# SYLLABUS

# FOR

# MCA Programme

# H. N. B. GARHWAL UNIVERSITY
# SRINAGAR (GARHWAL)

Department of Computer Science and Engineering

***School of Engineering and Technology***

**H.N.B. GARHWAL UNIVERSITY**

**(A Central University)**

Regulations, Curricula, Syllabus and Scheme of Examinations (Credit and Semester System)

# Master of Computer Applications

**(With effect from session 2020-2021)**

1. **Duration** of the MCA program shall be 2 years, divided into 4 semesters ***(as per F. No. AICTE/AB/MCA/20-21 dated 03.07.2020 and approval of UGC meeting 545 held on 19.12.2019)***. Each semester should have 15 – 18 weeks.

2. **Admission** will be based on Entrance examination conducted by the University. Candidates studying in the final year / semester of their qualifying degree may appear for the entrance examination. The Entrance examination will consist of questions from the following:

| | | |
|---|---|---|
| Mathematics(10+2 level) | : | 80% |
| Aptitude and Mental ability | : | 20% |

OR

As per University norms.

3. **Eligibility for admission**: Passed BCA/Bachelor Degree in Computer Science & Engineering or equivalent Degree. OR Passed B.Sc./ B.Com. / B.A. with Mathematics at 10+2 level or at Graduation Level ***(With additional bridge Courses as per the norms of the University)***. Obtained at least 50% (45% in case of candidate belonging to reserved category) at the qualifying examination

4. Course Structure
   - Two kinds of courses/subjects/papers are offered - core courses and elective courses. Core courses are offered by the department conducting the programme. Elective courses are offered either by the department conducting the programme or by any other department.
   - Elective courses should be relevant to the programme for which the student is admitted and are identified by the department.
   - Each course shall have a unique alphanumerical code.
   - No regular student shall register for more than 18 credits and less than 10 credits per semester.
   - The minimum total credits required for the successful completion of a fourth semester MCA programme is 72.

5. **Evaluation** of all semester papers will be in two parts viz. Continuous Assessment (CA) and End Semester Assessment (ESA). *Forty percent marks will be set apart for CA and sixty percent marks will be set apart for ESA, for theory, practical and project parts*. Weightage for theory, practical and project components will be according to the credit distribution.

Continuous assessment includes assignments, seminars, periodic written examination etc. There shall be a minimum of two test papers of 15% marks each and one assignment of 10% marks.

**End Semester Assessment:**

***Question pattern (Theory part):*** There shall be eight *question carrying equal marks*. Each question may contain sub divisions also. Student has to answer any four full questions, selecting one question from each unit, to secure full marks.

***Question pattern (Practical part):*** One compulsory question that may contain sub divisions is to be attempted by the student.

**Project**:

**Major Project:** The Major project work should be carried out in the final semester in an Industry / R and D organization / Department. If the project is carried out in an Industry / R and D organization outside the campus, then a co-guide shall be selected from the Department. If the project work is of interdisciplinary in nature, a co-guide shall be taken from the other department concerned. Every student should do the Major Project individually and no grouping is allowed. All the candidates are required to get the approval of their synopsis and the guide before commencement of the project from the Department. A Supervisor / Guide should be a postgraduate in CS or allied subject or a person of eminence in the area in which student has chosen the project. A Departmental committee duly constituted by the Head of the Department will review the project periodically every month. The Continuous Assessment marks (CA) will be based on the periodic progress and progress report. At the end of the semester the candidate shall submit the Project report (two bound copies and one soft copy) duly approved by the guide, co-guide for End Semester Assessment. A board of two examiners appointed by the University should conduct evaluation for ESA. If project work and the report are found to be not up to the expected standard, the examiners can ask the candidate to modify and resubmit the project report after incorporating the suggestions of the examiners. Such reports shall be resubmitted within the stipulated period suggested by the examiner(s).

**6. Grading:**

As per University/UGC Norms.

7. **Grade Card**

7.1 The university under its seal shall issue to the students a grade card on completion of each semester and a consolidated grade statement at the end of the MCA programme.

7.2 Grade card shall contain the following.

- Title of the courses.
- The credits associated with and grades awarded for each course.
- The number of credits earned by the student and the grade point average.
- The total credits earned by the student till that semester.

7.3 The grade card issued on completion of the programme shall contain the name of the programme, the department / school offered the programme, the

titles of the courses taken, the credits associated with each course, grades awarded, the total credits earned by the student, the CGPA and the class in which the student is placed.

8. **Ranking:** Only those candidates who have passed all the papers in the first appearance within the minimum period will be considered for ranking on the basis of CGPA for the entire course.

9 **Attendance:** Will be applied as per university norms.

10. **Scrutiny shall be allowed as per the rules of the University.** Revaluation is not permitted.H. N. B. Garhwal University Srinagar Garhwal

# H. N. B. Garhwal University Srinagar Garhwal
# Master of Computer Application (MCA)

## Programme Structure

### SEMESTER - I

| | | |
|---|---|---|
| SET/CSE/MCA/C101 | : | Object Oriented Programming Using C++ |
| SET/CSE/MCA/C102 | : | Mathematical Foundation of Computer Science |
| SET/CSE/MCA/C103 | : | Computer Organization and Architecture |
| SET/CSE/MCA/C104 | : | Software Engineering |
| SET/CSE/MCA/C105 | : | Operating System with Case Study of UNIX/LINUX |
| SET/CSE/MCA/CP11 | : | Object Oriented Programming Using C++ |
| SET/CSE/MCA/CP12 | : | Shell Programming |

### SEMESTER - II

| | | |
|---|---|---|
| SET/CSE/MCA/C201 | : | Data and File Structure |
| SET/CSE/MCA/C202 | : | Data Base Management System |
| SET/CSE/MCA/C203 | : | Theory of Computation |
| SET/CSE/MCA/C204 | : | Data Communication and Computer Networks |
| SET/CSE/MCA/C205 | : | Combinatorics and Graph Theory |
| SET/CSE/MCA/CP21 | : | Data Structures Using 'C' |
| SET/CSE/MCA/CP22 | : | Data Base Management System |
| SET/CSE/MCA/SS21 | : | Self Study* |

### SEMESTER - III

| | | |
|---|---|---|
| SET/CSE/MCA/C301 | : | Network Security and Cryptography |
| SET/CSE/MCA/C302 | : | Design and Analysis of Algorithm |
| SET/CSE/MCA/C303 | : | Machine Learning |
| SET/CSE/MCA/E1 | : | Elective I |
| SET/CSE/MCA/E2 | : | Elective II |
| SET/CSE/MCA/EP31 | : | Elective I |
| SET/CSE/MCA/EP32 | : | Elective II |
| SET/CSE/MCA/SS31 | : | Self Study* |

### SEMESTER - IV

| | | |
|---|---|---|
| SET/CSE/MCA/E3 | : | Elective III |
| SET/CSE/MCA/E4 | : | Elective IV |
| SET/CSE/MCA/EP41 | : | Elective III |
| SET/CSE/MCA/PR41 | : | Project |
| SET/CSE/MCA/SS41 | : | Self Study* |

**FIRST SEMESTER:**

| S.No | Course No. | Subject | Evaluation – Scheme | | | | | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Period | | | Sessional | | | Examination | | |
| | | | L | T | P | TA | CT | TOT | ESE | Sub. Total | |
| **Theory** | | | | | | | | | | | |
| 1. | SET/CSE/MCA/C101 | Object Oriented Programming Using C++ | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 3 |
| 2. | SET/CSE/MCA/C102 | Mathematical Foundation of Computer Science | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 3 |
| 3. | SET/CSE/MCA/C103 | Computer Organization and Architecture | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 3 |
| 4. | SET/CSE/MCA/C104 | Software Engineering | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 2 |
| 5. | SET/CSE/MCA/C105 | Operating System with Case Study of UNIX/LINUX | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 3 |
| **Practical** | | | | | | | | | | | |
| 1. | SET/CSE/MCA/CP11 | Object Oriented Programming Using C++ | - | - | 3 | 40 | - | 40 | 60 | 100 | 2 |
| 2. | SET/CSE/MCA/CP12 | Shell Programming | - | - | 3 | 40 | - | 40 | 60 | 100 | 2 |
| | | **Total** | **15** | **5** | **6** | **130** | **150** | **280** | **420** | **700** | **18** |

**SECOND SEMESTER:**

| S.No | Course No. | Subject | Evaluation – Scheme | | | | | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Period | | | Sessional | | | Examination | | |
| | | | L | T | P | TA | CT | TOT | ESE | Sub. Total | |
| **Theory** | | | | | | | | | | | |
| 1. | SET/CSE/MCA/C201 | Data Structures | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 3 |
| 2. | SET/CSE/MCA/C202 | Data Base Management System | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 3 |
| 3. | SET/CSE/MCA/C203 | Theory of Computation | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 3 |
| 4. | SET/CSE/MCA/C204 | Data Communication and Computer Networks | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 2 |
| 5. | SET/CSE/MCA/C205 | Combinatorics and Graph Theory | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 3 |
| **Practical** | | | | | | | | | | | |
| 1. | SET/CSE/MCA/CP21 | Data Structures Using 'C' | - | - | 3 | 40 | - | 40 | 60 | 100 | 2 |
| 2. | SET/CSE/MCA/CP22 | Data Base Management System | - | - | 3 | 40 | - | 40 | 60 | 100 | 2 |
| | | **Total** | **15** | **5** | **6** | **130** | **150** | **280** | **420** | **700** | **18** |
| 1. | SET/CSE/MCA/SS21 | Self Study | 2 | 1 | - | - | - | - | - | - | 3 |

TA : Teacher Assessment
CT : Class Test
ESE : End Semester Examination
SUB TOT. : Subject Total
TOT. : Total

**THIRD SEMESTER:**

| S.No | Course No. | Subject | Evaluation – Scheme | | | | | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Period | | | Sessional | | | Examination | | |
| | | | L | T | P | TA | CT | TOT | ESE | Sub. Total | |
| **Theory** | | | | | | | | | | | |
| 1. | SET/CSE/MCA/C301 | Network Security and Cryptography | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 3 |
| 2. | SET/CSE/MCA/C302 | Design and Analysis of Algorithm | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 3 |
| 3. | SET/CSE/MCA/C303 | Machine Learning | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 3 |
| 4. | SET/CSE/MCA/E1 | Elective I | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 3 |
| 5. | SET/CSE/MCA/E2 | Elective II | 3 | 1 | - | 10 | 30 | 40 | 60 | 100 | 2 |
| **Practical** | | | | | | | | | | | |
| 1. | SET/CSE/MCA/EP31 | Elective I | - | - | 3 | 40 | - | 40 | 60 | 100 | 2 |
| 2. | SET/CSE/MCA/EP32 | Elective II | - | - | 3 | 40 | - | 40 | 60 | 100 | 2 |
| | | **Total** | **15** | **5** | **6** | **130** | **150** | **280** | **420** | **700** | **18** |
| 1. | SET/CSE/MCA/SS31 | Self Study | 2 | 1 | - | - | - | - | - | - | 3 |

**FOURTH SEMESTER:**

| S.No | Course No. | Subject | Evaluation – Scheme | | | | | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Period | | | Sessional | | | Examination | | |
| | | | L | T | P | TA | CT | TOT | ESE | Sub. Total | |
| **Theory** | | | | | | | | | | | |
| 1. | SET/CSE/MCA/E3 | Elective III | 3 | 1 | - | 10 | 20 | 30 | 70 | 100 | 3 |
| 2. | SET/CSE/MCA/E4 | Elective IV | 3 | 1 | - | 10 | 20 | 30 | 70 | 100 | 3 |
| **Practical** | | | | | | | | | | | |
| 1. | SET/CSE/MCA/EP41 | Elective III | - | - | 3 | 30 | - | 30 | 70 | 100 | 2 |
| 2. | SET/CSE/MCA/PR41 | Project | - | 3 | 3 | - | - | - | 400 | 400 | 10 |
| | | **Total** | **6** | **5** | **6** | **50** | **40** | **90** | **610** | **700** | **18** |
| 1. | SET/CSE/MCA/SS41 | Self Study | 2 | 1 | - | - | - | - | - | - | 3 |

TA : Teacher Assessment
CT : Class Test
ESE : End Semester Examination
SUB TOT. : Subject Total
TOT. : Total

**Elective I**
**(Choose any one)**

| | |
|---|---|
| E1.1 | Graphics and Animation |
| E1.2 | JAVA Programming |
| E1.3 | Internet of Things |
| E1.4 | Online Course from NPTEL/SWAYAM (Not being run by Department) |

**Elective II**
**(Choose any one)**

| | |
|---|---|
| E2.1 | Android Application Development |
| E2.2 | Compiler Design |
| E2.3 | Human- Computer Interaction |
| E2.4 | Computer Vision |

**Elective III**
**(Choose any one)**

| | |
|---|---|
| E3.1 | Natural Language Processing |
| E3.2 | Image Processing |
| E3.3 | Cloud Computing |
| E3.4 | Online Course from NPTEL/SWAYAM (Not being run by Department) |

**Elective IV**
**(Choose any one)**

| | |
|---|---|
| E4.1 | Artificial Intelligence |
| E4.2 | E-Commerce |
| E4.3 | Data Mining |
| E4.4 | Management Information System |

**Online Course from NPTEL/SWAYAM**

- Programming, Data Structures and Algorithms using Python
- Data Science for Engineers
- Python for Data Science
- Data Analytics with Python
- Deep Learning for Computer Vision
- Introduction to Industry 4.0 and industrial Internet of Things
- Social Networks
- Privacy and Security in Online Social Media
- Introduction to Blockchain Technology and Applications
- Information Security - 5 - Secure Systems Engineering
- User-centric Computing for Human-Computer Interaction
- Applied Natural Language Processing

***Self Study**
**(Choose any one for semester II, III& IV)**

- Professional Communication
- Cyber Laws
- Robotics
- Pattern Recognition Techniques
- E-Governance
- Fuzzy logic & Neural Networks
- Ethical Hacking

**SET/CSE/MCA/C101: Object Oriented Programming Using C++**

Introduction: Introduction to OOP, Basic Concepts of OOP, Applications of OOP. Introduction to C++, Introduction to C++ stream I/O, declarations in C++, Creating New data types in C++, function Prototypes, Inline functions, Reference Parameters, Const Qualifier, Dynamic memory allocation, default arguments, Unary Scope resolution operator, Linkage specifications.
Class, Constructors, Friend Class : Introduction, Comparing class with Structure, Class Scope, Accessing Members of a class, Constructor, Destructor, Const objects, Const member functions, Friend class, Friend function, This pointer, Data abstraction and Information hiding, container classes and Iterators.

Overloading and Inheritance: Operator Overloading, Fundamentals, Restrictions, Overloading stream, Insertion and stream extraction operators, Overloading unary and binary operators, Converting between types, Overloading ++ and --. Inheritance, Introduction, Protected members, Casting base _class pointers to derived _class pointers Overloading Base class members in a Derived class, Public, Protocols and Private inheritance, Direct base classes and Indirect Base Classes, Using Constructors and Destructors in Derived classes, Implicit Derived class object to base class object conversion.

Virtual Functions : Introduction, Type fields and switch statements, Virtual functions, Abstract base classes and concrete classes, Polymorphism, Dynamic binding, Virtual destructors.
C++ Stream I/O : Streams, Stream Input, Stream Output, Unformatted I/O, Stream manipulators, Stream format states, Stream error, States.

Files : File Operations –File pointers – error Handling during file Operations
Templates Handling: Templates, Function templates, Class templates, Overloading template functions, Class template and non type parameters, Templates with Multiple parameters.
Exception Handling: Exception handling, Basic of C++ exception, Catching an exception, re-throwing an exception, exception specifications.

**References:**


1. Deitel H.M. and Deitel P.J. – "How to Program C++" – PHI – 2003
2. Al stevenes – "C++ Programming" – Wiley dreamtech – 2003.
3. Herbert Scheldt, "Complete Reference".
4. Starting out with OOPS in C++ : Tony Gaddis, Wiley dreamtech India Pvt. Ltd.
5. E. Balagurusamy "Object Oriented Programming with C++".
6. Yashwant Kanetkar, "Let Us C++".
7. C++ Programming by Herbert Scheldt – 2004.

**SET/CSE/MCA/C102: Mathematical Foundation of Computer Science**

Relation: Type and compositions of relations, Pictorial representation of relations, Equivalence relations, Partial ordering relation.
Function: Types, Composition of function, Recursively defined function.

Mathematical Induction: Piano's axioms, Mathematical Induction, Discrete Numeric Functions and Generating functions, Simple Recurrence relation with constant coefficients, Linear recurrence relation without constant coefficients, Asymptotic Behaviour of functions
Algebric Structures: Properties, Semi group, monoid, Group, Abelian group, properties of group, Subgroup, Cyclic group, Cosets, Permutation groups, Homomorphism, Isomorphism and Automorphism of groups.

Calculus: Functions, limits and Continuity, differentiation and Integration, Differential Equations.
Linear equations and Matrices: Row/column operations, Gaussian Elimination, Decomposition, inverse.
Determinant: Properties of determinants, Cramer's Rule, determinants to transpose and inverse.

Vector spaces: Linear independence, Bases, subspace and dimensionality.
Inner Products and Norms: Length, angle, direction cosines; Orthogonalization.
Prepositional Logic: Preposition, First order logic, Basic logical operations, Tautologies, Contradictions, Algebra of Proposition, Logical implication, Logical equivalence, Normal forms, Inference Theory, Predicates and quantifiers, Posets, Hasse Diagram.

## References:


1. Liptschutz, Seymour, "Discrete Mathematics", TMH.
2. Trembley, J.P. and R. Manohar, "Discrete mathematical Structure with Application to Computer Science", TMH.
3. Kenneth H. Rosen, "Discrete Mathematics and its applications', TMH.
4. Doerr Alan and Levasseur Kenneth, "Applied Discrete Structure for Computer Science, Galgotia Pub. Pvt. Ltd.
5. Gersting "Mathematical Structure for Computer Science", WH freeman and Macmillan
6. Korthage, R.R.: Discrete Computational Structures, Academic Press.
7. C.L.Liu "Elements of Discrete Maehmatics", McGraw Hill.
8. Peter Grossman, "Discrete Mathematics for Computer", Palgrave Macmillian.

**SET/CSE/MCA/C103: Computer Organization and Architecture**

Representation of information and Basic Building Blocks: Number System: Binary, Octal, Hexadecimal and their conversion, Character Codes: BCD, ASCII, EBCDIC. Digital Codes: Gray Code, XS-3 Code.
Logic circuits : Basic Logic Functions, Synthesis of Logic Functions Using AND, OR and NOT Gates, Minimization of Logic Expression, Synthesis with NAND and NOR Gates, Implementation of Logic Gates, Flip-Flops, Registers and Shift Registers, Counters, Decoders, Multiplexers, Programmable Logic Devices , Sequential Circuits.

Basic Structure of Computer Hardware and Software: Functional units, Basic operational concepts, Bus structures, Software, Performance, Distributed Computing.
Addressing Methods : Basic Concepts, Memory Locations, Main Memory Operations, Addressing Modes, Basic I/O operations, Stacks and Queues, Subroutines.

Processing Unit : Some Fundamental Concepts, Execution of a Complete Instruction, Hardwired Control, Performance Considerations, Micro Programmed Control, Signed Addition and Subtraction, Arithmetic and Branching Conditions, Multiplication of Positive Numbers, Signed-Operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations.

Input-output Organization: Accessing I/O Devices, Interrupts, Direct Memory Access, I/O Hardware, Standard I/O Interfaces.
Memory: Semiconductor RAM memories, Read-Only Memories, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements.
Introduction to Computer Peripherals: I/O Devices, On-Line Storage.

## References:


1. Willam Stalling, "Computer Organization and Architecture" Pearson Education Asia
2. Mano Morris, "Computer System Architecture" PHI
3. Zaky and Hamacher, "Computer Organization: McGraw Hill
4. B. Ram, "Computer Fundamental Architecture and Organization" New Age
5. Tannenbaum, "Structured Computer Organization" PHI.
6. Hayes: Computer Architecture and Organization, Mc Graw Hill.
7. G.L. Jr.: Computer design, Computech Press Langdon.
8. Bywater: Hardware- Software Design of digital System

**SET/CSE/MCA/C104: Software Engineering**

Introduction: Introduction to software engineering, Importance of software, evolving role of software, Software Characteristics, Software Components, Software Applications, Software Crisis, Software engineering problems, Software Development Life Cycle, Software Process.
Software Requirement Specification: Analysis, Principles, Water Fall Model, The Incremental Model, Prototyping, Spiral Model, Role of management in software development, Role of matrices and Measurement, Problem Analysis, Requirement specification, Monitoring and Control.

Software-Design: Design principles, problem partitioning, abstraction, top down and bottom up-design, Structured approach functional versus object oriented approach, design specifications and verification, Monitoring and control, Cohesiveness, coupling, Forth generation techniques, Functional independence, Software Architecture, Transaction and Transaction and Transform Mapping, Component level Design, Forth Generation Techniques.
Coding: Top-Down and Bottom-Up programming, structured programming, information hiding, programming style and internal documentation.
Testing principles, Levels of testing, functional testing, structural testing, test plane, test case specification, reliability assessment, software testing strategies, Verification and validation, Unit testing, Integration Testing, Alpha and Beta testing, system testing and debugging.
Software Project Management: The Management spectrum (The people, the product, the process, the project) Cost estimation, project scheduling, staffing, software configuration management, Structured Vs. Unstructured maintenance, quality assurance, project monitoring, risk management.
Software Reliability and Quality Assurance: Reliability issues, Reliability metrics, Reliability growth modeling, Software quality, ISO 9000 Certification for software industry, SEI capability maturity model, comparison between ISO and SEI CMM. CASE (Computer Aided Software Engineering): CASE and its scope, CASE support in software life cycle, documentation, project management, internal interface, Reverse Software Engineering, Architecture of CASE environment.

**References:**


1. Pressman, Roger S., "Software Engineering: A Practitioner's Approach Ed. oston: McGraw Hill
2. Jalote, Pankaj, "Software Engineering Ed.2"New Delhi: Narosa 2002
3. Schaum's Series, "Software Engineering" TMH
4. Ghezzi Carlo and Others "Fundamentals of Software Engineering" PHI
5. Alexis, Leon and Mathews Leon, "Fundamental of Software Engg.
6. Sommerville, Ian, "Software Engineering" AWL
7. Fairly, "Software Engineering" New Delhi" TMH
8. Pfleerger, S. "Software Engineering" Macmillan, 1987
9. Software Testing Tools: Dr. Prasad, Wiley dreamtech India Pvt. Ltd.

**SET/CSE/MCA/C105: Operating System with Case Study of UNIX/LINUX**

Introduction, What is an Operating System, Simple Batch Systems, Multiprogrammed Batches systems, Time-Sharing Systems, Personal-computer systems, Parallel systems, Distributed Systems, Real-Time Systems.

Memory Management: Background, Logical versus Physical Address space, swapping, Contiguous allocation, Paging, Segmentation, Segmentation with Paging Virtual Memory: Demand Paging, Page Replacement, Page-replacement Algorithms, Performance of Demand Paging, Allocation of Frames, Thrashing, Other Considerations, Demand Segmentation.

Processes: Process Concept, Process Scheduling, Operation on Processes, Cooperating Processes, Interprocess Communication

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple- Processor Scheduling, Real-Time Scheduling, Algorithm Evaluation.

Process Synchronization: Background, The Critical-Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors, Synchronization in Solaris 2, Atomic Transactions.

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock, Combined Approach to Deadlock Handling.

Device Management: Techniques for Device Management, Dedicated Devices, Shared Devices, Virtual Devices; Device Characteristics-Hardware Consideration, Input or Output Devices, Storage Devices, Channels and Control Units, Independent Device Operation, Buffering, Multiple Paths, Block Multiplexing, Device Allocation Consideration, Secondary-Storage Structure: Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Reliability, Stable-Storage Implementation.

Information Management: Introduction, A Simple File System, General Model of a File System, Symbolic File System, Basic File System, Access Control Verification, Logical File System, Physical File System File-System Interface: File Concept, Access Methods, Directory Structure, Protection, Consistency Semantics File-System Implementation: File-System Structure, Allocation Methods, Free-Space Management, Directory Implementation, Efficiency and Performance, Recovery.

**References:**


1. Abraham Siberschatz and Peter Baer Galving "Operating System Concepts'
2. Milan Milankovic, "Operating Systems, Concept and Design" McGraw Hill
3 . R. C. Joshi "Operating System", Wiley dreamtech India Pvt. Ltd.
4. Harvey M Ddeital "Operating System" Addison Wesley

**SET/CSE/MCA/C201: Data and File Structure**

Introduction: Basic Terminology, Elementary Data Organization, Data Structure operations, Algorithm Complexity and Time-Space trade-off. Arrays: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Ordered list, Sparse Matrices, and Vector. Stacks: Array Representation and Implementation of stack, Operations and Stacks: Push and POP, Array Representation of Stack, Linked Representation of stack, Operations Associated with Stacks, Application of stack, Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack. Recursion: Recursive definition and processes, recursion in C, example of recursion, Tower of Hanoi Problem.

Queues: Array and linked representation and implementation of queues, Operations on Queue; Create, Add, Delete, Full and Empty, Circular queue, Dequeue, and Priority Queue. Link List: Representation and implementation of Singly linked lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List of Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction.

Trees: Basic terminology, Binary Tree, Binary tree representation algebraic Expressions, Complete Binary Tree, Extended Binary Tree, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees. Traversing Threaded Binary tree, Huffman algorithm. Searching and Hashing: Sequential search, comparison and analysis, Hash Table, Hash Function, Collection Resolution Strategies, Hash Table Implementation.

Sorting: Insertion Sort, Bubble sorting, Quick Sort, Two way Merge Sort, Heap Sort, Sorting on Different Keys, Practical Consideration for Internal Sorting. Binary Search Trees, AVL Tree, B-trees.

File Structures: Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices.

**References:**


1. Horowitz and Sahani, "Fundamentals of data Structures" Galgotia
2. R. Kruse etal, "Data Structures and Program Design in C" Person Education
3. A.M. Tenenbaum etal, "Data Structures and Program Design in C" Person Education
4. Lipschutz, "Data Structure", TMH
5. K Loudon, "Mastering Algorithms With C", Shroff Publishers and Distributors
6. Bruno R Preiss, "Data Structure and Algorithms with Object Oriented Design Pattern in C++, Jhon Wiley and Sons, Inc.
7. Adm Frozdek, "Data Structures and Algorithms in C++" Thomson Asia
8. Pal G. Sorenson, "An Introduction to Data Structures with Application", TMH
9. C and Data Structure: Desh Pandey, Wiley dreamtech India Pvt. Ltd.
10. Data Structures- Principles and Fundamental : Keogh Davidson, Wiley dreamtech

**SET/CSE/MCA/C202: Data Base Management System**

Introduction: An overview of database management system, Database System Vs File System, Database system concepts and architecture, data models schema and instances, data independence and data base language and interfaces, Data definitions language, DMI, Overall Database structure.
Data modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.

Relational Data Model and Language: Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus.

Introduction to SQL: Characteristics of SQL, Advantages of SQL, SQL data types and literals, Types of SQL commands, SQL operators and their procedure, Tables, views and indexes Queries and sub queries, Aggregate functions, Insert, update and delete operations, Joints, Unions, Intersection, Minus, Cursors in SQL. PL/SQL, Triggers and clusters.

Database Design and Normalization: Functional dependencies, normal forms, first, second third normal forms, BCNF, inclusion dependencies, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design

**References:**


1. Date C.J. "An Introduction to Database System". Addision Wesley
2. Korth, Silbertz, Sudarshan, "Database Concepts" McGraw Hill
3. Database Management System: V. K. Jain, Wiley dreamtech
4. Elmasri, Navathe, "Fundamentals of Database Systems" Addision Wesley
5. Paul Beynon Davis, "Database Systems" Palgrave Macmillan
6. Bipin C. Desai, "An introduction to Database Systems", Galgotia Pub.
7. Begining SQL: Paul Wilton, Wiley dreamtech

**SET/CSE/MCA/C203: Theory of Computation**

Introduction to the Theory of computation and Finite Automata: Mathematical preliminaries and Notation, three basic concepts, applications, deterministic Finite Acceptors, Nondeterministic finite acceptors, equivalence of Deterministic and Nondeterministic finite acceptors, reduction of the Number of states in Finite Automata.
Regular Languages, regular grammars and Properties of Regular Languages: regular expressions, connection between regular expressions and regular languages, regular grammars, closure properties of regular languages, elementary questions about regular languages, identifying language.
Contest-free languages and simplification of context-free grammars and normal forms: context-free grammars, parsing and ambiguity, context-free grammars and programming languages, methods of transforming grammars, two important normal forms.

Pushdown automata and properties of context-free languages: Non-deterministic pushdown automata, pushdown automata and context-free language, deterministic pushdown automata and deterministic context-free languages, two pumping lemmas, closure properties and decision algorithms for context-free language.

Turning machines and other models of turning machines: the standard turning machine, combining turning machines for complicated tasks, Turing's thesis, minor variation on the turning machine, combining turning machines, a universal turning machine .

**References:**

1. An introduction to Formal Languages and Automata, Peter Linz, Narasa publishing House, 1997.
2. Introduction to Languages and the Theory of Automata- John C Martin MGH 1997

Introduction to Automata Languages and Computation,- J P Hopcroft. J D Ullman, Narosa Publication

**SET/CSE/MCA/C204: Data Communication & Computer Networks**

Introduction and The Physical Layer: Uses of Computer Networks, Network Hardware, Network Software, Topology, Network types, Reference Model (OSI, TCP/IP Overview), The Physical Layer, Theoretical Basis for Data Communication, Guided Transmission Media, Wireless Transmission, Communication Satellites, Digital and Analog Signal, FSK, PSK, modulation techniques, Switching techniques.

The Data Link Layer: Data Link Layer Design Issues, Error Detection and Correlation, Flow Control Protocols, Stop-and-wait Flow Control, Sliding – Window Flow Control, Error Control, Stop-and-wait ARQ, Go-back-N, Selective-repeat, Example of Data Link Protocols- HDLC.

The Medium Access Control Sub Layer: The Channel Allocation Problem, Multiple Access Protocols, Ethernet, wireless LANs, Blue Tooth, Data Link Layer Switching.
The Network Layer: Network Layer Design Issues, Routing, Quality of Service, Internetworking,

The Transport Layer : The Transport layer Services, Elements of Transport Protocols, A Simple Transport Protocol, The Internet Transport Protocols; UDP, TCP, Performance Issues, Congestion control.
Application Layer: Network Security, DES, RSA algorithms, Domain Name System, Simple Network Management Protocol, Electronic mail, File Transfer Protocol, Hyper Text Transfer Protocol, Cryptography and compression Techniques.

**References:**


1. A.S. Tanenbaum, "Computer Networks, 3rd Edition," PHI
2. W.Stallings, "Data and Computer Communication" Macmillan Press
3. Comer, "Internetworking with TCP/IP" PHI
4. Comer, "Computer networks and Inter" PHI
5. Forouzan, "Data Communication and Networking:. TMH
6. Principle of Digital Communication and Computer Network, Dr. Prasad, Wiley Dreamtech India.

**SET/CSE/MCA/C205: Combinatorics and Graph Theory**

Rules of sum and products, Permutation, Combination, Permutation groups and application, Probability, Remsey Theory, Discrete numeric function and generating function, combinatorial problems, Difference equation.
Recurrence Relation: Introduction, Linear recurrence relation with constant coefficient, Homogeneous solution, Particular solution, Total solution, Solution by the method of generating function.

Graphs, sub-graphs, some basic properties, Walks, Path and circuits, Connected graphs, Disconnected graphs and component, Eular and Hamiltonian graphs, Various operation on graphs, Tree and fundamental circuits, Distance diameters, Radius and pendent vertices, Rooted and binary trees, Counting trees, Spanning trees, Finding all spanning trees of a graph and a weighted graph.

Cut-sets and cut vertices, some basic properties, All cut sets in a graph, Fundamental circuit and cut sets, Connectivity and seperatability, Network flows, Planner graphs, Combinatorial and geometric dual, Kuratowski to graph detection of planarity, Geometric dual, Some more criterion of planarity, Thickness and Crossings, Vector space of a graph and vectors, basis vectors, cut set vector, circuit vector, circuit and cut set verses sub spaces, orthogonal vector and sub space. Indicidence matrix and adjacency matrix of graphs.

Coloring and covering partitioning of graph, Chromatic number, Chromatic partitioning, Chromatic polynomials, Matching, covering, Four color problem, Directed graph, Types of directed graphs, Directed paths and connectedness, Euler digraph, Tree and directed edges, Fundamental circuit in digraph, Matrices A,B,C of digraph adjacency matrix of digraph, Enumeration and its types, counting of labeled and unlabeled trees, Polya's theorem, Graph enumeration with polyas theorem, Graph theoretic algorithm.

**References:**


1. Deo Narsing, :Graph Theory with applications to engineering and computer science", PHI
2. Tremblay and Manohar, :Discrete mathematical structures with applications to computer Science:, TMH
3. Joshi K.D., "Fundamental of discrete mathematics:, New Age International
4. John Truss, "Discrete mathematics of computer scientist"
5. C.L. Liu, "Discrete mathematics"

**SET/CSE/MCA/C301: Network Security and Cryptography**

Introduction of Cryptography: Introduction To security: Attacks, Services and Mechanisms, Security, Attacks, Security Services, Conventional Encryption: Classical Techniques, Conventional Encryption Model, and steganography, Classical Encryption Techniques. Modern Techniques: Simplified DES, Block Cipher Principles, DES Standard, DES Strength, Differential and Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operations.

Conventional Encryption Algorithms: Triples DES, Blowfish, International Data Encryption Algorithm, RCS, CAST-128, CR2 Placement and Encryption Function, Key Distribution, Random Number Generation, Placement of Encryption Function.

Public Key Encryption: Public-Key Cryptography: Principles of Public-Key Cryptosystems, RSA Algorithm, Key, Key Management, Fermat's and Euler's Theorm, Primality, Chinese Remainder Theorem.
Hash Functions: Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Function Birthday Attacks, Security of Hash Function and MACS, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA), Digital Signatures: Digital Signature, Authentication Protocol, Digital Signature Standard (DDS) Proof of Digital Signature Algorithm.

Network and System Security: Authentication Applications: Kerberos X-509, Directory Authentication Service, Electronic Mail Security, Pretty Good Privacy (PGP),S/Mine Security: Architecture, Authentication Header, Encapsulating Security Payloads, Combining Security Associations, Key Management, Web Security: Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction (Set), System Security: Intruders, Viruses, Firewall Design Principles, Trusted Systems.

**References:**


1. William Stallings, "Cryptography and Network Security: Principles and Practice"' Prentice hall, New Jersey
2. Johannes A. Buchmann, "Introduction to Cryptography" Springer-Verlag
3. Atul Kahate, "Cryptography and Network Security" TMH
4. Network Security Bible : Eric Cole, Wiley dreamtech India Pvt. Ltd.
5. Practical Cryptography "Bruce Schneier" Wiley dreamtech India Pvt. Ltd.

**SET/CSE/MCA/C302: Design and Analysis of Algorithms**

Introduction: Algorithms, Analysis of Algorithms, Design of Algorithms, and Complexity of Algorithms, Asymptotic Notations, Growth of function, Recurrences. Sorting in polynomial Time: Insertion sort, Merge sort, Heap sort, and Quick sort Sorting in Linear Time: Counting sort, Radix Sort, Bucket Sort Medians and order statistics.

Elementary Data Structure: Stacks, Queues, Linked list, Binary Search Tree, Hash Table.
Advanced Data Structure: Red Black Trees, Splay Trees, Augmenting Data Structure Binomial Heap, B-Tree, Fibonacci Heap, and Data structure for Disjoint Sets. Union-find Algorithm, Dictionaries and priority Queues, mergeable heaps, concatenable queues.

Advanced Design and Analysis Techniques: Dynamic Programming, Greedy Algorithm, Backtracking, Branch-and-Bound, Amortized Analysis.
Graph Algorithms: Elementary Graph Algorithms, Breadth First search, Depth First search, Minimum Spanning Tree, Kruskal's Algorithms, Prim's Algorithms, Single Source Shortest Path, All pair Shortest Path, Maximum flow and Traveling Salesman Problem.
Randomized Algorithms, String Matching, NP-Hard and NP-Completeness Approximation Algorithms, Sorting Network, Matrix Operations, Polynomials and the FFT, Number Theoretic Algorithms.

**References:**


1. Horowitz Sahani, "Fundamentals of Computer Algorithms." Galgotia
2. Coremen Leiserson etal, "Introduction to Algorithms", PHI
3. Brassard Brately, :Fundamental of Algorithms" PHI
4. M.T. Goodrich etal, "Algorithms Design" John Wiley
5. A.V. Aho etal. "The Design and analysis of Algorithms" Person Education
6. Algorithms and Data Structure: Boldwin Scragg, Wiley dreamtech

**SET/CSE/MCA/C303: Machine Learning**

Introduction: Well-Posed learning problems, Basic concepts, Designing a learning system, Issues in machine learning. Types of machine learning: Learning associations, Supervised learning, Unsupervised learning, Reinforcement learning

Decision Tree Learning: Decision tree representation, appropriate problems for decision tree learning, Univariate Trees (Classification and Regression), Multivariate Trees, Basic Decision Tree Learning algorithms, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

Bayesian Learning: Bayes theorem and concept learning, Bayes optimal classifier, Gibbs algorithms, Naive Bayes Classifier, Bayesian belief networks, The EM algorithm.

Artificial Neural Network: Neural network representation, Neural Networks as a paradigm for parallel processing, Linear discrimination, pairwise separation, Gradient Descent, Logistic discrimination, Perceptron, Training a perceptron, Multilayer perceptron, Back propagation Algorithm. Recurrent Networks, dynamically modifying network structure.

Genetic Algorithms: Basic concepts, Hypothesis space search, Genetic programming, Models of evolution and learning, Parallelizing Genetic Algorithms.

Data Mining Techniques for Analysis: Classification: Decision tree induction, Bayes classification, Rule-based classification, Support Vector Machines, Classification Using Frequent Patterns, k-Nearest-Neighbor, Fuzzy-set approach Classifier, Clustering: K-Means, k-Medoids, Agglomerative versus Divisive Hierarchical Clustering Distance Measures in
Algorithmic Methods, Mean-shift Clustering

**References:**


1. Mitchell T.M., Machine Learning, McGraw Hill
2. Bishop C., Pattern Recognition and Machine Learning, Springer-Verlag
3. Stephen Marsland, Machine Learning: An Algorithmic Perspective, CRC Press

## SET/CSE/MCA/E1.1: Graphics and Animation

Graphics Primitives: Display Devices: Refresh Cathode Ray Tube, Raster Scan Display, Plasma display, Liquid Crystal display Plotters, Printers. Input Devices: Keyboard, Trackball, Joystick, Mouse, Light Pen, Tablet, and Digitizing Camera.

Input Techniques: Positioning techniques, Potentiometers, Constraints, Scales and Guidelines, Rubber-Band techniques, Dragging Dimensioning techniques and Graphical Potentiometers, Pointing and Selection: the use of selection points defining a boundary rectangle, multiple selections, Menu selection.
Mathematics for Computer Graphics: Point representation, Vector representation, Matrices and operations related to matrices, Vector addition and vector multiplication, Scalar product of two vectors, Vector product of two vectors.
Line Drawing Algorithms: DDA Algorithms, Bresenham's Line algorithm.
Segment and Display files: Segments, Functions for segmenting the display file, Posting and posting a segment, segment naming schemes, Default error conditions, Appending to segments, Refresh concurrent with reconstruction, Free storage allocation, Display file structure.

Graphics Operations: Clipping, Point Clipping, Line Clipping, Polygon Clipping. Filling: Inside Tests, Flood fill algorithm, Boundary-Fill Algorithm and scan-line polygon fill algorithm.
Conics, Curves and Surfaces: Quadric surfaces: Sphere, Ellipsoid, and Torus. Superquadrics: Superellipse, superellipsoid, Spline and Bezier Representations: Interpolation and approximation splines, parametric continuity conditions, Geometric Continuity Conditions, Spline specifications. Bezier curves and surfaces.
Transformation: 2D transformation, Basic Transformations, Composite transformations: Reflection, Shearing, Transformation between coordinate systems. 3D Graphics: 3D Display Methods, 3D transformations, Parallel projection, Perspective projection, Visible lines and surfaces identification, Hidden surface removal.

### References:


1. Donald Hearn and M Pauline Baker, "Computer Graphics" PHI
2. Steven Harrington, "Computer Graphics: A Programming Approach" TMH
3. Prajapati A.K. "Computer Graphics" PPM Ed2
4. Foley James D, "Computer Graphics" AW Ed2
5. Newman and Sprould, "Principle of to Interactive Computer Graphics" McGraw Hill
6. Rogers, "Procedural Elements of Computer Graphics", McGraw Hill
7. Rogers and Adams, "Mathematical Elements of Computer Graphics" McGraw Hill

## SET/CSE/MCA/E1.2: JAVA Programming

Overview of JAVA : The genesis of java, An overview of java, java virtual machine (JVM),Java development kit (JDK), Java Vs C++, Data types, Literals, Variables, and Arrays, Operators, Control statements, Introducing Class, closer look at Methods and class, Nested and inner class ,Exploring Java.lang, String handling ,Constructor, Garbage collection and finalize() method.

Inheritance, Packages and interface- Types of inheritance, Access specifiers class inheritance, using super, method overriding, Abstract class, constructor in multilevel inheritance, using final with inheritance, Dynamic method dispatch, Defining package, CLASSPATH, Access protection, Importing package, Defining and implementing interface, Extending interface, Nested interface.
Exception handling and Multithreading: Using try and catch, multiple catch classes, Nested try statements, throw, throws and finally, Built in exception, Uncaught exception, Creating own exception class, Java Thread Model – Main thread, Creating own Thread, Life cycle of thread, Thread priorities, Synchronization and messaging, Intertribal communication, Suspending, Resuming and stopping thread.

Input Output and Networking : Byte stream and character stream ,Predefined stream, reading console input, writing consol output, PrintWriter class, Reading and writing files Networking – classes and interfaces, Socket and overview, TCP/IP client socket and server, Inet address, URL Connection, Datagram.
Applet, AWT and Event handling – Applet life cycle, Creating an applet, Using image and sound in applet, passing parameter. AWT- Overview of java.awt package, Component and Containers, control component and layout manager. Event handling –The delegation-event model, Event classes, Source of event, Event listener interfaces, handling mouse and keyboard event, Adapter class.

### References:


1. Naughton P and schildt H. Java: The complete reference, Osborne Mcgra-Hill, Berkeley, USA, 1997.
2. Simply JAVA :An Introduction to JAVA programming By James R. Levenick ,Firewall Media publication New,Delhi
3. Balguruswami : Java Programming
4. Core JAVA for beginners by Rashmi Kanta Das ,Vikas Publication.

**SET/CSE/MCA/E1.3: Internet of Things**

Introduction: Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.

Elements of IOT: Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

IOT Case studies: Industrial automation, Transportation, Agriculture, Healthcare, Home Automation

**References:**


1. Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, CRC Press
2. Vijay Madisetti, Arshdeep Bahga, Ïnternet of Things, A Hands-on Approach, University Press
3. Pethuru Raj and Anupama C. Raman, The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press

**SET/CSE/MCA/E1.4:** Online Course from NPTEL/SWAYAM

This course has to be completed by the students by choosing courses from NPTEL/SWAYAM/MOOCs/etc. They should undergo the online course completely, submit assignments, projects, etc. and appear for the final exam conducted by the online instructor. **The awarded certificate must be submitted for the award of credits in this course.**

This is **an open course** which student can select from the offered online courses and **can be of any discipline** of the interest of the student but should not be the courses offered in this
Programme of study.

**SET/CSE/MCA/E2.1 : Android Application Development**

Introduction to Android: The Android Platform, Android SDK, Android Studio installation, Android Installation, building First Android application, Understanding Anatomy of Android Application, Android Manifest file.

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

Using Common Android APIs: Using Android Data and Storage APIs, managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

**References:**


1. Meier Reto and Lake Ian, *"Professional Android",* Wrox
2. John Horton, Android Programming for Beginners, Packt Publishing

**SET/CSE/MCA/E2.2 : Compiler Design**

Compiler Structure: Compilers and Translators, Various Phases of Compiler, Pass Structure of Compiler, Bootstrapping of Compiler.
Programming Language: High level languages, lexical and syntactic structure of a language, Data elements, Data Structure, Operations, Assignments, Program unit, Data Environments, Parameter Transmission.
Lexical Analysis: The role of Lexical Analyzer, A Simple approach to the design of Lexical Analyzer, Regular Expressions, Transition Diagrams, Finite state Machines, Implementation of Lexical Analyzer, Lexical Analyzer Generator: LEX, Capabilities of Lexical Analyzer.

The Syntactic Specification of Programming Languages: CFG, Derivation and Parse tree, Ambiguity, Capabilities of EFG.
Basic Parsing Techniques: Top-Down parsers with backtracking, Recursive descent Parsers, Predictive Parser, Bottom-up Parsers, Shift-Reduce Parsing, Operator Precedence Parsers, LR parsers (SLR, Canonical LR, LALR) Syntax Analyzer Generator: YACC

Intermediate Code Generation: Different Intermediate forms: Three address code, Quadruples and Triples, Syntax Directed Translation mechanism and attributed definition. Translation of Declaration, Assignment, Control flow, Boolean expression, Array References in arithmetic expressions, procedure calls, case statements, postifix translation.
Run Time Memory Management: Static and Dynamic storage allocation, stack based memory allocation schemes, Symbol Table management.

Error Detection and Recovery: Lexical phase errors. Syntactic phase errors, semantic errors.
Code Optimization and Code Generation: Local optimization, Peephole optimization, Basic blocks and flow Graphs, DAG, Data flow analyzer, Machine Model, Order of evaluation, Register allocation and code selection.

**References:**


1. Alfred V Aho, Jeffrey D. Ullman, "Principles of Compiler Design", Narosa
2. A.V. Aho, R. Sethi and J.D.Ullman, "Compiler Principle, Tech and tools" AW
3. H.C. Holub "Compiler Design in C", Printice Hall Inc.
4. Apple, "Modern Computer Implementation in C: Basic Design" Cambridge Press
5. Modern Compiler Design: Dick Grune, Wiley dreamtech India Pvt. Ltd.
6. Starting Out with Modern Compiler " David Gaddis Wiley dreamtech India Pvt. Ltd.

**SET/CSE/MCA/E2.3 : Human- Computer Interaction**

Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design.
The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.
Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions.

Screen Designing:- Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls.
Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.
Software tools – Specification methods, interface – Building Tools.
Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.

**References:**


1. Human – Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson Education
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech,
3. User Interface Design, Soren Lauesen , Pearson Education.

**SET/CSE/MCA/E2.4 : Computer Vision**

Fundamentals of Image Processing: Sources of imagery, Physics of imaging, Representing, acquiring and displaying images, Grayscale, color, noise, lens distortion, and filtering. Preprocessing, and image correction, Enhancing features and correcting imperfections, Addressing noise, lens distortion, and blurring.

Computer Vision Paradigms: Bottom-up, top-down, neural net, feedback, Pixels, lines, boundaries, regions, and object representations, Low-level, intermediate-level and high-level vision, Historical and illustrative examples.

Finding Edges and Lines: Finding edges (low-level), Gradients, zero crossing detectors, line models, Roberts, Sobel, Cany, Finding and grouping lines (intermediate-level), Boundary tracing, line fitting, Hough transform.

Region Processing and 3D Vision: Finding elementary regions (low-level), Merging, splitting and grouping regions (intermediate-level), Grouping and analyzing lines and regions (high-level), Stereo and Motion, Optical Flow, Motion Understanding Representing the environment and Matching, Clouds, generalized cylinders, semantic nets, Matching line and region groups to object representations (high-level).

Applications: Face detection, Face recognition, Foreground and background separation, object detection and tracking, combining views from multiple cameras, Identifying road signs, Gait analysis.

**References:**


1. Digital Image Processing - R.C. Gonzalez and R.E. Woods, Third Edition, Pearson, 2014
2. Computer & Machine Vision - E. R. Davies, Fourth Edition, Academic Press, 2012
3. Computer Vision - A Modern Approach - D.A. Forsyth and J. Ponce, PHI Pvt. Ltd, 2009
4. Image Processing, Analysis and Machine Vision - M. Sonka, V. Hlavac, and R. Boyle, Thomson Asia Pvt. Ltd., Singapore, 2001

**SET/CSE/MCA/E3.1: Natural Language Processing**

Regular expressions and automata, Morphology and Finite State transducers, N – grams.

Word classes and part of speech tagging, Context free grammars for English, Parsing with context free grammars.
Features and Unifications, Lexicalized and Probabilistic parsing.
Semantics: Representing meaning, Semantic analysis, Lexical semantics, Word Scene Disambiguation and Information retrieval.

Pragmatics: Discourse, Dialog and Conversational Agents, Natural Language Generation, Machine Translation.

**References:**

1. Daniel, Jurafsky and Martin, Speech and Language Processing, Pearson, 2003

**SET/CSE/MCA/E3.2 : Image Processing**

Introduction: Digital Image Processing, The origins of Digital Image Processing, Examples of Digital Image Processing application, Fundamental steps in Digital Image processing, Components of Image Processing system Fundamentals: Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels, Linear and Nonlinear Operations.

Image Enhancement in the spatial domain: Background, Some basic gray level transformation, Introduction of Histogram processing, Enhancement using Arithmetic/Logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Image Enhancement in the Frequency Domain : Introduction.

Image Restoration: Model of the Image Degradation/Restoration process, Noise Models, Restoration in the presence of noise only spatial filtering, Inverse filtering, Minimum Mean Square Error (Wiener) filtering, Geometric mean filter, Geometric Transformations, Image Compression: Fundamentals, Lossy Compression, Lossless Compression, Image Compression models, Error-free Compression : Variable length coding, LZW coding, Bit plane coding, Run length coding, Introduction to JPEG.

Morphology: Dilation, Erosion, Opening and Closing, Hit-and Miss transform, Morphological Algorithms : Boundry Extraction, Region filling, Extraction of connected components, Convex Hull,
Image Segmentation: Definition, characteristics of segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region based segmentation. Introduction to Representation and Description, Introduction to Object Recognition.

**References:**


1. Digital Image Processing: Rafael C. Gonzalez and Richard E.Woods. Addision Wesley.
2. Fundamentals of Digital Image Processing. Anil K. Jain, PHI.
3. Digital Image Processing and Analysis : B. Chanda and D. Dutta Majumber, PHI.
4. Image Processing in C : Dwayne Phillips, BPB.

## SET/CSE/MCA/E3.3 : Cloud Computing

Introduction- Objectives, From collaborative to the Cloud – A short history Client – Server Computing, Peer-to-Peer Computing, Distributed Computing, Collaborative Computing, Cloud Computing, Functioning of Cloud Computing, Cloud Architecture, Cloud Storage, Cloud Services, Industrial Applications.

Business Values, Introduction-Objectives, Service Modeling, Infrastructure Services, Platform Services, Software Services - Software as service modes- Massively scaled software as a service- Scale of Economy, Management and Administration.

Inside Cloud Computing- Introduction- Objectives, Feeling Sensational about Organization, Making Strategy Decisions- Governance Issues- Monitoring Business Processes- IT Cost Management,

Cloud Service Administration- Service Level Agreements and Monitoring-Support Services-Accounting Services, Resource Management- IT Security- Performance Management-Provisioning- Service Management, Untangling Software Dependencies.

Cloud Computing Technology- Introduction-Objectives, Clients – Mobile – Thin – Thick, Security - Data Linkage - Offloading Work - Logging - Forensics - Development – Auditing, Network- Basic Public Internet- The Accelerated Internet- Optimised Internet Overlay- Site-to-Site VPN- Cloud Providers- Cloud Consumers - Pipe Size- Redundancy, Services- Identity- Integration- Mapping- Payments- Search.

Accessing the Cloud- Introduction-Objectives, Platforms- Web Application Framework-Web Hosting Services- Proprietary Methods, Web Applications- API's in Cloud Computing, Browsers for Cloud Computing- Internet Explorer- Mozilla Firefox- Safari-Chrome.

Data Management- Introduction- Objectives, Data Security- Data Location- Data Control-Securing data for transport, Scalability and Cloud Services- Large Scale Data Processing-Databases and Data Stores- Data Archival.

Information Storage in Cloud Computing- Introduction- Objectives, Storage as a Service, Storage Providers- Amazon Simple Storage Service- Nirvanix- Google Bigtable Datastore-MobileMe- Live Mesh, Storage Security, Merits and Demerits of Storage.

Discovery of Private and Hybrid Clouds- Introduction- Objectives, Need for Privacy-Defining a private cloud- Public, Private, and Hybrid Clouds – A Comparison, Examining the Economics of the private cloud- Assessing capital expenditures- Vendor Private Cloud Offerings, The Up Key Vendors- Service Oriented- Systems Integrators- Technology Enablers.

Cloud Computing Standards- Introduction- Objectives, Best Practices and Standards, Practical Issues- Interoperability- Portability- Integration- Security, Standards Organizations and Groups- Cloud Security Alliance- Distributed Management Task Force (DMTF)-National Institute of Standards and Technology (NIST)- Open Cloud Consortium (OCC)-Open Grid Forum (OGF)- Object Management Group (OMG)- Storage Networking Industry Association (SNIA)- Cloud Computing Interoperability Forum (CCIF)- Vertical Groups.

Desktop and Device Management- Introduction- Objectives, Desktop Virtualization- Across Industries- Client Desktops, Desktop placement in the cloud- Merits- Desktop as a Service (DaaS), Desktop Management- Watching the four areas- Asset Management.

Cloud Governance-Introduction-objectives, IT Governance, Deciding the Governor, Risk Assessment of running the cloud- Understanding possible risks- Performance monitoring and measurement- Measurement Methods, Working of Governance- Establishment of the Governance Body- IT Service Performance – Monitoring and Measuring- Cataloging control and Compliance Data.

Migrating to the Cloud- Introduction- Objectives, Cloud Services for individuals- Available Services - Skytap Solution, Cloud Services Aimed at the mid – market, Enterprise Class Cloud Offerings- MS Exchange - VMotion- VMWare vCenter Converter- Hyper – V Live Migration, Migration- Applications needed for migration - Moving existing data to cloud-Using the Wave approach.

Migrating to the Cloud- Introduction- Objectives, Analyzing the Services- Establishing a Baseline and Metrics- Tools, Best Practices- Finding the Right vendor- Phased-in Vs Flash-cut Approaches- Bringing in Creativity, How Cloud computing might evolve- Researcher Predictions- Responding to Changes- Getting ready.

**SET/CSE/MCA/E4.1: Artificial Intelligence**

Introduction: Definition and meaning of artificial intelligence, A.I. techniques, pattern recognition, Level of, speech recognition representation in A.I. properties of internal representation.
Production System: Different types of tracing, strategies, graph search strategies, Heuristic graph, search procedure, AND/OR graph, relationship between decomposional and compatible systems, searching Gate Tree, min-max search game playing, actual game playing.

Introduction to Predicate Calculus: Predicates and Arguments, connectives, Simplifications of strategies, extracting answers from Resolution Refutation. Control strategies.

Rule Based Deduction Systems: Forward and backward deduction system, resoling with AND/OR graph, computation, deduction and program synthesis, central knowledge for rules based deduct systems.
Managing Plans of Action: Plan interpreter, planning decisions, execution monitoring and re-planning domain of application robot motion planning and game playing.

Structural Object Representation: Semantic networks semantic market matching deductive operations on structured objects.
Architectural for A.I. Systems: Knowledge, acquisitions representation IMAGES PROCESSING, Natural language processing.

**References:**


1. Introduction to artificial Intelligence Eugene Charnik Drew MC mott
2. Artificial Intelligence Elaine Rice.
3. Principal of Artificial Intelligence, Nelson, Springer-Verlag.
4. Artificial Intelligence Application Programming: Tim Jones, Wiley dreamtech

**SET/CSE/MCA/E4.2: E-Commerce**

Introduction: Electronic Commerce - Technology and Prospects, Definition of E-Commerce, Economic potential of electronic commerce, Incentives for engaging in electronic commerce, forces behind E-Commerce, Advantages and Disadvantages, Architectural framework, Impact of E-Commerce on business.

Network Infrastructure of E-Commerce: Internet and Intranet based E-Commerce Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, FRAME RELAY).
Mobile Commerce: Introduction, Wireless Application Protocol, WAP Technology, Mobile Information device, Mobile Computing Applications.

Web Security: Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.
Encryption: Encryption techniques, Symmetric Encryption-Keys and data encryption standard, Triple encryption. Asymmetric encryption-Secret key encryption, public and private pair key encryption, Digital Signature, Virtual Private Network.
Electronic Payments: Overview, The SET protocol, payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking EDI Application in business, E-Commerce Law, Forms of Agreement, Govt. policies and Agenda.

## References:

1. Ravi Kalakota, Andrew Winston, :Frontiers of Electronic Commerce" Addison Wesley.
2. Bajaj and Nag. "E-Commerce the cutting edge of Business". TMH.
3. P. Loshin, John Vacca, "Electronic Commerce" Firewall Media, N.Delhi.
4. E Business and Commerce: Brahm Cazner, Wiley dreamtech.

**SET/CSE/MCA/E4.3 : Data Mining**

Introduction to data mining, need for data warehousing and data mining, application potential, keywords and techniques. Data Warehousing and On-line analytical Processing (OLAP): Aggregation operations, models for data warehousing, star schema, fact and dimension tables , conceptualization of data warehouse and multidimensional databases, Relationship between warehouse and mining.

Data mining primitives: Data preprocessing, data integration, data transformation. Definition and specification of a generic data mining task. Description of Data mining query language with examples. Association analysis: Different methods for mining association rules in transaction based data bases. Illustration of confidence and support. Multidimensional and multilevel association rules. Classification of association rules. Association rule algorithms – A priori and frequent pattern growth.

Classification and Prediction: Different classification algorithms. Use of genie index, decision tree induction, Bayesian classification, neural network technique of back propagation, fuzzy set theory and genetic algorithms.
Clustering: Partition based clustering, hierarchical clustering, model based clustering for continuous and discrete data. Scalability of clustering algorithms. Parallel approaches for clustering.

Web mining: Web usage mining, web content mining, web log attributes. Data mining issues in object oriented data bases, spatial data bases and multimedia data bases and text data bases.

**References:**

1. J. Han, M. Kamber, “Data Mining Concepts and Techniques”, Harcourt India Pvt Ltd, 2001
2. M. Dunham, “ Data Mining : introductory and Advanced Topics”, Pearson Pub, 2003
3. A.K. Pujari, “Data Mining Techniques”, Universities Press.

**SET/CSE/MCA/E4.4 : Management Information System**

Management Information System : Definition, MIS as an evolving concept, MIS and other Academic Disciplines, Subsystems of an MIS.
Structure of MIS : Elements of an Information System, MIS support for Decision making, MIS Structure.
Hardware, Software, and communications Technology for Information Systems.

System and Design : Systems Development Initiative, Different Methodologies - Life Cycle and Prototype approach, Detailed study on Life Cycle Design and Implementation. Case Study.

Managerial Decision Making : Decision Making Process, Group Decision Support Systems, Architecture of GDSS, Categories of GDSS.
Decision Support System : Definition and Components of DSS (Data Base Management System, Model Base Management System, Support Tools), Applications of DSS, Functions of DSS.

A study of Computerization in different functional areas of a typical manufacturing/business organization i.e Marketing, production, material, financial, personal.

**References:**

1. Management Information Systems Gordon B. Davis and Margerethe H. Olson Mc-Graw-Hill