Indian laws, IT act, Public key certificate Legal issues for Internet Commerce: Trademarks and Domain names, Copyright, Jurisdiction issues, Service provider liability, Enforceable online contract. Risks: Paper Document vs. Electronic document, Authentication of Electronic document, Laws.

##### **Module 5: Security Issues [10L]**

Security Solutions: how criminals plan attacks, passive attack, Active attacks, cyber stalking ,Symmetric and Asymmetric Cryptosystems, RSA, DES, and Digital Signature, Protocols for secure messaging, Secure Electronic Transaction (SET) Protocol, Electronic cash over internet, Internet Security, Search engines, Intelligent agents in E-Commerce Electronic payment systems

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Module 6: Mobile Commerce & Security [10L]

E-security, Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cell phones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop.

#### Text Books:

1. E-Commerce: Strategy, Technologies & Applications, David Whitley, Mcgraw Hill, 2000.
2. E-commerce: The Cutting Edge Of Business, K. K. Bajaj and Debjani Nag, 2nd Edition, Mcgraw Hill, 2017.

#### Reference Books:

1. Handbook of Electronic Commerce, Shaw et al.,Springer, 2000
  2. Global Electronic Commerce- Theory and Case Studies, C. Westland and T. H. K. Clark, University Press, 2001.
  3. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Sunit Belapure and Nina Godbole, Wiley India, 2011.
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### Paper Name: Big Data

Paper Code: MCA E504B

Credits: 4

Total Contact: 40L

#### COURSE OBJECTIVES:

1. Introduce students the concept and challenge of big data (3 V's: volume, velocity, and variety).
2. Teach students in applying skills and tools to manage and analyze the big data.

#### COURSE OUTCOMES:

At the end of this course, learners will be able to:

1. Understand the concept and challenge of big data and why existing technology is inadequate to analyze the big data;
2. Collect, manage, store, query, and analyze various form of big data
3. Gain hands-on experience on large-scale analytics tools to solve big data problems using Hadoop
4. Understand the impact of big data for business decisions and strategy.

#### Syllabus:

##### Module 1: INTRODUCTION TO BIG DATA [5L]

Introduction – distributed file system – Big Data and its importance

Four Vs, Drivers for Big data,

Big data analytics, Big data applications.

Algorithms using MapReduce, Matrix-Vector

Multiplication by MapReduce.

##### Module 2: INTRODUCTION TO HADOOP [5L]

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

Big Data – Apache Hadoop & Hadoop EcoSystem  
Moving Data in and out of Hadoop  
Understanding inputs and outputs of MapReduce  
Data Serialization.

### **Module 3: HADOOP ARCHITECTURE [10L]**

Hadoop Architecture  
Hadoop Storage: HDFS,  
Common Hadoop Shell commands  
Anatomy of File Write and Read.,  
NameNode, Secondary NameNode, and DataNode,  
Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers  
Cluster Setup – SSH & Hadoop Configuration  
HDFS Administering –Monitoring & Maintenance.

### **Module 4: HADOOP ECOSYSTEM AND YARN [10L]**

Hadoop ecosystem components  
Schedulers - Fair and Capacity,  
Hadoop 2.0 New Features-  
NameNode High Availability,  
HDFS Federation,  
MRv2, YARN, Running MRv1 in YARN.

### **Module 5: HIVE AND HIVEQL, HBASE [10L]**

Hive Architecture and Installation,  
Comparison with Traditional Database,  
HiveQL - Querying  
Data - Sorting And Aggregating,  
Map Reduce Scripts,  
Joins & Subqueries, HBase concepts-  
Advanced Usage, Schema Design,  
Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster,  
HBase uses Zookeeper and how to Build Applications with Zookeeper.

### **Text Book:**

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.

### **References:**

1. Chris Eaton, Dirk deroos et al. , “Understanding Big data ”, McGraw Hill, 2012.
2. Tom White, “HADOOP: The definitive Guide” , O'Reilly 2012.

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**Paper Name: Image Processing**

**Paper Code: MCAE 504C**

**Credits: 4**

**Total: 44L**

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### COURSE OBJECTIVES:

1. To know about image fundamentals and mathematical transforms necessary for image processing.
2. To gather knowledge about image enhancement techniques
3. To know about image restoration procedures.
4. To learn the image compression procedures.
5. To study the image segmentation and representation techniques.

### COURSE OUTCOME:

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques.
5. Interpret Image compression standards.
6. Interpret image segmentation and representation techniques.

### Syllabus:

#### Module 1: Introduction to Digital Image Processing [9L]

Elements of digital image processing systems, Vidicon and Digital Camera working principles, Elements of visual perception Brightness, contrast, hue, saturation, mach band effect, Color image fundamentals - RGB, HSI models, Image sampling and quantization, Dither Two-dimensional mathematical preliminaries, Two-dimensional mathematical preliminaries, Introduction to Fourier Transform and DFT, Discrete Cosine Transform and its properties, Karhunen – Loeve transforms and its properties, Singular Value Decomposition and its properties.

#### Module 2: Image Enhancement [9L]

Spatial Domain methods: Basic grey level transformation, Histogram equalization Histogram specification techniques, Noise Distributions, Image subtraction and Image averaging, Smoothing, sharpening filters, Geometric mean, Harmonic mean, Contraharmonic mean filters, Homomorphic filtering, Color image enhancement techniques, Color image enhancement techniques.

#### Module 3: Image Restoration [9L]

Model of Image Degradation/restoration process, Noise models, Unconstrained restoration, Lagrange multiplier, Least mean square filtering, Constrained least mean square filtering, Inverse filtering-removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations, Spatial transformation.

#### Module 4: Image Compression [9L]

Need for data compression, Different types of compression, Variable length coding-Huffman Coding, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Lossy Compression: Transform coding, Wavelet coding, Basics of Image compression standards: JPEG, MPEG standards.

#### Module 5: Image Segmentation [8L]

Edge detection, Edge linking via Hough transform, Thresholding, Region Based segmentation, Region growing, Region splitting and Merging, Segmentation by morphological watersheds – basic concepts, Dam construction, Watershed segmentation algorithm.

### Text Books:

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

1. Digital Image Processing, Rafael C Gonzalez, Richard E Woods, 2nd Edition, Pearson Education, 2003.
2. Digital Image Processing and Analysis, B. Chanda & D. D. Majumder, PHI, 2nd Edition, 2011.

### References:

1. Fundamentals of Digital Image Processing, Anil K. Jain, PHI, 1994
  2. Image Processing, Analysis & Machine Vision, Sonka et al, 4th Edition, Springer, 2014.
  3. Digital Image Processing, B. Jähne, 6th Edition, Springer India, 2005.
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## Paper Name: Network Security & Cryptography

Paper Code: MCAE505A

Credits: 4

Total: 40L

### COURSE OBJECTIVES:

- To know the methods of conventional encryption.
- To understand the concepts of public key encryption and number theory.
- To know the network security tools and applications.
- To understand the system level security practices.

### COURSE OUTCOMES:

- Students will have the basic knowledge about different methods of conventional encryption.
- Students will have the knowledge about the concepts of public key encryption and number theory.
- Students will acquire knowledge about authentication functions, message authentication codes and different hash algorithms.
- Students will acquire knowledge about network security tools and authentication applications.

### Syllabus:

#### Module 1: [5L]

Attacks on Computers & Computer Security Introduction, Need for Security, Security approaches, Principles of Security, Types of attack.

#### Module 2: [7L]

Cryptography: Concepts & Techniques Introduction, Plaintext & Ciphertext, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size

#### Module 3: [8L]

Symmetric Key Algorithm Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm.

#### Module 4: [5L]

Asymmetric Key Algorithm, Digital Signature and RSA Introduction, Overview of Asymmetric key

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).

### Module 5: [6L]

Internet Security Protocols, User Authentication Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.

### Module 6 : [5L]

Electronic Mail Security Basics of mail security, Pretty Good Privacy, S/MIME.

### Module 7: [4L]

Firewall Introduction, Types of firewall, Firewall Configurations, DMZ Network

### Text Book:

1. William Stallings - Cryptography and Network Security - Pearson Education, New Delhi, 5th Edition, 2011. ( Chapter 16 – 19 and online chapter 20 – 22)

### References:

1. Behrouz A. Forouzan, Debdeep Mukhopadhyay - Cryptography and Network Security -Tata McGraw-Hill Education Pvt. Ltd., 2nd Edition, 2011
2. Charles Pfleeger - Security in computing - Prentice Hall of India, 4th Edition, 2006.

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## Paper Name: Cloud Computing

Paper Code: MCAE 505B

Credits: 4

Total: 40L

### COURSE OBJECTIVES:

This course will help the students to get familiar with the followings:

- cloud computing fundamentals
- architectures
- services, implementation and deployment techniques
- programming concept
- security & risk management
- Research trends

### COURSE OUTCOMES:

- Compare the strengths and limitations of cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Apply suitable virtualization concept
- Choose the appropriate Programming approach
- Understand risk involvement
- Able to find current research areas

### Syllabus:

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Module 1: Introduction to Cloud Computing [4L]

Introduction-Component of CC, Comparing CC with Virtualization, Grids, Utility Computing. Impact of CC on business, Key drivers for CC. Cloud Types- Private, Public, Cloud API.

### Module 2: Cloud Computing Architecture [5L]

Technologies for Network Based System, System Models for Distributed and Cloud Computing, NIST Cloud Computing Reference Architecture.(Cloud Consumer, Cloud Provider, Cloud Auditor, Cloud Broker, Cloud Carrier)

### Module 3: Virtualization [5L]

Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data-center Automation.

### Module 4: Infrastructure & Services [4L]

Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources.

### Module 5: Service Management [5L]

Service Level Agreement (SLA), Web Service SLA, Cloud SLA VS. Web Service SLA, Service Level Objectives (SLOs), SLA Requirements.

### Module 6: Data & Resource Management [5L]

Resource management in Cloud, Data Center Power Consumption, Steps towards Energy Efficiency, VM scheduling on Multi-core Systems, Power-aware Scheduling , VM Management , Energy Savings.

### Module 7: Parallel and Distributed Programming Paradigms [5L]

Parallel and Distributed Programming Paradigms – MapReduce , Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack, Aneka, CloudSim.

### Module 8: Security and risk management [5L]

Security for Virtualization Platform, Security for SaaS, PaaS, IaaS, Data Security, Data Integrity, Cloud Storage Gateways, Cloud Firewall.

### Module 9: Research Trends in Cloud Computing [2L]

#### Text Book:

1. Cloud Computing”, by Rajib Chopra, 1<sup>st</sup> Edition, New Age International Publishers.

#### Reference Books:

1. Cloud Computing: A Hands-on Approach, Arshdeep Bahga & Vijay Madiseti, Universities Press.
2. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS & IaaS), Michael J. Kavis, Wiley.
3. Cloud Computing, M N Rao, Prentice Hall India.

**Paper Name: Internet of Things**

**Paper Code: MCA E505C**

**Credits: 4**

**Total: 40L**

**COURSE OBJECTIVES:**

1. To introduce the concept and vision of IoT.
2. Understand IoT Market perspectives.
3. Data & Knowledge Management and uses of Devices in IoT Technology.
4. Understand the State-of-the-Art IoT Architectures
5. Real World IoT applications: Industrial Automation, Building Automation, Agriculture, Healthcare & Environment, etc.

**Prerequisites:** Linux, Networking, Cloud Computing, C and Python Programming basics.

**COURSE OUTCOMES:**

1. Able to understand the application areas of IOT
2. Able to realize the evolution of Internet of Things in Mobile Devices, Cloud & Sensor Networks
3. Able to understand building blocks of Internet of Things and characteristics.

**Syllabus:**

**Module 1: [4L]**

- Introduction to IoT
- Sensing
- Actuation

**Module 2: [4L]**

- Review of Networking
- IoT Communication Protocols

**Module 3: [4L]**

- Sensor Networks
- Machine-to-Machine Communications
- Interoperability in IoT

**Module 4: [6L]**

- Introduction to Arduino Programming
- Integration of Sensors and Actuators with Arduino

**Module 5: [6L]**

- Introduction to Raspberry Pi Programming
- Implementation of IoT with Raspberry Pi

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Module 6: [4L]

- Introduction to Software Defined Network [SDN]
- SDN for IoT
- Data Handling and Analytics

### Module 7: [4L]

- Review of Cloud Computing
- Sensor-Cloud
- Fog Computing

### Module 8: [4L]

- Smart Cities and Smart Homes
- Connected Vehicles
- Smart Grid
- Industrial IoT

### Module 9: [4L]

- Case Studies: Agriculture, Healthcare, Environment, etc.

### Text books:

1. *Internet of Things: A Hands-on Approach*, by Arshdeep Bahga and Vijay Madisetti [Universities Press].
2. *Getting Started with Arduino, 3rd Edition*, by Massimo Banzi & Michael Shiloh [SPD/Maker Media].
3. *Getting Started with Raspberry Pi, 3rd Edition*, by Matt Richardson & Shawn Wallace, [SPD/Maker Media].

### References:

1. *Introduction to Internet of Things*, Online Course by Prof. Sudip Misra [NPTEL].
  2. *The Internet of Things: Enabling Technologies, Platforms, and Use Cases*, Pethuru Raj and Anupama C. Raman [CRC Press].
  3. *Getting Started with Sensors*, Kimmo Karvinen & Tero Karvinen [SPD/O'Reilly].
  4. Web tutorials: <https://circuitdigest.com/internet-of-things-iot-projects>
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## Paper Name: Advanced Java Technologies Lab

Paper Code: MCAE 592A

Credits: 4

Total: 40P

### COURSE OBJECTIVES:

1. Understanding programming concepts in Advanced Java
2. Analyzing different problems in Web Applications and providing solutions
3. Applying the knowledge to develop Web Applications for industries and individuals.

### COURSE OUTCOMES:

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

The students will

1. Gain the basic concepts to program in Advanced Java Framework.
2. be able to understand working of basic web applications, architectures and protocols.
3. be able to analyze problems and produce web application solutions to the problems.
4. be able to apply specific knowledge to develop projects to help industries and individuals.

### Syllabus:

**Module 1:** Review of Basic Java Concepts [4P]

**Module 2:** Multithreading and Exception Handling [4P]

**Module 3:** Swing Programming [4P]

**Module 4:** Applet Programming [4P]

**Module 5:** JDBC Programming [4P]

**Module 6:** Servlet Programming [4P]

**Module 7:** JSP Programming [4P]

**Module 8:** Java Mail programming [4P]

**Module 9:** STRUTS Framework Programming [4P]

**Module 10:** Review of Concepts and Case Studies [4P]

### Text Book:

1. Java -The Complete Reference, Herbert Schildt, Tata McGraw-Hill, 7th Edition, 2008.

### Reference Book:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, 2nd Edition, PHI Learning, New Delhi, 2014.
  2. Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Kogent Learning Solutions Inc, Dreamtech, 2015.
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**Paper Name: Python Programming Lab**

**Paper Code: MCA E592B**

**Credits: 4**

**Total: 40P**

**COURSE OBJECTIVES:**

- To introduce Python programming language through its core language basics and program design techniques suitable for modern applications.
- To understand the wide range of programming facilities available in Python covering graphics, GUI, data visualization and Databases.
- To utilize high-performance programming constructs available in Python to strengthen applications development in practical scenarios. .

**COURSE OUTCOMES:**

- Design real life situational problems and think creatively about solutions of them.
- Apply a solution clearly and accurately in a program using Python.
- Apply the best features of Python to program real life problems

**Syllabus:**

**Module 1: Introduction to Python [4P]**

Two modes of using Python Interpreter

Variables and Data Types

Operators and their Precedence

Python Strings

Slicing

Python Lists

Mutable and Immutable Types

Input from the Keyboard

**Module 2: Loops and Iterations [4P]**

Iteration: *while* and *for* loops

Python Syntax, Colon & Indentation

Syntax of 'for loops'

Conditional Execution: *if*, *elif* and *else*

Modify loops : *break* and *continue*

**Module 3: Functions and More Strings & Lists [4P]**

Functions

Optional and Named Arguments

More on Strings & Lists experiments

Split and Join

Manipulating and Copying Lists

**Module 4: Modules and Packages [4P]**

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

Python Modules and Packages  
Different ways to import Packages  
File Input/Output  
The pickle module  
Formatted Printing  
Exception Handling

### **Module 5: Graphics, GUI and Object Oriented Programming [4P]**

Turtle Graphics  
Writing GUI Programs  
Object Oriented Programming in Python  
Inheritance, reusing code

### **Module 6: Arrays and Matrices [4P]**

The NumPy Module  
Creating Arrays and Matrices  
Copying  
Arithmetic Operations  
Cross product & Dot product  
Saving and Restoring  
Matrix inversion  
Vectorized Functions

### **Module 7: 2D & 3D Data Visualization [4P]**

The Matplotlib Module  
Multiple plots, Polar plots, Pie Charts  
Plotting mathematical functions, Sine function and friends  
Parametric plots, Astroid, Ellipse, Spirals of Archimedes and Fermat, Polar Rose  
Power Series & Fourier Series  
2D plot using colors, Fractals, Meshgrids  
3D Plots, Surface Plots & Line Plots  
Wire-frame Plots  
Mayavi, 3D visualization

### **Module 8: Files and Streams [4P]**

File related modules in Python  
File modes and permissions  
Reading & Writing data from a file  
Redirecting output streams to files  
Working with directories, CSV files and Data Files

### **Module 9: Python and Databases [4P]**

ODBC and Python  
Working with Databases in MySQL  
Working with Tables in MySQL  
Managing users in MySQL  
Accessing MySQL data from Python

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

Working with SQLite Database

### Module 10: Python Networking [4P]

Launching HTTP server in Python

Creating own TCP server in Python

Making HTTP requests

Working with TCP & UDP

#### Text books:

1. Python for Education – Ajith Kumar B. P., Inter University Accelerator Center, New Delhi, 2010
2. Python Training Guide – Mercury Learning & Information USA, BPB Publications, 2015

#### References:

1. Learn to Program, University of Toronto: <https://www.coursera.org/learn/learn-to-program>
2. Spoken Tutorial - IIT Bombay: <https://swayam.gov.in/course/4178-spoken-tutorial-python-english>
3. Python Cookbook: Recipes for Mastering Python 3, 3rd Edition - David Beazley & Brian K. Jones, O'Reilly Media, Inc., 2013

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### Paper Name: Linux System Administration Lab

Paper Code: MCA E592C

Credits: 4

Total Contact: 40P

#### COURSE OBJECTIVES:

1. To introduce the practical concepts of System & Network Administration in Linux.
2. To learn Advanced Administration in the Linux Environment.
3. To introduce automation of system administrative tasks using shell/python scripts.
4. To enable the learner to become Linux System Administrator in the IT Industries

#### COURSE OUTCOMES:

1. Make appropriate decisions during the configuration process to create a properly functioning Linux environment.
2. Use programs and utilities to administer a Linux machine.
3. Explain how a Linux server can be integrated within a multi-platform environment.
4. Analyze the need for security measures for a Linux environment.
5. Identify the different uses and advantages of Linux in a business environment

**Prerequisites:** Basic UNIX & Shell/Python Scripting Concepts

#### Syllabus:

##### Module 1: [4P]

User Management in Linux

##### Module 2: [4P]

Linux Booting Process

- Starting Up and Shutting Down
- Run level Management

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Module 3: [4P]

#### Linux Data Management

- disk management
- file management

### Module 4: [16P]

#### TCP/IP Network Administration

- Network Configuration
- Telnet/SSH Configuration
- NFS Configuration
- FTP Configuration
- HTTP Configuration
- DNS Configuration
- DHCP Configuration
- Firewall Configuration

### Module 5: [12P]

#### Administrative Task Automation

- Shell/Python Scripting

#### Text books:

- *Linux Labs and Open Source Technologies*, Deven Shah, Dayanand Ambawade & Kogent Learning Solutions Inc., Dreamtech Press, 2014.
- *Python for Unix and Linux System Administration*, Jeremy Jones & Noah Gift, O'Reilly Media, 2009

#### References:

- *Red Hat Linux Networking and System Administration*, 3rd Edition, Terry Collings and Kurt Wall, Wiley, 2005.
- Linux Admin - Shell Scripting :  
[https://www.tutorialspoint.com/linux\\_admin/linux\\_admin\\_shell\\_scripting.htm](https://www.tutorialspoint.com/linux_admin/linux_admin_shell_scripting.htm)
- Linux Web Tutorials: <http://www.yolinux.com/TUTORIALS/index.html>
- Linux System Administrator's Guide: <http://tldp.org/LDP/sag/html/sag.html>

### Name: Minor Project

Code: MCA 596

Credits: 6 (8P)

Total: 80P

#### Course Objectives:

1. To give the students Hands on experience of system development life cycle.
2. To make the students apply in real life the technologies learnt during the course.
3. To expose the students to real life project development environments involving deadlines and team work.
4. To make the students learn new upcoming technologies not covered during the course while applying in projects.

#### Course Outcomes:

1. Students will have hands of experience of system development life cycle.
2. The students will learn to apply the technologies learnt during the course in real life projects.
3. Students will learn to work in real life project development environments involving deadlines and teamwork.
4. Students will learn to pick up and apply upcoming technologies in project development not covered during the course.

## Course Curriculum & Syllabus of Master of Computer Application (MCA) Program

### Guidelines:

- Students may be offered software/hardware development or research oriented projects.
  - Faculty members may offer project proposals from their side and students may choose from them.
  - Students may also submit project proposals not covered in the faculty provided list, which may be guided by the interested faculty members.
  - Same project ideas may be submitted by more than one student group, but may be unique at the implementation level, as per the judgement of the department.
  - Students may be encouraged to take up more innovative projects involving contemporary technologies, leading to research paper and/or patent publications.
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### **Name: Group Discussion**

**Code: MCA 580\***

**Credits: 0**

**Total: 0**

### Course Objectives:

1. To develop listening and reasoning skills of the students to contribute to the achievement of group goals.

### Course Outcomes:

1. Students will develop an attitude of listening and reasoning to contribute to the group objectives through collaborative team work.

### Guidelines:

1. Topics may be chosen by the faculty members based on contemporary technology culture prevalent in the society.

## MCA 6<sup>th</sup> Semester

**Name: Major Project**

**Code: MCA 691**

**Credits: 30 (30P)**

**Total: 300P**

**Course Objectives:**

1. To give the students Hands on experience of real life system development life cycle.
2. To make the students apply in real life the technologies learnt during the course.
3. To expose the students to real life project development environments involving deadlines and team work.
4. To make the students learn new upcoming technologies not covered during the course while applying in projects.

**Course Outcomes:**

1. Students will have hands of experience of real life system development life cycle.
2. The students will learn to apply the technologies learnt during the course in real life projects.
3. Students will learn to work in real life project development environments involving deadlines and teamwork.
4. Students will learn to pick up and apply upcoming technologies in project development not covered during the course.

**Guidelines:**

- Students may be encouraged to take up internship projects in industry or research/academic institutions.
- Students may be offered software/hardware development or research oriented projects if taken in house.
- Faculty members may offer project proposals from their side and students may choose from them.
- Students may also submit project proposals not covered in the faculty provided list, which may be guided by the interested faculty members.
- Co-guidance with external institutes/industry may also be allowed.
- Same project ideas may be submitted by more than one student group, but may be unique at the implementation level, as per the judgement of the department.
- Students may be encouraged to take up more innovative projects involving contemporary technologies, leading to research paper and/or patent publications.
- Minor Projects from the previous semester may also be carry forwarded with significant upgradations.

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**Name: Grand Viva**

**Code: MCA 692**

**Credits: 4**

**Course Objectives:**

1. To test the students regarding their holistic learning of the concepts during the entire program.

**Course Outcomes:**

1. After the process students will be able to judge their holistic learning experience during the program.

**Guidelines:**

1. The queries may focus on judgment of the basic knowledge in the topics covered during the entire program.