



MANIPAL
UNIVERSITY JAIPUR
University under Section 2(f) of the UGC Act

PROGRAMME PROJECT REPORT (PPR)

For

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

CENTRE FOR DISTANCE AND ONLINE EDUCATION (CDOE)

MANIPAL UNIVERSITY JAIPUR

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PROGRAMME PROJECT REPORT

Introduction

The BCA programme of **Online Learning – Manipal University Jaipur** is directed at preparing students for the challenges of supervisory and middle level management positions in private or the public sector. The programme blends the core disciplines of Management and Information Systems into a balanced programme providing today's manager with the entire range of skills required to become an effective manager. In addition, the programme offers general business management courses to broaden the prospective manager's knowledge base.

1. Programme Mission and Objectives

The Bachelor of Computer Applications (BCA) programme aims to provide a high-quality undergraduate education in Computer Applications through the online learning mode. The programme equips students with strong technical competencies in software development, enabling them to excel in the software industry. In addition to technical expertise, the programme also focuses on the development of communication, interpersonal, and other essential soft skills. Overall, the BCA programme strives to nurture individuals who are academically proficient, professionally motivated, and industry ready.

The objectives of the BCA programme are to:

- Provide a strong foundation in computer science and information technology by developing conceptual understanding of programming, software development, databases, networking, and emerging computing technologies.
- Develop analytical, logical, and problem-solving abilities required for designing efficient computational solutions to real-world problems.
- Equip students with practical programming skills using contemporary programming languages, development tools, and computing platforms relevant to industry requirements.
- 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's 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 area of their choice, gain knowledge of not only managerial skills including analysis, databased 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 Learner

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

Semester 1		
Course Code	Course Name	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
Semester 2		

Course Code	Course Name	Credits
DCA1206	Basic Statistics and Probability	4
DCA1207	Data Structures	4
DCA1208	Database Management System	4
DCA1209	Principle 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 Name	Credits
DCA2105	Computer Organization and Architecture	4
DCA2106	Java Programming	4
DCA2107	Data Communication & Protocols	4
DCA2108	Operating Systems	4
DCA2109	PE1- Artificial Intelligence for Problem Solving	4
DCA2131	Java Programming Lab	1
DCA2132	Operating System Lab	1
Total Credits		22
Semester-4		
Course Code	Course Name	Credits
DCA2205	Python Programming	4
DCA2206	Software Engineering	4
DCA2207	Data Mining & Visualization	4
DCA2208	Introduction to Network Security	4
DCA2209	PE2- System Software	3
DCA2232	Python Programming Lab	1
DCA2233	Data Mining and Visualization Lab	1
Total Credits		21
Semester-5		
Course Code	Course Name	Credits
DCA3105	Mobile Application Development	4
DCA3106	Machine Learning	4
DCA3107	PE3 - Cloud Computing & Applications	4
DCA3133	Mobile Application Development - Lab	1
DCA3134	Machine Learning Lab	1
DCA3108	Aptitude and Technical Development	2
1. Electives		
DCA31E1	Distributed Systems	3
DCA31E2	Big Data Analytics	3
DCA31E3	Ethical Hacking	3
Total Credits		19
Semester-6		
Course Code	Course Name	Credits
DCA3203	Wireless Communication	4
DCA3204	Unix and Shell Programming	4
DCA3205	PE5 - Big Data	4
DCA3232	Unix and Shell Programming Lab	1

DCA3206	Project	2
1. Electives		
DCA31E4	Cloud Storage and Data Management	3
DCA31E5	Data Visualization with Python	3
DCA31E6	Information Systems Security	3
Total Credits		18
Grand Total credits		124

BCA Sem 1

Course Code: DCA1105	Course Title : Fundamentals of Mathematics
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Unit No	Unit Name & Unit description
1	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.
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.
3	Limit: Intuitive idea of limit, Limits of- Polynomial and Rational Functions, Trigonometric, Exponential and Logarithmic Functions, Continuity as a limit
4	Some Standard Limits: Definition of derivative using the limits, General Derivative Formulae's, Indeterminate Forms, Limit of indeterminate Forms
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
6	Special Functions - Part I: Trigonometric functions Inverse Trigonometric Function, exponential functions
7	Special Functions - Part II: Logarithmic functions, hyperbolic functions, inverse circular functions
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
9	Differentiation: Introduction, Geometric Interpretation of Differentiation, Theorems of Derivatives, Differentiation of Implicit Function, Higher Order Derivatives
10	Differentiation of Trigonometric Functions and Inverse Circular Functions: How to differentiate a function
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

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
13	Integration - Part II: Integration by parts, integration of rational functions
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)

Course Code: DCA1106	Course Title : Technical Communication
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Unit No	Unit Name & Unit description
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
2	Vocabulary Building: Word formation, Affixes, Compound words, Synonyms, Antonyms, Homophones and Homonyms, Misspelt words
3	Grammar Essentials: Punctuations, Parts of speech, Active and passive voice, Direct and indirect speech, Concord, Common errors
4	Effective Sentence Construction: Techniques of effective sentence constructions, Précis writing
5	Professional Communication: Emails, Memos, Reports, Proposals
6	Job Application Essentials & Interview Skills: Cover letter, Resume, LinkedIn profile, Interview skills
7	Public Speaking and Presentation Skills: Preparing a presentation, Body language, Voice modulation, Use of visual aids, Handling audience questions

Course Code: DCA1107	Course Title : C Programming
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Unit No	Unit Name & Unit description
1	Introduction to C: Importance, Program structure
2	Basics of C Programming: Data Types, Variables, Constants
3	I/O Operations in C: printf, scanf
4	Operators and Expressions: Operator precedence and associativity, arithmetic operators, relational operators, bitwise operators
5	Flow of Control Part 1: If-else statements, switch case statement
6	Flow of Control Part 2: Looping constructs - for, while, do-while
7	Arrays Part 1: Declaration, Initialization
8	Arrays Part 2: Sorting, Multi-dimensional arrays
9	Strings Part 1: String declaration and initialization, built-in string handling functions
10	Strings Part 2: Operations on strings, String manipulation programs

11	Functions Part 1: Introduction, Function declaration, definition and call
12	Functions Part 2: Types of functions, Function returning more values
13	Functions Part 3: Function with operators, function and decision statements, function and loop operators
14	Functions Part 4: Function with Arrays.

Course Code: DCA1108	Course Title : Fundamentals of Computers & Digital Systems
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Unit No	Unit Name & Unit description
1	Introduction to Computers: Digital and Analog signals, Block diagram of a computer hardware, Generation of Computers, Types of Computers
2	Memory and Storage Devices: Overview of memory, Types of memory, Traditional and Modern Storage Devices
3	Input and Output Devices: Various types of Input Devices, Various types of Output Devices
4	Introduction to Number Systems: Binary, Decimal, Octal, Hexadecimal
5	Boolean Algebra and Logic Gates: Boolean Algebra, De-Morgan's law, Simplification of Boolean algebra, Basic and Universal Logic Gates
6	Simplification Methods: K-map and Tabulation method
7	Combinational Circuits - Part 1: Introduction to Combinational circuit, Half Adder Circuit, Full Adder Circuit
8	Combinational Circuits - Part 2: Half Subtractor, Full Subtractor, Binary Parallel Adder, Carry Propagation, Magnitude Comparator
9	Advanced Combinational Circuits: Decoder, Encoder, Multiplexer, De-multiplexer Circuit, Design of Code Converter
10	Introduction to Sequential Circuits: Introduction to Latches & Flip Flops
11	Types of Flip Flops: S-R, D, J-K, T Flip Flop
12	Synchronous Counters: Overview and Design of Synchronous Counters
13	Asynchronous Counters: Overview and Design of Asynchronous Counters
14	Shift Registers: Overview and Use of Shift Registers

Course Code: DCA1109	Course Title: Introduction to Web Programming
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Unit No	Unit Name & Unit description
1	Introduction to HTML: Features, uses & versions of HTML, Syntax, Head & Body Sections
2	Advanced HTML Features: Inserting texts, Text alignment, Using images in pages, Hyperlinks – text and images, Bookmarks, Backgrounds and Color controls
3	Tables and Text Styling in HTML: Creating and using Tables in HTML, Use of font size & Attributes, List types and its tags

4	Introduction to CSS: Cascading Style sheets – defining and using simple CSS
5	HTML Forms: Introduction to HTML forms, Form Elements, Input Types, Form Attributes
6	Basic Web Designing: Introduction to Visual Design Principles, Website Creation and Maintenance
7	Introduction to JavaScript: The JavaScript Language, Syntax, Variables and Data Types, Statements, Operators
8	Advanced JavaScript: Literals, Functions, Objects, Arrays, Built-in Objects, JavaScript Debuggers
9	Data Representation in Web: Overview of JSON, Data Types, Parsing, Stringify
10	Introduction to HTTP: Basics of HTTP, HTTP Methods, Status Codes
11	Handling Cookies in JavaScript: Creating and Reading Cookies in JavaScript
12	Electronic Commerce: E – Business model, E – Marketing, Online payments and security
13	Understanding APIs in Web Development: What is an API?, Understanding REST APIs, Fetching data from APIs using JavaScript
14	Basic Web Accessibility: Introduction to Web Accessibility, Accessibility Guidelines and Best Practices

Course Code: DCA1110	Course Title: Environmental Science
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Unit No	Unit Name & Unit description
1	Introduction to Environmental Science: Multidisciplinary nature, scope and importance, sustainability and sustainable development
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
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
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
5	Environmental pollution and Policies – I: Type, causes, effects, and controls of Air, Water, and soil pollution.
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.
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

Course Code: DCA1206	Course Title : Basic Statistics and Probability
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Unit No	Unit Name & Unit description
1	Introduction to Basic Statistics: Population, Sample, Data Condensation, Definition and Scope of Statistics
2	Data Classification: Raw Data, Attributes and Variables, Classification, Frequency Distribution.
3	Measures of Central Tendency: Introduction: Concept of Central Tendency, Requirements of a Good Measure of Central Tendency
4	Measures of Central Tendency: Arithmetic Mean: Concept and Calculation of Arithmetic Mean.
5	Measures of Central Tendency: Median, Mode: Concept and Calculation of Median, Mode
6	Measures of Dispersion: Introduction: Concept of Dispersion, Absolute and Relative Measure of Dispersion
7	Measures of Dispersion: Range, Variance, and Standard Deviation: Range, Variance, Standard Deviation
8	Basic Counting Principles: Introduction to Basic Counting Principles, Simple Examples
9	Introduction to Probability: Sample Space, Events, Basic Probability Concepts.
10	Types of Experiments: Deterministic and Non-deterministic Experiments
11	Events in Probability: Discrete Sample Space, Events, Types of Events, Simple Event Operations
12	Probability Rules: Addition & Multiplication Rules of Probability
13	Conditional Probability and Independence: Introduction to Conditional Probability, Independent Events
14	Simple Probability Problems: Understanding and Solving Simple Probability Problems

Course Code: DCA1207	Course Title : Data Structures
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Unit No	Unit Name & Unit description
1	Introduction to Data Structures: Definitions, Concept of Data Structures, Overview of Data Structures
2	Introduction to Arrays: Definitions, Terminologies
3	One-Dimensional Array: Memory Allocation, Operations on Array, Application of Arrays
4	Introduction to Multidimensional Arrays: Two-Dimensional Array Representation
5	Introduction to Linked Lists: Definition, Single Linked List

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

Course Code: DCA1208	Course Title : Database Management Systems
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Unit No	Unit Name & Unit description
1	Introduction to DBMS: Concept of Database, Characteristics of Database Approach, Importance of DBMS, Overview of DBMS
2	Database Systems: Types of Database Systems, Advantages and Disadvantages of DBMS
3	Data Models: Concept of Data Models, Types of Data Models, Overview of Relational Model
4	Introduction to ER Models: Concept of Entity-Relationship Model, Entities and Attributes, Relationships, Keys
5	ER Diagrams: Components of ER Diagram, Symbols and Notations of ER Diagram, Converting ER Diagrams into Tables
6	Introduction to Relational Model: Concepts, Terminologies, Codd's Rules, Keys in Relational Model
7	Relational Algebra: Basic Operations of Relational Algebra, Derived Operations
8	Introduction to SQL: SQL Syntax, Data Types, Basic SQL Commands
9	SQL Querying: SQL Select Statement, Where Clause, SQL Operators, SQL Joins
10	Data Manipulation in SQL: Insert, Update and Delete Statements, Truncate, Drop and Alter Commands
11	Introduction to Normalization: Concept of Functional Dependencies, Introduction to Normalization, First Normal Form (1NF)
12	Normalization and Normal Forms: Second Normal Form (2NF), Third Normal Form (3NF), BCNF
13	Introduction to Transaction Processing: Concept of Transactions, Properties of Transactions (ACID Properties)
14	Cursors and Triggers in SQL: Concept of Cursors, Working with Cursors, Concept of Triggers, Working with Triggers

Course Code: DCA1209	Course Title : Principle of Programming Languages
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Unit No	Unit Name & Unit description
1	Introduction: Programming language design, Compilation vs interpretation, Programming environments
2	Language Spectrum and Study Motivation: Different paradigms, Mixed-level languages, Motivation for studying programming languages
3	Names, Scope, and Bindings: Concept of binding time, Object lifetime and storage management
4	Implementing Scope and Separate Compilation: Scope rules, Binding of reference environments, Separate compilation
5	Control Flow: Structured and Unstructured: Expression evaluation, Sequencing, Selection, Iteration
6	Control Flow: Recursion and Non-determinacy: Concept and implementation of recursion, Concept of non-determinacy
7	Data Types: Basic and Composite: Type systems, Type checking, Records and variants
8	Data Types: Special and Abstract: Arrays, Strings, Sets, Pointers, Recursive types, Lists, Files, Tuples, Hash Maps
9	Subroutines and Control Abstraction: Stack layout, Calling sequences, Parameter passing, Generic subroutines and modules
10	Exception Handling and Co-routines: Concept and implementation of exception handling, Concept and use of co-routines
11	Data Abstraction and Object Orientation: Object oriented programming, Encapsulation, Inheritance, Polymorphism, Interfaces, Dynamic method binding
12	Functional Programming: Origins, Concepts, Scheme, Evaluation order, Higher-order functions
13	Concurrent Programming: Concepts, thread Management, Synchronization
14	Scripting Languages: Python: Concepts, Use cases, JavaScript: Concepts, Use cases

Course Code: DCA1210	Course Title : Object Oriented Programming Using C++
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Unit No	Unit Name & Unit description
1	Introduction to Object-Oriented Programming: Evolution of OOP, Characteristics of OOP, Difference between C and C++
2	Basic Structure of C++: Keywords, Identifiers, Data Types, Variables Declaration and Definition, Constants
3	Operators and Program Structure in C++: Operators, C++ Program Structure, Control and Conditional Statement
4	Type Casting and Pointers in C++: Type Casting, Introduction to Pointers, Dynamic Memory Allocation, Memory Deallocation
5	Arrays in C++: Introduction to Arrays, Types of Arrays, Array Operations
6	Introduction to Classes and Objects: Concept of Classes and Objects, Data Members and

	Member Functions, Returning Objects, Array of Objects
7	Scope Resolution and Constructors/Destructors in C++: Scope Resolution Operator, Constructor and Destructor, Function Overloading
8	Advanced Object-Oriented Concepts: Friend Function, Inline Function, Operator Overloading
9	Inheritance in C++: Introduction to Inheritance, Types of Inheritance, Access Controllers
10	Virtual Functions and Abstract Classes: Concept of Virtual Functions, Introduction to Abstract Classes
11	Introduction to I/O Streams: Streams Hierarchy, Input Streams, Output Streams
12	File and Cloud Storage Operations in C++: Implementing Various File Operations on Basic Data Types, Random Access Files, Introduction to Cloud Storage Operations
13	Exception Handling in C++: Introduction to Exception Handling, try-catch Block, Throwing Exceptions
14	C++ Standard Library: Overview of C++ Standard Library, Basic Usage, Practical Examples

BCA Sem 3

Course Code: DCA2105	Course Title : Computer Organization and Architecture
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Unit No	Unit Name & Unit description
1	Introduction to Computer Architecture: Block Diagram of Computer, Memory Section, Input/Output Section, CPU
2	Central Processing Unit: Registers, Arithmetic Unit, Instruction Handling Areas, Stacks
3	Micro Operations: Register Transfer, Bus and Memory Transfer, Arithmetic Micro operations
4	Logic and Shift Micro Operations: Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit
5	Basic Computer Organization and Design: Instruction Codes, Operation Code, Timing and Control
6	Instruction Cycle: Memory Reference Instructions, Input Output Instructions and Interrupts
7	Control Memory: Control Word, Microinstruction, Microprogramming, Control Memory, Hardwired
8	Central Processing Unit: Organization: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes
9	Introduction to CPU Architectures: Superscalar, VLIW, and SIMD architectures
10	Pipelining and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Vector Processing, Array Processors
11	Input Output Organization: I/O Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt
12	Advanced I/O Mechanisms: DMA, IOP, Serial Communication
13	Memory Organization: Associative Memory, Cache Memory, and Virtual Memory
14	Introduction to Modern Microprocessors: Overview of modern microprocessors such as ARM, MIPS, and x86.

Course Code: DCA2106	Course Title : Java Programming
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Unit No	Unit Name & Unit description
1	Introduction to Java: Overview of Java, Features of Java, Comparing Java and C++
2	Basic Syntax in Java: Data types, Identifiers
3	Introduction to Object-Oriented Programming in Java: Class, Object, Method, Constructor, Encapsulation, Abstraction
4	Arrays in Java: One-Dimensional Array, Multi-Dimensional Array
5	Inheritance in Java: Inheritance Basics, Method Overriding, Abstract Class, Final Class, Multilevel Hierarchy
6	String Handling: String Class, String Constructors, String Operations
7	Packages and Interfaces in Java: Creating, Implementing and Importing Packages, Interfaces and Their Uses
8	Exception Handling in Java: Exception Handling Basics, Types of Exceptions, Catch Clauses, Java's Built-in Exceptions
9	Multithreading in Java: Creating Threads, Thread Priorities, Synchronization, Suspending, Resuming and Stopping Threads
10	Basic Java Packages: Classes and Methods in java.lang, java.util, java.io
11	Event Handling in Java: Event Handling Basics, Event Model, Event Classes, Event Listener Interfaces
12	Introduction to GUI in Java: Introduction to Swing, Swing Components
13	Advanced GUI in Java: Using Swing Components, Layout Managers in Swing
14	Introduction to Java Frameworks: Basics of Spring Framework

Course Code: DCA2107	Course Title : Data Communication and Protocols
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Unit No	Unit Name & Unit description
1	Data Transmission : Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity
2	Transmission Media : Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission
3	Signal Encoding Techniques : Analog and Digital Signals, Digital-To-Digital Conversion: Line Coding Schemes, Block Coding, Scrambling
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
5	Digital Data Communication Techniques : Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations
6	Data Link Control Protocols : Flow Control, Error Control, High-Level Data Link Control (HDLC)
7	Multiplexing-1: Frequency-Division Multiplexing (FDM), Time-Division Multiplexing (TDM),

8	Multiplexing -2 : CDMA, CSMA, OFDMA
9	Spread Spectrum : The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS)
10	Cellular Wireless Communication Techniques-I : Introduction, Generations: 1G, 2G, 3G,4G
11	Cellular Wireless Communication Techniques-II : Generations: 5G and introduction to 6G
12	Introduction to Network Protocols-I : Understanding the TCP/IP model, IP addressing
13	Introduction to Network Protocols-II : TCP and UDP, DNS, HTTP, FTP
14	Network Security : Basic concepts, Encryption and Decryption, Firewalls, VPN

Course Code: DCA2108	Course Title : Operating Systems
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Unit No	Unit Name & Unit description
1	Introduction to Operating Systems: Basic concepts, Types of Operating Systems: Simple Batch Systems, Multi-programmed Batched Systems, Time Sharing Systems
2	Operating Systems Architecture: Operating System Structure, System Components, Protection
3	Introduction to Processes: Process Concept, Operation on Processes, Cooperating Processes
4	Inter-Process Communication: Inter-process Communication, Message Passing, Process Scheduling
5	CPU Scheduling: Scheduling Criteria, Scheduling Algorithms
6	Process Synchronization: Critical-Section Problem: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware
7	Process Synchronization: Semaphores: Semaphore Concept, Semaphore Usage, Basics of Semaphores
8	Deadlocks: Deadlock Characterization, Deadlock Prevention and Avoidance
9	Deadlocks: Detection and Recovery: Deadlock Detection, Recovery from Deadlock
10	Memory Management: Logical vs Physical Address Space, Swapping, Contiguous Allocation
11	Memory Management: Paging: Concept of Paging, Hardware and Software Aspects of Paging
12	Virtual Memory: Demand Paging, Benefits of Virtual Memory
13	Page Replacement: Page Replacement, Page-replacement Algorithms
14	Overview of Modern Operating Systems: Case Study on Modern Operating Systems like UNIX, Linux, Windows, Introduction to Cloud Operating Systems

Course Code: DCA2109	Course Title : Artificial Intelligence for Problem Solving
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Unit No	Unit Name & Unit description
1	Introduction to AI: Definition and Importance of AI, Application of AI, Intelligent Agents
2	Problem Solving Techniques: Goal formulation, Problem types, Problem-solving agents
3	Uninformed Search Techniques: Breadth-first search, Depth-first search, Iterative deepening
4	More Uninformed Search Techniques: Bidirectional search, Hill climbing, Uniform cost search
5	Informed Search Techniques: Heuristics, Greedy search, A* search
6	More Informed Search Techniques: AO* search, Constraint satisfaction problems
7	Game Playing: Minimax Algorithm, Alpha-beta pruning
8	Game Playing: Introducing basic games and strategies
9	Knowledge and Reasoning: Introduction to logical reasoning, Basic concepts of propositional logic
10	Knowledge Representation: Semantic Networks, Frame, Scripts, Situation calculus
11	Reasoning Techniques: Forward chaining, Backward chaining, Resolution
12	Planning in AI: Planning problem, Partial order planning, Planning graphs
13	Uncertain Knowledge and Reasoning: Introduce basics of probability and probabilistic reasoning
14	Machine Learning Basics: Supervised, Unsupervised, Reinforcement Learning

BCA Sem 4

Course Code: DCA2205	Course Title : Python Programming
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Unit No	Unit Name & Unit description
1	Introduction to Python: Python overview, installation, Python Shell, Python script execution
2	Python Basics: Expressions, Data types, Variables, Operators
3	Control Flow in Python: Conditional Statements, Looping constructs
4	Python I/O Operations: Standard I/O, File I/O
5	Data Structures (Part 1): Lists: Basics, Operations, Slicing, List comprehension
6	Data Structures (Part 2): Sets: Basics, Operations
7	Data Structures (Part 3): Tuples: Basics, Operations
8	Data Structures (Part 4): Dictionaries: Basics, Operations
9	Functions in Python (Part 1): Basics of Functions, Function Definitions, Calling Functions
10	Functions in Python (Part 2): Recursion,
11	Object Oriented Programming in Python (Part 1): Classes, Objects, Class and Instance Variables
12	Object Oriented Programming in Python (Part 2): Inheritance, Polymorphism
13	The Python Standard Library (Part 1): Strings and Text Handling, Networking
14	The Python Standard Library (Part 2): Database Access

Course Code: DCA2206	Course Title : Software Engineering
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Unit No	Unit Name & Unit description
1	Introduction to System Concepts: Definition, Elements of System, Characteristics of System, Types of System, System Concepts
2	Introduction to Software Engineering: Definition, Need for Software Engineering, Software Characteristics, Software Qualities (McCall's Quality Factors)
3	Requirement Analysis: Definition of System Analysis, Requirement Anticipation, Knowledge and Qualities of System Analyst, Role of a System Analyst
4	Feasibility Study and Types: User Transaction Requirement, User design Requirements, SRS(System Requirement Specification)
5	Software Development Methodologies: SDLC (System Development Life Cycle), Waterfall Model, Iterative and Incremental Development
6	Advanced Software Development Methodologies: Spiral Model, Prototyping Model, Introduction to Agile Model, RAD and Lean Software Development
7	Analysis Tools: Entity Relationship Diagrams, Data Flow Diagrams (DFD), Data Dictionary & Elements of Data Dictionary
8	Design Tools: Pseudo code, Input and Output Design, UML Diagrams
9	Structured System Design: Modules Concepts and Types of Modules, Structured Chart
10	Good Design Principles: Qualities of Good Design, Coupling, Types of Coupling, Cohesion, Types of Cohesion
11	Software Testing: Definition, Test characteristics, Verification and Validation
12	Black Box Testing: Understanding Black Box Testing, Equivalence Partitioning and Boundary Value Analysis
13	White Box Testing: Understanding White Box Testing, Statement and Branch Coverage
14	Advanced Software Testing: Stress Testing, Performance Testing, Load Testing and Usability Testing

Course Code: DCA2207	Course Title : Data Mining & Visualization
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Unit No	Unit Name & Unit description
1	Introduction to Data Mining: Importance of Data Mining, Data Mining functionalities, Basic Data Mining structure, Data Mining Applications
2	Operational Database and Data Warehouse: Differences between Operational Database and Data Warehouse
3	Multidimensional Data Model: Data Cubes. Schemas, Measures, Data Reprocessing
4	Data Mining Primitives: Data Cleaning, Data Integration and Transformation
5	Data Reduction: Discretization and concept of Hierarchy Generation
6	Schema Design: Star and snow-Flake Schema
7	Data Mining Algorithms: Part 1: Association Rule Mining
8	Data Mining Algorithms: Part 2: Classification and Clustering Basics

9	Introduction to Data Visualization: Importance of data visualization, data types, different tools for data visualization
10	Understanding Graphs: Two-dimensional graph, three-dimensional graph
11	Introduction to Dashboard: Need of dashboards
12	Chart Types: Part 1: Pie Chart, Bar Chart, Histogram, Gantt Chart, Heat Map, Box and Whisker Plot
13	Chart Types: Part 2: Waterfall Chart, Area Chart, Scatter Plot, Pictogram Chart, Timeline, Highlight Table, Bullet Graph
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

Course Code: DCA2208	Course Title : Introduction to Network Security
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Unit No	Unit Name & Unit description
1	Introduction to Network Security: Network security goals, Assurance, Authenticity, Trust management, Anonymity
2	Threats and Attacks: Eavesdropping, Alteration, Denial-of-service, Masquerading, Repudiation, Correlation and traceback
3	Security Principles: Economy of mechanism, Fail-safe defaults, Complete mediation, Open design
4	More Security Principles: Separation of privilege, Least privilege, Least common mechanism, Psychological acceptability, Work factor, Compromise recording
5	Access Control: Access Control, Role-based access control
6	Cryptosystems: Symmetric cryptosystems, Symmetric key distribution, Public-key cryptography
7	Digital Security: Digital signatures, Hash functions, Message authentication codes, Digital certificates
8	Passwords, Social Engineering, Cybersecurity Education: Passwords, Password complexity, Social Engineering, Cybersecurity education and awareness training
9	Physical Security: Physical Security: Authentication, TEMPEST, RFID, Biometrics
10	Operating System and Application Security: Operating System Concepts and Buffer-over-flow, Operating System Security Application Program Security, Malware
11	Network Security: Protocols: ARP, ICMP, Sniffing, IP Spoofing
12	Network Security: Sessions and Attacks: TCP, UDP, NAT, TCP Session Hijacking, DoS
13	Network Security: Services, Devices and IoT: DNS, SSH, VPN, IPSec, SSL, Firewall, Wireless security, IoT security
14	Web Security and Cybercrime: Web Security, Cryptography, Security Models and Practice, Digital Right Management, Spam and Cybercrime

Course Code: DCA2209	Course Title : System Software
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Unit No	Unit Name & Unit description
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.
2	Language Processor: Language Processing activities, Fundamentals of language processing, Fundamentals of language specification, Language processor development tools.
3	Assemblers: Introduction to Assembler, Assembler Directives, Forward Reference, Types of Assemblers, Data Structure of Assembler, Assembler Design One Pass Assembler, Two Pass Assembler.
4	Macros and Macro Processor: Macro definition and Call, Macro expansion, Nested macro calls, Advanced macro facility, Design of macro processor.
5	Loaders: Basic functions of loader, Design, A Simple Bootstrap Loader, Machine dependent loader feature, Machine Independent loader features, Loader design options.
6	Linker: Introduction to Linker, Relocation and Linking Concepts, Design a Linker, Self-relocating Programs, Linking for Overlays.
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.
8	Text Editor: Text Editor: An Introduction, Interactive Debugging System, Debugging Functions and Capabilities, Relationship with Other Parts of the System, User interface Criteria.
9	Device Driver – I: Device Driver, Role of Device, Drivers, Classes of Devices, Security issues, Design issues.
10	Device Driver – II: PCI Bus Drivers, The Peripheral Component Interconnect (PCI) Interface, USB Drivers
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.
12	Android Operating System: Android Operating System, Android Architecture, Linux Kernel, Android Architecture Libraries, Android Architecture Application Framework, Applications, Security and Permission.

BCA Sem 5

Course Code: DCA3105	Course Title : Mobile Application Development
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Unit No	Unit Name & Unit description
1	Introduction to Android: Android and its versions, features, various Android devices on the market, The Android Market application store
2	Android Development Environment: System Requirements, Android SDK, Installing Java, Android Studio
3	Overview of Threads: The Application Main Thread
4	Multimedia in Android: Audio, Video, Camera Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures
5	Android Architecture: The Android Software Stack, The Linux Kernel, Android Runtime (ART), Android Runtime – Core Libraries
6	Android Software Development Platform: Understanding Java SE, Kotlin and the ART, The Directory Structure of an Android Project, Common Default Resources Folders
7	Android Framework Overview: Android Application Components, Android Activities, Android Services, Broadcast Receivers, Content Providers, Android Intent Objects, Android Manifest XML
8	Understanding Android Views: View Groups and Layouts, Designing for Different Android Devices, Views and View Groups, Android Layout Managers, The View Hierarchy
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
10	Displaying Pictures: Gallery, ImageSwitcher, GridView, and ImageView views to display images, Creating Animation
11	Saving and Loading Files: Android file management
12	SQLite Databases: Room Database, Android Database Design
13	Exposing Access to a Data Source: Room Library, LiveData, ViewModel, Data Binding
14	Android Application Development: Practical aspects of developing an Android application, Best practices, Using Kotlin, Latest trends and frameworks in Android development

Course Code: DCA3106	Course Title : Machine Learning
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Unit No	Unit Name & Unit description
1	Introduction to Machine Learning: Basics of Machine Learning
2	Supervised Machine Learning: Overview, Applications and Examples
3	K- Nearest Neighbors: Introduction, Algorithm, Examples
4	Naïve Bayes: Concept, Mathematical Background, Applications
5	Decision Trees: Decision Tree Algorithms, Applications
6	Support Vector Machines: Introduction, Optimization Problem, Kernel trick
7	Unsupervised Machine Learning: Introduction, Applications
8	Cluster Analysis: Types of Clustering, Clustering Algorithms
9	K-Means Clustering: Algorithm, Advantages and Disadvantages

10	Association Rule Mining: Introduction, Applications, Challenges
11	Apriori Algorithm: Explanation, Examples, Applications
12	Regression Analysis: Basics, Types of Regression
13	Linear and Nonlinear Regression: Concepts, Use-cases
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)

Course Code: DCA3107	Course Title : Cloud Computing & Applications
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Unit No	Unit Name & Unit description
1	Introduction to Cloud Computing: Evolution, Benefits, Barriers, Cloud SPI Models, Comparison with Cluster Computing
2	Understanding Cloud Computing Architectures: NIST Cloud Architecture, Modern Cloud Architecture, Types of Hypervisor
3	Cloud Characteristics, Service Models, and Deployment: Models and Characteristics of Cloud Computing, Differences between Different Service Models
4	Overview of Technology Involved in Cloud Computing: Overview of Hardware, Software and Infrastructure required for Cloud Computing
5	Data Centers and Containerization in Cloud Computing: Classic Data Centers Vs. Virtualized Data Centers, Storage Virtualization, Overview of Containerization, Docker, Kubernetes
6	Compute Virtualization: Virtual Machine Components, Compute Virtualization Techniques, Converting Physical to Virtual Machines
7	Desktop and Application Virtualization: Understanding Desktop and Application Virtualization, Benefits and Challenges
8	Virtualized Data Center Networking: Network Virtualization in VDC, VDC Network Infrastructure and Components, VLAN and VSAN
9	Service Management in Cloud Computing: Service Level Agreements, Quality of Service, Billing and Accounting, Scaling Cloud Hardware
10	Data Management in Cloud Computing: Data Security and Storage, Data Privacy, Access Management
11	Cloud Security and Privacy: Infrastructure Security, Data Security and Privacy
12	Standards and Interoperability in Cloud Computing: Understanding Cloud Computing Standards, Interoperability Challenges
13	Migration to Cloud Computing: Technical Considerations for Migration, Benefits and Challenges
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

Elective-1

Course Code: DCA31E1	Course Title : Distributed Systems
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Unit No	Unit Name & Unit description
1	Introduction to Distributed Systems: Distributed System definition, goals, system architecture, distributed computing models, advantages, disadvantages, design issues
2	Basics of Distributed Shared Memory (DSM): Definition, architecture, File Model and their architecture, access models, file applications
3	Detailed Study of Distributed Shared Memory (DSM): Continuation of DSM architecture, discussion on data consistency models, memory coherence, replication, and caching
4	Inter Process Communications: Part 1: Client-Server communication, Introduction to Remote Procedure Calls (RPCs), RPC architecture
5	Inter Process Communications: Part 2: Detailed discussion on Synchronization in distributed systems, Clock synchronization, Event ordering
6	Mutual Exclusion in Distributed Systems: Need for mutual exclusion in distributed systems, Algorithms for distributed mutual exclusion
7	Distributed Scheduling: Issues, components, types, and algorithms of distributed scheduling
8	Deadlocks in Distributed Systems: Part 1: Understanding deadlocks, Issues in deadlock detection and resolution
9	Deadlocks in Distributed Systems: Part 2: Deadlock handling strategies, Algorithms for deadlock detection and resolution
10	Distributed File Systems: Basics of distributed file systems, Design issues, Case study of NFS
11	Replication and Fault Tolerance: Need for replication, Fault-tolerance, Replication for performance, for reliability
12	Multimedia in Distributed Systems: Multimedia data standards, QoS management, Modern protocols for multimedia transmission

Elective-2

Course Code: DCA31E2	Course Title : Big Data Analytics
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Unit No	Unit Name & Unit description
1	Introduction to Big Data: Understanding Big Data, Characteristics of Big Data (Volume, Variety, Velocity, Veracity), Importance and Benefits of Big Data
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
3	Big Data Technologies Overview: Hadoop Ecosystem, NoSQL Databases, In-memory Databases, Data Warehousing
4	Introduction to Hadoop: Overview of Hadoop, Hadoop Architecture, HDFS, MapReduce
5	Advanced Hadoop Components: Overview of Hive, Pig, HBase, Zookeeper

6	NoSQL Databases: Understanding NoSQL Databases, CAP Theorem, Types of NoSQL Databases (Document, Key-Value, Columnar, Graph)
7	Introduction to Big Data Analytics: Overview of Big Data Analytics, Descriptive Analytics, Predictive Analytics, Prescriptive Analytics
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
9	Text Analytics and Natural Language Processing: Understanding Text Analytics, Natural Language Processing Techniques, Sentiment Analysis
10	Social Media and Web Analytics: Understanding Social Media Analytics, Web Analytics, Social Network Analysis
11	Big Data Visualization: Principles of Data Visualization, Tools for Big Data Visualization, Visualizing Large Datasets
12	Privacy and Ethics in Big Data: Understanding Data Privacy, Ethical Considerations in Big Data, Regulations and Compliance

Elective-3

Course Code: DCA31E3	Course Title : Ethical Hacking
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Unit No	Unit Name & Unit description
1	Introduction to Ethical Hacking: Understanding Ethical Hacking, Difference between Ethical Hacking and Hacking, Ethical Hacking concepts, Hacking Phases
2	Ethics and Legality: Ethical Hacking Ethics, Hacking Laws and Penalties, Reporting Security Incidents
3	Footprinting and Reconnaissance: Information Gathering, Google Hacking, Social Engineering Techniques
4	Scanning Networks: Understanding IP Addresses, Network Scanning Techniques, Port Scanning, Vulnerability Scanning
5	System Hacking: Password Cracking Techniques, Privilege Escalation, Spyware, Keyloggers, Covering Tracks
6	Malware Threats: Understanding Viruses, Worms, Trojans, Bots, Ransomware, Antivirus Evasion Techniques
7	Sniffing and Spoofing: Network Sniffing Techniques, MAC Spoofing, IP Spoofing, DNS Spoofing
8	Social Engineering: Types of Social Engineering, Phishing, Baiting, Quid Pro Quo, Pretexting
9	Denial of Service: Understanding Denial of Service and Distributed Denial of Service Attacks, Botnets, DoS/DDoS Countermeasures
10	Session Hijacking: Understanding Session Hijacking, Session Hijacking Tools and Techniques, Session Hijacking Countermeasures
11	Web Server and Web Application Attacks: Web Server Attacks, Web Application Vulnerabilities, SQL Injection, Cross-Site Scripting, Cross-Site Request Forgery

12	Wireless Network Hacking: Wireless Networks Vulnerabilities, Wi-Fi Hacking Techniques, Wi-Fi Security
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BCA Sem 6

Course Code: DCA3203	Course Title: Wireless Communication
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Unit No	Unit Name & Unit description
1	Introduction to Wireless Communication: Evolution of Mobile Communication Systems, Challenges in Wireless Communication
2	Basics of Electromagnetic Spectrum: Introduction to the Electromagnetic Spectrum, Basics of Antennas
3	Cellular Concepts and Design: Introduction to Cellular Systems, Handoff Mechanism
4	Multiple Access Techniques: FDMA, TDMA, CDMA, OFDM, Comparison with other multiple access techniques
5	Modulation Techniques in Wireless Communication: Basics of Modulation, Analog Modulation Techniques, Digital Modulation Techniques
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)
7	3G Cellular Networks: Introduction to 3G Networks, UMTS (Universal Mobile Telecommunications System), CDMA2000, Transition to 4G
8	4G & 5G Networks: Characteristics of 4G networks, LTE (LongTerm Evolution) & LTE Advanced, Introduction to 5G Networks, 5G Technologies & Architectural Shifts, Applications of 5G Networks, Challenges and Issues in 5G
9	WLAN (Wireless Local Area Network): WLAN (Wireless Local Area Network): Basics of WLAN, WLAN Standards & Technologies, WLAN Architecture, WLAN Security
10	Bluetooth & Personal Area Networks: Introduction to Personal Area Networks (PANs), Bluetooth Technology Overview, Bluetooth Pairing & Connectivity, Other PAN Technologies, Security in PANs
11	Wireless Sensor Networks: Basics of Sensor Networks, WSN Architecture, Routing Protocols in WSN, Security in WSNs
12	Satellite Communication: Introduction to Satellite Communication, Satellite Orbits, Satellite Components, Satellite Applications
13	Security in Wireless Communication: Introduction to Wireless Security, Cryptography Basics, Attacks on Wireless Networks
14	Trends & Future of Wireless Communication: Integration of AI in Wireless Communication, Quantum Communication, Edge Computing in Wireless Networks

Course Code: DCA3204	Course Title: Unix and Shell Programming
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Unit No	Unit Name & Unit description
1	Introduction to Unix: Origin and Evolution of Unix, Unix System Architecture, Basic Concepts and Terminologies, Popular Applications and Tools in Unix
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
3	File System Structure: Understanding the Unix File System Hierarchy, File Types and Classifications, Inodes and File System Metadata Symbolic Links vs. Hard Links
4	Filters and Pipes: Introduction, Basic Filters Text Processing Filters, Combining Filters with Pipes
5	Redirection and Advanced Filtering and Transformation: Standard Input, Output, and Error, Redirection Operators, Advanced Filtering and Transformation
6	Processes in Unix: Introduction, Process Attributes, Process Creation and Termination, Signals and Process Communication, Inter-Process Communication (IPC)
7	Vi Editor: Introduction to Vi, Vi Modes, Basic Navigation, Basic Editing Searching and replacing
8	Shell Scripting Basics – I: Introduction to Shell Scripting, Basic Script Structure, Variables and Environment, User Input
9	Shell Scripting Basics – II: Arithmetic Operations, Conditional Statements, Loops, Input and Output, Functions
10	File and String Operations in Scripts: File Reading Operations, File Writing Operations, File Testing, Basics of String Operations String Manipulation Commands, String Comparisons
11	Advanced Shell Features: Introduction to Advanced Shell Features Shell Environment Variables, Job Control
12	System Administration Basics: User and Group Management Disk Management, System Monitoring
13	Networking in Unix: Basic Networking Commands, File Transfer Protocols
14	Advanced Topics & Trends: Introduction to Advanced Shells, Automating System Tasks, Current Trends in Unix and Shell Programming

Course Code: DCA3205	Course Title : Big Data
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Unit No	Unit Name & Unit description
1	Introduction to Big Data: Definition and Characteristics of Big Data, Evolution and Importance of Big Data, Sources of Big Data, Big Data Challenges
2	Big Data Architecture: Introduction to Big Data Architecture, Data Sources and Data Collection
3	Big Data Storage: Data Storage Architectures, Data processing Architectures
4	Big Data Processing: Introduction to MapReduce, Writing and Executing MapReduce Programs, Other Processing Models: Spark, Flink
5	Apache Spark & RDDs: Introduction to Spark, Resilient Distributed Datasets (RDD), Spark Operations: Transformations and Actions

6	Data Analysis using Spark: Introduction to SparkSQL, DataFrames and Datasets in Spark, Machine Learning with Spark (MLlib)
7	Big Data Visualization: Importance of Visualization, Tools for Big Data Visualization, Basic Visualization Techniques
8	Big Data in Cloud: Benefits of Cloud for Big Data, Introduction to Cloud Providers, BigData Services in Cloud
9	Big Data Security & Privacy: Challenges in Big Data Security, Encryption, Authentication, and Authorization, Privacy Concerns and Regulations
10	Big Data Applications: Big Data in Business Analytics, Healthcare, Social Media, and Transportation, Real-time Analytics and Streaming Data
11	Big Data Tools and Platforms: Overview of Tools, Platform: Hadoop Ecosystem, Comparing Big Data Tools
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
13	Future of Big Data: Trends in Big Data: Quantum Computing, AI Integration, Impact of 5G on Big Data, Challenges and Opportunities Ahead
14	Knowledge of Practical Setup: Setting up Hadoop and Spark Environments, Performing Data Analysis using Tools Learned

Elective-1

Course Code: DCA31E4	Course Title : Cloud Storage and Data Management
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Unit No	Unit Name & Unit description
1	Introduction to Cloud Computing: Overview of Cloud Computing, Cloud Service Models, Cloud Deployment Models
2	Basics of Cloud Storage: Introduction to Cloud Storage, Types of Cloud Storage, Comparison with Traditional Storage Systems
3	Popular Cloud Storage Providers: Amazon Web Services (AWS), Google Cloud Storage (GCS), Microsoft Azure
4	Basics of Data Management: Introduction, Role of Metadata in Cloud Data Management, Data Lifecycle in Cloud
5	Database Services in the Cloud: Relational Databases in the Cloud, NoSQL Database Services, Database Migration to the Cloud
6	Data Security and Privacy: Data Encryption, Identity and Access Management (IAM), Best Practices for Cloud Data Security
7	Data Availability and Disaster Recovery: Redundancy and Replication Strategies, Backup Strategies in the Cloud, Cloud-based Disaster Recovery Solutions
8	Data Integration and APIs: Introduction, RESTful APIs, SDKs and Tools for Cloud Data Management
9	Data Analytics and the Cloud: Introduction to Big Data Analytics, Cloud Data Warehouses, Data Lakes, ETL (Extract, Transform, Load) Processes in the Cloud
10	Cloud Orchestration and Automation: Introduction, Cloud Orchestration Basics, Infrastructure as Code (IAC)

11	Content Delivery Networks (CDN): Introduction to CDNs, Basic Architecture of CDN, Integration with Cloud Storage
12	Hybrid Cloud Storage: Introduction to Hybrid Cloud, Role of Hybrid Cloud in Modern Business, Data Management in Hybrid Cloud

Elective-2

Course Code: DCA31E5	Course Title : Data Visualization with Python
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Unit No	Unit Name & Unit description
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
2	Basics of Matplotlib: Introduction, Advanced Matplotlib
3	Introduction to Seaborn: Introduction, Setting up Seaborn, Basic Seaborn Plots, Styling with Seaborn
4	Advanced Seaborn Techniques: Advanced Categorical Plots, Visualizing Statistical Relationships, Matrix Plots, FacetGrid and Multi-plot Grids
5	Time Series Visualization – I: Interactive Visualization with Plotly: Introduction to Plotly, Plotly Graph Objects, Interactivity in Plotly
6	Time Series Visualization – II: Introduction to Time Series, Handling Time Series Data in Python, Basic Time Series Plots, Seasonal Decomposition
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
8	Geospatial Data Visualization: Introduction to Geospatial Data, Creating Maps with Python, Choropleth Maps
9	Visualization in Data Science: Introduction to Data Exploration, Visualization for Statistical Analysis, Correlation and Covariance Plots
10	Advanced Topics in Visualization: 3D Visualizations with Python, Network Visualization with NetworkX, Visualization with Large Datasets
11	Integrating Visualizations with Web Applications: Flask and Django, Embedding Matplotlib and Plotly Visualizations in Web Pages Creating Dashboards using Dash by Plotly
12	Tools & Extensions: Introduction to Jupyter and Jupyter Lab, Widgets for Interactive Visualizations, Exporting and Sharing Visualizations

Elective-3

Course Code: DCA31E6	Course Title : Information Systems Security
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Unit No	Unit Name & Unit description
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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
2	The Need for IT Security: Business Needs-Protecting the functionality, Enabling the safe operations, Protecting the data, safe guarding the technology asset
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
4	Cryptography: Basics of Cryptography, Symmetric Encryption: DES, AES Asymmetric Encryption: RSA, ECC, Digital Signatures and Certificates
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
6	Network Security -I: Understanding Infrastructure Security, Device Based Security, Media-Based Security, Monitoring and Diagnosing; Monitoring Network-Firewall
7	Network Security – II: Intrusion Detection System, Intrusion Prevention system; OS and Network Hardening, Application Hardening; Physical and Network Security- Policies Standards and Guidelines
8	Web Security: Web vulnerabilities: SQL Injection, Cross-Site Scripting (XSS), Session Management and Cookies Security, OWASP Top Ten
9	Application Security: Secure Coding Principles, Buffer Overflows, Input Validation and Parameterized Queries
10	Cloud and IoT Security: Cloud Security Challenges, IoT Vulnerabilities Best Practices for Cloud and IoT Security
11	Physical Security: Threats to Physical Infrastructure, Surveillance Systems Biometric Security Systems
12	Security Policies and Compliance: Importance of Security Policies, ISO/IEC 27001 Standards, GDPR and other Regulatory Compliances

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)	124 Credits

5.4. Faculty and support staff requirement

Academic Staff	Number available to meet the required delivery norms
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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 chatbot or course mentors.

5.7. Student Support Services

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 45% (40% 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. Programme Fee & Financial assistance policy

Suggested Fee for BCA programme is INR 1,35,000/- (One lakh Thirty Five thousand only). Overseas students need to remit equivalent of 2196 USD to University for Non-Resident Indians), 2556 USD for Foreign Nationals and 1920 USD for African Students.

A scholarship of upto 20% 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
3	8 Credits	16 weeks	16 hours	32 hours	40	40	88	240

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	1 st January
		July	1 st 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	30 th April
		July	30 th October
5	Project Report Submission (Applicable during Final semester)	January	30 th April
		July	30 th 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	3 rd week of May
		July	3 rd week of Nov
8	Term End Examination	January	2 nd week of June (TEE June)
		July	2 nd 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 student's learning in a course would be evaluated based on Internal assignments, student's 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 bodies 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 (One Assignment for two-credit paper and two Assignments for four-credit paper). 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 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:

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

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

No lab based courses are offered in this program.

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 BCA programme is as follows:

Sl. No.	Expenditure Heads	Approx. Amount
1	Programme Development (Single Time Investment)	84,00,000 INR
2	Programme Delivery (Per Year)	18,00,000 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 self-assessments regularly and use the results to improve its systems, processes etc. and finally quality of programmes.