MANIPAL UNIVERSITY
JAIPUR

PROGRAMME PROJECT REPORT (PPR)

For

Bachelor of Computer Applications (BCA)

ONLINE DEGREE PROGRAMME

DIRECTORATE OF ONLINE EDUCATION (DOE)
MANIPAL UNIVERSITY, JAIPUR-303 007
RAJASTHAN

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PROGRAMME PROJECT REPORT

1. Introduction

The Programme leading to the award of Bachelor of Computer Applications (BCA) is developed to prepare students to take up a career in the field of IT and Computer Applications. This is an Under Graduate Programme where students are exposed to various areas of Computer Applications including the latest developments in the Industry.

2. Program Mission and Objectives

To afford a Quality Undergraduate Degree in Computer Applications (BCA) through Online Learning mode to provide the students prominent skills in software development, BCA program allows them to excel in the software industry. It also trains students to develop soft skills. This Bachelor of Computer Applications programme aims to develop personnel that are academically competent and professionally motivated.

The objectives of the BCA programme are to:

- Prepare professionally trained students in the areas of programming, databases, software engineering, web- designing and networking and other completer application areas to acquire knowledge in various domain-based prospects
- Encourage students to communicate effectively and to improve their competency skills to solve real time problems related to IT
- Enable students to employ modern computer languages and applications for their successful career
- Enable students to Learn technologies and IT languages, so that business problems can be addressed.
- Create platforms for the students to become entrepreneurs and a relish for higher studies.

2. Relevance of Programme with Manipal University, Jaipur Mission and Goals

In order to align with the mission and goals of Manipal University Jaipur, the Online BCA Programme is planned to enable students and working professionals gain knowledge in various domains of management, specialize in a domain of their choice, gain knowledge of not only managerial skills including analysis, data based decision making and entrepreneurship, but also introduce them to managerial role in newer and emerging markets, products and technologies.

Vision

Global Leadership in Higher Education and Human Development

Mission

- Be the most preferred University for innovative and interdisciplinary learning
- Foster Academic research and professional excellence in all domains
- Transform young minds into competent professionals with good human values

3. Nature of Prospective Target Group of Learners

The BCA program through online learning provides personalized approach; this program is for the group of people who aspire to build/grow in their career through flexible timings. This program is also for the working professionals, who want to earn and learn simultaneously. The applicants are the people who plan their learning process as per their convenience without a fixed class schedule.

This Online programme has been designed for conventional learners, as well as working professionals and other individuals aspiring to acquire knowledge and associated academic credentials. Considering that all candidates interested in pursuing a degree may not be able to afford the same through a campus mode for reasons of paucity of time or financial constraints, online delivery is a feasible option to enable them to acquire knowledge and skills. Delivery through this mode also contributes towards Gross Enrolment Ratio (GER) of 50% by 2035, as envisaged by the Government of India.

The programme is so designed that the prospective students who may not be able to afford full time, residential BCA are provided with high value learning, anytime, anyplace, at one's own pace.

4. Appropriateness of programme to be conducted in Online mode to acquire specific skills and competence

The courses in the programme are delivered through Self-Learning e-Module which is a modular unit of e-learning material which is inter-alia self-explanatory, self-contained, self-directed at the learner, and amenable to self-evaluation, and enables the learner to acquire the prescribed level of learning in a course of study and includes contents in the form of a

combination of the following e-Learning content, and made available through four-quadrant approach namely,

(a) e-Tutorial - faculty led Audio - Video Lectures, (b) e-Content (combination of PDF/ epub) Text Materials, (c) Discussion forum for raising of doubts and clarifying the same on real time basis by the Course Coordinators/Course Mentors assigned to students (d) Self-Assessment Quiz, Test and Assignments to reinforce learning. Reference books are also mentioned in the syllabus. Latest Edition of Reference books may be referred to.

A robust Learning Management System that keeps track of delivery of e-Learning Programmes, learner's engagement, assessment, results and reporting in one centralized location, is in place. All of the above can be done/delivered by online and other platforms without much loss of fidelity. Hence the BCA programme is suited for Online mode of learning.

5. Instructional Design

5.1. Curriculum design

Curriculum has been designed by experts in the area of Management and care has been taken to include contemporary topics, as well as topics that also inculcate environmental awareness in students. The curriculum and syllabus are approved by the Board of Studies, Centre for Internal Quality Assurance (CIQA) and University Academic Council which consists of experts from Academia and Industry.

5.2. Programme structure and detailed syllabus

5.2.1. Programme Structure

Course Key	Course	Credits
FIRST YEAR-FIRST SEMESTER		
DCA1101	Fundamentals of IT and Programming	2
DCA1102	Programming in C	4
DCA1103	Basic Mathematics	4
DCA1104	Understanding PC and Troubleshooting	4
DCA1130	Programming in C – Practical	2
SECOND SEMESTER		
DCA1201	Operating System	4
DCA1202	Data Structure and Algorithms	4
DCA1203	Object Oriented Programming – C++	4

DCA1204	Communication Skills and Personality Development	4
DCA1205	Digital Logic	4
DCA1230	Data Structures and Algorithm using C++ – Practical	2
SECOND YEAR- THIRD SEMESTER		
DCA2101	Computer Oriented Numerical Methods	4
DCA2102	Database Management System	4
DCA2103	Computer Organization	4
DCA2104	Basics of Data Communication	4
DCA2130	DBMS – Practical	2
FOURTH SEMESTER		
DCA2201	Computer Networking	4
DCA2202	Java Programming	4
DCA2203	System Software	4
DCA2204	Principles of Financial Accounting and Management	4
DCA2230	Java Programming – Practical	2
DCA2231	System Software Programming – Practical	2
THIRD YEAR-FIFTH SEMESTER		
DCA3101	Web Design	4
DCA3102	Visual Programming	4
DCA3103	Software Engineering	4
DCA3104	Python Programming	4
DCA3130	Visual Programming – Practical	2
DCA3131	Web Design – Practical	2
DCA3132	Python Programming - Practical	2
	Elective – I (Choose One)	4
DCA3141	Compiler Design	
DCA3142	Graphics and Multimedia	
DCA3143	E-Commerce	
SIXTH SEMESTER		
DCA3201	Mobile Application Development	4
DCA3231	Mobile Application Development – Practical	2
DCA3202	Project	10
	Elective – II (Choose One)	4
DCA3241	Advanced Web Design	
DCA3242	Open Source Systems	
DCA3243	Cloud Computing	
	Elective – III (Choose One)	4
DCA3244	Knowledge Management	
DCA3245	Software Project Management	
DCA3246	Supply Chain Management	
	Total Credits	**126**

5.2.2. Detailed Syllabus

First Year

First Semester

Course Code: DCA1101	Course Title: Fundamentals of IT & Programming

Unit 1	**Introduction to Computers:** Computer–Definitions, The evolution of computers, Characteristics of computers, Organization of a Computer.
Unit 2	**Computer Generation & Classifications:** Generation of Computer, Classification of Computers, Distributed Computer System, Parallel Computers.
Unit 3	**Computer Memory:** Memory System, Memory Cells, Memory Arrays, Memory Limitations, Random Access Memory (RAM), Read Only Memory (ROM), External Memory (Secondary Memory), Floppy Disk Drives, Compact Disk Read Only Memory, Magnetic Storage Drives , Physical Devices Used to construct Memories.
Unit 4	**Introduction to Computer Software:** Computer Software: Overview of operating systems. Overview of application software, Overview of proprietary software, Overview of open source technology.
Unit 5	**Software Development, Design and Testing:** Software Development, Analysis and Design, Coding, Software Testing Software Paradigms, Programming Methods, Software Applications.
Unit 6	**Operating System Concepts:** Introduction to Operating System Concepts, Functions of Operating System, Development of Operating System, Operating System Components, Operating System Services, Operating Systems for Different Computers.
Unit 7	**Communication System Concepts:** Basic elements of communication system, Data Communication, Network Types, OSI Reference Model, Transmission Control Protocol/Internet protocol Model, Internet Web browsers, Web servers, Hypertext Transfer Protocol (HTTP), World Wide Web (WWW), Internet protocol Addressing.

References Books

1. Alex Leon & Mathews Leon, *Fundamentals of Information Technology*, Leon Techworld
2. B. Ram, *Computer fundamentals: architecture and organization*, New Age International
3. William Stallings, *Data and Computer Communications*, 9th Edition
4. P. K. Sinha & Priti Sinha, *Computer Fundamentals*, BPB Publications

Course Code: DCA1102	Course Title: Programming in C

Unit 1	**Introduction to C Programming:** Features of C and its Basic Structure, Simple C programs, Constants, Backslash Character Constants, Concept of an Integer and Variable, Rules for naming Variables and assigning values to variables.
Unit 2	**Operators and Expressions** Arithmetic Operators, Unary Operators, Relational and Logical Operators, The Conditional Operator, Library Functions, Bitwise Operators, The Increment and Decrement Operators, The Size of Operator, Precedence of operators.
Unit 3	**Data Types and Input/Output Operators:** Floating-point Numbers, The type cast Operator, The type **char,** Keywords, Character Input and Output, Formatted input and output, The **gets()** and **puts()** functions, Interactive Programming.
Unit 4	**Control Statements and Decision Making:** The **goto** statement, The **if** statement, The conditional expression, The **switch** statement, The **while** loop, The **do…while** loop, The **for** loop, The **break** statement and **continue** statement.
Unit 5	**Functions:** Function Basics, Function Prototypes, Recursion, Function Philosophy.
Unit 6	**Storage Classes:** Storage Classes and Visibility, Automatic or local variables, Global variables, Static variables, External variables
Unit 7	**Arrays and Strings:** One Dimensional Arrays, Passing Arrays to Functions, Multidimensional Arrays, Strings.
Unit 8	**Pointers :** Basics of Pointers, Pointers and One-dimensional Arrays, Null pointers, Pointers as Function Arguments, Pointers and Strings, Pointers and two-dimensional arrays.
Unit 9	**Structures and Unions:** Basics of Structures, Structures and Functions, Arrays of Structures, Pointers to Structures, Self-referential Structures, Unions.
Unit 10	**The Preprocesso**r: File Inclusion, Macro Definition and Substitution, Macros with Arguments, Nesting of Macros, Conditional Compilation.
Unit 11	**Dynamic Memory Allocation and Linked List:** Dynamic Memory Allocation, Allocating Memory with malloc, Allocating Memory with **calloc**, Freeing Memory, Reallocating Memory Blocks, Pointer Safety, The Concept of linked list.
Unit 12	**File Management:** Defining and Opening a file, Closing Files, Input/Output Operations on Files, Predefined Streams, Error Handling during I/O Operations, Random Access to Files, Command Line Arguments.
Unit 13	**Advanced Data Representation:** Exploring Data Representation, Abstract Data Types, Stack as an Abstract Data Type, Array, Queue as an Abstract Data Type.

References Books

1. E. Balagurusamy, *Programming with ANSI C*, Tata McGraw-Hill Publishers, New

Delhi

2. Byron S. Gottfried, Schaum's Outline Series, *Theory and Problems of Programming with C*, McGraw-Hill Publishers, New Delhi

Course Code: DCA1103	**Course Title: Basic Mathematics**

Unit 1	**Set Theory:** Sets and their Representations, The Empty Set, Finite and Infinite Sets, Equal and Equivalent Sets, Subsets, Power Set, Universal Set, Venn Diagrams, Complement of a Set, Operations on Sets, Applications of Sets, Cartesian Product of Sets.
Unit 2	**Mathematical Logic:** Statements, Basic Logical Connectives, Conjunction, Disjunction, Negation, Negation of Compound Statements, Truth Tables, Tautologies, Logical Equivalence, Applications.
Unit 3	**Modern Algebra:** Binary Operation: Addition Modulo *n,* Multiplication Modulo *n,* Semigroup, Properties of Groups, Subgroup.
Unit 4	**Trigonometry:** Radian or Circular Measure, Trigonometric Functions, Trigonometrical ratios of angle when is acute, Trigonometrical ratios of certain standard angles, Allied Angles, Compound Angles, Multiple and Sub-multiple angle.
Unit 5	**Limits and Continuity:** The Real Number System, The Concept of Limit, Concept of Continuity.
Unit 6	**Differentiation:** Differentiation of Powers of *x,* Differentiation of e^x and log *x,* Differentiation of Trigonometric Functions, Rules for Finding Derivatives, Different types of Differentiation, Logarithmic Differentiation, Differentiation by Substitution, Differentiation of Implicit Functions, Differentiation from Parametric Equation, Differentiation from First Principles.
Unit 7	**Integrations:** Integration of Standard Functions, Rules of Integration, More Formulas in Integration, Definite Integrals.
Unit 8	**Differential Equations:** First Order Differential Equations, Practical Approach to Differential Equations, First Order and First Degree Differential Equations, Homogeneous Equations, Linear Equations, Bernoulli's Equation, Exact Differential Equations.
Unit 9	**Complex Numbers:** Complex Numbers, Conjugate of a Complex Number, Modulus of a Complex Number, Geometrical Representation of Complex Number, Exponential Form of a Complex Number, De-Moivre's Theorem, n^{th} Roots of a Complex Number.
Unit 10	**Matrices and Determinants:** Definition of a Matrix, Operations on Matrices, Square Matrix and Its Inverse, Determinants, Properties of Determinants, The Inverse of a Matrix, Solution of Equations Using Matrices and Determinants, Solving equations using determinants.
Unit 11	**Infinite Series:** Convergence and Divergence, Series of Positive Terms, Binomial Series, Exponential Series, Logarithmic Series.
Unit 12	**Probability:** Concept of Probability, Sample Space and Events, Three Approaches

	to Probability, Kolmogorov's Axiomatic Approach to Probability, Conditional Probability and Independence of Events, Baye's theorem.
Unit 13	**Basic Statistics:** Measures of Central Tendency, Standard Deviation, Discrete Series, Methods: Deviation taken from Assumed Mean, Continuous Series, Combined Standard Deviation, Coefficient of Variation, Variance.

References Books

1. Algebra and Trigonometry by Richard Brown
2. Integral calculus by Shanthi Narayan Publication – S. Chand & Co.
3. Differential calculus by Shanthi Narayan Publication – S. Chand & Co.
4. Problems in Calculus of one variable by I. A. Maron Publication – CBS Publishers
5. Trigonometry by S.L. Loney Publication – S. Chand & Co.
6. Applied & Computational Complex Analysis by Peter Henrici
7. Mathematical Analysis by K.G. Binmore.

Course Code: DCA1104	**Course Title: Understanding PC and Troubleshooting**
Unit 1	CPU Essentials, The BUSes, Processor Modes, Modern CPU concepts: CISC vs. RISC CPUs, Circuit Size and Die Size, Processor Speed, Processor Cooling, System Clocks, Architectural Performance Features
Unit 2	**Processors**: Intel 8088/8086, Intel 80386, Intel Pentium P5, Intel, Pentium with MMX technology, Intel Pentium Pro (P6 Machine), Intel Pentium II, Intel Core 2, Intel Atom, AMD CPU,
Unit 3	**CPU Overclocking**: Overclocking Requirements, Potential Pitfalls, Overclocking the System, Overclocking the Intel Processors
Unit 4	**The Memory:** Essential memory concepts: Memory organization, Memory package, Modules, Memory considerations: Memory speed, Memory types, Memory techniques, Selection and installation of memory: Getting the right amount, Filling banks, Troubleshooting: Memory test equipment, Repairing SIMM/DIMM/RIMM sockets, Contact corrosion
Unit 5	**Motherboard:** Sockets and slots, Expansion slots, Memory slots, The power of chipsets, Form factor, Motherboard Upgradation: Considerations, Performing the upgrade
Unit 6	**Buses:** Industry standard architecture (ISA): 8-Bit-ISA, 16-BIT-ISA, Peripheral component Interconnect (PCI): PCI Bus configuration and signals, PCI layout, PCI signals, Accelerated graphics Port: AGP vs PCI, AGP layout, AGP signals, FSB, Dual Independent Bus(DIB), Troubleshooting

Unit 7	**CMOS:** CMOS Optimization tactics, Configuring the standard CMOS setup, Troubleshooting
Unit 8	**BIOS:** BIOS: Power-On-Self-Test (POST), Routines, BIOS features: AMI BIOS, Awards BIOS, Microid Research BIOS (MR BIOS), Identifying the BIOS chip, BIOS and boot sequences, BIOS shortcomings and compatibility issues: Device drivers, BIOS shadowing, Direct Control, BIOS bugs, Troubleshooting
Unit 9	**Power Supplies and Power Management:** Switching Regulations, Potential Power Problems: Recognizing the problems, Dealing with the power problems, Upgradation, Power Management in windows OS, Troubleshooting: Switching power supplies, Power management
Unit 10	**Storage Devices:** The Hard Drive: Construction, IDE drive standard and features, CD-ROM Drive: Basics of CD-ROM drive, DVD Drive DVD media, DVD drive and decoder, Blue-Ray disc drive: Physical Media, Software standards, Flash Memory drive: Essential components of flash drive, Size and style of packaging
Unit 11	**Parallel Port:** Signals and time diagram, Port operation, IEEE1284 Modes, Troubleshooting: Preventing parallel port trouble, Configuration of parallel port device under Windows
Unit 12	**Serial Port:** Asynchronous Communication: The data frame, Signals, Baud Vs BPS, Serial Port functioning: DTE Vs DCE, Serial port signals, Modems: Constructing and operating a modem, Signal modulation, Installing a modem, Troubleshooting Configuration, Serial port conflicts
Unit 13	**Input–Output Devices:** Mice: Mouse, Trackball, Cleaning a Pointing Device, Keyboards, Sound Boards: Recording, Playback, Sampling Concept, The Role of MIDI, Inside Look of a Sound Board, Troubleshooting a Sound Board: Hardware (Resource) Conflicts, Other Sound Card Problems, Full-Duplex Drivers, Soundboard Accelerations, Multiple Codec's, WAV Playback Problems
Unit 14	**Video Adapters and Accelerators:** Conventional Video Adapters: Text and Graphics, Video BIOS Direct X, Replacing/Updating an Adapter, Classification of Video Display Hardware, Graphics Accelerators, Factors for Video Speed, 3D Graphics Accelerator Issues: The 3D Process, Issues in 3D Speed, Improving 3D Performance
Unit 15	**SCSI and USB Systems:** SCSI concepts, Installing a SCSI system, SCSI considerations, Troubleshooting, USB systems: USB concepts, USB architecture, Troubleshooting
Unit 16	**PC Assembly:** Plug and Play Devices, PnP under Windows OS, Enabling PnP under Linux, Troubleshooting, Identification of Cables in Computers, Fitting of Cabinet, Mounting Motherboard in Cabinet.

Reference Books

1. Troubleshooting, Maintaining and Repairing PC's by Stephen J. Bigelow, TMH
2. Inside the IBM PC by Peter Norton, PHI

Course Code: DCA1130	**Course Title:** Programming in C – Practical

Simple C Programs (expression-oriented operations). Programs to illustrate various operators in C. Programs using branching constructs (if, if-else-if, switch case). Programs using looping constructs (for, while, do-while continue, break). Programs on 1D Arrays, Programs on 2D Arrays. Programs on strings. Programs using functions (with and without recursion), passing parameters by value and reference. Programs on Structures, Array of Structure, Union, Programs for operations on File handling, Programs on ADT

Reference Books

1. E. Balaguruswamy, *Programming in ANSI C*, (5e), Tata McGraw Hill.
2. E. Balaguruswamy, *Computing Fundamentals & C Programming*, (2e), TataMcGraw Hill
3. R. Thareja, *Computer Fundamentals and Programming in C*, (1e), Oxford University Press
4. B. A. Forouzan, R. F. Gilberg*, Computer Science: A structured programming Approach* Using C, (3e), Cole Publishing Company-Cengage

Second Semester

Course Code: DCA1201	**Course Title: Operating System**

Unit 1	**Operating System – An Introduction:** Definition and Functions of Operating System, Evolution of Operating Systems, Types of Operating Systems, Operating System Structures: Layered Approach, Kernel Based Approach, Virtual Machine Approach.
Unit 2	**Operating System Architecture:** Operating System as an Extended Machine, Layered Approach, Micro-Kernels, UNIX Kernel Components, Modules, Introduction to Virtual Machines, Virtual Environment and Machine Aggregation, Implementation Techniques.
Unit 3	**Process Management:** Process State, Process Control Block, Process Scheduling, Operation on Processes, Co-operating Processes, Threads.
Unit 4	**CPU Scheduling Algorithms:** Basic Concepts of Scheduling, Scheduling Algorithms, Evaluation of CPU Scheduling Algorithms
Unit 5	**Process Synchronization:** Inter-process Communication, The Critical-Section Problem, Semaphores, Monitor, Hardware Assistance.
Unit 6	**Deadlocks:** System Model, Deadlock Characterization, Necessary conditions for deadlock, Resource-allocation graph, Deadlock Handling, Deadlock Prevention,

	Deadlock Avoidance: Safe state, Resource-allocation graph algorithm, Banker's algorithm, Deadlock Detection: Single instance of a resource, Multiple instances of a resource, Recovery from deadlock.
Unit 7	**Memory Management:** Logical vs. Physical Address Space, Swapping, and Contiguous Allocation: Single partition allocation, Multiple partition allocation, Fragmentation, Paging, Segmentation.
Unit 8	**Virtual Memory:** Need for Virtual Memory Technique, Demand Paging, Concept of Page Replacement, Page Replacement Algorithms: FIFO page replacement algorithm, Optimal algorithm, LRU page replacement algorithm, Thrashing.
Unit 9	**File System Interface and Implementation:** Concept of a File, File Access Methods, Directory Structure, Allocation Methods, Free Space Management, Directory Implementation.
Unit 10	**Input – Output Architecture:** I/O Structure, I/O Control Strategies, The I/O Address Space.
Unit 11	**Operating Systems in Distributed Processing:** Centralized and Distributed Processing, Network Operating System (NOS) Architecture, Functions of NOS, Global Operating System (GOS), Remote Procedure Call (RPC), Distributed File Management.
Unit 12	**Security and Protection:** Attacks on Security, Computer Worms, Computer Virus, Security Design Principles, Authentication, Protection Mechanism, Encryption, Security in Distributed Environment.
Unit 13	**Multiprocessor Systems** Multiprocessors, Multiprocessor Classification, Multiprocessor Interconnections, Types of Multiprocessor Operating Systems (MOS), MOS Functions and Requirements, Operating System Design and Implementation Issues.
Unit 14	**Windows Operating Systems: Latest** Windows' Architecture, Common Functionality.

Reference Books

1. Abraham Silberschatz & Peter Baer Galvin, "Operating System Concepts", PHI.
2. Andrew S. Tanenbaum, "Operating Systems: Design and Implementation", Pearson Education.
3. Andrew S. Tanenbaum, "Modern Operating Systems", TMH.

Course Code: DCA1202	**Course Title: Data Structures and Algorithms**

Unit 1	**Data Structures Basics:** Structure and Problem Solving, Data Structures, Data Structure Operations, Algorithm: Complexity and Time-Space Trade off.
Unit 2	**Linked List:** Linked List and its representation in memory, Traversing a Linked List, Searching a Linked List, Memory Allocation and Garbage

	Collection, Insertion into Linked list, Deletion from a Linked list, Types of Linked List.
Unit 3	**Stacks and Queues:** Stack, Array implementation of stack, Linked list implementation of stack, Applications of Stack, Evaluation of a postfix expression, Infix to postfix conversion, Queue, Array implementation of queue, Linked list implementation of queue.
Unit 4	**Trees and Binary Trees:** Tree: Definition and Concepts, Binary Tree: Definition and Concepts, Types of Binary Tree, Traversal on Binary Tree, Representation of Binary Tree, Conversion of General Tree to Binary Tree, Sequential and Other Representations of Binary Tree.
Unit 5	**Graphs:** Basic Concepts about Graphs, Matrix Representation of Graphs, List Structures, Other Representations of Graphs, Algorithms for Graph Traversal, Spanning Trees.
Unit 6	**Directed Graphs:** Types of Directed Graphs, Binary Relation as a Digraph, Euler's Digraphs, Matrix Representation of Digraphs.
Unit 7	**Applications of Graphs:** Topological Sorting, Weighted Shortest Path–Dijkstra's Algorithm, Minimum Spanning Tree (MST), Introduction to NP-Completeness, Definition of NP, Optimization versus decision problems, Classes P and NP, NP-complete problems, NP-hardness and NP-completeness.
Unit 8	**Searching and Sorting Techniques:** Sorting Notations and concepts, Bubble sort, Merge sort, Selection sort, Heap sort, Searching: Sequential searching, Binary searching.
Unit 9	**Elementary Algorithms:** Notation for Expressing Algorithms, Role and Notation for Comments, Example of an Algorithm, Problems and Instances, Characteristics of an Algorithm, Building Blocks of Algorithms, Procedure and Recursion, Outline of Algorithmics, Specification Methods for Algorithms.
Unit 10	**Mathematical Functions and Notations:** Functions and Notations, Modular Arithmetic/Mod Function, Mathematical Expectation in Average Case Analysis, Efficiency of an Algorithm, Well Known Asymptotic Functions and Notations, Analysis of Algorithms–Simple Examples.
Unit 11	**Divide and Conquer:** Divide and Conquer Strategy, Binary Search, Max. and Min., Merge Sort, Quick Sort.
Unit 12	**Greedy Method:** Greedy Method Strategy, Optimistic Storage on Tapes, Knapsack Problem, Job Sequencing with Deadlines, Optimal Merge Pattern, Single Source Shortlist Paths
Unit 13	**Dynamic Programming:** Dynamic Programming Strategy, Multistage Graphs, All Pair Shortest Paths, Traveling Salesman Problems.
Unit 14	**Backtracking:** Backtracking Strategy, 8-Queens Problem, Sum of Subsets, Knapsack Problem.
Reference Books	
1. E. Horowitz, S. Sahni and S. Rajasekaran, Computer Algorithms, (2e), University	

Press

2. T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein, Introduction to Algorithms, (3e), MIT press

Course Code: DCA1203	Course Title: Object Oriented Programming – C++
Unit 1	Overview of OOP Concepts: Evolution of Programming Methodologies, Difference between C and C++, Introduction to OOP and its basic features, Basic components of a C++ program and program structure, Data types
Unit 2	Variables: declaration and definition, Tokens of C++: Identifiers, Keywords, Constants, Operators, Identifiers, C++ I/O Methods: cin- cout, Structure of C++ programs.
Unit 3	Control Statements, Arrays and Pointers: Control statements, Conditional control statements, Iteration statements, Introduction to arrays, Declaration and definition of arrays, Initialization of array, Multidimensional arrays, Two-dimensional arrays, N-dimensional arrays, Pointer.
Unit 4	Functions and Structures: Introduction to Functions, Passing Data to Functions: Pass by value, Pass by reference, scope and Visibility of Variables in Functions, Storage classes, Strings, Structures and Unions.
Unit 5	**Classes and Abstraction:** Creating Classes, Objects, Access Specifiers, Objects and Arrays, Objects and Functions, Objects and Pointers, Abstract class, *this* Pointer, Friend Functions, Static Variable and Static Functions.
Unit 6	**Constructors and Destructors:** Constructors, Multiple Constructors, Parameterized constructors using Dynamic Objects, Copy Constructors, Destructors, Name Space.
Unit 7	**Operator Overloading:** Operator Overloading in C++, Overloading Unary Operators, Overloading binary operators, Type Conversions.
Unit 8	**Inheritance:** Inheritance in C++, Public, Private and Protected Inheritance, Types of Inheritance, Function Overriding, Multiple Inheritance, Constructors in derived classes.
Unit 9	**Polymorphism and Virtual Functions:** Introduction to polymorphism, Types of polymorphism, Function overloading, Introduction to Virtual Functions, Pure Virtual Functions, Function Overloading v/s Function Overriding.
Unit 10	**Files and Streams:** Introduction to files and streams, Character and String input and output to files, Command Line Arguments and Printer Output, Pre-processor Directives.
Unit 11	**Standard Input and Output:** Understanding the C++ iostream hierarchy, Basic Programming using Streams, Formatted console I/O Operations.
Unit 12	**Files:** Opening and closing a file, checking for Failures with File Commands, Checking the I/O Status – Flags, Dealing with Binary Files, Some Useful Functions.
Unit 13	**Class Templates:** Implementing a class template, Class template with multiple parameters, Function Templates, Template Instantiation, Class Template Specialization, Template Function Specialization, Template Parameters, Static Members and Variables, Templates and Friends, Templates and Multiple – File Projects.
Unit 14	**Standard Template Library:** STL Components, Sequence Containers, Associative Containers, Derived Containers, Iterators.
Unit 15	**Exception Handling:** Basics of Exception Handling, Exception Handling

	Mechanism, Throwing Mechanism, Catching Mechanism, Multiple catch statements, User Defined Exception Class, Termination vs. Resumption, Exception Specifications, Rethrowing an Exception, Uncaught Exceptions, Standard Exceptions, Programming with Exceptions.

Reference Books

1. E Balagurusamy , “Object Oriented Programming with C++” - Sixth Edition, Tata McGraw-Hill Education.
2. Nicolai M. Josuttis, “The C++ Standard Library: A Tutorial and Handbook”, Addison-Wesley Professional.
3. Sarang Poornachandra “Object-Oriented Programming with C++ “2Nd Ed., PHI Learning Pvt. Ltd.

Course Code: DCA1204	**Course Title: Communication Skills and Personality Development**
Unit 1	**Language and Communication:** Concept of Communication, Process of Communication, Barriers of Effective Communication, Types of Communication: Verbal Communication, Non-verbal Communication.
Unit 2	**Oral Communication** Introduction, Advantages and Disadvantages of Oral Communication, One-to-One Oral Communication.
Unit 3	**Listening Skills:** Meaning of Listening, Types of Listening, Barriers to Effective Listening, Strategies for Effective Listening, Semantic Markers.
Unit 4	**Reading Skills:** Definition and Meaning of Reading, Purpose of Reading, Types of Reading, SQ3R Technique of Reading.
Unit 5	**Writing Skills** Paragraph: Qualities of a good paragraph, Parts of a paragraph, Static Description, Process Description, Describing Facts and Figures.
Unit 6	**Business Writing:** Business Letter Writing, Principles of writing letters, Structure of a business letter, Types of Business Letter, Job Application, Other Business Communication.
Unit 7	**Organisational Documents:** Memo, Language of a Memo, Components of a Memo, Format of a Memo, Circulars and Notices
Unit 9	**Personality:** Introduction Objectives, Personality: Categories of Personality, Self-Image, Improving the level of self-acceptance, Factors affecting Personality Development, Defense Mechanism, Personality characteristics in Organization, Factors that determine our Attitude
Unit 9	**A Stitch in Time Saves Nine:** Introduction, Concept and Applications of Time Management, Recognizing the Importance of Time: Theories of Time Management, Causes for Wastage of Time, Methods for Managing Time Efficiently
Unit 10	**Leadership:** Introduction, Leadership – Explanation, Role and Functions of a Good Leader, Criticality of Team Leadership, Research of different kinds of

	leaders, Methods of developing effective leaders, Leadership styles, Leader's Three top mistakes, Challenges faced by a Leader
Unit 11	**Interpersonal Behavior:** Introduction, Understand Self, Diagnosis of Type of Self/Identifying own type of self, Effect of Interpersonal Behavior of Interpersonal Relationship, Transactional Analysis, Open Self Personality

Reference Books

1. Green, David. Contemporary English Grammar Structures and Composition. Madras: Macmillan India Limited
2. Introduction to Management. ICFAI Center for Management Research.
3. Kahn, John Ellison (Ed.). Reader's Digest: How To Write and Speak Better. London: The Reader's Digest Association Limited.
4. Sharma R.C and Mohan Krishna. Business Correspondence and Report Writing: A Practical Approach to business and Technical Communication. Tata McGrawHill: New Delhi.
5. Sonnenberg Frank K., "Barriers to Communication" Journal of Business Strategy, Vol. 11, Issue 4 (July/August 1990): p 56-59. Luft, Joseph (1969). "Of Human Interaction," Palo Alto, CA: National Press
6. Kelly, Anita E. and McKillop, Kevin J. (1996), "Consequences of Revealing Personal Secrets." Psychological Bulletin

Course Code: DCA1205	**Course Title: Digital Logic**

Unit 1	**Number System:** Decimal Number System, Binary Number Systems, Octal number systems, Hexadecimal Number systems, Negative Number Representation, Signed Magnitude Representation, Conversion from one number system to other number system, Complements Arithmetic.
Unit 2	**Boolean Algebra:** Rules and Laws of Boolean Algebra with Derivations, Basic Gates (NOT, AND & OR), Universal Gates (NAND & NOR), Exclusive-OR & Exclusive-NOR Gates, Exercises on Realizing Circuits with Universal Gates.
Unit 3	**Techniques for Simplifying Boolean Expressions:** Boolean Algebra, Boolean Expressions and Functions, More on Boolean Functions, Functional Completeness, Simplification of Boolean Functions, Karnaugh Maps, Quine-McCluskey Method.
Unit 4	**Combinational Circuits:** Definition of Combinational Circuits, Types of Combinational Circuits, Gray Code and its Properties, BCD Code and its Properties, Excess-3 Code and its Properties.
Unit 5	**Sequential Circuits and Applications:** Definition of Sequential Circuits, Latch, Flip-Flop, Real world Applications of Sequential Circuits.
Unit 6	**Shift Registers and Applications:** Definition of Shift Registers, Types of Shift Registers, Case Study IC's.

Unit 7	**Basics of Counters and Design of Counters:** Typical Counters, Design of Modulo-N counters, Problem on Counter Design.
Unit 8	**Design of Real World Logic Circuits:** Traffic Signal Systems, Two Way Switches, Electronic Tennis Scoring System, Temperature and Weather Forecast Systems.
Unit 9	**Digital Equipment:** MODEM, Digital Multi-meter, Digital Versatile Disks.
Unit 10	**Data Converter: DAC/ADC:** Working Principle and Circuits of Analog to Digital Converters, Digital to Analog Converters.

Reference Books

1. Mano M. Morris *Digital Logic and Computer Design*. PHI Private Limited.
2. Unger H Stephen *The Essence of Logic Circuits* Second Edition, S. Chand & Company.
3. Roth Jr H. Charles *Fundamentals of Logic Design.* Fifth Edition, Thomson India Edition.
4. Malvino and Leach *Digital Principles and Applications.* Fifth Edition, Tata McGraw-Hill.

Course Code: DCA1230	**Course Title: Data Structures and Algorithm using C++ – Practical**

Simple C++ programs without using the concept of classes and objects, classes, friend functions, Parameterized, default and copy constructor, destructor, static members Inheritance, Dynamic method, dispatch, Files, Dynamic allocation, operator overloading, Templates, overloaded functions, virtual functions, implement various console I/O functions i.e. width(), precision().

Reference Books:

1. E. Balaguruswamy, *"Object Oriented Programming with C++"* , TMH.
2. Herbert Schildt, *"C++ The Complete Reference"*, TMH.

Second Year

Third Semester

Course Code: DCA2101	Course Title: Computer Oriented Numerical Methods
Unit 1	**Errors and Computation:** Mathematical Preliminaries, Significant digits, Errors and their computations, Absolute, Relative and Percentage errors, Taylors Series, Error Propagation, Total Numerical errors, Blunders: Formulation Errors, Data Uncertainty
Unit 2	**Finite Difference Operator:** Finite Differences: Forward Difference, Backward Difference, Central Differences, Shift Operator, Average Operator, Differential Operator, Differences of Polynomials, Factorial Polynomials
Unit 3	**Solution of Algebraic and Transcendental Equations:** Graphical and Analytical Methods, Interval Halving Method (or Bisection Method), Regula-Falsi Method (or False Position or Method of Chords), Successive Approximation Method or picard iteration methods, Newton – Raphson Method, Ramanujan's Method
Unit 4	**Matrices and Solutions of Systems of Linear Equations-Direct Methods:** Linear Equations, Existence of Solution of systems of linear equations-Direct Methods: Matrix Inversion Method, Gauss Elimination Method, Gauss-Jordan Method, Cramer's rule, LU Decomposition
Unit 5	**Iterative Methods:** Gauss - Jacobi Method, Gauss Seidel Method, Eigen Values and Eigen Vectors
Unit 6	**Curve Fitting:** Graphical Method (Linear Law): Laws Reducible to the linear law, Method of Group Averages, Method of Least Squares: Fitting a Straight line, Fitting a, Parabola y = a + bx + cx2, Fitting a curve of the form y = axb, Fitting an Exponential Curve, Method of Moments
Unit 7	**Interpolation with Equal intervals:** Newton's Forward Difference Interpolation Formula, Newton's Backward Difference Interpolation Formula, Central differences formula: Gauss Forward formula, Gauss Backward Formula, Stirling's Formula, Bessel's formula
Unit 8	**Interpolation with Unequal Intervals:** Lagrange's Interpolation Formula, Divided Differences, Newton's Divided Difference Formula, Inverse Interpolation- Lagrange's method
Unit 9	**Numerical Differentiation:** Newton's Formulae, Derivatives using Newton's General Interpolation Formula, Difference Equations
Unit 10	**Numerical Integration:** Gaussian Quadrature formula, Trapezoidal Rule, Simpson's one third rule, Simpson's three eighth rule
Unit 11	**Numerical Solution of Ordinary Differential Equations:** Initial Value Problems, Picard's method of Successive Approximation, Taylor's series method, Euler's method, Modified Euler's method, Runge-Kutta method: Runge-Kutta Second Order, Runge-Kutta Fourth Order, Predictor Corrector Method: Miline's method, Adams- Moulton's Method
Unit 12	**Boundary Value Problems:** Method of Finite Differences solving BVP, Solving of Laplace's and Poisson's Equations

Reference Books

1. S. S. Sastry, *Introductory Methods of Numerical analysis*, Prentice Hall of India private limited
2. S.S. Sastry, *Engineering Mathematics*, Prentice Hall India Private Limited
3. E. Balagurusamy, *Numerical Methods*, Tata McGraw – Hill Publishing Company Limited.
4. B. S. Grewal, *Numerical Methods*, Khanna publishers, New Delhi.
5. V. Rajaraman, *Computer Oriented Numerical Methods*–Prentice-Hall of India Private Limited.
6. K. Sankara Rao, *Numerical Methods for Scientists and Engineers*, Prentice Hall India Limited.
7. Jain MK, Jain RK and Iyengar, *Numerical Analysis for Scientists and Engineers*.

Course Code: DCA2102	**Course Title: Database Management System**

Unit 1	**Introduction**: Significance of Database, Database System Applications, Data Independence, Data Modeling for a Database, Entities and their Attributes, Entities, Attributes, Relationships and Relationships Types, Advantages and Disadvantages of Database Management System, DBMS Vs RDBMS
Unit 2	**Database System Architecture:** Three Level Architecture of DBMS: The External Level or Subschema, The Conceptual Level or Conceptual Schema, The Internal Level or Physical Schema, Mapping, MySQL Architecture, SQL Server 2000 Architecture, Oracle Architecture
Unit 3	**Database Management System Facilities**: Data Definition Language, Data Manipulation Language, Database Management System Structure, Database Manager, Database Administrator, Data Dictionary
Unit 4	**Distributed Processing:** Information and Communications Technology System (ICT), Client / Server Architecture
Unit 5	**Database Models and Implementation:** Data Model and Types of Data Models: Relational Data Model, Hierarchical Model, Network Data Model, Object/Relational Model, Object-Oriented Model, Entity-Relationship Model: Modeling using E-R Diagrams, Notation used in E-R Model, Relationships and Relationship Types, Associative Database Model
Unit 6	**File Organization for Conventional DBMS:** Storage Devices and its Characteristics: Magnetic Disks, Physical Characteristics of Disks, Performance Measures of Disks, Optimization of Disk-Block Access, File Organization: Fixed-Length Records, Variable-Length Records, Organization of Records in Files, Sequential file Organization, Indexed Sequential Access Method (ISAM), Virtual Storage Access Method (VSAM)
Unit 7	**RDBMS:** Relational Database Management System, RDBMS Properties: The Entity-Relationship Model, Overview of Relational Query Optimization, System Catalog in a Relational DBMS: Information Stored in the System Catalog, How Catalogs are Stored, SQL: Categories of SQL Commands, Data Definition, Data Manipulation Statements, SELECT–The Basic Form, Subqueries, Aggregate Functions, GROUP BY Feature, Updating the Database, Data Definition Facilities, Embedded SQL: Declaring Variables and

	Exceptions, Embedding SQL Statements, Transaction Processing, Consistency and Isolation, Atomicity and Durability
Unit 8	**Relational Algebra:** Basic Operations: Union, Difference Intersection, Cartesian Product, Additional Relational Algebraic Operations: Projection, Selection, JOIN, Division
Unit 9	**Relational Calculus:** Tuple Relational Calculus: Semantics of TRC Queries, Domain Relational Calculus, Relational ALGEBRA vs Relational CALCULUS
Unit 10	**Normalization:** Functional Dependency, Anomalies in a Database, Properties of Normalized Relations, First Normalization, Second Normal Form Relation, Third Normal Form, Boyce-Codd Normal Form (BNCF), Fourth and Fifth Normal Form
Unit 11	**Query Processing and Optimization:** Query Interpretation, Equivalence of Expressions, Algorithm for Executing Query Operations: External sorting, Select operation, Join operation, PROJECT and set operation, Aggregate operations, Outer join, Heuristics in Query Optimization, Semantic Query Optimization, Converting Query Tree to Query Evaluation Plan, Cost Estimates in Query Optimization Measure of query cost, Catalog information for cost estimation of queries, Join Strategies for Parallel Processing, Parallel join, Pipelined multiway join, Physical organization
Unit 12	**Distributed Databases:** Structure of Distributed Database, Trade-offs in Distributing the Database: Advantages of Data Distribution, Disadvantages of Data Distribution, Design of Distributed Databases: Data Replication, Data Fragmentation
Unit 13	**Object Oriented Database Management System:** Next Generation Data Base System, New Database Application, Object Oriented Database Management System, Features of Object Oriented System, Advantages of Object Oriented Database Management System, Deficiencies of Relational Database Management System, Difference between Relational Database Management System and Object Oriented Database Management System, Alternative Object Oriented Database Strategies
Unit 14	**Object Relational Mapping:** Significance of Mapping, Mapping Basics, Mapping a Class Inheritance Tree, Mapping Object Relationships: Types of relationships, Implementation of object relationships, Implementation of relational database relationships, Relationship mappings, Mapping ordered collections, Mapping recursive relationships, Modelling with Join Tables, Open Source Object Relational Mapping Software
Unit 15	**Technological Trends in DBMS:** Cloud Computing: Functioning of Cloud Computing, Cloud Architecture, Cloud Storage and Cloud Services, Cloud Industrial Applications, Temporal Database, Big Data, NoSQL Databases: Types of NoSQL databases, Advantages and Disadvantages of NoSQL, SQL Databases vs. NoSQL Databases.

Reference Books

1. Ramakrishnan, R. & Gehrke, J. (2003), Database Management Systems, McGraw-Hill, Higher Education.
2. Rob, P. & Coronel, C. (2006), Database Systems: Design, Implementation and Management, Thomson Learning.
3. Silberschatz, Korth & Sudarshan (1997), Database System Concepts, McGraw-Hill
4. Navathe, E. (2000), Fundamentals of Database Systems, Pearson Education Asia
5. Paul Beynon-Davies (2003), Database Systems, Palgrave.
6. Toby Teorey, Sam Lightstone and Tom Nadeau (2006), Database Modeling & Design, Elsevier Inc.

Course Code: DCA2103	**Course Title: Computer Organization**

Unit 1	**Computer Evolution:** Brief history of Computer, Structure of a Computer System, Arithmetic Logic Unit, Control Unit, Bus Structure, Von Neumann Architecture.
Unit 2	**Basic Arithmetic Operations:** Integer Addition and Subtraction, Fixed and Floating point numbers, Signed numbers, Booths Algorithm, Hardware Implementation, IEEE Standards, Floating Point Arithmetic, The accumulator, Shifts, Carry and Overflow.
Unit 3	**Central Processing Unit and Instructions:** Instruction Characteristics, CPU with Single BUS, Types of Operands, Types of Operations, Addressing Modes, Instruction Formats.
Unit 4	**Processor Organization:** Parallelism and Computer Arithmetic, Floating Point in the 8086, Programmers Model of 8086, Max/Min Mode, Register Organisation, Instruction Cycles, Read Write cycles, Addressing Modes.
Unit 5	**Control Unit Design:** Micro operations, Control of the CPU, Data Path inside A CPU, Sequencing of Control Signals, Hardwired Control Unit.
Unit 6	**Memory Organization:** Characteristics of Memory Systems, Main Memory, Memory system considerations, Memory interleaving.
Unit 7	**High Speed Memories:** Cache Memory, Principles of cache memory, Structure of cache and main memory, Performance using cache memory, Elements of Cache Design, Mapping functions, Replacement algorithms, External Memory, Virtual memory, Memory Management in Operating Systems.
Unit 8	**Secondary Memory:** Magnetic Disk and Tape, Digital Audio Tape (DAT), RAID, Optical memory.
Unit 9	**I/O Organization:** Need of I/O Module, External Devices, Input/Output Module, Programmed I/O, Interrupt Driven I/O, Data Transfer Techniques, Direct Memory Access (DMA), Intel 8237, Buses, I/O Interface, Synchronous and Asynchronous Data Transfer, Parallel I/O 8255, Serial I/O 8251, PCI, SCSI Bus, Serial I/O, Case let: Program Controlled I/O.
Unit 10	**Peripherals:** Input Devices, Output Devices.
Unit 11	**Multiprocessor Configuration:** Multiprocessing, Coupled Multiprocessor, Contention problems in multiprocessor systems, Coprocessor, I/O Processor, Caselet.

Unit 12	**Microprogramming:** Basic Principles, Computer Clock, Microinstructions and its timing, Control Path, Microcode, Machine Instructions.
Unit 13	**Parallel Organization:** Parallel Organization, Instruction Set Architecture(ISA), Vector Processing Requirements, Characteristics of vector processing, Super Scalar Processors, The emergence and spread of super scalar processors, Specific task of Super scalar processing, Super Scalar Instruction Issue.

Reference Books

1. Jordan H. *Computer System Design & Architecture*. PHI
2. William Stalling," *Computer Organization and Architecture*", Prentice Hall, Person Education Asia
3. John P. Hayes, "*Computer Architecture and Organization*", McGraw Hill,
4. Tannenbaum, "*Computer Organization*", PHI
5. Mano Moris, "*Computer System Architecture*", Prentice Hall of India

Course Code: DCA2104	**Course Title: Basics of Data Communication**

Unit 1	**Introduction:** Data Communication and Networking for Today's Enterprise, Communication Model, Data Communications: Criteria for a data communication network, Classification of computer network, Classification by network topologies, Classification by range, Internet.
Unit 2	**Protocol Architecture and Internet Based Applications:** Introduction, need for a Protocol Architecture, TCP/IP Protocol Architecture, OSI Model, Standardization within a Protocol Architecture, Traditional Internet based Applications
Unit 3	**Data and Signals:** Introduction, Analog and Digital signals, Periodic Analog Signals, Digital Signals, Transmission Impairment: Attenuation, Distortion, Noise, Data Rate Limits: Noiseless channel: Nyquist Bit Rate, Noisy channel: Shannon capacity, Performance: Bandwidth, Throughput, Latency, Bandwidth-delay product, Jitter.
Unit 4	**Digital Transmission:** Introduction, Digital to digital conversion: Line Encoding, Types of Line, Coding, Unipolar scheme, Polar schemes, Biphase: Manchester and differential, Manchester, Bipolar schemes, Scrambling, Analog to Digital Conversion: Pulse code modulation (PCM), Delta modulation (DM), Transmission Modes.
Unit 5	**Analog Transmission:** Introduction, Digital to analog conversion, Amplitude shift keying, Frequency shift keying, Phase shift keying, Quadrature amplitude modulation, Analog to analog conversion: Amplitude modulation, Frequency modulation, Phase modulation.
Unit 6	**Transmission Media:** Introduction, Guided transmission media, Twisted pair

	cable, Coaxial cable, Fiber optic cable, Wireless transmission: Radio waves, Microwaves, Infrared, Line of sight transmission.
Unit 7	**Switching:** Introduction, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks, Structure of a Switch.
Unit 8	**Digital Data Communication Techniques:** Introduction, Asynchronous and synchronous transmission, Types of errors, Error detection, Error correction, Line configuration.
Unit 9	**Multiplexing:** Introduction, Frequency Division Multiplexing, Wavelength Division Multiplexing, Time Division Multiplexing (TDM), Synchronous time division multiplexing, Statistical time division multiplexing, Asymmetric Digital Subscriber Line.
Unit 10	**Spread Spectrum:** Introduction, Concept of Spread Spectrum, Frequency hopping Spread Spectrum, Direct Sequence Spread Spectrum, Code Division Multiple Access.
Unit 11	**Data Link Control Protocols:** Introduction, Protocols for Noiseless Channels, Simplest protocol, Stop-and-wait protocol, Protocols for Noisy Channels, Stop-and-wait automatic repeat request, Go-back-N-automatic repeat request, Selective repeat automatic repeat request, High-level Data Link Control Protocol (HDLC), Point-to-Point Protocol (PPP).
Unit 12	**Data Link Layer – Error Detection and Correction:** Introduction, Error detection and correction, One and two dimensional parity checks, Cyclic redundancy check (CRC), Hamming code, Framing, Flow and error control.
Unit 13	**Wired LANs:** Introduction, IEEE Standards, Standard Ethernet, Changes in the Standard, Bridged Ethernet, Switched Ethernet, Full duplex Ethernet, Fast Ethernet, Gigabit Ethernet.
Unit 14	**Wireless LANs:** Introduction, IEEE802.11: Architecture, Medium Access Control sub layer, Addressing mechanism, Physical layer, Bluetooth: Bluetooth Architecture, Bluetooth Layers.

Reference Books

1. Behrouz A. Forouzan, Sophia Chung Fegan, “Data Communications and Networking”.
2. William Stallings, “Data and Computer Communications”, Sixth edition, Pearson Education, Delhi.
3. Taub and Schilling, “Principles of Communication Systems”, Tata Mc Graw Hill, Delhi..
4. S. Tanenbaum, “Computer Networks”, Pearson Education.
5. N. Olifer, V. Olifer, “Computer Networks: Principles, technologies and Protocols for Network design”, Wiley India Edition.
6. Simon Poulton, Packet Switching and X.25 Networking, Pitman publishing.
7. Walrand, P. Varaiya, “High Performance Communication Networks”, Morgan Kaufmann.

Course Code: DCA2130	**Course Title: DBMS – Practical**

MySQL setup: data migration from MySQL to portable file as well as uploading data from portable file to MySQL. SQL: Creating, Altering, and Dropping tables with Constraints, Insert Table. Detailed SELECT with sub-queries, EQUI-JOINS, correlated sub-queries. GROUPING, SET, UPDATE, DELETE, VIEWS. PL/SQL: Program Development: Iterative PL/SQL Blocks.
Reference Books 1. R. Ehmasri, S. Navathe, Fundamentals of Database Systems*, (6e), Addison-Wesley.* 2. Silberschatz, H. F. Korth, S. Sudarshan, *Database System Concepts*, (6e), McGraw-Hill. 3. C.J. Date, *Introduction to Database Systems*, (8e), Pearson Education.

Fourth Semester

Course Code: DCA2201	**Course Title: Computer Networking**

Unit 1	**Introduction to Computer Networks:** Network Hardware**,** Network Edge End Systems, Clients and Servers Connectionless and Connection-Oriented Services, Reference Models, OSI Reference Model, TCP/IP Reference Model, Network Performance, History of Networking, Development of Packet Switching 1961-72, Networks and Internetworking 1972-80, Rapid growth of Networks 1980-90, The Internet Explosion 1990s, Recent Development.
Unit 2	**Data Link Layer and Local Area Networks:** Modulation and Multiplexing, Ethernet (IEEE 802.3), Wireless LANs, Wi-Fi (802.11), Bluetooth (802.15.1), Cell phone technologies, Link Virtualization, Asynchronous Transfer Mode (ATM), Multiprotocol Label Switching (MPLS), Multiple Access Protocols.
Unit 3	**Data Link Layer – Framing and Error Detection:** Framing**,** Byte-Oriented Protocols (BISYNC, PPP, DDCMP)**,** Bit-Oriented Protocols (HDLC)**,** Clock-based Framing (SONET)**,** Error Detection and Correction**.**
Unit 4	**Data Link Layer – Reliable Transmission:** Data Link Layer Design Issues**,** Services provided to the Network Layer**,** Framing**,** Error Control**,** Flow Control**,** Elementary Data Link Protocols**,** Simplex Protocol**,** Stop and Wait Protocol for an Error-free Channel**,** Stop and Wait Protocol for a Noisy Channel.
Unit 5	**Data Link Layer – Sliding Window Protocols:** Sliding Window Protocols, One-bit Sliding Window Protocols, Protocol Using Go-Back-N, Protocol using selective repeat, Concurrent Logical Channels**.**
Unit 6	**Network Layer–Internetworking:** Virtual Circuits and, Datagram Networks, The Internet Protocol (IP), IPV4 Addressing, IPV6 Addressing.
Unit 7	**Network Layer–Advanced Internetworking:** Routing Algorithms**,** Shortest Path Algorithm**,** Flooding**,** Distance Vector Routing**,** Link State Routing**,**

	Hierarchical Routing**,** Multicast and Broadcast Routing**,** Routing in Internet**,** Intra-AS Routing in the Internet: Routing Information Protocol (RIP)**,** Intra-AS Routing in the Internet: Open Shortest Path First (OSPF)**,** Inter-AS Routing: Border Gateway Protocol (BGP).
Unit 8	**Transport Layer Protocols:** Process-to-Process Delivery, Connectionless Transport: UDP, Connection-oriented Transport: TCP, Transport for Real-Time Applications (RTP).
Unit 9	**Transport Layer – Congestion Control:** Congestion Control Algorithms**,** Congestion Avoidance Mechanisms.
Unit 10	**Transport Layer – Resource Allocation and Quality of Service:** Issues in Resource Allocation**,** Queuing**,** Quality of Service.
Unit 11	**Application Layer Protocols:** Electronic Mail, HTTP.
Unit 12	**DNS and World Wide Web:** Name Space**,** The Domain Name System**,** The World Wide Web.
Unit 13	**Multimedia Networking:** Presentation Formatting, Multimedia Data, Lossless Compression Techniques, Streaming stored audio and video.
Unit 14	**Network Security**: Communication Security, IP Security (IPSec), E-mail Security, Web Security.

Reference Books

1. Andrew S Tanenbaum, David J. Wetherall, *"Computer Networks,"*.
2. Larry L. Peterson, Bruce S. Davie, *"Computer Networks- a Systems Approach"*.
3. James F. Kurose, Keith W. Ross, *"Computer Networking-A top-down approac,"*.
4. Behrouz A. Forouzan, Sophia Chung Fegan, *"Data Communication and Networking"*.
5. William Stallings, *"Computer Networking With Internet Protocols and Technology".*

Course Code: DCA2202	**Course Title: Java Programming**

Unit 1	**Introduction to Java:** History of Java, Features of Java, Java Virtual Machine (JVM), Java Runtime Environment (JRE) and Java Development Kit (JDK), Security in Java.
Unit 2	**Java Basics**: Keywords, Working of Java, Including Comments, Data Types in Java, Variables in Java, Using Classes in Java, Declaring Methods in Java, Code to Display Test Value, The main() Method, Invoking a Method in Java, Java Generics, Saving, Compiling and Executing a Java Programs Saving.
Unit 3	**Operators and Control Statements**: Operators, Control Flow Statements.
Unit 4	**Arrays and Strings:** String Handling, Special String Operations, Character Extraction, String Comparison, Searching Strings, String Modification, StringBuffer.
Unit 5	**Inheritance, Package and Interface:** Inheritance, Packages, Interface, Nested Classes.
Unit 6	**Exception Handling**: Definition of an Exception, Exception Classes, Common Exceptions, Exception Handling Techniques.
Unit 7	**Streams in Java**: Streams Basics, The Abstract Streams, Stream Classes, Readers and Writer, Random Access Files, Serialization, Stream API.
Unit 8	**Event Handling:** Components of an Event, Event Classes, Event Listener, Event-

	Handling, Adapter Classes, Inner Classes, Anonymous Classes.
Unit 9	**Other Features in Java**: Assertion, Variable Argument (Varargs), Java Static Import, Autoboxing and Unboxing, Java Enum, Java Annotation, Java Custom Annotation.
Unit 10	**Java Swing and JavaFX**: Java Foundation Classes, Java Swing Packages, Swing Component Classes, Swing Components, JavaFX – Architecture, Layout Pane**.**
Unit 11	**Java Data Base Connectivity (JDBC):** Java Data Base Connectivity, Database Management, Mechanism for connecting to a back end database (ODBC), Loading the ODBC driver.
Unit 12	**RMI, CORBA and Java Beans**: Remote Method Invocation (RMI), Common Object Request Broker Architecture (CORBA), What is Java IDL?, Java Beans**.**
Unit 13	**Java Server Pages and Servlets:** Java Server Pages (JSP), Servlets, History of Web Application, Web Architecture, Servlet Life Cycle.
Unit 14	**Networking in Java**: Networking in Java, URL Objects.
Reference Books 1. S. Tanenbaum, “Computer Networks”, Pearson Education Asia. **2.** Behrouz Forouzan, “Data Communication and Networking”, Tata McGraw Hill.	

Course Code: DCA2203	**Course Title: System Software**

Unit 1	**Introduction to Software Processor:** System Software and Machine Architecture, Architecture of Intel 8086, Data and Instruction Formats, Addressing modes, Instruction sets, I/O and Programming.
Unit 2	**Language Processor**: Language Processing activities, Fundamentals of language processing, Fundamentals of language specification, Language processor development tools.
Unit 3	**Assemblers**: Introduction to Assembler, Assembler Directives, Forward Reference, Types of Assemblers, Data Structures of Assembler, Assembler Design One Pass Assembler, Two Pass Assembler.
Unit 4	**Macros and Macro Processor**: Macro definition and Call, Macro expansion, Nested macro calls, Advanced macro facility, Design of macro processor.
Unit 5	**Loaders:** Basic functions of loader, Design, A Simple Bootstrap Loader, Machine dependent loader feature, Machine Independent loader features, Loader design options.
Unit 6	**Linker:** Introduction to Linker, Relocation and Linking Concepts, Design a Linker, Self-relocating Programs, Linking for Overlays.
Unit 7	**Interpreter:** Introduction to Interpreter, Overview of compiler, Phases of Compiler, Lexical Analysis, Syntax Analysis, Intermediate Code Generation, Code Optimization, Difference between compiler and Interpreter, Scanning, Symbol table, Parsing expression and assignment, Control statements, Simple interpreter design.
Unit 8	**Text Editor**: Text Editor: An Introduction, Interactive Debugging System, Debugging Functions and Capabilities, Relationship with Other Parts of the System, User interface Criteria.
Unit 9	**Device Driver – I**: Device Driver, Role of Device, Drivers, Classes of Devices, Security issues, Design issues.

Unit 10	**Device Driver – II:** PCI Bus Drivers, The Peripheral Component Interconnect (PCI) Interface, USB Drivers
Unit 11	**Universal Plug and Play**: UPnP Protocol Stack, Addressing, Ad-Hoc networks, Discovery, Simple Service Discovery Protocol (SSDP), Service Identification Communication Model, Discovery Requests and Presence, Announcements, Network Transport, Description, Control, Eventing, Presentation.
Unit 12	**Android Operating System**: Android Operating System, Android Architecture, Linux Kernel, Android Architecture Libraries, Android Architecture Application Framework, Applications, Security and Permission.
Unit 13	**Memory and Process Management in Android**: Introduction to Android Memory, Use of Memory for Each Application, Dalvik Virtual Machine, Understanding Application Priority and Process States Application, Processes and Threads, Interprocess Communications.

Reference Books

1. Dhamdhere, D M : Systems Programming and Operating Systems, Tata Mc Graw Hill
2. Sumitabha Das : Unix System V.4 Concepts and Applications, Tata Mc Graw Hill

Course Code: DCA2204	**Course Title: Principles of Financial Accounting and Management**
Unit 1	**Financial Accounting – An Introduction:** Introduction: Basic Accounting Concepts: Double Entry Accounting: The Accounting Trail: Financial Statements and their Nature: The Accounting Equation:
Unit 2	**Primary Books:** Introduction: Ground Rules of Journalisation: Types of Journals:
Unit 3	**Secondary Books:** Introduction: Types of secondary books: Posting techniques in the ledger:
Unit 4	**Trial Balance and Final Accounts:** Introduction: Preparation of the Trial Balance: Errors and their Rectification: Final Accounts:
Unit 5	**An Introduction to Financial Management:** Introduction: Finance Functions; Investment Decision, Financing Decision, Dividend Policy decision, Liquidity Decision: Interface between Finances and other Functions; Marketing-Finance Interface, Production-Finance Interface, Top Management-Finance Interface: Financial Goals; Profit Maximization, Wealth Maximization, Other Objectives:

Unit 6	**Financial Planning:** Introduction: Steps in Financial Planning: Factors Affecting Financial Plan: Estimation of Financial Requirements of a Firm; Capitalization, Cost Approach, Earnings Approach, Over-capitalization, Under-capitalization:
Unit 7	**Working Capital Management I:** Introduction: Components of Current Assets and Current Liabilities; Current Assets, Current Liabilities: Concepts of Working Capital: Objective of Working Capital Management: Need for Working Capital: Operating Cycle: Determinants of Working Capital: Estimation of Working Capital; Estimation of Current Assets, Estimation of Current Liabilities: Cash Management; Motives of Holding Cash, Objectives of Cash Management, Determining the Cash Needs– Models for Determining Optimal Cash, Baumol Model, Miller-Orr model, Cash Planning, Cash Forecasting and Budgeting.
Unit 8	**Working Capital Management II:** Inventory Management; Role of Inventory in Working Capital, Purpose of Inventories, Costs Associated with Inventories, Inventory Management Techniques, ABC System, Economic Order Quantity (EOQ), Re-order Point, Pricing of Inventories: Receivables Management; Objectives, Costs Associated with Maintaining Receivables, Credit Policy, Credit Standards, Credit Period, Cash Discounts, Collection Program.
Unit 9	**Financial Statement Analysis:** Introduction: Meaning of Ratio Analysis; Steps in Ratio Analysis: Classification of Ratios; Balance Sheet Ratio Analysis, Profit and Loss Account Ratio Analysis, Combined Ratio Analysis: Advantages of Ratio Analysis: Limitations of Ratio Analysis: Computation of Ratios (Problems):
Unit 10	**Funds Flow Analysis:** Introduction: Meaning of Fund Flow Statement: Objectives of Fund Flow Statement: Steps in Preparation of Fund Flow Statement: Computation of changes in Working Capital and Fund from Operation:
Unit 11	**Cash Flow Analysis:** Introduction: Meaning of Cash Flow Statement: Objectives of Cash Flow Statement: Uses of Cash Flow Statement: Steps in Preparing Cash Flow Statement: Difference between Cash and Fund Flow Statement: Computation of Cash from Operations (Problems):
Unit 12	**Understanding Cost:** Introduction; Classification of Cost: On the basis of

	behaviour of cost, On the basis of elements of the cost; Overheads and Non-cost Items: Overheads, Classification of Overheads, Non cost items; Determination of total cost; Cost sheet: Proforma of cost sheet; Estimation of Cost.
Unit 13	**Marginal Costing & Break-even Analysis:** Introduction; Basic concept of marginal costing: Meaning and Features of Marginal costing, Advantages of Marginal Costing, Limitations of Marginal Costing; Concept of Profit and Contribution; Concept of Profit/Volume Ratio; Break Even Point (B.E.P.): Methods of calculating Break Even Point, Assumptions, Uses and Limitations of Break Even Analysis, Factors affecting Break Even Point and Margin of safety, Break-Even Chart.
Unit 14	**Budgetary Control:** Introduction; Meaning of Budget; Meaning, Essentials and Objectives of Budgetary Control; Steps in Budgetary Control; Types of Budgets; Preparation of Flexible Budget; Merits and Demerits of Budgetary Control.

References:

1. Cost and Management Accounting – Duncan Williamson
2. Management Accounting – I. M. Pandey
3. Fundamentals of Management Accounting – T. P. Ghosh
4. Management Accounting – B. S. Raman
5. Cost Accounting – Jawaharlal

Course Code: DCA2230	**Course Title: Java Programming - Practical**

Java programs using classes and objects and various control constructs such as loops etc, and data structures such as arrays, structures and functions. Java programs for creating Applets for display of images and texts. Programs related to Interfaces and Packages. Input/Output and random files programs in Java. Java programs using Event driven concept. Programs related to network programming.

Reference Books

1. Daniel Young, “Introduction to JAVA Programming”, PHI, Latest Edition

Course Code: DCA2231	Course Title: System Software Programming – Practical

Packet Monitoring software (tcpdump, snort, ethereal), Trace route, Ping, Finger, Nmap, Server configuration (FTP, SMTP, DNS), NFS Configuration, Firewall Configuration using iptables/ipchains (Linux only), Experiments using Turbo C Assembler.

Reference Books

1. System Software: "*An Introduction to Systems Programming for VTU"* by Leland L Beck.

Third Year

Fifth Semester

Course Code: DCA3101	Course Title: Web Design

Unit 1	**Introduction to Internet:** Basics of Internet, History of internet, Different connection types, Components, Routers and dial up networking.
Unit 2	**World Wide Web:** Concept of WWW (World Wide Web) and its applications, Web browser, Web server, Web pages and Search engines.
Unit 3	**Internet Services and Internet security:** Types of Networking Protocols and Services, Internet Security Issues, Domain Name Services and IP addressing.
Unit 4	**HTML–URl, List, Hyper Links:** Language, History of HTML, Structure of HTML Document, Tags, Paragraph, Heading, Text, List and Hyperlinks.
Unit 5	**Web page Authoring using HTML:** Elements of HTML Forms, Constructing tables, Table formatting.
Unit 6	**Cascading Style Sheets (CSS):** Concept of cascading style sheets, Types of style sheets, Style placement, Text and Font properties, CSS properties.
Unit 7	**DHTML:** Introduction of DHTML, DOM, Event handling, Data binding, Browser object models.
Unit 8	**PHP:** PHP, Framework of a PHP document, Installation steps, PHP functions-Pass parameter in a function, Get and post function of PHP. PHP functions, Object oriented features of PHP and backend database named MYSQL.
Unit 9	**JavaScript Programming:** Utility of JavaScript, basic programming concepts like variable declaration, Data types, Operators, Looping statements, Functions and JavaScript objects.
Unit 10	**JavaScript Programming:** Implementation of Arrays, Server side programming, Cookies and Event handling.
Unit 11	**XHTML:** Introduction of XHTML, Benefits of XHTML, XHTML rules, Framework tags, Text format tags and Image formats. Features of XHTML,

	email, Forms controls and Validating form using JavaScript.

Reference Books

1. R. Moseley & M. T. Savaliya, *Developing Web Applications*, (2e) Wiley-India.
2. Team at Kogent Learning Solutions Inc., *Web Technologies, Black Book*, (1e) Dreamtech Press.
3. Team at Kogent Learning Solutions Inc., *HTML 5, Black Book*, (2e) Dreamtech Press.
4. J. Sklar, *Web Design Principles,* (5e)Cengage Learning.
5. Harwani, *Developing Web Applications in PHP and AJAX*, (1e) McGrawHill.

Course Code: DCA3102	**Course Title: Visual Programming**

Unit 1	**Introduction to VB.NET:** Overview of Visual Basic .Net, Architecture of .Net platform, Just-In-Time compiler and the .NET Framework library.
Unit 2	**VB.NET Development Environment**: Overview of VB .NET environment, Integrated development environment of VB .NET.
Unit 3	**Mastering VB Language:** Data types, Operators, Control and Looping statement, Error handling techniques.
Unit 4	**Windows Application in VB.NET:** User interface, View controls and Bars controls.
Unit 5	**Object Oriented Programming in VB.NET:** Overview of Object Oriented Programming. OOPS concepts: Constructors, Destructors, Method overloading, Polymorphism interfaces.
Unit 6	**Attributes, Delegates and Events:** Concepts of attributes in VB .NET and Custom Attribute. Concept of Event in VB .NET. Event handler, Event handlers, Role of delegates.
Unit 7	**File Handling:** File handling techniques, File stream concepts, StreamReader and StreamWriter classes, the binary file handling technique using the BinaryReader and BinaryWriter classes. File and directory classes.
Unit 8	**Databases in VB.NET**: Databases, Connection with the data source, SQL queries.
Unit 9	**Data Access with ADO.NET:** Data access with ADO .NET. Operation Data bases. Retrieval of data with the Data grid controls. SQL server and ADO.NET in data base access.
Unit 10	**Exception Handling in VB.NET:** Exception handling. Keywords in structured exception handling. Exit Try and Using exception properties.
Unit 11	**XML in VB.NET**: XML in VB .NET, Create, Open and Read an XML file in VB.NET, Search and Filter the XML file, Serialization in XML.
Unit 12	**Tersus Platform:** Tersus to design an application graphical mode without any code. Tersus development platform with its components like Tersus studio, Tersus model libraries and the Tersus server, Modeling basic display and the logic behind the screen.
Unit 13	**Data Access:** Data access in Tersus platform, Action models for populating the process.
Unit 14	**Application for Mobile Devices**: Applications for mobile devices, Android Operating System, Different application platform to create mobile application.

	App inventor for Android is explored with its application development environment. Android SDK.

Reference Books

1. Steven Holzner. *Visual Basic 6 Programming Black Book.* Dreamtech Publications.
2. Rod Stephens and Brian Hochgurtel*. Visual Basic .NET and XML: Harness the Power of XML in VB.NET Applications, Wiley.*

Course Code: DCA3103	**Course Title: Software Engineering**

Unit 1	**Software Development Approaches:** Evolving role of software, Software characteristics and its applications.
Unit 2	**Software Design Process:** Software engineering and Software development models (Serial, Linear, Sequential development model), Iteration model, Increment model, Parallel, Concurrent development model.
Unit 3	**Software Reliability:** Software reliability metrics and Reliability programming for software reuse.
Unit 4	**Software Design Principles:** System models, Software and Architectural design.
Unit 5	**Object Oriented Design:** Object oriented design, Service usage, Object interface design and Structural decomposition.
Unit 6	**Assessment of Process Life-cycle Models:** Overview of the Assessment of process, Dimension of process, and the need for a business model in Software engineering.
Unit 7	**Configuration Management:** Change management, Version and Release management, Software maintenance, Software reengineering, and Software re-factoring.
Unit 8	**Software Testing Techniques:** Software testing fundamentals, Testing principles, White box testing, Control structure testing, Black box testing, Boundary value analysis, and GUIs. Testing.
Unit 9	**Software Testing Assurance**: Quality and Configuration audits, Performance monitoring. Verification and Validation (V&V), Test plan, Test strategies, Testing methods and tools.
Unit 10	**Software Testing Strategies:** Organizing for software testing, Software testing strategy, Unit testing, Top-down integration, and Bottom-up integration testing.
Unit 11	**People and Software Engineering:** Traditional software engineering vs Modern engineering,
Unit 12	**Software Technology and Problem Solving:** Software technology as enabling business tool and a Limited business tool**.** Diversification of problem solving strategies in SE
Unit 13	**Case Study**

Reference Books

1. Rajib Mall. Fundamentals of Software Engineering. PHI publications 2018
2. Roger S. Pressman, “Software Engineering”, Tata McGraw Hills, 5th Edition, 2009.
3. Ian Sommerville, “Software Engineering”, Pearson Education Asia, 6th Edition, 2005.

Course Code: DCA3104	Course Title: Python Programming

Unit 1	**Python concepts**: Expressions, values, types, variables,
Unit 2	**Programs and algorithms** control flow, file I/O, the Python execution model.
Unit 3	**Data structures**: List, set, dictionary (mapping), tuple, graph (from a third-party library),
Unit 4	**Mutable and immutable data structures** Distinction between identity and (abstract) value.
Unit 5	**List** slicing (sublist), list comprehension (shorthand for a loop),
Unit 6	**Functions**: Procedural abstraction, functions as values, recursion, function design methodology.
Unit 7	**The Python Library**: String and Text Handling,
Unit 8	**Data Structures - Algorithms**, Threading, Networking,
Unit 9	**Web Programming**, Graphical Programming, Database Access

Reference Books

1. D. M. Beazley, Python Essential Reference, (1e) Amazon Books.
2. M. Lutz, Programming Python, (4e), O'Reilly Media.

Course Code: DCA3130	Course Title: Visual Programming – Practical

Write a VB.Net program to add two given numbers, Program for generating a Student mark sheet with percentage and Grade, Program for booking a conference room in a company, Calculator program similar to windows Calculator (the non-scientific one) using control array. Program to retrieve data from database and display using grid control. Program that similar to Notepad (include File and Edit menu), program to perform data manipulation (insert, update, delete) in MySQL database, Program for exception handling, Program to read the XML File, Program to read the data from the source file and write into the destination file also display the number of lines in the source file.

Reference Books

1. Steven Holzner. Visual Basic 6 Programming Black Book. Dreamtech Publications.
2. Rod Stephens and Brian Hochgurtel. Visual Basic .NET and XML: Harness the Power of XML in VB.NET Applications, Wiley.

Course Code: DCA3131	Course Title: Web Design – Practical

Program to create an HTML page with the tags -a) Paragraph, pre and Break tag b) Heading (h1 …h6) and Text alignment tags, Create a HTML page with following tags a) Order, Unordered and nested list tags b) Hyper link, Create a HTML page with following tags a) Image tag b) Table tag, Create a HTML pages with frame tags, webpage to illustrate CSS (cascading style sheet) and usage of internal and external CSS along with HTML pages. DHTML program for handling any two mouse events. DHTML program for handling any two mouse events. PHP programming a) Write a PHP program to read a number and display its square root. b) PHP program which reads a file, writes data to file and also delete a file. JavaScript Programming a) Write a JavaScript program to compare two dates b) A JavaScript program for Form validation. XHTML page with following tags a) Image b) Linking to specific part of page
Reference Books 1. R. Moseley & M. T. Savaliya, *Developing Web Applications*, (2e) Wiley-India. 2. Team at Kogent Learning Solutions Inc., *Web Technologies, Black Book*, (1e) Dreamtech Press. 3. Team at Kogent Learning Solutions Inc., *HTML 5, Black Book*, (2e) Dreamtech Press. 4. J. Sklar, *Web Design Principles,* (5e) Cengage Learning. 5. Harwani, *Developing Web Applications in PHP and AJAX*, (1e) McGrawHill. 6. P.J. Deitel & H.M. Deitel, *Internet and World Wide Web How to program*, (4e) Pearson.

Course Code: DCA3132	**Course Title: Python Programming – Practical**

Learner will get guided to set of exercises to Implement a sequential search, create a calculator program, Explore string functions, Implement Selection Sort, Implement Stack, Read and write into a file, Demonstrate usage of basic regular expression, Demonstrate use of advanced regular expressions for data validation, Demonstrate use of List Demonstrate use of Dictionaries, Create Comma Separate Files (CSV), Load CSV files into internal Data Structure, Write script to work like a SQL SELECT statement for internal Data Structure made in earlier exercise, Write script to work SQL Inner Join for an internal Data Structure made in earlier exercise
References Books: D. M. Beazley, Python Essential Reference, (1e) Amazon Books. M. Lutz, Programming Python, (4e), O'Reilly Media.

Elective I

Course Code: DCA3141	Course Title: Compiler Design

Unit 1	**Introduction to Compiling:** Concept of Compiler, Task of Compilers, Phases of computer, Analysis for a source program. Pass-scan of the source language, Reading the Input and writing an output file
Unit 2	**Lexical Analysis:** Role of Lexical analyzer, Structure of the tokens of the source language, Translate the diagram into a program for finding tokens.
Unit 3	**Lexical Analyzer Generator:** Design of Lexical analyzer generator
Unit 4	**Syntax Analysis:** Concept of Syntax analysis, context free graph and role of parser, Context free grammar, Parsing techniques, Classifications of parser-LR, SLR, LR (k), and LALR parser.
Unit 5	**Syntax-Directed Translation**: Introduction of Syntax-directed, Translations for programming language
Unit 6	**Type Checking:** Introduction of Type Checking, Systems Types, Types of Expressions, Overloading of functions and Operators, Polymorphic functions and Algorithm of unification.
Unit 7	**Run-Time Environments:** Run time environment issues and concepts-source language issues, Storage organization, Storage allocation, Strategies, Parameter passing, Access to non-local names, Memory allocation in block structured language and Garbage collection.
Unit 8	**Intermediate Code Generation:** Definition of Intermediate languages and its representations, Declaration and assignment statements for various programming constructs and translation of Boolean expressions.
Unit 9	**Code Generation:** Introductory concept of code generation, Run-time environment-allocation of storage locations for the objects named in the source program, Target program mechanism to access variables, Linkages between Procedures and Passing parameters.
Unit 10	**A Simple Code Generator:** Design process of a simple code generator, Register allocation and assignments process of a code generator. Direct acyclic graph.
Unit 11	**Code Optimization:** Principle of optimization, Important techniques of transformation to optimize the code

Reference Books

1. P. Linz, *An Introduction To Formal Languages and Automata*, (4e) Narosa Publishing House
2. J. Martin, *Introduction to Languages and the Theory of Computation*, (3e) McGraw Hill.
3. A. K. Pandey, *Concepts of Compiler Design,* S.K. Kataria & Sons.

Course Code: DCA3142	Course Title: Graphics and Multimedia

Unit 1	**Introduction to Computer Graphics and Graphics System:** Introduction of computer graphics, Visualization and Image processing, Present and Interact picture presentation, RGB color model, Direct coding and lookup table. Devices Graphics storage and input output devices, Computer graphics software.
Unit 2	**Scan Conversion:** Introduction of Scan conversion process, Point and Line drawing algorithm- DDA and Bresenham's algorithm. Circle generation algorithm, Ellipse generating algorithm, Scan line polygon, Fill algorithm- Boundary fill and Flood fill algorithm.
Unit 3	**2D Transformation:** Overview of 2D transformations, Rotation, Translation, Scaling, Reflection and Shear, Matrix representations and homogeneous coordinates and transformations between coordinate system.
Unit 4	**2D Viewing:** Two dimensional viewing algorithm, Clipping operation, Point clipping, Line clipping and Polygon clipping.
Unit 5	**3D Transformation and Viewing:** Methods for modeling and performing geometric transformations in three dimensions. Rotation about an arbitrary axis in space and reflection, Methods for obtaining views of a three dimensional scene.
Unit 6	**Curves:** Curves and Surfaces representation, Bezier curve, B-Spline curves, Bezier surface, B-Spline surface and rational B-Spline curve.
Unit 7	**Hidden Surfaces:** Different methods for the determination process.
Unit 8	**Coloring and Shading Models:** Process of altering the color of an object/surface/polygon in the 3D scene, Light and Color models, Interpolating shading model and texture.
Unit 9	**Multimedia:** Uses of multimedia, The role of Hypertext, Hypermedia, Image, Video and standards in Multimedia.
Unit 10	**Audio:** Standard and the compression technique, Digital audio, MIDI, Processing, Sampling and compression of sound.
Unit 11	**Video:** The concept of video in multimedia, Compression technique, Compression MPEG standards, Compression through spatial and temporal redundancy, Inter-frame and Intra-frame compression.
Unit 12	**Animation:** Role of animation in Multimedia, Types, Techniques, Key frame animation, Utility, Morphing and Virtual reality concepts.

Reference Books

1. R. Steinmetz, K. Narstedt, "*Multimedia Fundamentals: Vol 1-Media Coding and Content Processing*", 2nd Edition, Pearson Education.

2. P.K. Andleigh, K. Thakrar, "*Multimedia Systems Design*", PH.

Course Code: DCA3143	Course Title: E-Commerce

Unit 1	**Introduction to E-Commerce:** Introduction, Benefits, Goals, Components, Functions, Process and types of E-Commerce.
Unit 2	**E–Commerce Activities:** Different modes of operation, Matrix, Resources, Stages of opportunity development, and various functional requirements of E-Commerce.

Unit 3	**Internet:** Different types of networking, Internet works, Components of Internet and Website, Internet for Business transactions.
Unit 4	**ISP, WWW and Portals:** Purpose of an ISP and its various types, ISPs function, Concept of WWW (World Wide Web), Components of WWW, Portals and different from that of websites.
Unit 5	**Reference Models:** Different reference available models, Functionality, Advantages and disadvantages.
Unit 6	**XML and Data Warehousing:** Extensible Markup Language (XML) in developing E–Commerce websites, HTML VS XML, Advantages and disadvantages of various applications of XML in E-Commerce.
Unit 7	**E–Marketing:** Importance of E-Marketing, Traditional vs Modern marketing.
Unit 8	**E-Security:** Network and Website security risks, Vulnerability of Internet sites and security issues related to E-mail, Hacker, Security incidents on internet.
Unit 9	**E-Payment Systems:** Introduction of E-Payment system, Transaction on Internet, Modes of payment followed by different websites, Modern payment system functions, Importance of net banking.
Unit 10	**E-Customer Relationship Management:** Customer relationship management, E-Commerce website for business organization, Importance of web technology in maintaining a good customer relationship management.
Unit 11	**Supply Chain:** Importance of supply chain management for business, Necessity of supply chain management, Goals and Functions, Different strategies incorporated by business houses while dealing with supply chain management.
Unit 12	**Wireless Application Protocol:** Understanding the protocol (WAP), Architecture and working of wireless application protocol.
Unit 13	**Knowledge Management:** Management system, E-Commerce website and organization, Features of knowledge management tools and process.
Unit 14	**Implementation of E-Commerce:** Insight of an E-Commerce website, Understanding and Practical implementation.

Reference Books

1. Ravi lalakota, Andrew Whinston *"Frontiers of Electronic Commerce"*, Addision Wesley.
2. V.K. Garg and N.K. Venkita Krishna, *"Enterprise Resource Planning-Concepts and Practice"*, PHI.

Sixth Semester

Course Code: DCA3201	Course Title: Mobile Application Development

Unit 1	**Introduction:** Android, Android versions and its feature set, The various Android devices on the market, The Android Market application store
Unit 2	**Android Development Environment** - System Requirements, Android SDK, Installing Java, and ADT bundle - Eclipse Integrated Development Environment (IDE). An Overview of Threads, The Application Main Thread.
Unit 3	**Multimedia:** Audio, Video, Camera Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures.
Unit 4	**Android Architecture Overview**: The Android Software Stack, The Linux Kernel
Unit 5	**Android Runtime** - Dalvik Virtual Machine, Android Runtime – Core Libraries, Dalvik VM Specific Libraries, Java Interoperability Libraries, Android Libraries, Application Framework
Unit 6	**Android Software Development Platform:** Understanding Java SE and the Dalvik Virtual Machine, The Directory Structure of an Android Project, Common Default Resources Folders. Android Framework Overview: Android Application Components
Unit 7	**Android Activities**: Defining the UI, Android Services: Processing in the Background
Unit 8	**Broadcast Receivers**: Announcements and Notifications Content Providers: Data Management, Android Intent Objects: Messaging for Components
Unit 9	**Android Manifest XML:** Declaring Your Components. Understanding Android Views, View Groups and Layouts Designing for Different Android Devices
Unit 10	**Android Layout Managers,** The View Hierarchy, Designing an Android User Interface using the Graphical Layout Tool.
Unit 11	**Graphical User Interface Screen with views:** Displaying Text with TextView, Retrieving Data from Users, Using Buttons, Check Boxes and Radio Groups, Getting Dates and Times from Users, Using Indicators to Display Data to Users.
Unit 12	**Displaying Pictures:** Gallery, ImageSwitcher, GridView, and ImageView views to display images, Creating Animation. Files, Content Providers, and Databases: Saving and Loading Files.
Unit 13	**Databases** SQLite Databases**,** Android Database Design, Exposing Access to a Data Source through a Content Provider, Content Provider Registration, Native Content Providers

References:
1. B. Phillip , C. Stewart, B. Hardy, K. Marsicano, Android Programming, The Big Nerd Ranch Guide, (3e), Big Nerd Ranch LLC.
2. R. Meier, Professional Android 4 Application Development, (3e), Wiley India (Wrox).
3. J. C. Sheusi, Android Application Development for Java Programmers, (1e), Cengage Learning.
4. W.M.Lee, Beginning Android 4 Application Development, (1e), Wiley India (Wrox).

Course Code: DCA3231	**Course Title: Mobile Application Development – Practical**

Develop an application that uses GUI components, Font and Colors. Develop an application that uses layout managers and event listeners. Develop a native calculator application to calculate the arithmetic operations. Write an application that draws basic graphical primitives on the screen. Develop an application that makes use of database to add the info, and show the search result. Implement an application that implements multi-threading. Develop a native application that uses GPS location information. Implement an application that writes data to the SD card. Implement an application that creates an alert upon receiving a message. Write a mobile application that creates alarm clock.

References Books :

1. B. Phillip , C. Stewart, B. Hardy, K. Marsicano, Android Programming, The Big Nerd Ranch Guide, (3e), Big Nerd Ranch LLC.
2. R. Meier, Professional Android 4 Application Development, (3e), Wiley India (Wrox).
3. J. C. Sheusi, Android Application Development for Java Programmers, (1e), Cengage Learning
4. W.M.Lee, Beginning Android 4 Application Development, (1e), Wiley India (Wrox).

Course Code: DCA3202	**Course Title: Project**

The project work is part of the BCA program which will a hands on experience to students in developing quality software applications. During the development of the project, a student shall involve himself in all the stages of the software development life cycle (SDLC) like requirements analysis, systems design, software development/coding, testing and documentation, with an overall emphasis on the development of reliable software systems.

The primary emphasis of the project work is to understand and gain the knowledge of the principles of software engineering practices, and develops good understanding of SDLC.

Every student shall undertake Project work in the V semester starting with the project synopsis and culminating with the project report in the VI semester. Students are encouraged to choose a project, of six months' duration either at place of work or any other location.

It is advised to students to develop their project for solving problems of software industry or any research organization. Topics selected, should be appropriate enough to justify as a BCA project.

Elective II

Course Code: DCA3241	Course Title: Advanced Web Design

Unit 1	**HTML Basics:** Introduction of HTML, HTML elements, Creation of simple web pages using HTML, Tags, List, Color and Forms.
Unit 2	**XML Programming:** History of XML, Purposes, and Comparison with other technologies. XML basics, XML tools, Validating XML document with DTD and XML Namespace, XSLT, Transforms XML in other XML document, Important XPath, XML transformation, Validating XML schemas and XSL-FO Namespace. Concept of SOAP, SOAP elements. Architecture of web services description languages (WSDL) and advantages of WSDL.
Unit 3	**XML and Database:** Data extracted from an XML document in a relational database, XML publishing methods. Sarissa and Drag and Drop concepts.
Unit 4	**Asynchronous JavaScript and XML:** AJAX, Features of AJAX, Components of JavaScript and its syntax rules.
Unit 5	**Ajax–XMLHttpRequest Object:** XMLHttpRequest object, Synchronous and Asynchronous data retrieval, Elements and properties of CSS, Concept of frameworks, Toolkits.
Unit 6	**Ajax–Object Oriented JavaScript:** Feature of JavaScript- Object Oriented feature of JavaScript, MVC design pattern for web application, Components of JSON like, JSON syntax and Paresr.
Unit 7	**J2ME:** Introduction of Java platforms, Components of J2ME, Mobile Information Device Profile (MIDP)
Unit 8	**Introduction to HTML5:** Dynamic webpages i.e., History of HTML5, New features of HTML5, Elements in HTML 5, Media, Canvas, Form, and Input type elements, Video format in HTML 5.
Unit 9	**HTML5–Audio and Canvas:** Concept of incorporating audio in HTML5, Canvas element and new HTML5, Input types, Store and Retrieve data of web pages.
Unit 10	**HTML5–Form Elements and Attributes:** New attributes of HTML5, HTML5 global.
Unit 11	**HTML5 for Mobile Applications:** HTML5 with mobile application development, HTML5 benefits, Mobile design and device characteristics, HTML for a puzzle application.

Reference Books

1. DT Editorial Services . HTML 5 Black Book (Covers CSS3, JavaScript, XML,XHTML, AJAX, PHP, jQuery) 2Ed. Dreamtech Publications.
2. R. Moseley & M. T. Savaliya, Developing Web Applications, (2e) Wiley-India.
3. Team at Kogent Learning Solutions Inc., Web Technologies, Black Book, (1e) Dreamtech Press.

Course Code: DCA3242	Course Title: Open Source Systems

Unit 1	**Software Development Using Open Source Systems:** Concept of Open Source along with its tools, Components, and Methodologies, Applications using the Open Source. Free and Open Source Software (FOSS) philosophy.
Unit 2	**Licensing:** Licensing, Types of licensing, Intellectual proprietary right and its part in FOSS. Difference between Commercial license and Open source license.
Unit 3	**Open Source Licensing, Contract, and Copyright Law:** Basic principles of copyright law, Definitions of Contract, Copyright and the Open source, Open source software licensing, Warranties, Issues with copyrights and patents.
Unit 4	**The MIT, BSD, Apache Licenses:** MIT (or X) license, BSD (Berkeley Source Distribution) license, Apache license in detail, Free software licenses.
Unit 5	**Academic Free Licenses:** Concept of Academic Free License (AFL), AFL provisions and applications.
Unit 6	**The GPL, LGPL, and Mozilla Licenses:** General Public License (GPL) and Mozilla Public License (MPL), Safeguarding the open source freedom of every open source.
Unit 7	**QT, Artistic, and Creative Commons Licenses:** Provisions of the Q Public License, Artistic License (Perl), The concept of the Creative Common License.
Unit 8	**Non-Open Source Licenses:** Concept of non-open source licenses, Granted rights under licenses, Non-open source licenses and classic proprietary licenses, Sun community source license and Microsoft shared source initiative.
Unit 9	**Open Source Development:** Infrastructure required for an open source project, public code archive, Project documentation, Bug database, Open mailing list, Project website, Importance of Concurrent Versioning System (CVS) and Source Control Management (SCM), Stages in the software development life cycle, Information to build a community and the principles, Open source project Decision making wrt ending a project, or join an existing open source, Open source software development process and the use of open source software projects in the software company, Ways of running an open source project.
Unit 10	**Legal Impacts of Open Software and Free Software Licensing:** Basic technique of entering into a contract, Constitutional development related to software contracts, Self-enforcing nature of open source and free software licenses.
Unit 11	**Legal impacts of the open source and free software licensing at the global level:** Global scope for open source licenses, Indian contribution to the open source culture and effort of European Union, Short comings of open source licensing, Issues of open source licensing, Demand for the patented software, Communities that are trying to enforce and strengthen the open source and free software licensing, Compatible and incompatible licensing, Cross licensing methods.
Unit 12	**Software Development Using Open Source and Free Software Licenses:** Open source and free software licensing, Methods of open source software development, Analysis of the forking of software, and its requirement, Key things to choose the license for a new project, Process of

	drafting your own software license for a new open source project.

Reference Books

1. C. DiBona , M. Stone , D. Cooper, Open Sources 2.0: The Continuing Evolution, O'REILLY.
2. D. Woods, G. Guliani , Open Source for the Enterprise: Managing Risks, Reaping Rewards, O'REILLY.
3. A. Metzger, Free and Open Source Software (FOSS) and other Alternative License Models: A Comparative Analysis, Springer.

Course Code: DCA3243	**Course Title: Cloud Computing**
Unit 1	**Introduction to cloud computing:** Fundamental concepts of cloud computing, types of Cloud computing, Cloud architectures and its functions.
Unit 2	**Business Values:** Cloud service modeling (SaaS, PaaS and IaaS).
Unit 3	**Inside Cloud Computing:** Cloud strategic decisions, Governance issues, Monitor and Management of the IT cost effectively.
Unit 4	**Cloud Service Administration:** Service Level Agreements (SLA) and its supportive services, IT security and performance management and provisioning of service management.
Unit 5	**Cloud Computing Technology:** Clients consisting of Hardware/Software, Cloud computing application process, Security issues in Cloud computing technology and Measures to maintain safe data, Third party service security issue.
Unit 6	**Accessing the Cloud:** Tools to connect with the Cloud, Understanding the particular needs of users.
Unit 7	**Cloud Data Management:** Different Cloud security issues, Data control mechanisms and Cloud data Storage as a Service.
Unit 8	**Information Storage in Cloud Computing:** Cloud Storage, Cloud storage providers, Cloud data security.
Unit 9	**Discovery of Private and Hybrid Clouds:** Role of Private cloud, and cycled with the Public Clouds, Cloud services vendor.
Unit 10	**Cloud Computing Standards:** Practices and standards and its practical issues, Standard organisation and groups.
Unit 11	**Desktop and Device Management:** Virtual desktop, Virtual desktop environment.
Unit 12	**Cloud Governance:** IT governance, Risk to assess the Cloud, Working of governance (Monitoring and Measuring the performance).
Unit 13	**Migrating to the Cloud:** Migration tools, Strategies for people at different levels.
Unit 14	**Future Practice of Cloud Computing:** Future cloud computing and how Cloud computing should evolve further.
Reference Books	

1. Miller M, *Cloud Computing*, 8th Edition, Que Publishers.
2. Buyya R K, *Cloud Computing: Principles and Paradigms*, Wiley Press.

Elective III

Course Code: DCA3244	Course Title: Knowledge Management
Unit 1	**Overview of Knowledge Management:** Introduction of knowledge management, Value of intellectual capital, Issues in knowledge management.
Unit 2	**The Nature of Knowledge:** Data, Information and Knowledge, Types of knowledge, Knowledge vs Expertise, Characteristics of Knowledge.
Unit 3	**Technologies to Manage Knowledge:** Artificial Intelligence, Usage of knowledge management, Cognitive Psychology, Significance of heuristic search in Knowledge-Based Systems.
Unit 4	**Knowledge Management Systems Life Cycle:** Development of Knowledge Management Systems, Challenges of Knowledge Management Systems and means to overcome, Conventional system vs Knowledge Management Systems Life Cycle (KMSLC), KMSLC approaches.
Unit 5	**Knowledge Creation and Knowledge Architecture:** Knowledge creation and factors of knowledge transferred, Nonaka's Model for knowledge creation and transformation, Knowledge architecture, Knowledge management system.
Unit 6	**Capturing the Tacit Knowledge:** Techniques of capturing the tacit knowledge, Experts, Development of relationship with experts, Significance of fuzzy reasoning in capturing the knowledge, Interview as a tacit knowledge capture tool.
Unit 7	**Knowledge Capturing Techniques:** Knowledge capturing techniques, On-Site Observation (Action Protocol), Brainstorming, Electronic brainstorming, Protocol analysis (Think-Aloud Method), Consensus decision making, Repertory grid, Nominal Group Technique (NGT), Delphi method, Concept mapping and Black boarding.
Unit 8	**Knowledge Codification:** Knowledge codification, Codification tools/procedures, Modes of knowledge conversion and knowledge developer's skill set.
Unit 9	**Knowledge Transfer in E-World:** Transferring and sharing knowledge, fundamentals of knowledge transfer, Prerequisites for transfer, Methods of knowledge transfer, Types of knowledge transfer, Knowledge sharing.
Unit 10	**Learning from Data:** Concept of learning and significance of data, Visualization in learning, Artificial Neural Network as a learning model, Association rules and classification trees.
Unit 11	**Knowledge Management Assessment:** Significance of assessing knowledge management, Types of knowledge management assessment, Qualitative and Quantitative knowledge management assessments, Knowledge management solutions.
Unit 12	**Knowledge Based Systems:** Knowledge based system through user's view and developer's view, Representation knowledge forms and Methods, Knowledge engineering.

Unit 13	**Case-Based Reasoning (CBR):** Weaknesses of rule-based systems, CBR, Method of adaptation used in CBR, Significance of indexing the case library, Advantages and Disadvantages of case based systems.
Unit 14	**Knowledge Elicitation–Converting Tacit Knowledge to Explicit:** Knowledge elicitation, Interviews and observation, One-on-one interviews, Observational elicitation and team interviewing.
Unit 15	**Discovering New Knowledge–Data Mining:** Data mining as a tool in knowledge, Discovery and knowledge management, Classical statistics and Statistical pattern recognition tools for data mining, Symbolic rules and artificial neural networks as a technique, The future of knowledge management.

Reference Books

1. E. M. Awad, Knowledge Management, Person.
2. Jay Liebowitz, Knowledge Management: Learning from Knowledge Engineering, CRC Press.

Course Code: DCA3245	**Course Title: Software Project Management**
Unit 1	**Software Development Organization and Roles:** Introduction of management spectrum for an organization, IT organizational structures and job roles in software development.
Unit 2	**Overview of Project Management:** Project management, Factors influencing project management, Project development phases and project management associations.
Unit 3	**Project Planning:** Different tasks in project planning, work breakdown structures and different planning methods.
Unit 4	**Estimation and Budgeting of Projects:** Estimating cost involved in software development, Techniques used in cost estimation, Software engineering models.
Unit 5	**Project Scheduling:** Project scheduling techniques, Gantt chart and Critical Path Method, Automated tools available for project scheduling.
Unit 6	**Project Monitoring and Controlling:** Steps to process improvement, Project communication plans and techniques.
Unit 7	**Risk Management:** Risks play a critical role in software projects, Managing risks and its challenging activity, Risk management aids.
Unit 8	**Configuration Management:** Principal activity in configuration management, Version Control, Change Control and Configuration Audit.
Unit 9	**Team Development and Conflict Management:** Conflict avoidance among team members.
Unit 10	**Software Quality Assurance:** Software quality assurance activities, Various standards in software quality: ISO and SEI.
Unit 11	**CASE (Computer Aided Software Engineering) Tools:** Introduction to classification of CASE tools, Steps for implementing CASE tools.
Unit 12	**Testing Techniques:** Software testing techniques, Black box and White box testing.

Unit 13	**Software Re-engineering:** Software maintenance, Software re-engineering process model, Technical problems of re-engineering.
Unit 14	**Project Closure:** Introduces project closure analysis, Project closure analysis reports from case studies.

Reference Books

1. R. S. Pressman, *Software Engineering: A Practitioners Approach*, (3e) McGraw Hill.
2. R. Mall, *Fundamentals of Software Engineering*, (4e) PHI Publication.
3. K. K. Aggarwal and Y. Singh, *Software Engineering*, (3e) New Age International Publishers.
4. P. Jalote, *Software Engineering*, Wiley, (1e).
5. Sommerville, *Software Engineering*, Addison Wesley.

Course Code: DCA3246	**Course Title: Supply Chain Management**

Unit 1	**Concept of Supply Chain:** Concepts of supply chain management (SCM), Supply Chain Integration, Strategic Decision in Supply Chain, Key Issues in Supply Chain Management.
Unit 2	**Scope of Supply Chain Management:** Scope of Supply Chain Management, Supply Chain Management as a Management Philosophy, Value chain for Supply Chain Management, Supply Chain Management in global environment and stages of SCM development.
Unit 3	**SCM Strategies Performance:** Supply chain Strategies, Supply chain Drivers and Obstacles and Purchasing aspects of Supply Chain, Demand forecasting and aggregate planning, predictable viability.
Unit 4	**The Role of IT in Supply Chain:** Role of IT in a Supply Chain, Supply Chain IT framework, Supply Chain Macro Processes, Internet technologies and Supply Chain.
Unit 5	**Supply Chain Information System:** Supply Chain Information Systems (SCIS), E-Business in Supply Chain, Framework for measuring Supply Chain costs.
Unit 6	**Integrating Impact of IT integrated SCM:** Infrastructure of information technology in SCM, Influence of E-Commerce on SCM, Process of IT integration with SCM and its impact.
Unit 7	**Decision Support Systems for SCM:** Decision Support System (DSS), Components of DSS, Decision types of DSS, Information technology support systems for effective supply chain decision making.
Unit 8	**Customer and Service Management:** Creating the Customer-Centric Supply Chain, Applying technology to CRM, New concepts in customer management technologies.
Unit 9	**Manufacturing and Supply Chain Planning:** Chain planning, Impact of chain planning.
Unit 10	**Logistics Resource Management:** Logistics resource management (LRM), LRM in the age of global internet, Third party logistics (3PL) services.
Unit 11	**Supplier Relationship Management: Integrating Suppliers into the Value Chain:** Purchasing, Internet-driven SRM environment and

	Implementation of E-SRM.
Unit 12	**The Future of IT in the Supply Chain:** Internal supply chain management, Supplier relationship management, Transaction Management Foundation and Data mining concepts
Reference Books 1. S. Chopra, P. Meindl , D. Vir Kalra, Supply Chain Management, Person. 2. S. Janat, Supply Chain Management 2(e), Pearson. **3.** V. V. Sople, Supply Chain Management: Text and Cases, Pearson.	

5.3. Duration of the programme

Programme	Level	Duration	Maximum duration for completion	Credits
BCA	Bachelor's Degree	3 years	(3+ 3) years (As per UGC Notification on Specification of Degree, 2014)	126 Credits

5.4. Faculty and support staff requirement

Academic Staff	Number available to meet the required delivery norms
Programme Coordinator	1 member
Course Coordinator	1 member
Course Mentor	1 member per batch of 250 students

5.5. Instructional delivery mechanisms

The Directorate of Online Education of MUJ comprises of faculty members and staff who are well versed in Distance Education and Online delivery.

An Academic calendar depicting dates for all major events during each semester will be prepared by faculty members and shared with students through LMS, at the beginning of each academic session.

Apart from providing content in the form of Self Learning Material, enough e-learning resources in the form of Audio and Video content will be provided to students. Regular engagement of students will be ensured through the following means:

- Conduct of Webinars/live lectures/online lectures/Virtual Class
- By encouraging them to participate in mandatory Discussion Forums to stimulate their thinking, and to be able to fearlessly express their views in forums. These discussion

forums will be moderated by faculty to provide equal opportunity for everyone to participate, as well as to ensure maintenance of decorum of the forum.

- Through periodic formative assessments

Regular evaluation of content learnt will be provided for, through Self-Assessment Questions within the SLM, as well as quizzes on the LMS. The quizzes can be taken any number of times, so that they reach a stage of being able to answer questions without errors, which is a reflection of their understanding of the concept. .

Effort will be made to provide case studies to enhance their analytical ability and make right decisions.

Link to National Portals (SWAYAM/NPTEL) will be provided, as also link to University's digital library portal.

All links to additional reading will be provided in the LMS. Interested students can study beyond the confines of the syllabus.

5.6. Identification of media–print, audio or video, online, computer aided

LMS provides for all audio video content (e-learning material, e-pubs, faculty-led video sessions, virtual classrooms and discussion boards), dashboard of their progress in learning, comparison with their peers in terms of learning, regular notifications regarding upcoming Webinars/virtual classes, Assignments, Discussion Forum participations and Examinations. It also provides an opportunity for raising queries if any, and seek answers to the same, by chat bot or course mentors.

5.7. Student Support Services

The Student Support services will be facilitated by the Directorate of Online Education, Manipal University Jaipur, Rajasthan which includes the pre-admission student support services like counselling about the programme including curriculum design, mode of delivery, fee structure and evaluation methods. Post-admission student support services include guiding students towards accessing e-identity card, LMS portal, Academic calendar and

academic delivery. Examinations support staff shall answer queries pertaining to conduct of end-semester examinations, evaluation and issue of certificates.

6. Procedure for Admission, Curriculum Transaction and Evaluation

The purpose of Online education by Manipal University, Jaipur is to provide flexible learning opportunities to students to attain qualification, wherever learners are not able to attend the regular classroom teaching. Academic programmes offered for such candidates under Online Learning mode will be conducted by Directorate of Online Education-Manipal University, Jaipur with support of the various University schools. The programmes/courses may be termed Online mode for award of Degree. Eligibility criteria, programme/course structure, curriculum, evaluation criteria and duration of programme shall be approved by Board of Studies and Academic Council which are based on UGC guidelines.

Candidates seeking admissions in any programme offered by Directorate of Online Education-Manipal University, Jaipur shall fill up online application form available on DOE-MUJ website. Before applying, candidates must check eligibility criteria for programme that they are interested in. Details about Eligibility criteria, programme structure, curriculum, duration, and fee structure are available on the website.

6.1. Procedure for Admission

6.1.1 Minimum Eligibility Criteria for admission

10+2 from recognized board or equivalent qualification as recognized by Association of Indian Universities (AIU) or other competent body in any discipline with at least 50% (45% for Reserved category) marks in aggregate

Important Instructions:

- All admissions shall be provisional until and unless candidates meet the eligibility criteria.
- Admission will stand cancelled if a candidate does not meet eligibility criteria, or there is failure to pay programme/course fees.
- Admission will stand cancelled, if candidate does not submit proof of eligibility within stipulated time given by Directorate of Online Education-Manipal University, Jaipur.
- Directorate of Online Education-Manipal University, Jaipur has the right to make necessary changes from time to time as deemed fit in Eligibility criteria,

programme/course structure, curriculum, duration, fee structure and programme announcement dates. All changes will be notified on website.

- Candidates should carefully read all instructions given in Programme prospectus before start of application form.

6.1.2. Fee Structure and Financial assistance policy

Suggested Fee for BCA programme is INR 99,000/- (Ninety nine thousand only)

A scholarship of upto 25% on tuition fees will be provided to Divyang students and students from Public Sector Undertaking / Defence background.

6.2. Curriculum Transactions

6.2.1. Programme Delivery

Manipal University, Jaipur has state-of-the-art mechanism for online mode of Academic delivery to ensure quality education. Faculty members at MUJ offer expert guidance and support for holistic development of the students. Faculty members are not mere facilitators of knowledge but they also mentor students to make learning more engaging and maintain high retention level. The programme will be delivered with an aim to provide expertise and ensure that students excel in their domains. The features of programme delivery are:

- Online Mode of Academic Delivery
- Periodic review of Curriculum and Study material
- Live Interactive lectures from faculty / Course coordinators
- Continuous Academic and Technical support
- Guidance from Course Co-ordinators
- Learning and delivery support from Course Mentors

6.2.2. Norms for Delivery of Courses in Online Mode

S. No.	Credit value of the course	No. of Weeks	No. of Interactive Sessions		Hours of Study Material		Self-Study hours including Assessment etc.	Total Hours of Study (based on 30 hours per credit)
			Synchronous Online Counselling/ Webinars/ Interactive Live Lectures (1 hour per week)	Discussion Forum/ asynchronous Mentoring (2 hours per week)	e-Tutorial in hours	e-Content hours		
1.	2 Credits	6 weeks	6 hours	12 hours	10	10	22	60
2.	4 Credits	12 weeks	12 hours	24 hours	20	20	44	120

6.2.3. Learning Management System to support Online mode of Course delivery

LMS Platform has been built to help learners reach their potential in their chosen programme. It is a secure, reliable learning experience tool that works consistently on Web and Mobile devices. Its simple interface makes it easy for instructors to design courses, create content and grade assignments. It provides a great mobile experience due to the responsive design which is paired with purpose-built native apps. It provides seamless accessibility to ensure all tools are standards-compliant and easy for students to navigate using assistive technologies. It provides 24 X 7 learning experience to facilitate learning as per the pace chosen by learners. Digital portfolio functionality allows students to document and share their learning journey as it happens, on both web and mobile platforms.

6,2,4. Course Design:

The Course content is designed as per the SWAYAM guidelines using 4-quadrant approach as detailed below to facilitate seamless delivery and learning experience

(a) Quadrant-I i.e. e-Tutorial, that contains – Faculty led Video and Audio Contents, Simulations, video demonstrations, Virtual Labs

(b) Quadrant-II i.e. e-Content that contains - Portable Document Format or e-Books or Illustration, video demonstrations, documents as required.

(c) Quadrant-III i.e. Discussion forums to raise and clarify doubts on real time basis by the Course Coordinator and his team.

(d) Quadrant-IV i.e. Self-Assessment, that contains MCQs, Problems, Quizzes, Assignments with solutions and Discussion forum topics.

6.2.5. Academic Calendar

Sl No.	Event	Batch	Last Date (Tentative)
1	Commencement of semester	January	1st January
		July	1st July
2	Enrol student to Learning Management system	January	Within 2 working days of fee confirmation
		July	
3	Assignment Submission	January	March end and April end
		July	September end and October end
4	Submission of Synopsis (Applicable during Pre final semester)	January	30th April
		July	30th October
5	Project Report Submission (Applicable during Final semester)	January	30th April
		July	30th October
6	Webinars / Interactive Live Lectures and Discussion Forum for query resolution	January	Mar to May
		July	September to November
7	Admit Card Generation	January	3rd week of May
		July	3rd week of Nov
8	Term End Examination	January	2nd week of June (TEE June)
		July	2nd Week of December (TEE December)
9	Result Declaration of End Term Examination	January	Last week of August
		July	Last week of February

6.3. Evaluation

The students' learning in a course would be evaluated based on Internal assignments, students' response sheets, and semester end examinations. University adopts rigorous process in development of question papers, question banks, assignments and their moderation, conduct of examinations, evaluation of answer scripts by qualified teachers, and result declaration. The Directorate shall frame the question papers so as to ensure that no part of the syllabus is left out of study by a learner.

The evaluation shall include two types of assessments-continuous or formative assessment in the form of assignments, and summative assessment in the form of end semester examination or term end examination which will be held with technology supported remote proctored examination tool.

However, we shall be considering the guidelines issued by the Regulatory bolides from time-to-time about conduct of examinations.

The examinations shall be conducted to assess the knowledge acquired during the study. There shall be two systems of examinations viz., internal and external examinations. In the case of theory courses, the internal evaluation shall be conducted as Continuous Internal Assessment via Student assignments preparation, quizzes. The internal assessment shall comprise of maximum of 30 marks for each course (two Assignments each for four-credit theory papers). The end semester examination shall be of three hours duration for each course at the end of each semester.

6.3.1. Question Paper Pattern

Time: 3 Hours
Max. Marks: 70

Part A - (Multiple Choice Questions) - 10 x 2 Marks = 20 Marks

Part B - (Short Answers) - Answer any 4 (out of 6) 4 x 5 Marks = 20 Marks

Part C – (Long Answers) – Any 3 (out of 4) x 10 Marks = 30 Marks

6.3.2. Distribution of Marks in Continuous Internal Assessments

The following procedure shall be followed for awarding internal marks for theory courses. Student must submit two assignments for theory papers, each carrying 30 marks and average of both will be considered as internal assessment marks.

6.3.3. Passing Minimum

The students are considered as passed in a course if they score 40% marks in the Continuous Evaluation (IA) and Term-End Examinations (TEE) individually. If a student fails in any one component (failure to get 40% marks either in IA or TEE), then he/she will be required to re-appear for that component only (IA or TEE as the case may be).

6.3.4. Marks and Grades

Based on the total marks obtained for each course in Internal Assessment and Term End examinations, student will be awarded grade for that course. The following table gives the marks, grade points, letter, grades and classification to indicate the performance of the candidate.

Range of Marks	**Grade Points**	**Letter Grade**	**Description**
≥90 to ≤100	10	A+	Outstanding
≥80 to <90	9	A	Excellent
≥75 to <80	8	B+	Distinction
≥70 to <75	7	B	Very Good
≥60 to <70	6	C+	Good
≥50 to <60	5	C	Average
≥40 to <50	4	D+	Below Average
<40	0	F	Re-appear
ABSENT	0	AAA	ABSENT

For a semester:

Grade Point Average [GPA] = $\sum_i C_i G_i / \sum_i C_i$

Grade Point Average =

$$\frac{\text{Sum of the multiplication of grade points by the credits of the courses}}{\text{Sum of the credits of the courses in a semester}}$$

C_i = Credits earned for the course i in any semester
G_i = Grade Point obtained for course i in any semester.

n refers to the semester in which such courses were credited

For the entire programme:

Cumulative Grade Point Average [CGPA] = $\sum_n \sum_i C_{ni} G_{ni} / \sum_n \sum_i C_{ni}$

$$\text{CGPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the entire programme}}{\text{Sum of the credits of the courses for the entire programme}}$$

7. Requirement of the Laboratory Support and Library Resources

7.1. Laboratory Support

For Courses having practical component (programming and coding), Learners will have access to lab guide for unguided exercise and online tools to carry out practice of suggested exercises. Video tutorials will be provided for better understanding of concepts and methods to practice. Lab based virtual classrooms in Learning portal will guide students about the laboratory support to the learners in order to carry out practical exercise covered in the programme. There shall be provision of a practical guide made available for learners.

7.2. Library Resources

Directorate of Online Education, Manipal University Jaipur, Rajasthan has excellent Library facility with adequate number of copies of books in relevant titles for BCA programme. The Central Library of Manipal University, Jaipur is also having good source of reference books. The books available at both the libraries are only for reference purpose and lending services. In addition, reference books as prescribed will be procured. The Digital library access will also be made available to students who are enrolled into online mode of education. In addition, the university membership on Swayam/ NPTEL/ Knimbus will also be made available to students. Complete e-Learning resources to course would be made available on Learning management System for learning along with e-tutorial lectures. Further, expert lectures/workshops/ webinars by industry experts would also be conducted for the students.

8. Cost Estimate of the Programme and the Provisions

The cost estimate of the Programme and provisions for the fund to meet out the expenditure to be incurred in connection with M.B.A. Programme as follows:

Sl. No.	Expenditure Heads	Approx. Amount
1	Programme Development (Single Time Investment)	70,00,000 INR
2	Programme Delivery (Per Year)	9,00,000 INR
3	Programme Maintenance (Per Year)	42,00,000 INR

9. Quality assurance mechanism and expected programme outcomes

The quality of the programme depends on scientific construction of the curriculum, strong-enough syllabus, sincere efforts leading to skilful execution of the course of the study. The ultimate achievement of MCA programme of study may reflect the gaining of knowledge and skill in management area. Gaining of knowledge and skills in IT may help the students to get new job opportunities, upgrading their position not only in employment, but also in the society,

The benchmark qualities of the programme may be reviewed based on the performance of students in their end semester examinations. Also, the feedback from the alumni, students, parents and employers will be received and analysed for further improvement of the quality of the programme.

Manipal University, Jaipur has constituted Centre for Internal Quality Assurance (CIQA), which will assist Director, Directorate of Online Education to conduct periodic review and assessments and assist the Directorate to implement necessary quality measures and effectiveness in programme delivery. CIQA is constantly involved in reviewing all materials prepared by DOE, including syllabus, SLMs and e-learning content. CIQA will be involved in conducting studies to measure effectiveness of methods adopted for learning. As we proceed further, CIQA will involve in benchmarking quality of academic delivery, and perform various analyses, and guide all stakeholders towards upgrading quality constantly.

Centre for Internal Quality Assurance Committee (CIQAC) chaired by the Vice Chancellor consisting of internal and external experts oversees the functioning of Centre for Internal Quality Assurance and approve the reports generated by Centre for Internal Quality Assurance on the effectiveness of quality assurance systems and processes.

In addition to CIQA, as per the guidelines of National Assessment and Accreditation Council (NAAC), Manipal University, Jaipur has constituted Internal Quality Assurance Cell (IQAC), in which academicians, industry representatives and other stakeholders are nominated as members. The IQAC is a part of the institution’s system and work towards realisation of the goals of quality enhancement and sustenance, as quality enhancement is a continuous process. The prime task of the IQAC is to develop a system for conscious, consistent, and catalytic improvement in the overall performance of institutions. The work of the IQAC is the first step towards internalization and institutionalization of quality enhancement initiatives..

IQAC's elementary motive is to promote measures for institutional functioning towards quality enhancement through internalization of quality culture and institutionalization of best practices.

The guidelines on quality monitoring mechanism prescribed by the UGC have been adopted by the Centre for Internal Quality Assurance for conducting institutional quality audits, to promote quality assurance and enhance as well as spread best-in-class practices of quality assurance. University has setup an effective system for collecting feedback from the stakeholders regularly to improve its programmes. The University will conduct self-assessments regularly and use the results to improve its systems, processes etc. and finally quality of programmes.