

MCA(S1)01-01

KRISHNA KANTA HANDIQUI STATE OPEN UNIVERSITY
Housefed Complex, Dispur, Guwahati - 781 006



Master of Computer Applications

COMPUTER FUNDAMENTALS AND PC SOFTWARE

CONTENTS

- UNIT 1 : INTRODUCTION TO COMPUTER**
- UNIT 2 : BASIC COMPONENTS OF COMPUTER**
- UNIT 3 : INTRODUCTION TO OPERATING SYSTEM**
- UNIT 4 : MS DOS OPERATING SYSTEM**
- UNIT 5 : MS WINDOWS OPERATING SYSTEM**
- UNIT 6 : LINUX OPERATING SYSTEM**
- UNIT 7 : MICROSOFT WORD-PART I**
- UNIT 8 : MICROSOFT WORD-PART II**
- UNIT 9 : MICROSOFT EXCEL**
- UNIT 10 : FUNCTIONS IN EXCEL**
- UNIT 11 : MICROSOFT POWERPOINT**

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2. Prof. Jatindra Kr. Deka, Deptt. of Computer Science and Engineering, Indian Institute of Technology, Guwahati
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July, 2011

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Master of Computer Applications

DIGITAL LOGIC

CONTENTS

UNIT 1 : NUMBER SYSTEMS

UNIT 2 : BOOLEAN ALGEBRA

UNIT 3 : LOGIC GATES

UNIT 4 : COBINATIONAL CIRCUITS

UNIT 5 : SEQUENTIAL ORGANIZATION

UNIT 6 : MEMORY ORGANIZATION

Subject Experts

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COURSE INTRODUCTION

This is a course on **Digital Logic**. Digital logic has fascinated many people over the years. Everything in the digital world is based on the binary number system. Numerically, this involves only two symbols: 0 and 1. Digital Logic is a method by which electrical circuits are provided with a limited ability to make decisions. The most common use of digital logic today is in the control and arithmetic functions of digital computers, without which modern life would grind to a halt.

The course consists of six units :

The *first* unit discusses various number systems like decimal, binary, octal, hexadecimal and their conversion from one form to another. The unit also includes the methods of addition and subtraction of binary numbers, complements and fixed/floating point representations. Concept of BCD, ASCII, EBCDIC, Gray code etc are discussed at the end.

The *second* unit is on Boolean Algebra. The unit discusses various concept associated with Boolean Algebra like Boolean operators, Boolean expression, representation of Boolean expression in Canonical form, Karnaugh Map, Don't care condition etc.

The *third* unit discusses various logic gates, their conversion, truth tables, and the most important De-Morgan's theorem.

The *fourth* unit focuses on combinational circuits. This unit gives us the concept various adders and subtractors, multiplexers, demultiplexers, encoders, decoders etc. with their applications.

The *fifth* unit deals with sequential circuits which includes the concept of flip-flops, counters, registers.

The *sixth* unit is the last unit of this course which is on memory organization. This unit gives us the concept of RAM and its types, 2D and 3D organization of RAM, ROM, types of ROM, organization of simple ROM cell etc.

Each unit of this course includes some along-side boxes to help you know some of the difficult, unseen terms. Some "EXERCISES" have been included to help you apply your own thoughts. You may find some boxes marked with: "LET US KNOW". These boxes will provide you with some additional interesting and relevant information. Again, you will get "CHECK YOUR PROGRESS" questions. These have been designed to self-check your progress of study. It will be helpful for you if you solve the problems put in these boxes immediately after you go through the sections of the units and then match your answers with "ANSWERS TO CHECK YOUR PROGRESS" given at the end of each unit.

MASTER OF COMPUTER APPLICATIONS

Digital Logic

DETAILED SYLLABUS

	Marks	Page No.
UNIT 1 : Number Systems	15	5-44
Decimal, Binary, Hexadecimal and Octal. It's Conversion: Decimal to Binary/ Hexadecimal/Octal and vice versa. Addition/ Subtraction on Binary Numbers, Complement: r's and (r-1)'s complement. Fixed Point representation and Floating point representation, BCD, ASCII, EBCDIC, Gray code.		
UNIT 2 : Boolean Algebra	15	45-60
Boolean operators, Rules (postulates and basic theorems) of Boolean algebra, Dual and complement of Boolean expression, representation of Boolean expression in Canonical form, Boolean expression and their simplification by algebraic method and Karnaugh Map, Don't care condition.		
UNIT 3 : Logic Gates	15	61-79
Logic Gates(OR, AND, NOT, NAND, NOR, XOR, XNOR), Truth Tables, De-Morgan's theorem, Conversion of the logic gates.		
UNIT 4 : Combinational Circuits	20	80-113
Introduction to Combinational Circuits; Half-adder, Full-adder, Binary Parallel Adder, 4-bit Binary Parallel Adder, Serial Adder; Half-subtractor, Full-subtractor; Multiplexer: Basic 2-Input Multiplexer, 4-Input-Multiplexer, 8-to-1 Multiplexer, 16-to-1 Multiplexer, Multiplexer Applications; Demultiplexer: Parallel-to-Serial Converter, Data Distributors, 1-to-4 Demultiplexer; Encoder: Octal-to-Binary Encoder, Decimal-to-BCD Encoder; Decoder: Basic Binary Decoder, 3-line-to-8-Line Decoder, Magnitude Comparator		
UNIT 5 : Sequential Circuits	20	114-141
Sequential Circuits; Flip-Flops: RS, D, JK, MS; Counters: Asynchronous , Synchronous; Registers and its types, Shift Registers: Serial in-Serial out Registers, Shift-Left Register, Shift-Right Register, Serial-in-Parallel-out Shift Registers, Parallel-in-Serial-out Shift Registers, Parallel-in-Parallel-out Register, Applications of Shift Registers.		
UNIT 6 : Memory Organization	15	142-158
Random Access Memory : Types of RAM; Static RAM : Static RAM cell and its structure; DRAM : basic structure of DRAM; Organization of RAM : 2D organization, 3D organization; ROM : Types of ROM, organization of simple ROM cell.		

MCA(S1)03

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Housefed Complex, Dispur, Guwahati - 781 006



Master of Computer Applications
COMPUTER PROGRAMMING USING C

CONTENTS

- UNIT- 1 : Introduction to Programming**
- UNIT- 2 : Operators and Expressions**
- UNIT- 3 : Decision and Control Structures**
- UNIT- 4 : Storage Class**
- UNIT- 5: Functions**
- UNIT- 6: Arrays and Pointers**
- UNIT- 7: Structure and Union**
- UNIT- 8: File Handling**

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July 2011

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COURSE INTRODUCTION

This is a course on **Computer Programming using C**. C language is a very popular and powerful programming language for creating computer programs. It is because, for most of the system software developments, efficiency of time and space become crucial and can be very effectively achieved by C language. C language is suitable for many applications as it has an excellent support of high-level and low-level functionality. Although several new high level languages have already been developed, C language has not lost its importance and popularity.

With this course the learners will be able to write codes in C languages. They will be able to develop programs using various features of the language.

The course consists of eight units.

The **first unit** introduces some basics of programming. It gives us the concept of pseudo code, algorithm, flow chart and the fundamental elements of programming.

The **second unit** concentrates on operators and expressions. Different types of operators like arithmetic, logical, relational, bitwise etc. are discussed in this unit. Concepts like precedence and associativity of operators are also covered in this unit.

The **third unit** deals with the decision and control structures. It includes Input/output functions like *scanf()*, *printf()*, *gets()*, *puts()*, different kinds of conditional statements and loop structures etc.

The **fourth unit** concentrates on storage classes. Two important concepts - *macros* and *preprocessor* directive are also introduced in this unit.

The **fifth unit** is on functions. With this unit, learners will be acquainted with function declaration, definition, function call, formal and actual parameter and the concept of recursion.

The **sixth unit** gives us the concept of arrays and pointers. It includes array declaration, accessing array elements, concept of strings, pointer variables, passing pointer to a function, and the most important dynamic memory allocation.

The **seventh unit** concentrates on structure and union. It includes structure declaration, definition, array of structures, pointer to structure, defining and declaring union and enumerated data types.

The **eighth unit** focuses on file handling. With this unit learners will be acquainted with different operations associated with files.

Each unit of this course includes some along-side boxes to help you know some of the difficult, unseen terms. Some "EXERCISES" have been included to help you apply your own thoughts. You may find some boxes marked with: "LET US KNOW". These boxes will provide you with some additional interesting and relevant information. Again, you will get "CHECK YOUR PROGRESS" questions. These have been designed to make you self-check your progress of study. It will be helpful for you if you solve the problems put in these boxes immediately after you go through the sections of the units and then match your answers with "ANSWERS TO CHECK YOUR PROGRESS" given at the end of each unit.

MASTER OF COMPUTER APPLICATIONS

Computer Programming using C

DETAILED SYLLABUS

Unit 1: Introduction to Programming (Marks:12)

Basic Definition of Pseudo Code, Algorithm, Flowchart, Program, Elementary Data Types: Integer, Character, Floating Point and String Variables; Constants and Identifiers; Variable Declarations, Syntax and Semantics, Reserved Word, Initialization of Variable during Declarations, Symbolic Constants.

Unit 2: Operators and Expressions (Marks:12)

Expression in C; Different Types of Operators: Arithmetic, Relational and Logical, Assignment, Conditional, Increment and Decrement, Bitwise, Comma and Sizeof; Precedence and Associativity of Operators; Type Casting.

Unit 3: Decision and Control Structures (Marks:12)

Various Input /Output Functions: scanf, getch, getchar, printf, putchar; Conditional Statement- if, if- else, nested if-else switch; Other Statement: Break, Continue, Goto; Concept of Loops: While, Do-While, For, Nested Loop.

Unit 4: Storage Class (Marks:12)

Automatic, External, Static, Register, Scope and Lifetime of Variables, Macro, Preprocessor Directive.

Unit 5: Functions (Marks: 14)

Function: Function Declaration, Function Definition, Function Call, Function Parameters, Formal and Actual Parameter, Parameter Passing Methods, Recursive Function.

Unit 6: Arrays and Pointers (Marks: 14)

Arrays, 1-Dimensional Array, 2-Dimensional Array and its Declaration; String; Pointers: Declaration, Passing Pointer to a Function, Pointer and 1-Dimensional Arrays, Dynamic Memory Allocation.

Unit 7: Structures and Union (Marks: 12)

Structure Declarations, Definitions, Array of Structures, Pointers to Structures; Union: Definition, Declaration, Use; Enumerated Data Types; Defining Your Own Types (typedef)

Unit 8: File Handling (Marks: 12)

Opening, closing, reading and writing of files. Seeking forward and backward. Examples of file handling programs.

PGDCA-04

PGDCA

**FUNDAMENTALS OF NETWORKING
AND WEB TECHNOLOGY**

CONTENTS

UNIT 1 : INTRODUCTION TO COMPUTER NETWORK

UNIT 2 : NETWORK MODELS

UNIT 3 : TRANSMISSION MEDIA

UNIT 4 : INTERNET AND WWW

UNIT 5 : STATIC WEB PAGE DESIGN

UNIT 6 : HTML TAGS AND XML

UNIT 7 : JAVASCRIPT

Subject Experts

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July, 2011

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COURSE INTRODUCTION

This is a course on *Fundamentals of Networking and Web Technology*. This course is designed with an aim to acquaint the learners with the basics of computer network and web technology. The course introduces you to the hardware and the software needed for a network, explains how a small network is different from larger networks and the Internet.

The course consists of seven units.

The **first unit** includes the concept of computer network, how computers in a network are connected to each other and how they share information, different internetworking devices, transmission types as well as modes of communication etc.

The **second unit** is on network models which include concepts like protocol hierarchy along with ISO-OSI reference and TCP/IP models.

The **third unit** discusses various transmission media, wired as well as wireless technologies and various propagation methods.

The **fourth unit** deals with Internet and WWW which are very important concepts in the field of networking and Web.

The **fifth unit** is on web page design. Learners will be acquainted with basic HTML tags with the help of which they will be able to develop simple web pages.

The **sixth unit** deals with HTML forms and introduction to XML.

The **seventh unit** is the last unit of this course which introduces the learners to the concept of JavaScript.

Each unit of this course includes some along-side boxes to help you know some of the difficult, unseen terms. Some “EXERCISES” have been included to help you apply your own thoughts. You may find some boxes marked with: “LET US KNOW”. These boxes will provide you with some additional interesting and relevant information. Again, you will get “CHECK YOUR PROGRESS” questions. These have been designed to make you self-check your progress of study. It will be helpful for you if you solve the problems put in these boxes immediately after you go through the sections of the units and then match your answers with “ANSWERS TO CHECK YOUR PROGRESS” given at the end of each unit.

POST GRADUATE DIPLOMA IN COMPUTER APPLICATIONS

Fundamentals of Networking and Web Technology

DETAILED SYLLABUS

UNIT 1 : Basics of Computer Network

Computer Network: Definition, Goals; Broadcast and Point-To-Point Networks; Connectionless and Connection-Oriented Services; Network Devices; Network Topologies; Types of Network: LAN, MAN, WAN; Server Based LANs and Peer-to-Peer LANs; Transmission Types; Modes of Communication; Switching Techniques

UNIT 2 : Network Models

Design Issues of the Layer, Protocol Hierarchy, ISO-OSI Reference Model: Functions of each Layer; Various Terminology used in Computer Network; Connection-Oriented and Connectionless Services, Internet (TCP/IP) Reference Model, Comparison of ISO-OSI and TCP/IP Model

UNIT 3 : Transmission Media

Transmission Medium, Guided Media: Coaxial Cable, Twisted Pair, Fiber Optics Cable; Unguided Media: Radio Waves, Infrared, Micro-wave, Satellite

UNIT 4 : Internet Basics

Internet: Architecture, Accessing, Internet Service Providers (ISP), Organization of Internet Protocol suite, IP Address, DNS, URL; World Wide Web (WWW): Web Page, Web Servers, Web Browsers, Cookies

UNIT 5 : Static Web Page Design

Basics of HTML; Document Structure tags; Formatting tags; List tags; Hyperlink and Image tags; Table tags; Frame tags; Form tags.

UNIT 6 : HTML Tags and XML

HTML Form; Additional Advanced HTML Tags; Introduction of XML.

UNIT 7 : JavaScript

Client Side Programming; Basic Programming Concepts; Control Structures in JavaScript; Array; Functions;, Working With Form Object; Built-in Objects in JavaScript, User Defined Objects in JavaScript

MCA(S2)05

UTTARAKHAND OPEN UNIVERSITY



Master of Computer Applications
COMPUTER ORGANIZATION AND ARCHITECTURE



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MCA(S2) 06

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Maaster of Computer Application

DATA STRUCTURE THROUGH C LANGUAGE



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MCA(S2) 07

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Maaster of Computer Application

FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS



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Master of Computer Application

UTTARAKHAND OPEN UNIVERSITY

DISCRETE MATHEMATICS



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Housefed Complex, Dispur, Guwahati - 781 006



MCA-09-1(000751)



MScIT-09-1(001181)

MCA(S3)10

UTTARAKHAND OPEN UNIVERSITY



Master of Computer Application

OBJECT-ORIENTED PROGRAMMING THROUGH C++

BLOCK-1 & 2



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COURSE INTRODUCTION

This is a course on ***Object-Oriented Programming Through C++***. Object-oriented programming (OOP) is a programming paradigm that uses “objects” – data structures consisting of *data members* and *member functions* – and their interactions to design applications and computer programs. Programming techniques may include features such as *data hiding, data abstraction, encapsulation, modularity, polymorphism, and inheritance*. It was not commonly used in mainstream software application development until the early 1990s. Now-a days many modern programming languages like C++, JAVA support OOP features.

This course is divided into two blocks :

Block 1 describes basic elements of C++ language including data types, operators, manipulators, conditional statements, loops etc. Concept of functions in C++ are also covered in this block.

Block 2 concentrates on most important features of C++ language like class, constructor-destructor, overloading of operators, inheritance, virtual function and polymorphism. File handling in C++ is also discussed in this block.

Each unit of these blocks includes some along-side boxes to help you know some of the difficult, unseen terms. Some “EXERCISE” have been included to help you apply your own thoughts. You may find some boxes marked with: “LET US KNOW”. These boxes will provide you with some additional interesting and relevant information. Again, you will get “CHECK YOUR PROGRESS” questions. These have been designed to self-check your progress of study. It will be helpful for you if you solve the problems put in these boxes immediately after you go through the sections of the units and then match your answers with “ANSWERS TO CHECK YOUR PROGRESS” given at the end of each unit.

BLOCK - 1 INTRODUCTION

This is the *First Block* of the course '**Object-Oriented Programming Through C++**'. After completing this block, you will be able to write fairly complete programs using the basic tools that we have discussed in this block.

This block consists of the following six units :

- Unit - 1** introduces basic concept of OOP. Comparison of OOP with procedural programming and benefit of OOP are discussed in this unit.
- Unit - 2** concentrates on some basic elements like token, identifiers, variables, datatypes etc. In addition, the concept of streams in C++ are also discussed in this unit.
- Unit - 3** deals with the operators and manipulators used in C++.
- Unit - 4** concentrates on the discussion of decision and control statements like if, if-else, switch statements, loops: while, do-while, for; jump statement : break, continue, go to etc.
- Unit - 5** deals with the discussion of derived data types such as array, pointer, structure and union.
- Unit - 6** is the last unit of this block. This unit explains the concept of functions including the declaration of a function upto parameter passing techniques. In addition, some new concept like inline function, function overloading are also introduced in this unit.

The structure of Block 1 is as follows :

- Unit-1 : Introduction to Object-Oriented Programming**
- Unit-2 : Elements of C++ Language**
- Unit-3 : Operators and Manipulators**
- Unit-4 : Decision and Control Structures**
- Unit-5 : Array, Pointer and Structure**
- Unit-6 : Functions**

BLOCK - 2 INTRODUCTION

This is the second block of the course '*Object-Oriented Programming through C++*'. This block puts emphasis on important features of C++ language and covers how does it support the object-oriented programming paradigm. In some of our program in this block, we have declared the main function as '*void main ()*' with no *return* statement and '*int main ()*' with a *return* statement. Learners can use any one of these two delacratons as both are valid.

Unit-7 illustrates how data and functions can be combined into a single unit. This unit deals with the concept of classes and objects in C++. Declaration of class, object creation, accessing class members etc. are covered in this unit.

Unit-8 mainly focuses on two special functions in C++ language called constructors and destructors. The rules associated with using constructors and destructors are also defined in this unit.

Unit-9 deals with operator overloading. It discusses how the various operators like +,-,> etc. exhibit additional meaning when applied to user defined data types.

Unit-10 discusses inheritance in C++. It covers various forms of inheritance along with examples.

Unit-11 deals with the concept of polymorphism and virtual function. This unit illustrates the dynamic binding of functions to realize run-time polymorphism.

Unit-12 is the last unit of this block. This unit explains how to perform reading and writing data from files using C++ features.

The structure of Block 2 is as follows :

Unit-7 : Introduction to Classes and Objects

Unit-8 : Constructors and Destructors

Unit-9 : Operator Overloading

Unit-10 : Inheritance

Unit-11 : Virtual Functions and Polymorphism

Unit-12 : File Handling

MASTER OF COMPUTER APPLICATION

Object-Oriented Programming through C++

DETAILED SYLLABUS

BLOCK-1

Page No.

UNIT-1 : Introduction to Object-Oriented Programming	1 - 19
Basic concept of OOP, Comparison of Procedural Programming and OOP, Benefits of OOP, C++ compilation, Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C and C++.	
UNIT-2 : Elements of C++ Language	20 - 42
Tokens and identifiers: Character set and symbols, Keywords, C++ identifiers. Variables and constants: Integers & characters, Constants and symbolic constants, Dynamic initialization of variables, Reference variables, Basic data types in C++, Streams in C++	
UNIT-3 : Operators and Manipulators	43 - 64
Operators, Types of Operators in C++, Precedence and Associativity, Manipulators.	
UNIT-4 : Decision and Control Structures	65 - 94
if statement, if-else statement, switch statements, Loop: while, do-while, for; Jump statements : break, continue, go to.	
UNIT-5 : Array, Pointers and Structure	95 - 133
Arrays, pointer, structure, unions;	
UNIT-6 : Functions	134 - 151
main() function, components of function : prototype, function call, definition, parameter; passing arguments; types of function, inline function, function overloading.	

DETAILED SYLLABUS

BLOCK-2

Page No.

UNIT-7 : Introduction to Classes and Objects

152-190

Classes in C++, class declaration, declaring objects, Defining Member functions, Inline member function, Array of objects, Objects as function argument, Static data member and member function, Friend function and friend class.

UNIT-8 : Constructors and Destructors

191-209

Constructors, Instantiation of objects, Default constructor, Parameterized constructor, Copy constructor and its use, Destructors, Constraints on constructors and destructors, Dynamic initialization of objects.

UNIT-9 : Operator Overloading

210-228

Overloading unary operators: Operator keyword, arguments and return value; Overloading Unary and binary operators: arithmetic operators, manipulation of strings using operators, Type conversions.

UNIT-10 : Inheritance

229-264

Derived class and base class: Defining a derived class, Accessing the base class member, Inheritance: multilevel, multiple, hierarchical, hybrid; Virtual base class, Abstract class.

UNIT-11 : Virtual Functions and Polymorphism

265-283

Virtual functions, Pure virtual functions; Polymorphism, Categorization of polymorphism techniques: Compile time polymorphism, Run time polymorphism.

UNIT-12 : File Handling

284-298

File classes, Opening and Closing a file, File modes, Manipulation of file pointers, Functions for I/O operations.

MCA(S3)11

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Master of Computer Application

OPERATING SYSTEM



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MCA(S3)12

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Master of Computer Application

DESIGN AND ANALYSIS OF ALGORITHMS



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COURSE INTRODUCTION

This course is on ***Design and Analysis of Algorithms***. An algorithm is a systematic method containing a sequence of instructions to solve a computational problem. It takes some inputs, performs a well defined sequence of steps and produces some output. Algorithm design and analysis form a central theme in computer science. With this course we illustrate various concepts associated with algorithm design and analysis. The course consists of the following seven units:

Unit - 1 is an introductory unit on algorithms. With this unit learners will be acquainted with analysis of algorithm, complexity, various notations etc.

Unit - 2 concentrates on divide and conquer.

Unit - 3 is on Greedy method.

Unit - 4 concentrates on dynamic programming. .

Unit - 5 deals with backtracking.

Unit - 6 is on branch and bound.

Unit - 7 is on NP-Hard and NP-complete problems.

Each unit of this course includes some along-side boxes to help you know some of the difficult, unseen terms. Some “EXERCISES” have been included to help you apply your own thoughts. You may find some boxes marked with: “LET US KNOW”. These boxes will provide you with some additional interesting and relevant information. Again, you will get “CHECK YOUR PROGRESS” questions. These have been designed to make you self-check your progress of study. It will be helpful for you if you solve the problems put in these boxes immediately after you go through the sections of the units and then match your answers with “ANSWERS TO CHECK YOUR PROGRESS” given at the end of each unit.

MASTER OF COMPUTER APPLICATIONS

Design and Analysis of Algorithm

DETAILED SYLLABUS

Unit 1 : Introduction to Algorithms	(Marks:)	1-30
Algorithm, analysis, time complexity and space complexity, O-notation, Omega notation and Theta notation, Heaps and Heap sort, Sets and disjoint set, union and find algorithms. Sorting in linear time.		
Unit 2 : Divide and Conquer	(Marks:)	31-55
Divide and Conquer: General Strategy, Exponentiation. Binary Search, Quick Sort and Merge Sort		
Unit 3 : Greedy Method	(Marks:)	56-99
General Strategy, Knapsack problem, Job sequencing with Deadlines, Optimal merge patterns, Minimal Spanning Trees and Dijkstra's algorithm.		
Unit 4 : Dynamic Programming	(Marks:)	100-119
General Strategy, Multistage graphs, OBST, 0/1 Knapsack, Traveling Salesperson Problem, Flow Shop Scheduling		
Unit 5 : Backtracking	(Marks:)	120-147
Backtracking: General Strategy, 8 Queen's problem, Graph Coloring, Hamiltonian Cycles, 0/1 Knapsack		
Unit 6 : Branch and Bound	(Marks:)	148-156
General Strategy, 0/1 Knapsack, Traveling Salesperson Problem		
Unit 7 : P, NP-HARD AND NP-COMPLETE PROBLEMS	(Marks:)	157-174
Basic concepts, non-deterministics algorithms, NP-HARD and NP-COMPLETE classes, COOKS theorem		

MCA(S4)13

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Master of Computer Application

ADVANCED DATABASE MANAGEMENT SYSTEM



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MANAGEMENT ACCOUNTING



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MCA(S5)17

Master of Computer Applications



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Master of Computer Applications



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**FORMAL LANGUAGES
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DATA COMMUNICATION AND COMPUTER NETWORKS



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MCA-20
Master of Computer Application

UTTARAKHAND OPEN UNIVERSITY

LINUX SYSTEM ADMINISTRATION



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MCA(S6)21

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