# DIRA GANDHI DELHI TECHNICAL UNIVERSITY FOR WOMEN
## (Established by Govt. of Delhi vide Act 9 of 2012)

### Mater of Computer Applications (MCA)

### First Semester

| S. No. | Code | Subject | L-T-P | Credits | Category |
|---|---|---|---|---|---|
| 1 | MCA-101 | Fundamentals of Information Technology | 3-0-2 | 4 | DCC |
| 2 | MCA-103 | Problem Solving using C Programming | 3-0-4 | 5 | DCC |
| 3 | MCA-105 | Discrete Mathematics | 3-1-0 | 4 | DCC |
| 4 | MCA-107 | Computer Organization | 3-0-2 | 4 | DCC |
| 5 | HMC-101 | Professional Skills | 3-0-0 | 3 | HMC |
| TOTAL | | | | 20 | |

### Second Semester

| S. No. | Code | Subject | L-T-P | Credits | Category |
|---|---|---|---|---|---|
| 1 | MCA-102 | Data Structures | 3-0-4 | 5 | DCC |
| 2 | MCA-104 | Object Oriented Programming withC++ | 3-0-4 | 5 | DCC |
| 3 | MCA-106 | Software Engineering | 3-0-2 | 4 | DCC |
| 4 | MCA-108 | Operating Systems | 3-0-2 | 4 | DCC |
| 5 | HMC-102 | Human Values and Professional Ethics | 3-0-0 | 3 | HMC |
| TOTAL | | | | 21 | |

### Third Semester

| S. No. | Code | Subject | L-T-P | Credits | Category |
|---|---|---|---|---|---|
| 1 | MCA-201 | Design and Analysis of Algorithms | 3-0-2 | 4 | DCC |
| 2 | MCA-203 | Cloud Computing | 3-0-2 | 4 | DCC |
| 3 | MCA-205 | Database Management Systems | 3-0-2 | 4 | DCC |
| 4 | MCA-207 | Web Technologies | 3-0-2 | 4 | DCC |
| 5 | GEC-201 | Generic Open Elective-1 | 0-0-4 | 2 | GEC |
| 6 | HMC-202 | Principles of Management | 3-0-0 | 3 | HMC |
| 7 | MCA-153 | Industrial Training/Internship | - | 1 | DCC |
| TOTAL | | | | 22 | |

**Fourth Semester**

| S. No. | Code | Subject | L-T-P | Credits | Category |
|---|---|---|---|---|---|
| 1 | MCA-202 | Java Programming | 3-0-2 | 4 | DCC |
| 2 | MCA-204 | Artificial Intelligence | 3-0-2 | 4 | DCC |
| 3 | MCA-206 | Data Communications and Computer Networks | 3-0-2 | 4 | DCC |
| 4 | DEC-2xx | Departmental Elective-1 | 3-1-0 | 4 | DCC |
| 5 | HMC-202 | Disaster Management | 2-0-0 | 2 | HMC |
| 6 | HMC-204 | Organizational Behavior | 3-0-0 | 3 | HMC |
| TOTAL | | | | 21 | |

**Fifth Semester**

| S. No. | Code | Subject | L-T-P | Credits | Category |
|---|---|---|---|---|---|
| 1 | MCA-301 | Software Testing | 3-0-2 | 4 | DCC |
| 2 | DEC-303 | Machine Learning and Data Analytics | 3-0-2 | 4 | DCC |
| 3 | DEC-3xx | Departmental Elective -2 | 3-0-2 | 4 | DEC |
| 4 | DEC-3xx | Departmental Elective-3 | 3-0-2 | 4 | DEC |
| 5 | GEC-301 | Generic Open Elective-2 | 0-0-4 | 2 | GEC |
| 6 | MCA-351 | Minor Project | 3-0-0 | 3 | DCC |
| 7 | MCA-353 | Industrial Training/Internship | 1-0-0 | 1 | DCC |
| TOTAL | | | | 22 | |

**Sixth Semester**

| S. No. | Code | Subject | L-T-P | Credits | Category |
|---|---|---|---|---|---|
| 1 | MCA-352 | Major Project | - | 20 | DCC |

## List of Departmental Elective Courses

| Category | Course Code | Subject | Credits |
|---|---|---|---|
| **Departmental Elective Course-1** | MCA 208 | Computer Graphics and Multimedia Technologies | 3-0-2 |
| | MCA 210 | Soft Computing | 3-0-2 |
| | MCA 212 | Cyber Security and Forensics | 3-1-0 |
| | MCA 214 | Software Project Management | 3-0-2 |
| **Departmental Elective Course-2** | MCA 305 | Network Security | 3-0-2 |
| | MCA 307 | Advanced DBMS | 3-0-2 |
| | MCA 309 | E-Commerce | 3-0-2 |
| | MCA 311 | Software Quality Assurance | 3-1-0 |
| **Departmental Elective Course-3** | MCA 313 | Internet of Things (IoT) | 3-0-2 |
| | MCA 315 | Advanced Data Structures | 3-0-2 |
| | MCA 317 | Theory of Computation | 3-1-0 |
| | MCA 319 | Mobile Computing | 3-1-0 |

| Fundamentals of IT | |
|---|---|
| Course Code: MCA 101<br>Contact Hours: L-3 T-1 P-0<br>Course Category: DCC | Credits: 4<br>Semester: 3 |

Introduction

Computing and programming are essential to leverage the technical skills of a student. The course Fundamentals of Information Technology has become essential in the present age of computer technology and information, as the applications of information technology can be found in all aspects of our lives. This course is designed to meet the requirements of students having very little knowledge of computers and help them to learn from the basic fundaments of computers through applications of information technology.

Course Objective :

The focus of the subject is on introducing skills relating to IT basics, computer applications, programming, Operating systems and computer network basics etc.

Pre-requisite: Preliminary knowledge of computer, their operations and applications.

Course Outcome:

At the end of this course, student should be able to

- Understand basic concepts and terminology of information technology.
- Have a basic understanding of personal computers and their operations.
- Familiarise operating systems , programming languages, peripheral devices and networking.
- Understand the concepts related to computer software, hardware and storage fundamentals.

Pedagogy: Lectures will be delivered via discussions, whiteboard, slideshows and assignments.

Contents

| UNIT-I | 10 Hours |
|---|---|
| Information Concepts and Processing : Definition of Information Technology, Quality, need of information system, levels of information, data processing, definition of knowledge<br>Evolution of Computer, Block diagram of Computer<br>**Programming languages and Translators:** Low and high level languages, assembly language, 4GL and 5GL Introduction to assemblers, compilers, interpreters, linkers and loaders.<br>**Number System:** Bit, byte, binary, decimal, hexadecimal, and octal systems, conversion from one system to the other,<br>**Binary Arithmetic:** Addition, subtraction and multiplication. Representation of Information: Integer and floating point representation, Complement schemes, Character codes (ASCII, EBCDIC, BCD, Excess-3, Grey). | |
| UNIT-II | 11 Hours |
| **Introduction to Computer software:** Introduction to system software, categories of system and application, Distinction between systems software and Application software, Introduction to Software Development activities.<br>**Introduction to Computer Hardware:** CPU, Memory, different types of memories (Cache memory, virtual memory and Auxillary memory) , Various I/O devices.<br>**Storage Fundamentals:** Primary vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives. | |

| UNIT-III | 10 Hours |
|---|---|
| **Operating systems :** Evolution, introduction to OS , functions and facilities, Different types of operating systems (Batch, multi-programming, time sharing, multiprocessing, PC operating system, real time operating system, single tasking and multitasking OS , single user and multi-user OS)<br>**Introduction to process management:** process, threads, scheduling, characteristics of MS-DOS and Unix operating system , DOS and UNIX commands, Introduction to Database Management System and its types. | |
| UNIT-IV | 10 Hours |
| **Communication and Computer Network:** - Basic elements of a Communication System , Data transmission media, Digital and Analog, Network Types (LAN, WAN and MAN), inter networking devices and Communication Protocols, Intranet and Extranet, Hypertext Markup Language, WWW, HTTP, HTTPs, FTP, Telnet, Web Browsers, Search Engines, Email, Digital Signatures, Firewall. | |
| Text Books | |
| 1 | Anoop Mathew ,Fundamentals of Information Technology, Alpha Science International Ltd, 2013 |
| 2 | P. K. Sinha and Priti Sinha , “Computer Fundamentals”, BPB Publications, 2011. |
| 3 | Forouzan, Data Communication and Networking, McGraw Hill Education, 2017 |
| Reference Books | |
| 1 | V. Rajaraman, “Fundamentals of Computers”, PHI; 6th Revised edition edition ,2014 |
| 2 | Morris Mano, “ Computer System Architecture”, Pearson, 3rd Ed, 2017. |

| PROBLEM SOLVING USING C PROGRAMMING | |
|---|---|
| Course Code: MCA-103<br>Contact Hours: L-3 T-0 P-4<br>Course Category: DCC | Credits: 5<br>Semester: 1 |

Introduction:

This course provides an introduction to computer concepts, logic, and computer programming. It includes designing, coding, debugging, testing, and documenting programs using a high-level programming language.

Course Objectives:

- To learn the fundamental programming concepts and methodologies, essential to build efficient C programs.
- To practice the fundamental programming methodologies in the C programming language via lab sessions.
- To code, document, test, and implement a well-structured, robust computer program using the C programming language.
- To write reusable modules (collections of functions) in C.

Pre-requisite: None

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

- Gain a broad perspective of the uses of computer in engineering industry.
- Develop basic understanding of computers, the concept of algorithm and algorithmic thinking.
- Develop the ability to analyze a problem and develop an algorithm to solve it.
- Leverage C programming language to implement various algorithms, and develop the basic concepts and terminology of programming, in general.

Pedagogy:

The class will be taught using theory and tutorial based methods which include board teaching and presentations/slides, discussions etc. Along with classroom teaching, students will also be given assignments regarding the topics covered.

Contents

| UNIT-I | 11 Hours |
|---|---|
| **Introduction to Programming and its Environment:** Need for programming, Levels (High and Low) of programming, Development process (Preprocessor, Compiler, Linker and Loader), Linux –commonly used commands like mkdir, cd, ls, etc. , compiler –gcc, editor –vim<br>**C Language Introduction:** Program Structure through simple C programs, Constants and Variables, Data Types –Basic and Advanced, Operators and Expressions, Managing input and output operations using printf and scanf, Command line input, Conditional constructs, Looping constructs. Problem solving exercises based on –conditional and looping constructs. | |
| UNIT-II | 11 Hours |
| **Pointers, Arrays and Strings:** Concept of memory, Definition, Usage –address of and value at operation, Pointer arithmetic. Pointer to pointer, Arrays (Single and Multi-dimensional) and Strings–with emphasis on role of pointers in them, Pointer to Array, Array of pointers. Problem solving exercises based on –pointers, arrays and strings.<br>**Procedural programming:** Functions (Function Prototyping, passing parameters through call by value and call by reference, returning values, recursion), Program organization using functions, Emphasis on reusability through C examples. Problem solving exercises based on –functions. | |
| UNIT-III | 10 Hours |

| | |
|---|---|
| **File handling:** Concept of streams, File pointer, Reading and Writing to file, Closing a file, Random access in a file, Error handling during file I/O operations. Problem solving exercises based on –files.<br>**Problem Solving:** Algorithm, Flowchart and Pseudo code. Program design. | |
| UNIT-IV | 10 Hours |
| **Advanced concepts:** Pointers to functions and Callback functions. Storage classes (auto, extern, static, register), The C Preprocessor (#define, #undef, #include, #if conditional inclusion and other preprocessor directives), Defining New Data Types– Structures, Unions, Enumerated Types<br>**Dynamic Memory Management:** malloc, calloc, realloc, size of, free.<br>**Introduction to Data Structure**: Linked Lists and dynamic data structures. Problem solving exercises based on –advanced concepts and data structures | |
| Text Books | |
| 1 | Yashwant Kanetkar, "Let us C", BPB Publications, 16th edition, 2018. |
| 2 | B. Kernighan and D. Ritchie, "The ANSI C Programming Language", 2nd edition. |
| Reference Books | |
| 1 | Paul Deitel and Harvey Dietel, "How to Program", PHI, 8th Ed., 2015. |
| 2 | Behrouz A. Forouzan and Richard F. Gilberg, "Computer Science A Structured Programming Approach Using C", PHI, 3rd Ed., 2007 |
| 3 | Jeri R. Hanley and Elliot B. Koffman, "Problem Solving and Programming in C", Pearson, 8th Ed. 2015. |

| DISCRETE MATHEMATICS | |
|---|---|
| Course Code: MCA-105<br>Contact Hours: L-3 T-1 P-0<br>Course Category: DCC | Credits: 4<br>Semester: 1 |

**Introduction:**

Discrete mathematics forms the mathematical foundation of computer and information science. This course familiarizes with a broad range of mathematical objects like sets, functions, relations, graphs, that are omnipresent in computer science.

**Course Objectives:**

- To explain formal statements and their proofs; coming up with rigorous proofs themselves; and coming up with interesting results.
- To show at least one interesting and non-trivial result and give a full proof of introduced concepts.

**Pre-requisites:**

Basic mathematical operations

**Course Outcomes:**

On successful completion of this course, the students should be able to:

- Explain the concepts of set theory, relations, functions and Boolean algebra in the context of various fields of computer science e.g. Database, Automata, Compiler etc.
- Convert formal statements to logical arguments and correlate these arguments to Boolean logic, truth tables, rules of propositional and predicate calculus.
- Apply the fundamental principle of counting, combinatorics and recurrence relations to find the complex pattern and sequences in given datasets.
- For a given a mathematical problem, classify its algebraic structure.
- Develop the given problem as graph networks and apply the graph theory concepts for designing solutions of various computing problems e.g. shortest path, graph coloring, job sequencing, ranking the participants in a tournament problems etc.

**Pedagogy:**

The materials are delivered mostly through lectures videos to make complex subject easy to comprehend. More details on certain lessons are delivered through examples to provide more explanation.

Contents

| UNIT-I | 10 Hours |
|---|---|
| Set Theory: Notations, Types of sets, Multisets, Ordered pairs, Cartesian product, Combination of sets, Set Algebra, Proofs of some general identities on sets.<br>Relations: Representation, Relation types and properties, Operations on relations, Equivalence relations, Equivalence Partitions, Equality of relations, Order of relations, Partial ordering, Recursive definition of relation.<br>Closure: Reflexive, Symmetric and Transitive closures, Warshall's algorithm to compute transitive closure of a relation, Composite Relations, Functions, Classification of functions, Operation on functions.<br>Boolean Algebra: Introduction, Boolean functions, Representations and simplification of Boolean functions, Theorems of Boolean algebra, Algebraic manipulation of Boolean expressions, Logic implications, Karnaugh maps, Application of Boolean functions to synthesis of circuits.<br>Partially Ordered Sets and Lattices: Posets, lattices, Combination of partial order sets, Properties of lattices, Lattices as Algebraic systems, Sub lattices, Homomorphism, Hasse's diagram, Bounded, Complemented, Modular and Complete lattice | |
| UNIT-II | 11 Hours |
| Combinatorics: Principle of mathematical induction, Selected problems on mathematical induction, Fundamental principles of counting, Pigeonhole principle, Principle of inclusion and | |

exclusion.
Discrete Numeric Functions and Recurrence Relations: Introduction, Asymptotic behavior, Linear recurrence relations with constant coefficients (homogeneous and non homogeneous case, Solution of linear recurrence relations using generating functions.
Logic: Propositional logic, Tautology, Predicate Algebra, Quantifiers, Operators, Methods of proofs: direct, formal, informal, contradiction, induction, contraposition, exhaustive.

| UNIT-III | 11 Hours |
|---|---|

Discrete Probability: Sample space, Discrete Sample space, Types of Events: mutually exhaustive, mutually exclusive, Axioms of probability, Conditional probability, Total probability, Bayes' theorem, Univariate and bivaiate probability distributions, Discrete random variables, Probability mass function and cumulative distribution function, Mode and median and variance of a univariate and bivariate discrete probability distribution, Mathematical Expectation (Univariate and bivariate Random Variable), Expectation of a function of a random variable, Effect of change of origin and scale on mean and variance. Expectation and variance of sums of random variables. Conditional expectation and prediction. The Central Limit Theorem, Algebraic Structures: Definition, Groups, Subgroups and order, Cyclic Groups, Cosets, Lagrange's theorem, Semi groups and monoids, Cyclic semigraphs and submonoids, Congruence relations on semigroups, Normal Subgroups, Dihedral groups, Permutation and Symmetric groups, Group Homomorphisms, Properties of Rings and Fields, Integers Modulo n, polynomial arithmetic, quadratic residues, reciprocity, discrete logarithms, elliptic curve arithmetic.

| UNIT-IV | 10 Hours |
|---|---|

Graph theory: Path, cycles, handshaking theorem, bipartite graphs, sub-graphs, graph isomorphism, operations on graphs, Eulerian graphs and Hamiltonian graphs, planar graphs, Euler formula, travelling salesman problem, shortest path algorithms. Graphs, Euler tours, planar graphs, Hamiltonian graphs, Euler's formula, applications of Kuratowski's theorem, graph coloring, chromatic polynomials, trees, weighted trees, shortest path algorithms, spanning trees, the max-flow min-cut theorem.
Applications of Discrete Mathematics in Computer Science: Information Theory, Semantic Web, Formal Software Verification, Theorem Proving, Game Theory, Cryptography .

Text Books

| | |
|---|---|
| 1 | Rosen, Kenneth H., and Kamala Krithivasan. Discrete mathematics and its applications: with combinatorics and graph theory. Tata McGraw-Hill Education, 2012. |
| 2 | Seymour Lipschutz, Marc Laras Lipson, Varsha H. Patil, Discrete Mathematics (Schaum's Outlines) McGraw Hill Education; Revised Third edition (1 July 2017) |

Reference Books

| | |
|---|---|
| 1 | Deo, Narsingh. Graph theory with applications to engineering and computer science. Courier Dover Publications, 2017. |

| COMPUTER ORGANISATION | |
|---|---|
| Course Code: MCA--107<br>Contact Hours: L-3 T-0 P-2<br>Course Category: DCC | Credits: 4<br>Semester: 1 |

Introduction:

The course aims to provide students with an understanding of the design of fundamental blocks of a computer system and interfacing techniques of these blocks to achieve different configurations of a computer system. It covers the basic topics in the design of computational units, instruction organization, memory systems, control and data flow, and interconnections.

Course Objective:

- To have a thorough understanding of the basic structure and operation of a digital computer.
- To study the different ways of communicating with I/O devices and standard I/O interfaces.

Pre-requisite: Digital Systems and Computer Design

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

- Understand logic gates, flip flops and counters
- have clear understanding of Computer Architecture
- come to know about pipeline processing
- have an insight into RISC and CISC architectures

Pedagogy:

The class will be taught using theory and tutorial based methods which includes board teaching and presentations/slides, case studies, discussions etc. Along with classroom teaching, students will also be given assignments regarding the topics covered. The course instructor will demonstrate and explain about applications of Computer organisation techniques with research orientation.

Contents

| UNIT-I | 10 Hours |
|---|---|
| **Introduction and overview:** Multiplexes, Demultiplexers, Decoders, Adders<br>**Flip-flops:** S-R, JK, D, T, Master Slave and Edge triggered, Registers, shift registers, Bi-direction shift registers.<br>**Register Transfer and Microoperation:** Register transfer language, register transfer, bus and memory transfer, arithmetic microoperations, logic microoperations, shift microoperations. | |
| UNIT-II | 11 Hours |
| **Basic Computer Organization and Design:** Instruction codes, computer registers, computer instructions, timing & control, instruction cycle, memory reference instructions, input-output and interrupts, design of basic computer, design of accumulator logic.<br>**Micro programmed Control Unit:** Control memory, address sequencing.<br>**Central Processing Unit:** Introduction, general register organization, stack organization, instruction formats, addressing modes. | |
| UNIT-III | 11 Hours |
| **Pipeline and Vector processing:** Parallel Processing, pipelining, arithmetic pipeline, RISC Pipeline, Vector Processing, Array Processors.<br>**Input-Output Organization:** Peripheral devices, input-output interface, asynchronous data transfer, modes of data transfer, priority interrupt, direct memory access, input-output processor. | |

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|---|---|---|
| UNIT-IV | | 10 Hours |
| **Memory organization:** Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware.<br>**Multiprocessors:** Characteristics of multiprocessor, Interconnection Structure, Interprocessor Communication & Synchronization. | | |
| Text Books | | |
| 1 | Mano M, “Computer System and Architecture”, Pearson, 3rd Ed., 2009 | |
| 2 | Stallings W, “Computer Organization & Architecture”, PHI, 9th Ed., 2013. | |
| Reference Books | | |
| 1 | Hayes, J. P. “Computer Architecture and Organization”, McGraw Hill, 3rd edition, 2017. | |
| 2 | Andrew S. Tanenbaum, “Structured Computer Organization”, PHI, 6th Ed., 2016. | |
| 3 | P. V. S Rao, “Computer System Architecture”, PHI, 5th Ed., 2009. | |

| PROFESSIONAL SKILLS | |
|---|---|
| Course Code: HMC-101<br>Contact Hours: L-3 T-0 P-0<br>Course Category: HMC | Credits: 3<br>Semester: 1 |

**Introduction** - This course aims to enhance the students' professional communication skills by providing adequate exposure in verbal and nonverbal skills and related sub skills. The course is designed to provide awareness of appropriate communication strategies with social, organizational and cultural awareness. The course empowers students in day to day professional soft skills like listening skills, presentation skills, and group discussion etc.

**Course Objectives:**

- To know the process of professional communication and its various components.
- To improve language skills i.e. Listening Skills, Speaking Skills, Reading Skills and Writing Skills (LSRW).
- To create literary sensibility and enhance comprehension skills.
- To develop confidence for communicating in English language.

**Pre-requisites:** None

**Course Outcome** – After completion of the course, the students should be able to:

- Understand the importance of flawless communication in professional environment.
- Enrich knowledge and improve skills required for corporate world.
- Evaluate theoretical frameworks and concepts for the study of communication..
- Develop ethical professional habits.

**Pedagogy**:

- To provide knowledge of various communication processes through innovative and interactive classroom teaching sessions.
- To evaluate students' progress through practical sessions including Group discussion, Presentations, role plays and JAMs.

**Contents**

| UNIT-I | 10 Hours |
|---|---|
| Self analysis through SWOT, Johari window, Personality Development, Intra personal communication vs. Inter personal Communication and Relationships, Leadership Skills, Team Building, Public speaking, Individual Communication, Self advertising, Over stating and under stating, Time Management. | |
| UNIT-II | 12 Hours |
| **Communication Boosters:** Body language, Voice, Posture and gesture, Eye contact, Dress codes, Verbal crutches, Pronunciation, Contextualization: creating and understanding contexts, Aura words.<br>**Interview:** Types of Interview, Preparing for the Interviews, Attending the Interview, Interview Process, Employers Expectations, General Etiquette. | |
| UNIT-III | 10 Hours |

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|---|---|
| **Group Discussions:** Guidelines, Expressions, Evaluation. Video conferencing, Telephone skills, Teleconferencing, Participation in meetings: chairing sessions. Presentation Skills, Types of presentation, Capturing Data, Guidelines to make an effective presentation, Body Language, Voice Modulation, Integrating voice & picture, Audience Awareness, Presentation Plan, Visual Aids, Forms of Layout, Styles of Presentation, Management presentations. | |
| UNIT-IV | 10 Hours |
| **Letter writing:** Types of Letters, Business letters, E-mail, Fax, Pro-forma culture, Drafting the Applications, Format, Style, Effectiveness, study of sample letters, Elements of structure, Preparing a CV / Resume, Statement of Purpose, Paragraph Writing, Greeting, Memos, Reports, Minutes, Business correspondence. | |
| **Text Books** | |
| 1. | Rajendra Pal, J S Korlahhi. Essentials of Business Communication, Sultan Chand & Sons, 2017. |
| 2. | Andre J. Rutherford . Basic Communication Skills for Technology, Pearson Education Asia, 2014. |
| 3. | KR Lakshiminarayana: English for Technical Communication, Scitech Publications, 2015. |
| **Reference Books** | |
| 1. | RK Madhukar. Business Communication, Vikas Publishing House Pvt. Ltd. 2018. |
| 2. | English in Mind, Herbert Puchta and Jeff Stranks, 2nd Edition, Cambridge University Press 2010. |
| 3. | Suresh K, P. Srihari, J Savithri, Communication Skills and Soft Skills: An Integrated Approach,1st Edition, Pearson Education, 2010. |

| DATA AND FILE STRUCTURES | |
|---|---|
| Course Code: MCA- 102<br>Contact Hours: L-3 T-0 P-4<br>Course Category: DCC | Credits: 5<br>Semester: 2 |

Introduction:

This course covers the design, analysis, and implementation of data structures and algorithms to solve engineering problems using an object□oriented programming language. Topics include elementary data structures, (including arrays, stacks, queues, and lists), advanced data structures (including trees and graphs), the algorithms used to manipulate these structures, and their application to solving practical engineering problems.

Course Objectives:

- To learn efficient storage mechanisms of data for an easy access.
- To design and implement various basic and advanced data structures.
- To introduce various techniques for representation of the data in the real world.
- To develop applications using data structures.

Pre-requisite: Standard programming language C/C++, mathematical knowledge, knowledge of basic probability.

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

- choose appropriate data structure as applied to specified problem definition.
- handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
- apply concepts learned in various domains like DBMS, compiler construction etc.
- use linear and non-linear data structures like stacks, queues, linked list, trees and graphs etc.

Pedagogy

The class will be taught using theory and tutorial based methods which include board teaching, presentations/slides, discussions and case based studies. Along with classroom teaching, students will also be given assignments regarding the topics covered.

Contents

| UNIT-I | 11 Hours |
|---|---|
| **Introduction:** Abstract Data Type, Elementary Data Organization, Measuring efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations. Arrays: Single and Multidimensional Arrays,<br>**Representation of Arrays:** Row Major Order, and Column Major Order, Application of arrays, Sparse Matrices.<br>**Linked lists:** Array and Dynamic Implementation of Single Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition.<br>**Stacks:** Stack operations: Push & Pop, Array and Linked list implementation of Stack, Applications: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion. | |
| UNIT-II | 11 Hours |
| **Queues:** Operations: Create, Add, Delete, full and empty queues, Array and linked implementation of queues, Dequeue, Circular queues and Priority Queue. Hashing: Hash Function, Hash Table, Collision Resolution Strategies.<br>**Trees:** Basic terminology, Binary Trees, Array and linked list implementation, Types of Binary Tree, Extended Binary Trees, Algebraic Expressions , Tree Traversal algorithms: Inorder, Preorder and Postorder, Threaded Binary trees, Search, Addition and deletion of an element in a binary tree, AVL Trees, Heaps, B Trees, Trees and their applications, Evaluating an expression tree. | |
| UNIT-III | 10 Hours |

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|---|---|
| **Searching:** Sequential search, Binary Search. Sorting: Insertion Sort, Selection, Bubble Sort, Quick Sort, Merge Sort, Heap Sort, Radix Sort, Bucket Sort, Shell Sort, Graphs: Representation (Matrix and Linked), Traversals, Shortest path, Topological sort. Dijkstra's Algorithm, Floyd Warshall's Algorithm, Minimum Spanning Tree Algorithms (Kruskal's Algorithm, Prim's Algorithm). | |
| UNIT-IV | 10 Hours |
| **Files:** Creation and Processing of files, File handling using command line arguments, File opening, closing, modes, formatted inputs, output to file, reading/writing of files, accessing records randomly, updating files. Operations on files, Library functions, File Indexing (primary, secondary, clustered, unclustered, dense, sparse), File streams, Hierarchy of file stream classes, Error handling during file operations. | |
| Text Books | |
| 1 | Aaron Tanenbaum, "Data Structures Using C", 2nd edition, 2016 |
| 2 | Ellis Horowitz and Sartaj Sahni, "Fundamentals of data structures" 2nd edition, 2017 |
| Reference Books | |
| 1 | Seymour Lipschutz, "Data Structures", 2nd Edition, 2015 |
| 2 | Donald Knuth, "The Art of Computer Programming", 2015. |

| Object Oriented Programming with C++ | |
|---|---|
| Course Code: MCA-104<br>Contact Hours: L-3 T-0 P-4<br>Course Category: DCC | Credits: 5<br>Semester: 2 |

Introduction:

This course provides in-depth coverage of object-oriented programming principles and techniques. Topics include classes, objects, overloading, data abstraction, information hiding, encapsulation, inheritance, polymorphism, file processing, templates, exceptions, container classes etc.The course material embraces the C++11 language standard with numerous examples demonstrating the benefits of C++11. In the end some basics of Java will be covered

Course Objective:

- To learn object oriented programming (OOP) principles and get a flavour of modular programming

Pre-requisite:Basics of C Programming

Course Outcome:

- To learn basic programming in C++/ Java
- To learn OOP programming principles
- To develop OOP solutions to problems demonstrating usage of control structures, modularity, I/O and other standard language constructs
- To learn to apply modular programming semantic in real world problems

Pedagogy

- Emphasis on lab sessions where students will be given programming assignments to code in C++/Python/Java based on topics learnt in previous lectures.

Contents

| UNIT-I | 10 Hours |
|---|---|
| Need for Object Oriented Programming, Comparison of Programming paradigms, Characteristics of Object-Oriented Programming Languages, Introduction to Object Oriented concepts (classes, objects, encapsulation, inheritance, data hiding, abstraction, polymorphism) , Fundamentals Data Types & Literals Variables, Arrays, Operators, Control of Flow in OOP, Compilation and Execution of Process , Reference vs. Pointer variable, Classes and Objects: class declaration, Role of private, public and protected access specifiers, Memory organization of class, inline function, friend function, static members , constructor and destructors, instantiation of objects, default parameter value, object types | |
| UNIT-II | 11 Hours |
| Garbage collection, dynamic memory allocation, new and delete operator Polymorphism: Function overloading, Constructor overloading, Compile time polymorphism, Overloading Rules, Operator Overloading (Unary and Binary) as member function/friend function. Inheritance, Types of Inheritance, Use of | |

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|---|---|
| protected access specifier, Virtual base class, Ambiguity resolution using scope resolution operator and Virtual base class, Overriding inheritance methods, Constructors and Destructor in derived classes, Runtime polymorphism, | |
| UNIT-III | 11 Hours |
| Pointer to objects, Virtual Functions (concept of virtual table), pure virtual functions, Abstract Class, Managing Input / Output, Concept of streams, console I/O – formatted and unformatted, Manipulators, File I/O – Predefined classes, file opening & closing, file manipulation, read & write operations, sequential and random file access, Exception Handling: Basic mechanism, Throwing, Catching and Re-throwing. Namespace: Basic concept, role of scope resolution operator and using keyword | |
| UNIT-IV | 10 Hours |
| Introduction to Java- Overview and characteristics of Java, Data types, Organization of the Java Virtual Machine, Compilation and Execution Process in java , Java Classes, Packages and interfaces, Case Studies using C++ to build highly extensible software: System Sort, Apache Traffic Server, Apache Open Office Document Suite | |
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| Text Books | |
| 1 | Josée Lajoie and Stanley B. Lippman, “C++ Primer”, 5th Edition, 2013 |
| 2 | Herbert Schildt , “Java: The Complete Reference”, 7th Edition, TMH. |
| 3 | Martin C. Brown, “Python: The Complete Reference”, 4th Edition, TMH, 2018 |
| Reference Books | |
| 1 | Herbert Schildt, “C++: The Complete Reference”, 4th Edition, TMH, 2017 |
| 2 | Mark Lutz, “Learning Python”3rd Edition, O’’reilly Media, 2007 |
| 3 | Bjarne Stroustrup , “The C++ Programming Language”, Pearson, 3rd Ed, 2000 |

| SOFTWARE ENGINEERING | |
|---|---|
| Course Code: MCA-106<br>Contact Hours: L-3 T-0 P-2<br>Course Category: DCC | Credits: 4<br>Semester: 2 |

Introduction

This course covers the software development process, from requirements elicitation and analysis, through specification and design, to implementation, integration, testing, and maintenance (evolution). A variety of concepts, principles, techniques, and tools are presented, encompassing topics such as software processes, project management, people management, software requirements, system models, architectural and detailed design, user interface design, programming practices, verification and validation, and software evolution. Although the emphasis will be on modern approaches some more traditional software engineering techniques will also be discussed.

Course Objective (in bullets)

- To understand the coverage of the phases of the software process through study of related concepts, principles and techniques
- To carry out practical software development work using a systematic engineering approach.

Pre-requisite:

Fundamentals of Information Technology

Course Outcome

- Study of software engineering concepts, principles, and techniques
- Extensive coverage of the phases and activities of the software process
- Practical software development work within the framework of integrated development environments

Pedagogy

The class will be taught using theory and practical based methods.

Contents

| UNIT-I | 10 Hours |
|---|---|
| Introduction: Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models.<br>Software Requirements analysis & specifications: Requirement engineering, requirement elicitation techniques like FAST, QFD & Use case approach, requirements analysis using DFD, Data dictionaries & ER Diagrams, Requirements documentation, Nature of SRS, Characteristics & organization of SRS, Requirement Management, IEEE Std. for SRS. | |
| UNIT-II | 11 Hours |
| Software Project Planning: Size Estimation like lines of Code & Function Count, Cost Estimation Models, COCOMO, Putnam resource allocation model, Validating Software Estimates, Risk Management.<br>Software Design: Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design. | |
| UNIT-III | 11 Hours |
| Software Metrics: Software measurements: What & Why, Token Count, Halstead Software Science Measures, Data Structure Metrics, Information Flow Metrics.<br>Software Reliability: Importance, Hardware Reliability & Software Reliability, Failure and Faults, Reliability Models- Basic Model, Logarithmic Poisson Model, Software Quality Models, CMM & ISO 9001. | |
| UNIT-IV | 10 Hours |
| Software Testing: Testing process, Design of test cases, Introduction to functional testing & Structural testing, Unit Testing, Integration and System Testing, Debugging, Alpha & Beta Testing.<br>Software Maintenance: Management of Maintenance, Maintenance Process, Maintenance Models, Regression Testing, Reverse Engineering, Software Re- | |

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| engineering, Configuration Management, Documentation. | |
| Text Books | |
| 1 | K.K.Aggarwal, Yogesh Singh: Software Engineering, New Age International Ltd, 3rd Ed. 2008. |
| 2 | Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publishing, 2010. |
| Reference Books | |
| 1 | R.S. Pressman, Software Engineering – A Practitioner's Approach, 8th Edition, McGraw Hill, 2019. |
| 2 | Ian Sommerville, Software Engineering, 10th Edition, Pearson, 2017. |

| OPERATING SYSTEMS | |
|---|---|
| Course Code: MCA-108<br>Contact Hours: L-3 T-0 P-2<br>Course Category: DCC | Credits: 4<br>Semester: 2 |

Introduction:

This course aims at introducing classical internal algorithms and structures of modern operating systems including CPU scheduling, memory management, and device management. Topics including file systems, virtual memory, disk scheduling, concurrent processes, deadlocks, security, and integrity will be covered.

Course Objective (in bullets):

- To learn the fundamentals of Operating Systems.
- To learn the mechanisms of OS to handle processes and threads and their communication.
- To learn the mechanisms involved in memory management in contemporary OS.
- To gain knowledge on OS architecture, mutual exclusion algorithms, deadlock detection algorithms etc.
- To know the components and management aspects of concurrency management.

Pre-requisite: Analysis of algorithms, algorithm design techniques, programming knowledge in C, C++ or JAVA.

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

- Analyze the structure of OS and basic architectural components involved in OS design.
- Analyze and design the applications to run in parallel either using process or thread models of different OS.
- Analyze the various device and resource management techniques for timesharing systems.
- Understand the mutual exclusion and deadlock detection concepts.

Pedagogy

The class will be taught using theory and tutorial based methods which includes board teaching and presentations/slides, discussions, case studies etc. Along with classroom teaching, students will also be given assignments regarding the topics covered. The course instructor will demonstrate and explain about applications of Operating Systems techniques with real-time examples.

Contents

| UNIT-I | 10 Hours |
|---|---|
| **Introduction:** Definition, Role, Types of Operating System, Batch Systems, multi programming, time–sharing, parallel, distributed and real-time systems, Operating system structure, Operating system components and services, System calls, System programs, Virtual machines.<br>**Processes:** Process Concept, Process Scheduling, Operation on Processes, Cooperating Processes, Threads.<br>**CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real-Time Scheduling. | |
| UNIT-II | 11 Hours |
| **Interprocess Communication and Synchronization:** Background, The Critical-Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors, Message Passing.<br>**Deadlocks:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.<br>**Memory Management:** Background, Logical vs. Physical Address space, swapping, Contiguous allocation, Paging, Segmentation, Segmentation with Paging. | |

| UNIT-III | 11 Hours |
|---|---|
| **Virtual Memory:** Demand Paging and its performance, Page-replacement Algorithms, Allocation of Frames, Thrashing, page size and other Considerations, Demand Segmentation.<br>**Device Management:** Techniques for Device Management, Dedicated Devices, Shared Devices, Virtual Devices, Independent Device Operation, Buffering, Device Allocation Consideration<br>**Secondary-Storage Structure:** Disk Structure, Disk Scheduling, Disk Management, Swap Space Management, Disk Reliability. | |
| UNIT-IV | 10 Hours |
| **File-System Interface:** File Concept, Access Methods, Directory Structure.<br>**File-System Implementation**: Introduction, File-System Structure, Basic File System, Allocation Methods, Free-Space Management, Directory Implementation.<br>**Security:** The Security problem, Goals of protection, Access matrix, Authentication, Program threats, System threats, Intrusion detection. | |

| Text Books | |
|---|---|
| 1 | Silberschatz and Galvin, “Operating System Concepts”, John Wiley, 9th Ed., 2016 |
| 2 | Tannenbaum, “Operating Systems”, PHI, 5th Ed., 2000. |
| 3 | Deitel, Deitel and Choffnes, “Operating Systems”, Pearson, 3rd Edition, 2003 |
| Reference Books | |
| 1 | Madnick E. and Donovan J., “Operating Systems”, Tata McGraw Hill, 2017. |
| 2 | Flynn McHoes, “Operating System”, Cengage Learning, 6th edition, 2013. |
| 3 | Sibsankar Halder and Alex A. Arvind, “Operating System”, Pearson, 2009 |
| 4 | William Stallings, “Operating Systems Internals & Design Principles”, Pearson Education, 9th Ed., 2018 |

| HUMAN VALUES AND PROFESSIONAL ETHICS | |
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| Course Code: HMC-102<br>Contact Hours: L-3 T-0 P-0<br>Course Category: HMC | Credits: 3<br>Semester: 2 |

**Introduction:** Values and Ethicsare very relevant in today's environment of conflicts and stress in every profession, with obligations to be met by one person in many directions. A formal study will certainly improve one's ability and judgment and refine one's behaviour, decisions, and actions in performing the duty to the family, organization, and to the society.

**Course Objective:**

- To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.
- To inculcate Ethics and Human Values into the young minds and develop moral responsibility and mould them as best professional which will create ethical vision and achieve harmony in life.

**Prerequisite:** None

**Course Outcomes:**

Having successfully completed this course, the student will be able to

- Develop the capability of shaping themselves into outstanding personalities, through a value based life.
- Students turn themselves into champions of their lives.
- Students take things positively, convert everything into happiness and contribute for the happiness of others.
- Students become potential sources for contributing to the development of the society around them and institutions / organizations they work in.
- Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

**Pedagogy**: The learning and teaching methods include the use of weekly three-hour lectures to illustrate the subject and provide examples of the practical application of such topics. Lecture materials will be supported by directed reading and assignments.

**Contents**

| UNIT-I | 10 Hours |
|---|---|
| **Human Values**<br>Morals, Values and Ethics, Integrity, Work Ethic, Respect for Others, Living Peacefully, Caring, Sharing, Honesty, Valuing Time, Co-operation, Commitment, Empathy, Self-Confidence, Character, Spirituality. Indian values (on the conceptual framework of Vedas): Purusharth, Niskama karma, Religion and Human Values, Towards a World Religion, Ethical Living and Harmony in Life. | |
| UNIT-II | 10 Hours |
| **Ethics and Engineering Profession**<br>Profession and Professionalism, Ethical Theories: Kohlberg's Theory, Gilligan's Theory, Moral Dilemmas, Types of Enquiry, Uses of Ethical Theories, Engineering Profession, | |

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| Engineering Professionals- Training, Skill Set, Life Skills, Engineering Ethics: Making Senses and Issues, Ethical Obligations of Engineers, Ethical Codes for Engineers. | |
| UNIT-III | 12 Hours |
| **Engineering as a Social Experimentation, Safety Responsibility and Rights:** Engineering as experimentation, Engineers as responsible Experimenters, Concept of Safety and Risk, Engineer's Responsibility for Safety, Risk – Benefit Analysis, Case Studies: The challenger case study, The Three Mile Island, Fukushima Nuclear Disaster, Bhopal Gas Tragedy. Disaster Management, Professional Rights, Employee Rights, Intellectual Property Rights (IPRs), Human Rights and Human Responsibilities. Major Ethical Issues. | |
| UNIT-IV | 10 Hours |
| **Ethics and Global Issues** Ethics in Global Scenario, Multinational corporations, Environmental ethics, computer ethics, Business Ethics. Corporate Social responsibility, Weapons Development, Research Ethics. | |
| **Text Books** | |
| 4. | Govindarajan M., Natarajan S., Senthil Kumar V. S., "Engineering Ethics", Prentice Hall India Learning Private Limited, New Delhi, 2004. |
| 5. | Subramaniam R., "Professional Ethics", Oxford University Press, New Delhi, 2013. |
| 6. | Mike Martin and Roland Schinzinger, "Ethics in engineering", 4th Edition,McGraw-Hill Education 2004. |
| 7. | RR Gaur, R Sangal, GP Bagaria, "A Foundation Course in Human values and Professional Ethics", Excel Books Pvt. Ltd, New Delhi 2009. |
| 8. | A.N.Tripathi, "Human Values", New Age International Publishers, New Delhi, 2nd Edition, 2004. |
| **Reference Books** | |
| 4. | B.P. Banerjee, "Foundation of Ethics and Management", Excel Books, 2005. |
| 5. | Fleddermann, Charles D., "Engineering Ethics", Pearson Education. 2004. |
| 6. | Harris, Charles E., Protchard, Michael S. And Rabins, Michael, J., Wadsworth, "Engineering Ethics- Concepts and Cases", Thompson Learning, 2000 |
| 7. | Boatright, John R., "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003. |
| 8. | Swami Ranganathananda, "Universal Message of the Bhagavad Gita: An exposition of the Gita in the light of modern thought and modern needs", Vol. I – III, AdvaitaAshrama (Publication Department), Kolkata. 2000. |
| 9. | Peter Singer, "Practical Ethics", Oxford University Press, 1993 |