

PROGRAMME PROJECT REPORT (PPR)

For

Bachelor of Computer Application (BCA) (ONLINE DEGREE PROGRAMME)

CENTRE FOR DISTANCE AND ONLINE EDUCATION (CDOE) MANIPAL UNIVERSITY JAIPUR Dehmi Kalan, Off Jaipur-Ajmer Expressway, Jaipur, Rajasthan 303007

Director Centre for Distance and Online Education Manipal University Jaipur



UN.

SI. No	Contents	Page
		No
1.	Programme's Mission and Objectives	3
2.	Relevance of Programme with Manipal University, Jaipur Mission and	3
	Goals	
3.	Nature of Prospective Target Group of Learners	4
4.	Appropriateness of programme to be conducted in Online mode to	4
	acquire specific skills and competence	
5.	Instructional Design	5
	5.1. Curriculum design	
	5.2. Programme structure and Detailed syllabus	
	5.3. Duration of the programme	
	5.4. Faculty and support staff requirement	
	5.5. Instructional delivery mechanisms	
	6. Identification of media-print, audio or video, online, computer aided	
	5.7. Student Support Services	
6.	Procedure for Admission, Curriculum Transaction and Evaluation	49
	6.1. Procedure for Admission	49
	6.2. Curriculum Transactions	50
	6.3. Evaluation	52
7	Requirement of the Laboratory Support and Library Resources	55
8	Cost Estimate of the Programme and the Provisions	55
9	Quality Assurance Mechanism and Expected Programme Outcomes	56

List of Contents

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 Information Technology fand 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.

5.1.1. Programme Structure

Semester 1			
Course Code	Course	Credits	
DCA1105	Fundamentals of Mathematics	4	
DCA1106	Technical Communication	2	
DCA1107	C Programming	4	
DCA1108	Fundamentals of Computers & Digital Systems	4	
DCA1109	Introduction to Web Programming	4	
DCA1110	Environmental Science	2	
DCA1131	C Programming Lab	1	
DCA1132	Web Programming Lab	1	
	TOTAL CREDITS	22	
	Somoctor 2		

Course Code	Course	Credits
DCA1206	Basic Statistics and Probability	4
DCA1207	Data Structures	4
DCA1208	Database Management System	4
DCA1209	Principles of Programming Languages	4
DCA1210	Object-Oriented Programming using C++	4
DCA1231	Database Management System Lab	1
DCA1232	Data Structures using C++ Lab	1
	TOTAL CREDITS	22
	Semester 3	
Course Code	Course	Credits
DCA2105	Computer Organization and Architecture	4
DCA2106	Java Programming	4
DCA2107	Data Communication & Protocols	4
DCA2108	Operating Systems	4
DCA2109	Artificial Intelligence for Problem Solving	4
DCA2131	Java Programming Lab	1
DCA2132	Operating System Lab	1
	TOTAL CREDITS	22
	Semester 4	
Course Code	Course	Credits
DCA2205	Python Programming	4
DCA2206	Software Engineering	4
DCA2207	Data Mining & Visualization	4
DCA2208	Introduction to Network Security	4
DCA2232	Python Programming Lab	1
DCA2233	Data Mining and Visualization Lab	1
	TOTAL CREDITS	18
	Semester 5	

	Mobile Application Development	4
DCA3106	Machine Learning	4
DCA3107	Cloud Computing & Applications	4
	Elective-I	4
DCA3144	DISTRIBUTED SYSTEMS	
DCA3145	BIG DATA ANALYTICS	
DCA3146	ETHICAL HACKING	
DCA3133	Mobile Application Development Lab	1
DCA3134	Machine Learning Lab	1
DCA3108	Aptitude and Technical Development	2
	TOTAL CREDITS	20
	Semester 6	
Course Code	Course	Crodits
		creats
DCA3203	Wireless Communication	4
DCA3203 DCA3204	Wireless Communication Unix and Shell Programming	4
DCA3203 DCA3204 DCA3205	Wireless Communication Unix and Shell Programming Big Data	4 4 4 4
DCA3203 DCA3204 DCA3205	Wireless Communication Unix and Shell Programming Big Data Elective-II	4 4 4 4 4
DCA3203 DCA3204 DCA3205 DCA3244	Wireless Communication Unix and Shell Programming Big Data Elective-II CLOUD STORAGE & DATA MANAGEMENT	4 4 4 4 4
DCA3203 DCA3204 DCA3205 DCA3244 DCA3245	Wireless Communication Unix and Shell Programming Big Data Elective-II CLOUD STORAGE & DATA MANAGEMENT DATA VISUALIZATION WITH PYTHON	4 4 4 4
DCA3203 DCA3204 DCA3205 DCA3244 DCA3245 DCA3246	Wireless Communication Unix and Shell Programming Big Data Elective-II CLOUD STORAGE & DATA MANAGEMENT DATA VISUALIZATION WITH PYTHON INFORMATION SYSTEMS SECURITY	4 4 4 4
DCA3203 DCA3204 DCA3205 DCA3244 DCA3245 DCA3246 DCA3230	Wireless Communication Unix and Shell Programming Big Data Elective-II CLOUD STORAGE & DATA MANAGEMENT DATA VISUALIZATION WITH PYTHON INFORMATION SYSTEMS SECURITY Unix and Shell Programming Lab	4 4 4 4 4
DCA3203 DCA3204 DCA3205 DCA3244 DCA3245 DCA3246 DCA3230 DCA3206	Wireless Communication Unix and Shell Programming Big Data Elective-II CLOUD STORAGE & DATA MANAGEMENT DATA VISUALIZATION WITH PYTHON INFORMATION SYSTEMS SECURITY Unix and Shell Programming Lab Project	4 4 4 4 4 4 1 6
DCA3203 DCA3204 DCA3205 DCA3244 DCA3245 DCA3246 DCA3230 DCA3206	Wireless Communication Unix and Shell Programming Big Data Elective-II CLOUD STORAGE & DATA MANAGEMENT DATA VISUALIZATION WITH PYTHON INFORMATION SYSTEMS SECURITY Unix and Shell Programming Lab Project TOTAL CREDITS	4 4 4 4 4 4 1 6 23

BCA Sem 1

Fundamentals of Mathematics

Unit-Introduction to Function: Definition, Function as a special relation from one set to another,Pictorial Representation of Function, domain, co-domain and range of a function domain and

	range of function, Real valued Functions, Domain and Range of these functions, Relations and Functions.
Unit- 2	Composite Function: Definitions and Properties of Composite Functions, Sum, difference, product and quotients of a function, Introduction to Periodic Function, Properties of Even and Odd Function.
Unit- 3	Limit: Intuitive idea of limit, Limits of- Polynomial and Rational Functions, Trigonometric, Exponential and Logarithmic Functions, Continuity as a limit
Unit- 4	Some Standard Limits: Definition of derivative using the limits, General Derivative Formulaes, Indeterminate Forms, Limit of indeterminate Forms
Unit- 5	Continuity: Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit functions, Concept of exponential and logarithmic functions, Derivatives of logarithmic and exponential functions, Logarithmic differentiation, derivative of functions expressed in parametric forms. Second order derivatives, Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretation
Unit- 6	Special Functions - Part I: Trigonometric functions Inverse Trigonometric Function, exponential functions
Unit- 7	Special Functions - Part II: Logarithmic functions, hyperbolic functions, inverse circular functions
Unit- 8	Rational Functions and Partial Fraction: Partial Fractions -Introduction and Methods, Understanding simple linear factors, repeated linear factors, quadratic factors in a rational function,Numerical on Partial Fractions
Unit- 9	Differentiation: Introduction, Geometric Interpretation of Differentiation, Theorems of Derivatives, Differentiation of Implicit Function, Higher Order Derivatives
Unit- 10	Differentiation of Trigonometric Functions and Inverse Circular Functions: How to differentiate a function
Unit- 11	Maxima and Minima: Applications of derivatives: rate of change of bodies, increasing/decreasing functions, tangents and normal, use of derivatives in approximation, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool), Simple problems (that illustrate basic principles and understanding of the subject as well as real-life situations), Absolute Maximum and Minimum values of a function in a closed interval
Unit- 12	Integration - Part I: Understanding Integration-Integration as inverse process of differentiation, Integration of Simple Function using Substitution, Integration of Circular and Inverse circular Functions
Unit- 13	Integration - Part II: Integration by parts, integration of rational functions
Unit- 14	Definite Integral and Reduction Formula: Definite integral and their properties, reduction formula-Definite integrals as a limit of a sum, Fundamental Theorem of Calculus (without proof), Basic properties of definite integrals and evaluation of definite integrals Applications in finding the area under simple curves, especially lines, circles/parabolas/ellipses (in standard form only)

Unit-1	Introduction to Communication: Types of communication, Process of communication, Principles of communication, Channels of communication, Verbal and non-verbal communication, Formal and informal communication, Barriers to communication
Unit-2	Vocabulary Building: Word formation, Affixes, Compound words, Synonyms, Antonyms, Homophones and Homonyms, Misspelt words
Unit-3	Grammar Essentials: Punctuations, Parts of speech, Active and passive voice, Direct and indirect speech, Concord, Common errors
Unit-4	Effective Sentence Construction: Techniques of effective sentence constructions, Précis writing
Unit-5	Professional Communication: Emails, Memos, Reports, Proposals
Unit-6	Job Application Essentials & Interview Skills: Cover letter, Resume, LinkedIn profile, Interview skills
Unit-7	Public Speaking and Presentation Skills: Preparing a presentation, Body language, Voice modulation, Use of visual aids, Handling audience questions

C Programming

Unit-1	Introduction to C: Importance, Program structure
Unit-2	Basics of C Programming: Data Types, Variables, Constants
Unit-3	I/O Operations in C: printf, scanf
Unit-4	Operators and Expressions: Operator precedence and associativity, arithmetic operators,
	relational operators, bitwise operators
Unit-5	Flow of Control Part 1: If-else statements, switch case statement
Unit-6	Flow of Control Part 2: Looping constructs - for, while, do-while
Unit-7	Arrays Part 1: Declaration, Initialization
Unit-8	Arrays Part 2: Sorting, Multi-dimensional arrays
Unit-9	Strings Part 1: String declaration and initialization, built-in string handling functions
Unit-10	Strings Part 2: Operations on strings, String manipulation programs
Unit-11	Functions Part 1: Introduction, Function declaration, definition and call
Unit-12	Functions Part 2: Types of functions, Function returning more values
Unit-13	Functions Part 3: Function with operators, function and decision statements, function and
	loop operators
Unit-14	Functions Part 4: Function with Arrays.

Fundamentals of Computers & Digital Systems

Unit-1	Introduction to Computers: Digital and Analog signals, Block diagram of a computer hardware, Generation of Computers, Types of Computers
Unit-2	Memory and Storage Devices: Overview of memory, Types of memory, Traditional and Modern Storage Devices

Unit-3	Input and Output Devices: Various types of Input Devices, Various types of Output Devices
Unit-4	Introduction to Number Systems: Binary, Decimal, Octal, Hexadecimal
Unit-5	Boolean Algebra and Logic Gates: Boolean Algebra, De-Morgan's law, Simplification of Boolean algebra, Basic and Universal Logic Gates
Unit-6	Simplification Methods: K-map and Tabulation method
Unit-7	Combinational Circuits - Part 1: Introduction to Combinational circuit, Half Adder Circuit, Full Adder Circuit
Unit-8	Combinational Circuits - Part 2: Half Subtractor, Full Subtractor, Binary Parallel Adder, Carry Propagation, Magnitude Comparator
Unit-9	Advanced Combinational Circuits: Decoder, Encoder, Multiplexer, De-multiplexer Circuit, Design of Code Converter
Unit-10	Introduction to Sequential Circuits: Introduction to Latches & Flip Flops
Unit-11	Types of Flip Flops: S-R, D, J-K, T Flip Flop
Unit-12	Synchronous Counters: Overview and Design of Synchronous Counters
Unit-13	Asynchronous Counters: Overview and Design of Asynchronous Counters
Unit-14	Shift Registers: Overview and Use of Shift Registers

Introduction to Web Programming

Unit-1	Introduction to HTML: Features, uses & versions of HTML, Syntax, Head & Body
	Sections
Unit-2	Advanced HTML Features: Inserting texts, Text alignment, Using images in pages,
	Hyperlinks – text and images, Bookmarks, Backgrounds and Color controls
Unit-3	Tables and Text Styling in HTML: Creating and using Tables in HTML, Use of font size &
	Attributes, List types and its tags
Unit-4	Introduction to CSS: Cascading Style sheets – defining and using simple CSS
Unit-5	HTML Forms: Introduction to HTML forms, Form Elements, Input Types, Form
	Attributes
Unit-6	Basic Web Designing: Introduction to Visual Design Principles, Website Creation and
	Maintenance
Unit-7	Introduction to JavaScript: The JavaScript Language Syntax Variables and Data Types
	Statements, Operators
Unit-8	Advanced JavaScript: Literals, Functions, Objects, Arrays, Built-in Objects, JavaScript
	Debuggers
Unit-9	Data Representation in Web: Overview of JSON, Data Types, Parsing, Stringify
Unit-10	Introduction to HTTP: Basics of HTTP, HTTP Methods, Status Codes

Unit-11	Handling Cookies in JavaScript: Creating and Reading Cookies in JavaScript
Unit-12	Electronic Commerce: E – Business model, E – Marketing, Online payments and security
Unit-13	Understanding APIs in Web Development: What is an API?, Understanding REST APIs, Fetching data from APIs using JavaScript
Unit-14	Basic Web Accessibility: Introduction to Web Accessibility, Accessibility Guidelines and Best Practices

Environmental Science

Unit-1	Introduction to Environmental Science: Multidisciplinary nature, scope and importance, sustainability and sustainable development
Unit-2	Ecosystems & Natural Resources: Concept, structure and function of ecosystems, energy flow, food chain, food webs and ecological succession, examples. Land resources and land use change, Land degradation, soil erosion and desertification, deforestation
Unit-3	Water and Energy Resources: Use and over-exploitation of water, floods, droughts, conflicts. Renewable and non-renewable energy sources, alternate energy sources, growing energy needs, case studies
Unit-4	Biodiversity & Conservation: Levels, biogeographic zones, biodiversity patterns and hot spots, India as a mega-biodiversity nation; Endangered and endemic species, threats, conservation, biodiversity services
Unit-5	Environmental pollution and Policies – I: Type, causes, effects, and controls of Air, Water, and soil pollution.
Unit-6	Environmental pollution and Policies – II: Noise pollution, nuclear hazards and human health risks, fireworks, solid waste management, case studies. Climate change, global warming, ozone layer depletion, acid rain, environment laws, environmental protection acts, international agreements.
Unit-7	Human Communities and the Environment: Human population growth, human health and welfare, resettlement and rehabilitation, case studies, disaster management, environmental ethics, environmental communication and public awareness, case studies

BCA Sem-2

Basic Statistics and Probability

Unit-1	Introduction to Basic Statistics: Population, Sample, Data Condensation, Definition and Scope of Statistics
Unit-2	Data Classification: Raw Data, Attributes and Variables, Classification, Frequency Distribution.
Unit-3	Measures of Central Tendency: Introduction: Concept of Central Tendency, Requirements of a Good Measure of Central Tendency
Unit-4	Measures of Central Tendency: Arithmetic Mean: Concept and Calculation of Arithmetic Mean.
Unit-5	Measures of Central Tendency: Median, Mode: Concept and Calculation of Median, Mode
Unit-6	Measures of Dispersion: Introduction: Concept of Dispersion, Absolute and Relative Measure of Dispersion
Unit-7	Measures of Dispersion: Range, Variance, and Standard Deviation: Range, Variance, Standard Deviation, Coefficient of Variation
Unit-8	Basic Counting Principles: Introduction to Basic Counting Principles, Simple Examples
Unit-9	Introduction to Probability: Sample Space, Events, Basic Probability Concepts.
Unit-10	Types of Experiments: Deterministic and Non-deterministic Experiments
Unit-11	Events in Probability: Discrete Sample Space, Events, Types of Events, Simple Event Operations
Unit-12	Probability Rules: Addition & Multiplication Rules of Probability
Unit-13	Conditional Probability and Independence: Introduction to Conditional Probability, Independent Events
Unit-14	Simple Probability Problems: Understanding and Solving Simple Probability Problems

Data Structures

Unit-1	Introduction to Data Structures: Definitions, Concept of Data Structures, Overview of Data Structures
Unit-2	Introduction to Arrays: Definitions, Terminologies
Unit-3	One-Dimensional Array: Memory Allocation, Operations on Array, Application of Arrays
Unit-4	Introduction to Multidimensional Arrays: Two-Dimensional Array Representation
Unit-5	Introduction to Linked Lists: Definition, Single Linked List

Unit-6	Operations on Linked Lists: Representation in Memory, Operations (Insertion, Deletion, Modification)
Unit-7	Special Linked Lists: Circular Linked List
Unit-8	Introduction to Stacks: Definition, Array and Linked-List Representation of Stack
Unit-9	Operations on Stack: Operations on Stack: Push, Pop
Unit-10	Applications of Stack: Basic Applications of Stack
Unit-11	Introduction to Queues: Definition, Array and Linked-List Representation of Queue
Unit-12	Operations on Queue: Operations on Queue: Insertion, Deletion
Unit-13	Circular Queue: Operations on Circular Queue
Unit-14	Sorting and Searching: Insertion Sort, Selection Sort, Merge Sort, Linear Search, Binary Search

Database Management Systems

Unit-1	Introduction to DBMS: Concept of Database, Characteristics of Database Approach, Importance of DBMS, Overview of DBMS
Unit-2	Database Systems: Types of Database Systems, Advantages and Disadvantages of DBMS
Unit-3	Data Models: Concept of Data Models, Types of Data Models, Overview of Relational Model
Unit-4	Introduction to ER Models: Concept of Entity-Relationship Model, Entities and Attributes, Relationships, Keys
Unit-5	ER Diagrams: Components of ER Diagram, Symbols and Notations of ER Diagram, Converting ER Diagrams into Tables
Unit-6	Introduction to Relational Model: Concepts, Terminologies, Codd's Rules, Keys in Relational Model
Unit-7	Relational Algebra: Basic Operations of Relational Algebra, Derived Operations
Unit-8	Introduction to SQL: SQL Syntax, Data Types, Basic SQL Commands
Unit-9	SQL Querying: SQL Select Statement, Where Clause, SQL Operators, SQL Joins
Unit-10	Data Manipulation in SQL: Insert, Update and Delete Statements, Truncate, Drop and Alter Commands
Unit-11	Introduction to Normalization: Concept of Functional Dependencies, Introduction to Normalization, First Normal Form (1NF)
Unit-12	Normalization and Normal Forms: Second Normal Form (2NF), Third Normal Form (3NF), BCNF
Unit-13	Introduction to Transaction Processing: Concept of Transactions, Properties of Transactions (ACID Properties)

Unit-14	Cursors and Triggers in SQL: Concept of Cursors, Working with Cursors, Concept of
	Triggers, Working with Triggers

Principles of Programming Languages

Unit-1	Introduction: Programming language design, Compilation vs interpretation, Programming environments
Unit-2	Language Spectrum and Study Motivation: Different paradigms, Mixed-level languages, Motivation for studying programming languages
Unit-3	Names, Scope, and Bindings: Concept of binding time, Object lifetime and storage management
Unit-4	Implementing Scope and Separate Compilation: Scope rules, Binding of reference environments, Separate compilation
Unit-5	Control Flow: Structured and Unstructured: Expression evaluation, Sequencing, Selection, Iteration
Unit-6	Control Flow: Recursion and Non-determinacy: Concept and implementation of recursion, Concept of non-determinacy
Unit-7	Data Types: Basic and Composite: Type systems, Type checking, Records and variants
Unit-8	Data Types: Special and Abstract: Arrays, Strings, Sets, Pointers, Recursive types, Lists, Files, Tuples, Hash Maps
Unit-9	Subroutines and Control Abstraction: Stack layout, Calling sequences, Parameter passing, Generic subroutines and modules
Unit-10	Exception Handling and Co-routines: Concept and implementation of exception handling, Concept and use of co-routines
Unit-11	Data Abstraction and Object Orientation: Object oriented programming, Encapsulation, Inheritance, Polymorphism, Interfaces, Dynamic method binding
Unit-12	Functional Programming: Origins, Concepts, Scheme, Evaluation order, Higher- order functions
Unit-13	Concurrent Programming: Concepts, thread Management, Synchronization
Unit-14	Scripting Languages: Python: Concepts, Use cases, JavaScript: Concepts, Use cases

Object Oriented Programming Using C++

Unit-1	Introduction to Object-Oriented Programming: Evolution of OOP, Characteristics of OOP, Difference between C and C++
Unit-2	Basic Structure of C++: Keywords, Identifiers, Data Types, Variables Declaration and Definition, Constants

Unit-3	Operators and Program Structure in C++: Operators, C++ Program Structure, Control and Conditional Statement
Unit-4	Type Casting and Pointers in C++: Type Casting, Introduction to Pointers, Dynamic Memory Allocation, Memory Deallocation
Unit-5	Arrays in C++: Introduction to Arrays, Types of Arrays, Array Operations
Unit-6	Introduction to Classes and Objects: Concept of Classes and Objects, Data Members and Member Functions, Returning Objects, Array of Objects
Unit-7	Scope Resolution and Constructors/Destructors in C++: Scope Resolution Operator, Constructor and Destructor, Function Overloading
Unit-8	Advanced Object-Oriented Concepts: Friend Function, Inline Function, Operator Overloading
Unit-9	Inheritance in C++: Introduction to Inheritance, Types of Inheritance, Access Controllers
Unit-10	Virtual Functions and Abstract Classes: Concept of Virtual Functions, Introduction to Abstract Classes
Unit-11	Introduction to I/O Streams: Streams Hierarchy, Input Streams, Output Streams
Unit-12	File and Cloud Storage Operations in C++: Implementing Various File Operations on Basic Data Types, Random Access Files, Introduction to Cloud Storage Operations
Unit-13	Exception Handling in C++: Introduction to Exception Handling, try-catch Block, Throwing Exceptions
Unit-14	C++ Standard Library: Overview of C++ Standard Library, Basic Usage, Practical Examples

BCA Sem-3

Computer Organization and Architecture

Unit-1	Introduction to Computer Architecture: Block Diagram of Computer, Memory Section, Input/Output Section, CPU
Unit-2	Central Processing Unit: Registers, Arithmetic Unit, Instruction Handling Areas, Stacks
Unit-3	Micro Operations: Register Transfer, Bus and Memory Transfer, Arithmetic Micro operations
Unit-4	Logic and Shift Micro Operations: Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit
Unit-5	Basic Computer Organization and Design: Instruction Codes, Operation Code, Timing and Control
Unit-6	Instruction Cycle: Memory Reference Instructions, Input Output Instructions and Interrupts
Unit-7	Control Memory: Control Word, Microinstruction, Microprogramming, Control Memory, Hardwired
Unit-8	Central Processing Unit: Organization: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes
Unit-9	Introduction to CPU Architectures: Superscalar, VLIW, and SIMD architectures
Unit-10	Pipelining and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Vector Processing, Array Processors
Unit-11	Input Output Organization: I/O Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt
Unit-12	Advanced I/O Mechanisms: DMA, IOP, Serial Communication
Unit-13	Memory Organization: Associative Memory, Cache Memory, and Virtual Memory
Unit-14	Introduction to Modern Microprocessors: Overview of modern microprocessors such as ARM, MIPS, and x86.

Java Programming

Unit-1	Introduction to Java: Overview of Java, Features of Java, Comparing Java and C++

Unit-2	Basic Syntax in Java: Data types, Identifiers
Unit-3	Introduction to Object-Oriented Programming in Java: Class, Object, Method, Constructor, Encapsulation, Abstraction
Unit-4	Arrays in Java: One-Dimensional Array, Multi-Dimensional Array
Unit-5	Inheritance in Java: Inheritance Basics, Method Overriding, Abstract Class, Final Class, Multilevel Hierarchy
Unit-6	String Handling: String Class, String Constructors, String Operations
Unit-7	Packages and Interfaces in Java: Creating, Implementing and Importing Packages, Interfaces and Their Uses
Unit-8	Exception Handling in Java: Exception Handling Basics, Types of Exceptions, Catch Clauses, Java's Built-in Exceptions
Unit-9	Multithreading in Java: Creating Threads, Thread Priorities, Synchronization, Suspending, Resuming and Stopping Threads
Unit-10	Basic Java Packages: Classes and Methods in java.lang, java.util, java.io
Unit-11	Event Handling in Java: Event Handling Basics, Event Model, Event Classes, Event Listener Interfaces
Unit-12	Introduction to GUI in Java: Introduction to Swing, Swing Components
Unit-13	Advanced GUI in Java: Using Swing Components, Layout Managers in Swing
Unit-14	Introduction to Java Frameworks: Basics of Spring Framework

Data Communication and Protocols

Unit-1	Data Transmission : Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity
Unit-2	Transmission Media : Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission
Unit-3	Signal Encoding Techniques : Analog and Digital Signals, Digital-To-Digital Conversion: Line Coding Schemes, Block Coding, Scrambling
Unit-4	Signal Encoding Techniques : Analog-To-Digital Conversion: Pulse Code Modulation, Delta Modulation, Digital-To-Analog Conversion: Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying

Unit-5	Digital Data Communication Techniques : Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations
Unit-6	Data Link Control Protocols : Flow Control, Error Control, High-Level Data Link Control (HDLC)
Unit-7	Multiplexing - 1 : Frequency-Division Multiplexing (FDM), Time-Division Multiplexing (TDM),
Unit-8	Multiplexing -2 : CDMA, CSMA, OFDMA
Unit-9	Spread Spectrum : The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS)
Unit-10	Cellular Wireless Communication Techniques-I : Introduction, Generations: 1G, 2G, 3G,4G
Unit-11	Cellular Wireless Communication Techniques-II : Generations: 5G and introduction to 6G
Unit-12	Introduction to Network Protocols-I: Understanding the TCP/IP model, IP addressing
Unit-13	Introduction to Network Protocols-II : TCP and UDP, DNS, HTTP, FTP
Unit-14	Network Security : Basic concepts, Encryption and Decryption, Firewalls, VPN

Operating Systems

Unit-1	Introduction to Operating Systems: Basic concepts, Types of Operating Systems: Simple Batch Systems, Multi-programmed Batched Systems, Time Sharing Systems
Unit-2	Operating Systems Architecture: Operating System Structure, System Components, Protection
Unit-3	Introduction to Processes: Process Concept, Operation on Processes, Cooperating Processes
Unit-4	Inter-Process Communication: Inter-process Communication, Message Passing, Process Scheduling
Unit-5	CPU Scheduling: Scheduling Criteria, Scheduling Algorithms
Unit-6	Process Synchronization: Critical-Section Problem: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware
Unit-7	Process Synchronization: Semaphores: Semaphore Concept, Semaphore Usage, Basics of Semaphores
Unit-8	Deadlocks: Deadlock Characterization, Deadlock Prevention and Avoidance

Unit-9	Deadlocks: Detection and Recovery: Deadlock Detection, Recovery from Deadlock
Unit-10	Memory Management: Logical vs Physical Address Space, Swapping, Contiguous Allocation
Unit-11	Memory Management: Paging: Concept of Paging, Hardware and Software Aspects of Paging
Unit-12	Virtual Memory: Demand Paging, Benefits of Virtual Memory
Unit-13	Page Replacement: Page Replacement, Page-replacement Algorithms
Unit-14	Overview of Modern Operating Systems: Case Study on Modern Operating Systems like UNIX, Linux, Windows, Introduction to Cloud Operating Systems

Artificial Intelligence for Problem Solving

Unit-1	Introduction to AI: Definition and Importance of AI, Application of AI, Intelligent Agents
Unit-2	Problem Solving Techniques: Goal formulation, Problem types, Problem-solving agents
Unit-3	Uninformed Search Techniques: Breadth-first search, Depth-first search, Iterative deepening
Unit-4	More Uninformed Search Techniques: Bidirectional search, Hill climbing, Uniform cost search
Unit-5	Informed Search Techniques: Heuristics, Greedy search, A* search
Unit-6	More Informed Search Techniques: AO* search, Constraint satisfaction problems
Unit-7	Game Playing: Minimax Algorithm, Alpha-beta pruning
Unit-8	Game Playing: Introducing basic games and strategies
Unit-9	Knowledge and Reasoning: Introduction to logical reasoning, Basic concepts of propositional logic
Unit-10	Knowledge Representation: Semantic Networks, Frame, Scripts, Situation calculus
Unit-11	Reasoning Techniques: Forward chaining, Backward chaining, Resolution
Unit-12	Planning in AI: Planning problem, Partial order planning, Planning graphs

	·
Unit-14 Machine Learning Basics: Supervised, Unsupervised, Reinforcement	earning

BCA Sem 4

Python programming

Unit 1	Introduction to Python: Python overview, installation, Python Shell, Python script execution
Unit 2	Python Basics: Expressions, Data types, Variables, Operators
Unit 3	Control Flow in Python: Conditional Statements, Looping constructs
Unit 4	Python I/O Operations: Standard I/O, File I/O
Unit 5	Data Structures (Part 1): Lists: Basics, Operations, Slicing, List comprehension
Unit 6	Data Structures (Part 2): Sets: Basics, Operations
Unit 7	Data Structures (Part 3): Tuples: Basics, Operations
Unit 8	Data Structures (Part 4): Dictionaries: Basics, Operations
Unit 9	Functions in Python (Part 1): Basics of Functions, Function Definitions, Calling Functions
Unit 10	Functions in Python (Part 2): Recursion,
Unit 11	Object Oriented Programming in Python (Part 1): Classes, Objects, Class and Instance Variables
Unit 12	Object Oriented Programming in Python (Part 2): Inheritance, Polymorphism
Unit 13	The Python Standard Library (Part 1): Strings and Text Handling, Networking
Unit 14	The Python Standard Library (Part 2): Database Access

Software Engineering

Unit 1	Introduction to System Concepts: Definition, Elements of System,
	Characteristics of System, Types of System, System Concepts

Unit 2	Introduction to Software Engineering: Definition, Need for Software Engineering, Software Characteristics, Software Qualities (McCall's Quality Factors)
Unit 3	Requirement Analysis: Definition of System Analysis, Requirement Anticipation, Knowledge and Qualities of System Analyst, Role of a System Analyst
Unit 4	Feasibility Study and Types: User Transaction Requirement, User design Requirements, SRS(System Requirement Specification)
Unit 5	Software Development Methodologies: SDLC (System Development Life Cycle), Waterfall Model, Iterative and Incremental Development
Unit 6	Advanced Software Development Methodologies: Spiral Model, Prototyping Model, Introduction to Agile Model, RAD and Lean Software Development
Unit 7	Analysis Tools: Entity Relationship Diagrams, Data Flow Diagrams (DFD), Data Dictionary & Elements of Data Dictionary
Unit 8	Design Tools: Pseudo code, Input and Output Design, UML Diagrams
Unit 9	Structured System Design: Modules Concepts and Types of Modules, Structured Chart
Unit 10	Good Design Principles: Qualities of Good Design, Coupling, Types of Coupling, Cohesion, Types of Cohesion
Unit 11	Software Testing: Definition, Test characteristics, Verification and Validation
Unit 12	Black Box Testing: Understanding Black Box Testing, Equivalence Partitioning and Boundary Value Analysis
Unit 13	White Box Testing: Understanding White Box Testing, Statement and Branch Coverage
Unit 14	Advanced Software Testing: Stress Testing, Performance Testing, Load Testing and Usability Testing

Data Mining and Visualization

Unit 1	Introduction to Data Mining: Importance of Data Mining, Data Mining functionalities, Basic Data Mining structure, Data Mining Applications
Unit 2	Operational Database and Data Warehouse: Differences between Operational Database and Data Warehouse

Unit 3	Multidimensional Data Model: Data Cubes. Schemas, Measures, Data Reprocessing
Unit 4	Data Mining Primitives: Data Cleaning, Data Integration and Transformation
Unit 5	Data Reduction: Discretization and concept of Hierarchy Generation
Unit 6	Schema Design: Star and snow-Flake Schema
Unit 7	Data Mining Algorithms: Part 1: Association Rule Mining
Unit 8	Data Mining Algorithms: Part 2: Classification and Clustering Basics
Unit 9	Introduction to Data Visualization: Importance of data visualization, data types, different tools for data visualization
Unit 10	Understanding Graphs: Two-dimensional graph, three-dimensional graph
Unit 11	Introduction to Dashboard: Need of dashboards
Unit 12	Chart Types: Part 1: Pie Chart, Bar Chart, Histogram, Gantt Chart, Heat Map, Box and Whisker Plot
Unit 13	Chart Types: Part 2: Waterfall Chart, Area Chart, Scatter Plot, Pictogram Chart, Timeline, Highlight Table, Bullet Graph
Unit 14	Chart Types: Part 3 and Dashboard Development: Choropleth Map, Word Cloud, Network Diagram, Correlation Matrices, geographical plots, Density Maps, Bubble Chart, Tree maps. Dashboard development process, dashboard architecture

Introduction to Network Security

Unit 1	Introduction to Network Security: Network security goals, Assurance, Authenticity, Trust management, Anonymity
Unit 2	Threats and Attacks: Eavesdropping, Alteration, Denial-of-service, Masquerading, Repudiation, Correlation and traceback
Unit 3	Security Principles: Economy of mechanism, Fail-safe defaults, Complete mediation, Open design

Unit 4	More Security Principles: Separation of privilege, Least privilege, Least common mechanism, Psychological acceptability, Work factor, Compromise recording
Unit 5	Access Control: Access Control, Role-based access control
Unit 6	Cryptosystems: Symmetric cryptosystems, Symmetric key distribution, Public-key cryptography
Unit 7	Digital Security: Digital signatures, Hash functions, Message authentication codes, Digital certificates
Unit 8	Passwords, Social Engineering, Cybersecurity Education: Passwords, Password complexity, Social Engineering, Cybersecurity education and awareness training
Unit 9	Physical Security: Physical Security: Authentication, TEMPEST, RFID, Biometrics
Unit 10	Operating System and Application Security: Operating System Concepts and Buffer-over-flow, Operating System Security Application Program Security, Malware
Unit 11	Network Security: Protocols: ARP, ICMP, Sniffing, IP Spoofing
Unit 12	Network Security: Sessions and Attacks: TCP, UDP, NAT, TCP Session Hijacking, DoS
Unit 13	Network Security: Services, Devices and IoT: DNS, SSH, VPN, IPSec, SSL, Firewall, Wireless security, IoT security
Unit 14	Web Security and Cybercrime: Web Security, Cryptography, Security Models and Practice, Digital Right Management, Spam and Cybercrime

BCA Sem - 5

Mobile Application Development

Unit 1	Introduction to Android: Android and its versions, features, various Android devices on the market, The Android Market application store
Unit 2	Android Development Environment: System Requirements, Android SDK, Installing Java, Android Studio
Unit 3	Overview of Threads: The Application Main Thread
Unit 4	Multimedia in Android: Audio, Video, Camera Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures
Unit 5	Android Architecture: The Android Software Stack, The Linux Kernel, Android Runtime (ART), Android Runtime – Core Libraries
Unit 6	Android Software Development Platform: Understanding Java SE, Kotlin and the ART, The Directory Structure of an Android Project, Common Default Resources Folders
Unit 7	Android Framework Overview: Android Application Components, Android Activities, Android Services, Broadcast Receivers, Content Providers, Android Intent Objects, Android Manifest XML
Unit 8	Understanding Android Views: View Groups and Layouts, Designing for Different Android Devices, Views and View Groups, Android Layout Managers, The View Hierarchy
Unit 9	Designing Android User Interface: Using the Graphical Layout Tool, Material Design principles, Data Binding, 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 10	Displaying Pictures: Gallery, ImageSwitcher, GridView, and ImageView views to display images, Creating Animation
Unit 11	Saving and Loading Files: Android file management
Unit 12	SQLite Databases: Room Database, Android Database Design
Unit 13	Exposing Access to a Data Source: Room Library, LiveData, ViewModel, Data Binding
Unit 14	Android Application Development: Practical aspects of developing an Android application, Best practices, Using Kotlin, Latest trends and frameworks in Android development

Unit 1	Introduction to Machine Learning: Basics of Machine Learning
Unit 2	Supervised Machine Learning: Overview, Applications and Examples
Unit 3	K- Nearest Neighbors: Introduction, Algorithm, Examples
Unit 4	Naïve Bayes: Concept, Mathematical Background, Applications

Machine Learning

Unit 5	Decision Trees: Decision Tree Algorithms, Applications
Unit 6	Support Vector Machines: Introduction, Optimization Problem, Kernel trick
Unit 7	Unsupervised Machine Learning: Introduction, Applications
Unit 8	Cluster Analysis: Types of Clustering, Clustering Algorithms
Unit 9	K-Means Clustering: Algorithm, Advantages and Disadvantages
Unit 10	Association Rule Mining: Introduction, Applications, Challenges
Unit 11	Apriori Algorithm: Explanation, Examples, Applications
Unit 12	Regression Analysis: Basics, Types of Regression
Unit 13	Linear and Nonlinear Regression: Concepts, Use-cases
Unit 14	Problem-Solving in ML: State Space Search, Production System, Depth First Search, Breadth First Search, Heuristic Search (Hill Climbing, Best First Search and Problem Reduction)

Cloud Computing and Applications

Unit 1	Introduction to Cloud Computing: Evolution, Benefits, Barriers, Cloud SPI Models, Comparison with Cluster Computing
Unit 2	Understanding Cloud Computing Architectures: NIST Cloud Architecture, Modern Cloud Architecture, Types of Hypervisor
Unit 3	Cloud Characteristics, Service Models, and Deployment: Models and Characteristics of Cloud Computing, Differences between Different Service Models
Unit 4	Overview of Technology Involved in Cloud Computing: Overview of Hardware, Software and Infrastructure required for Cloud Computing
Unit 5	Data Centers and Containerization in Cloud Computing: Classic Data Centers Vs. Virtualized Data Centers, Storage Virtualization, Overview of Containerization, Docker, Kubernetes
Unit 6	Compute Virtualization: Virtual Machine Components, Compute Virtualization Techniques, Converting Physical to Virtual Machines
Unit 7	Desktop and Application Virtualization: Understanding Desktop and Application Virtualization, Benefits and Challenges
Unit 8	Virtualized Data Center Networking: Network Virtualization in VDC, VDC Network Infrastructure and Components, VLAN and VSAN
Unit 9	Service Management in Cloud Computing: Service Level Agreements, Quality of Service, Billing and Accounting, Scaling Cloud Hardware

Unit 10	Data Management in Cloud Computing: Data Security and Storage, Data Privacy, Access Management
Unit 11	Cloud Security and Privacy: Infrastructure Security, Data Security and Privacy
Unit 12	Standards and Interoperability in Cloud Computing: Understanding Cloud Computing Standards, Interoperability Challenges
Unit 13	Migration to Cloud Computing: Technical Considerations for Migration, Benefits and Challenges
Unit 14	Emerging Trends and Applications: Real-world Applications and Case Studies of Cloud Computing, Serverless Computing, Edge Computing, Hybrid Cloud, AI and Machine Learning in Cloud

Distributed Systems

Unit 1	Introduction to Distributed Systems: Distributed System definition, goals, system
	architecture, distributed computing models, advantages, disadvantages, design issues
Unit 2	Basics of Distributed Shared Memory (DSM): Definition, architecture, File Model and
	their architecture, access models, file applications
Unit 3	Detailed Study of Distributed Shared Memory (DSM): Continuation of DSM
	architecture, discussion on data consistency models, memory coherence, replication, and caching
Unit 4	Inter Process Communications: Part 1: Client-Server communication, Introduction to Remote Procedure Calls (RPCs), RPC architecture
Linit F	Lister Dresses Communications: Dort 2: Detailed discussion on Sunchronization in
Unit 5	distributed systems. Clock synchronization. Event ordering
Unit 6	Mutual Exclusion in Distributed Systems: Need for mutual exclusion in distributed
	systems, Algorithms for distributed mutual exclusion
Unit 7	Distributed Scheduling: Issues, components, types, and algorithms of distributed
	scheduling
Unit 8	Deadlocks in Distributed Systems: Part 1: Understanding deadlocks, Issues in deadlock
	detection and resolution
Unit 9	Deadlocks in Distributed Systems: Part 2: Deadlock handling strategies, Algorithms for
	deadlock detection and resolution
Unit 10	Distributed File Systems: Basics of distributed file systems, Design issues, Case study
	of NFS
Unit 11	Replication and Fault Tolerance: Need for replication, Fault-tolerance, Replication for
11:+ 12	performance, for reliability
Unit 12	Modern protocols for multimedia transmission

Unit 13	Introduction to Distributed Databases: Types of distributed databases, Characteristics of distributed databases, Data fragmentation, replication, and allocation techniques, NoSQL databases in distributed systems
Unit 14	Case Study and Emerging Topics: Case study of distributed system like Google's infrastructure, Advanced topics like peer-to-peer systems, cloud computing, edge computing, serverless computing

Big Data Analytics

Unit 1	Introduction to Big Data: Understanding Big Data, Characteristics of Big Data (Volume, Variety, Velocity, Veracity), Importance and Benefits of Big Data
Unit 2	Big Data Sources and Types: Types of Data (Structured, Semi-structured, Unstructured), Data Sources (Social Media, Sensor Data, Machine Data, Transactional Data), Data Storage and Management
Unit 3	Big Data Technologies Overview: Hadoop Ecosystem, NoSQL Databases, In- memory Databases, Data Warehousing
Unit 4	Introduction to Hadoop: Overview of Hadoop, Hadoop Architecture, HDFS, MapReduce
Unit 5	Advanced Hadoop Components: Overview of Hive, Pig, HBase, Zookeeper
Unit 6	NoSQL Databases: Understanding NoSQL Databases, CAP Theorem, Types of NoSQL Databases (Document, Key-Value, Columnar, Graph)
Unit 7	Introduction to Big Data Analytics: Overview of Big Data Analytics, Descriptive Analytics, Predictive Analytics, Prescriptive Analytics
Unit 8	Data Mining and Machine Learning for Big Data: Overview of Data Mining, Machine Learning Techniques for Big Data (Classification, Regression, Clustering), Deep Learning for Big Data
Unit 9	Text Analytics and Natural Language Processing: Understanding Text Analytics, Natural Language Processing Techniques, Sentiment Analysis
Unit 10	Social Media and Web Analytics: Understanding Social Media Analytics, Web Analytics, Social Network Analysis
Unit 11	Big Data Visualization: Principles of Data Visualization, Tools for Big Data Visualization, Visualizing Large Datasets
Unit 12	Privacy and Ethics in Big Data: Understanding Data Privacy, Ethical Considerations in Big Data, Regulations and Compliance
Unit 13	Big Data in the Cloud: Understanding Cloud Computing, Advantages of Cloud for Big Data, Big Data Services in AWS, Google Cloud, Azure
Unit 14	Case Studies and Current Trends in Big Data: Real-world Case Studies, Emerging Trends in Big Data (IoT, Edge Computing), Future of Big Data

Ethical Hacking

Unit 1	Introduction to Ethical Hacking: Understanding Ethical Hacking, Difference between Ethical Hacking and Hacking, Ethical Hacking concepts, Hacking Phases
Unit 2	Ethics and Legality: Ethical Hacking Ethics, Hacking Laws and Penalties, Reporting Security Incidents
Unit 3	Footprinting and Reconnaissance: Information Gathering, Google Hacking, Social Engineering Techniques
Unit 4	Scanning Networks: Understanding IP Addresses, Network Scanning Techniques, Port Scanning, Vulnerability Scanning
Unit 5	System Hacking: Password Cracking Techniques, Privilege Escalation, Spyware, Keyloggers, Covering Tracks
Unit 6	Malware Threats: Understanding Viruses, Worms, Trojans, Bots, Ransomware, Antivirus Evasion Techniques
Unit 7	Sniffing and Spoofing: Network Sniffing Techniques, MAC Spoofing, IP Spoofing, DNS Spoofing
Unit 8	Social Engineering: Types of Social Engineering, Phishing, Baiting, Quid Pro Quo, Pretexting
Unit 9	Denial of Service: Understanding Denial of Service and Distributed Denial of Service Attacks, Botnets, DoS/DDoS Countermeasures
Unit 10	Session Hijacking: Understanding Session Hijacking, Session Hijacking Tools and Techniques, Session Hijacking Countermeasures
Unit 11	Web Server and Web Application Attacks: Web Server Attacks, Web Application Vulnerabilities, SQL Injection, Cross-Site Scripting, Cross-Site Request Forgery
Unit 12	Wireless Network Hacking: Wireless Networks Vulnerabilities, Wi-Fi Hacking Techniques, Wi-Fi Security
Unit 13	Cryptography: Understanding Cryptography, Encryption Algorithms, Public Key Infrastructure, Cryptanalysis
Unit 14	Penetration Testing: Understanding Penetration Testing, Penetration Testing Methodologies, Reporting and Documentation

Aptitude and Technical Development

Unit 1	Quantitative Techniques: Number System, Percentage, Time & Distance, Profit & Loss, Time & Work, Average, Permutation & Combinations, Game Based, Vedic Maths for quicker calculations
Unit 2	Verbal Reasoning: Sentence Improvement, Sentence Rearrangement, Fill in the Blanks, more complex language understanding problems
Unit 3	Logical Reasoning: Coding & Decoding, Direction, Blood Relation, Puzzle, Series, Statement & Arguments, complex logical reasoning problems like logical deductions, critical reasoning

Unit 4	Interview Preparation and Group Discussion: Preparation techniques, Body language, Tips for group discussion, scenario-based questions, STAR method for answering
Unit 5	Programming Basics: C Fundamentals, Function, Array, Pointers, Structure and File Handling, basics of C++, Java with C
Unit 6	Advanced Object-Oriented Concepts: Basics of Object Oriented Programming, Types of Data Structure and their implementation, Program Logic Development, deeper understanding of OOP principles
Unit 7	DBMS and Data Structures & Algorithms: Basic concepts of DBMS, SQL Queries, Software, advanced data structures (tries, heaps etc.), and algorithms

BCA Sem 6

Wireless Communication

Unit 1	Introduction to Wireless Communication: Evolution of Mobile Communication
	Systems, Challenges in Wireless Communication
Unit 2	Basics of Electromagnetic Spectrum: Introduction to the Electromagnetic Spectrum,
	Basics of Antennas
Unit 3	Cellular Concepts and Design: Introduction to Cellular Systems, Handoff Mechanism
Unit 4	Multiple Access Techniques: FDMA, TDMA, CDMA, OFDM, Comparison with other
	multiple access techniques
Unit 5	Modulation Techniques in Wireless Communication: Basics of Modulation, Analog
	Modulation Techniques, Digital Modulation Techniques
Unit 6	2G Cellular Networks: Introduction to 2G, GSM (Global System for Mobile
	Communications), GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates
	for GSM Evolution)
Unit 7	3G Cellular Networks: Introduction to 3G Networks, UMTS (Universal Mobile
	Telecommunications System), CDMA2000, Transition to 4G
Unit 8	4G & 5G Networks: Characteristics of 4G networks, LTE (LongTerm Evolution) &
	LTEAdvanced, Introduction to 5G Networks, 5G Technologies & Architectural Shifts,
	Applications of 5G Networks, Challenges and Issues in 5G
Unit 9	WLAN (Wireless Local Area Network: WLAN (Wireless Local Area Network): Basics of
	WLAN, WLAN Standards & Technologies, WLAN Architecture, WLAN Security
Unit 10	Bluetooth & Personal Area Networks: Introduction to Personal Area Networks (PANs),
	Bluetooth Technology Overview, Bluetooth Pairing & Connectivity, Other PAN
	Technologies, Security in PANs
Unit 11	Wireless Sensor Networks: Basics of Sensor Networks, WSN Architecture, Routing
	Protocols in WSN, Security in WSNs
Unit 12	Satellite Communication: Introduction to Satellite Communication, Satellite Orbits,
	Satellite Components, Satellite Applications
Unit 13	Security in Wireless Communication: Introduction to Wireless Security, Cryptography
	Basics, Attacks on Wireless Networks
Unit 14	Trends & Future of Wireless Communication: Integration of AI in Wireless
	Communication, Quantum Communication, Edge Computing in Wireless Networks

Unix and Shell Programming

Unit 1	Introduction to Unix: Origin an Evolution of Unix, Unix System Architecture, Basic
	Concepts and Terminologies, Popular Applications and Tools in Unix
Unit 2	Basic Commands: Introduction to Unix Command-Line Interface (CLI)
	Navigating the File System, File Operations, File Viewing and Manipulation, File
	Permissions and Ownership, Getting Help and Information
Unit 3	File System Structure: Understanding the Unix File System Hierarchy, File Types and
	Classifications, Inodes and File System Metadata
	Symbolic Links vs. Hard Links
Unit 4	Filters and Pipes: Introduction, Basic Filters
	Text Processing Filters, Combining Filters with Pipes
Unit 5	Redirection and Advanced Filtering and Transformation: Standard Input, Output, and
	Error, Redirection Operators, Advanced Filtering and Transformation
Unit 6	Processes in Unix: Introduction, Process Attributes, Process Creation and Termination,
	Signals and Process Communication, Inter-Process Communication (IPC)
Unit 7	Vi Editor: Introduction to Vi, Vi Modes, Basic Navigation, Basic Editing

	Searching and replacing			
Unit 8	Shell Scripting Basics – I: Introduction to Shell Scripting, Basic Script Structure,			
	Variables and Environment, User Input			
Unit 9	Shell Scripting Basics – II: Arithmetic Operations, Conditional Statements, Loops, Input			
	and Output, Functions			
Unit 10	File and String Operations in Scripts: File Reading Operations, File Writing Operations,			
	File Testing, Basics of String Operations			
	String Manipulation Commands, String Comparisons			
Unit 11	Advanced Shell Features: Introduction to Advanced Shell Features			
	Shell Environment Variables, Job Control			
Unit 12	System Administration Basics: User and Group Management			
	Disk Management, System Monitoring			
Unit 13	Networking in Unix: Basic Networking Commands, File Transfer Protocols			
Unit 14	Advanced Topics & Trends: Introduction to Advanced Shells, Automating System			
	Tasks, Current Trends in Unix and Shell Programming			

Bigdata

Unit 1	Introduction to Big Data: Definition and Characteristics of Big Data,
	Evolution and Importance of Big Data, Sources of Big Data, Big Data Challenges
Unit 2	Big Data Architecture: Introduction to Big Data Architecture, Data Sources and Data
	Collection
Unit 3	Blg Data Storage: Data Storage Architectures, Data processing Architectures
Unit 4	Big Data Processing: Introduction to MapReduce, Writing and Executing MapReduce
	Programs, Other Processing Models: Spark, Flink
Unit 5	Apache Spark & RDDs: Introduction to Spark, Resilient Distributed Datasets (RDD),
	Spark Operations: Transformations and Actions
Unit 6	Data Analysis using Spark: Introduction to SparkSQL, DataFrames and Datasets in
	Spark, Machine Learning with Spark (MLlib)
Unit 7	Big Data Visualization: Importance of Visualization, Tools for Big Data Visualization,
	Basic Visualization Techniques
Unit 8	Big Data in Cloud: Benefits of Cloud for Big Data, Introduction to Cloud Providers, Big
	Data Services in Cloud
Unit 9	Big Data Security & Privacy: Challenges in Big Data Security, Encryption,
	Authentication, and Authorization, Privacy Concerns and Regulations
Unit 10	Big Data Applications: Big Data in Business Analytics, Healthcare, Social Media, and
	Transportation, Real-time Analytics and Streaming Data
Unit 11	Big Data Tools and Platforms: Overview of Tools, Platform: Hadoop Ecosystem,
	Comparing Big Data Tools
Unit 12	Big Data Ethics and Regulations: Ethics in Data Collection and Analysis
	GDPR, CCPA, and Other Data Protection Regulations Bias and Fairness in Big Data
Unit 13	Future of Big Data: Trends in Big Data: Quantum Computing, AI Integration, Impact of
	5G on Big Data, Challenges and Opportunities Ahead
Unit 14	Knowledge of Practical Setup: Setting up Hadoop and Spark Environments, Performing
	Data Analysis using Tools Learned

Cloud Storage and Data Management

Unit 1	Introduction to Cloud Computing: Overview of Cloud Computing, Cloud
11	Service Models, cloud Deployment Models
Unit 2	Basics of Cloud Storage: Introduction to Cloud Storage, Types of Cloud
	Storage, Comparison with Traditional Storage Systems
Unit 3	Popular Cloud Storage Providers: Amazon Web Services (AWS), Google Cloud
	Storage (GCS), Microsoft Azure
Unit 4	Basics of Data Management: Introduction, Role of Metadata in Cloud Data
	Management, Data Lifecycle in Cloud
Unit 5	Database Services in the Cloud: Relational Databases in the Cloud, NoSQL
	Database Services, Database Migration to the Cloud
Unit 6	Data Security and Privacy: Data Encryption, Identity and Access Management
	(IAM), Best Practices for Cloud Data Security
Unit 7	Data Availability and Disaster Recovery: Redundancy and Replication
	Strategies, Backup Strategies in the Cloud, Cloud-based Disaster Recovery
	Solutions
Unit 8	Data Integration and APIs: Introduction, RESTful APIs, SDKs and Tools for
	Cloud Data Management
Unit 9	Data Analytics and the Cloud: Introduction to Big Data Analytics, Cloud Data
	Warehouses, Data Lakes, ETL (Extract, Transform, Load) Processes in the
	Cloud
Unit 10	Cloud Orchestration and Automation: Introduction, Cloud Orchestration
	Basics, Infrastructure as Code (IAC)
Unit 11	Content Delivery Networks (CDN): Introduction to CDNs, Basic Architecture of
	CDN, Integration with Cloud Storage
Unit 12	Hybrid Cloud Storage: Introduction to Hybrid Cloud, Role of Hybrid Cloud in
	Modern Business, Data Management in Hybrid Cloud
Unit 13	Cloud Storage Costs and Optimization: Understanding Cloud Storage Pricing,
	Cost Monitoring and Reporting, Strategies for Cost Optimization
Unit 14	Emerging Trends: Multi-cloud Strategies, Edge Computing and Cloud
	Serverless Data Management

Data Visualisation with Python

Unit 1	Introduction to Data Visualization: Introduction, Role of Data Visualization in
	Business & Science, Elements and Components of a Visualization, Data Types
	and Visual Encodings, Setting Up Python for Visualization
Unit 2	Basics of Matplotlib: Introduction, Advanced Matplotlib
Unit 3	Introduction to Seaborn: Introduction, Setting up Seaborn, Basic Seaborn
	Plots, Styling with Seaborn
Unit 4	Advanced Seaborn Techniques: Advanced Categorical Plots, Visualizing
	Statistical Relationships, Matrix Plots, FacetGrid and Multi-plot Grids
Unit 5	Time Series Visualization – I: Interactive Visualization with Plotly: Introduction
	to Plotly, Plotly Graph Objects, Interactivity in Plotly
Unit 6	Time Series Visualization – II: Introduction to Time Series, Handling Time
	Series Data in Python, Basic Time Series Plots, Seasonal Decomposition
Unit 7	Visualization in Data Science: Geospatial Data Visualization: Visualizing
	Seasonal Patterns, Multiple Time Series, Visualizing Frequency Domain
	Advanced Time Series Plots, Interactive Time Series Visualization

Unit 8	Geospatial Data Visualization: Introduction to Geospatial Data, Creating Maps with Python, Choropleth Maps
Unit 9	Visualization in Data Science: Introduction to Data Exploration, Visualization for Statistical Analysis, Correlation and Covariance Plots
Unit 10	Advanced Topics in Visualization: 3D Visualizations with Python, Network Visualization with NetworkX, Visualization with Large Datasets
Unit 11	Integrating Visualizations with Web Applications: Flask and Django, Embedding Matplotlib and Plotly Visualizations in Web Pages Creating Dashboards using Dash by Plotly
Unit 12	Tools & Extensions: Introduction to Jupyter and Jupyter Lab, Widgets for Interactive Visualizations, Exporting and Sharing Visualizations
Unit 13	Visualization Best Practices: Choosing the Right Type of Visualization, Ensuring Clarity and Minimizing Noise, Storytelling with Data
Unit 14	Trends & Real-World Applications: Data Journalism and Storytelling, Business Intelligence with Python Visualization, Evolution and Future of Data Visualization

Information Systems Security

Unit 1	Introduction to Information Security: Introduction to Information Security,
	Basics Principles of Information Security, Critical Concepts of Information
	Security, Components of the Information System, Balancing Information
	Security and Access. Implementing IT Security. The system Development Life
	cycle, Security professional in the organization
Unit 2	The Need for IT Security: Business Needs-Protecting the functionality.
	Enabling the safe operations. Protecting the data, safe guarding the
	technology asset
Unit 3	Security Threats and Vulnerabilities: Threats-compromises to Intellectual
	property, Deliberate software attacks, Espionage and trespass, sabotage and
	vandalism, Attacks-Malicious Codes, Back Door, Denial of Service and
	Distributed Denial of Service, Spoofing, sniffing, Spam
Unit 4	Cryptography: Basics of Cryptography, Symmetric Encryption: DES, AES
	Asymmetric Encryption: RSA, ECC, Digital Signatures and Certificates
Unit 5	Risk Management: Definition of risk management, risk identification, and risk
	control, Identifying and Accessing Risk, assessing risk based on probability of
	occurrence and likely impact, the fundamental aspects of documenting risk
	via the process of risk assessment, The various risk mitigation strategy option
	the categories that can be used to classify controls
Unit 6	Network Security -I: Understanding Infrastructure Security, Device Based
	Security, Media-Based Security, Monitoring and Diagnosing; Monitoring
	Network-Firewall
Unit 7	Network Security – II: Intrusion Detection System, Intrusion Prevention
	system; OS and Network Hardening, Application Hardening; Physical and
	Network Security- Policies Standards and Guidelines
Unit 8	Web Security: Web vulnerabilities: SQL Injection, Cross-Site Scripting (XSS),
	Session Management and Cookies Security, OWASP Top Ten
Unit 9	Application Security: Secure Coding Principles, Buffer Overflows, Input
	Validation and Parameterized Queries
Unit 10	Cloud and IoT Security: Cloud Security Challenges, IoT Vulnerabilities
	Best Practices for Cloud and IoT Security

Unit 11	Physical Security: Threats to Physical Infrastructure, Surveillance Systems	
	Biometric Security Systems	
Unit 12	Security Policies and Compliance: Importance of Security Policies, ISO/IEC	
	27001 Standards, GDPR and other Regulatory Compliances	
Unit 13	Disaster Recovery and Business Continuity: Importance of Backups	
	Recovery Strategies, Business Continuity Planning	
Unit 14	Current Trends and Challenges: Quantum Cryptography, AI in Security, Future	
	Threat Landscape	

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 Centre for Distance and 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 Service

The Student Support services will be facilitated by the Centre for Distance and 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 Centre for Distance and 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 Centre for Distance and Online Education-Manipal University, Jaipur shall fill up online application form available on CDOE-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 CDOEs not meet eligibility criteria, or there is failure to pay programme/course fees.
- Admission will stand cancelled, if candidate CDOEs not submit proof of eligibility within stipulated time given by Centre for Distance and Online Education-Manipal University, Jaipur.
- Centre for Distance and 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 1,35,000/- (One lakh Thirty Five 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	No. of Weeks	No. of Interactive Sessions		Hours of Study Material		Self- Study	Total Hours
	the course		Synchronous Online Counselling/ Webinars/ Interactive Live Lectures (1 hour per week)	Discussion Forum/ asynchron ous Mentoring (2 hours per week)	e- Tutorial in hours	e- Content hours	hours including Assessm ent etc.	of Study (based on 30 hours per credit)
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

SI No.	Event	Batch	Last Date (Tentative)		
1	Commencement of	January	1 st January		
	semester	July	1 st July		
2	Enrol student to	January	Within 2 working days of fee		
	Learning Management system	July	confirmation		
3	Assignment	January	March end and April end		
	Submission	July	September end and October end		
4	Submission of	January	30 th April		
	Synopsis (Applicable during Pre final semester)	July	30 th October		
5	Project Report	January	30 th April		
	Submission (Applicable during Final semester)	July	30 th October		
6	Webinars / Interactive Live	January	Mar to May		
	Discussion Forum for query resolution	July	September to November		
7	Admit Card	January	3 rd week of May		
	Generation	July	3 rd week of Nov		
8	Term End	January	2 nd week of June (TEE June)		
	Examination	July	2 nd Week of December (TEE December)		
9	Result Declaration of	January	Last week of August		
	End Term Examination	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 Marks	of	Grade Points	Letter Grade	Description
≥90 to ≤100		10	A+	Outstanding
≥80 to <90		9	А	Excellent
≥75 to <80		8	B+	Distinction
≥70 to <75		7	В	Very Good
≥60 to <70		6	C+	Good
≥50 to <60		5	С	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 =

Sum of the multiplication of grade points by the credits of the courses

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] = $\sum_{n} \sum_{i} C_{ni} G_{ni} / \sum_{n} \sum_{i} C_{ni}$

CGPA = Sum of the multiplication of grade points by the credits of the entire programme 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 co ncepts 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

Centre for Distance and 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:

SI. 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 BCA 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, Centre for Distance and 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 CDOE, 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 selfassessments regularly and use the results to improve its systems, processes etc. and finally quality of pro