

Department of Computer Studies

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SYLLABUS

**BACHELOR OF COMPUTER APPLICATIONS (BCA)
(NEP)**

**First and Second Semester 2026-2027
Third and Fourth Semester 2027-2028
Fifth and Sixth Semester 2028-2029
Seventh and Eighth Semester 2029-2030**



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**Faculty of Engineering and Architecture
JAI NARAIN VYAS UNIVERSITY**

BACHELOR OF COMPUTER APPLICATIONS

First semester and Second semester (2026-2027)

NHEQF Level	Semester	Course Type	Course Code	Course Title	L	P	H/W	Total Hours	Credits	Total Credits	CA Marks	EoSE Marks	M.M.
4.5	I	MJR	04/BCA/MJR/101T	Fundamentals of Computers	6		6	90	6	6	30	120	150
4.5	I	MJR	04/BCA/MJR/102T	Programming with C	4		4	60	4	6	20	80	100
4.5	I	MJR	04/BCA/MJR/102P	C Programming Laboratory		2	4	60	2	6	10	40	50
4.5	I	MNR	04/BCA/MNR/103T	Mathematics for Computing	4		4	60	4	6	20	80	100
4.5	I	MNR	04/BCA/MNR/104P	Office Tools Laboratory		2	4	60	2	6	10	40	50
4.5	I	AEC	04/BCA/AEC/105T	English	4		4	60	4	4	20	80	100
4.5	I	SEC	-----	Skill Enhancement Course -I	3		3	45	3	3	15	60	75
										25			

NHEQF Level	Semester	Course Type	Course Code	Course Title	L	P	H/W	Total Hours	Credits	Total Credits	CA Marks	EoSE Marks	M.M.
4.5	II	MJR	04/BCA/MJR/151T	Operating System	6		6	90	6	6	30	120	150
4.5	II	MJR	04/BCA/MJR/152T	Object Oriented Programming with C++	4		4	60	4	6	20	80	100
4.5	II	MJR	04/BCA/MJR/152P	C++ Laboratory		2	4	60	2	6	10	40	50
4.5	II	MNR	04/BCA/MNR/153T	Data Structures and Algorithms	4		4	60	4	6	20	80	100
4.5	II	MNR	04/BCA/MNR/153P	Data Structures and Algorithms Laboratory		2	4	60	2	6	10	40	50
4.5	II	AEC	04/BCA/AEC/154T	Hindi			4	60	4	4	20	80	100
4.5	II	SEC	-----	Skill Enhancement Course -II	3		3	45	3	3	15	60	75
										25			

For certificate, exit after one year and minimum credit requirement is 50 credits and 4 credits from Internship

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BACHELOR OF COMPUTER APPLICATIONS

Third semester and Fourth semester (2027-2028)

NHEQF Level	Semester	Course Type	Course Code	Course Title	L	P	H/W	Total Hours	Credits	Total Credits	CA Marks	EoSE Marks	M.M.
5.0	III	MJR	04/BCA/MJR/201T	Computer Networks and wireless Technologies	6		6	90	6	6	30	120	150
5.0	III	MJR	04/BCA/MJR/202T	Database Management System	4		4	60	4		20	80	100
5.0	III	MJR	04/BCA/MJR/202P	Database Management System Laboratory		2	4	60	2	6	10	40	50
5.0	III	MNR	04/BCA/MNR/203T	JAVA Programming	4		4	60	4		20	80	100
5.0	III	MNR	04/BCA/MNR/203P	JAVA Programming Laboratory		2	4	60	2	6	10	40	50
5.0	III	MDC	04/BCA/MDC/204T	Information Technology Trends	3		3	45	3	3	15	60	75
5.0	III	VAC	-----	Value Added Course-I	3		3	45	3	3	15	60	75
										24			

NHEQF Level	Semester	Course Type	Course Code	Course Title	L	P	H/W	Total Hours	Credits	Total Credits	CA Marks	EoSE Marks	M.M.
5.0	IV	MJR	04/BCA/MJR/251T	Client Server and Cloud Computing	6		6	90	6	6	30	120	150
5.0	IV	MJR	04/BCA/MJR/252T	Introduction to Internet Technology	4		4	60	4	6	20	80	100
5.0	IV	MJR	04/BCA/MJR/252P	Internet Technology Laboratory		2	4	60	2		10	40	50
5.0	IV	MNR	04/BCA/MNR/253T	Python programming	4		4	60	4		20	80	100
5.0	IV	MNR	04/BCA/MNR/253P	Python programming Laboratory		2	4	60	2	6	10	40	50
5.0	IV	MDC	04/BCA/MDC/254T	Emerging IT Technologies	3		3	45	3	3	15	60	75
										21			

For Diploma, exit after two year and minimum credit requirement is 95 credits and 4 credits from Internship

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BACHELOR OF COMPUTER APPLICATIONS

Fifth semester and Sixth semester (2028-2029)

NHEQF Level	Semester	Course Type	Course Code	Course Title	L	P	H/W	Total Hours	Credits	Total Credits	CA Marks	EoSE Marks	M.M.
5.5	V	MJR	04/BCA/MJR/301T	VB.NET	4		4	60	4		20	80	100
5.5	V	MJR	04/BCA/MJR/301P	VB.NET Laboratory		2	4	60	2	6	10	40	50
5.5	V	MJR	04/BCA/MJR/302T	Mobile Application Development	4		4	60	4		20	80	100
5.5	V	MJR	04/BCA/MJR/302P	Mobile Application Development Laboratory		2	4	60	2	6	10	40	50
5.5	V	MNR	04/BCA/MNR/303T	Artificial intelligence and Machine Learning	6		6	90	6		30	120	150
5.5	V	MDC	04/BCA/MDC/304T	Digital Marketing	3		3	45	3	3	15	60	75
5.5	V	SEC	-----	Skill Enhancement Course -III	3		3	45	3	3	15	60	75
										24			

NHEQF Level	Semester	Course Type	Course Code	Course Title	L	P	H/W	Total Hours	Credits	Total Credits	CA Marks	EoSE Marks	M.M.
5.5	VI	MJR	04/BCA/MJR/351T	R Programming	4		4	60	4		20	80	100
5.5	VI	MJR	04/BCA/MJR/351P	R Programming Laboratory		2	4	60	2	6	10	40	50
5.5	VI	MJR	04/BCA/MJR/352T	Project Management	4		4	60	4		20	80	100
5.5	VI	MJR	04/BCA/MJR/352P	Minor Project		2	4	60	2	6	10	40	50
5.5	VI	MNR	04/BCA/MNR/353T	Data Science	4		4	60	4		20	80	100
5.5	VI	MNR	04/BCA/MNR/353P	Data Science Laboratory		2	4	60	2	6	10	40	50
5.5	VI	VAC	-----	Value Added Course-I	3		3	45	3	3	15	60	75
										21			

3

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BACHELOR OF COMPUTER APPLICATIONS

(Honours/ Honours with Research)

Seventh semester (2029-2030)

NHEQF Level	Semester	Course Type	Course Code	Course Title	L	P	H/W	Total Hours	Credits	Total Credits	CA Marks	EOSE Marks	M.M.
6.0	VII	MJR	04/BCA/MJR/401T	Web Technologies	4		4	60	4	6	20	80	100
6.0	VII	MJR	04/BCA/MJR/401P	Web Technologies Laboratory		2	4	60	2		10	40	50
6.0	VII	MJR	04/BCA/MJR/402T	Web Programming using ASP.NET	4		4	60	4	6	20	80	100
6.0	VII	MJR	04/BCA/MJR/402P	ASP.NET Laboratory		2	4	60	2		10	40	50
6.0	VII	MJR	04/BCA/MJR/403T	Visual Computing	4		4	60	4		20	80	100
6.0	VII	MJR	04/BCA/MJR/403P	Visual Computing Laboratory		2	4	60	2	6	10	40	50
6.0	VII	DSE	04/BCA/DSE/404T	Computer System Architecture	4		4	60	4	4	20	80	100
6.0	VII	DSE	04/BCA/DSE/405T	Compiler Design									
6.0	VII	DSE	04/BCA/DSE/406T	Advanced data Structure	4		4	60	4	4	20	80	100
			04/BCA/DSE/407T	Big DATA									
										26			

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BACHELOR OF COMPUTER APPLICATIONS

(Honours)

Eighth semester (2029-2030)

NHEQF Level	Semester	Course Type	Course Code	Course Title	L	P	H/W	Total Hours	Credits	Total Credits	CA Marks	EoSE Marks	M.M.
6.0	VIII	MJR	04/BCA/MJR/451T	Internet of Things	6		6	90	6	6	30	120	150
6.0	VIII	MJR	04/BCA/MJR/452T	Advanced JAVA Programming	4		4	60	4	6	20	80	100
6.0	VIII	MJR	04/BCA/MJR/452P	Advanced JAVA Programming Laboratory		2	4	60	2		10	40	50
6.0	VIII	DSE	04/BCA/DSE/453T	Blockchain	4		4	60	4	4	20	80	100
			04/BCA/DSE/454T	Software Engineering									
6.0	VIII	DSE	04/BCA/DSE/455T	Design and Analysis of Algorithm	4		4	60	4	4	20	80	100
			04/BCA/DSE/456T	Cyber Security									
6.0	VIII	DSE	04/BCA/DSE/457T	Natural Language Processing	4		4	60	4	4	20	80	100
			04/BCA/DSE/458T	Human Computer Interaction									
										24			

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5

BACHELOR OF COMPUTER APPLICATIONS
(Honours with Research)
Eighth semester (2029-2030)

NHEQF Level	Semester	Course Type	Course Code	Course Title	L	P	H/W	Total Hours	Credits	Total Credits	CA Marks	EoSE Marks	M.M.
6.0	VIII	MJR	04/BCA/MJR/451T	Internet of Things	6		6	90	6	6	30	120	150
6.0	VIII	MJR	04/BCA/MJR/452T	Advanced JAVA Programming	4		4	60	4	6	20	80	100
6.0	VIII	MJR	04/BCA/MJR/452P	Advanced JAVA Programming Laboratory		2	4	60	2		10	40	50
6.0	VIII	PRJ	04/BCA/PRJ/453	Dissertation					12	12	100	200	300
									24				

Skill Enhancement course List

NHEQF Level	Semester	Course Type	Course Code	Course Title	L	P	H/W	Total Hours	Credits	Total Credits	CA Marks	EoSE Marks	M.M.
4.5	I	SEC	04/BCA/SEC/105T	Programming Fundamentals and System Setup	3		3	45	3	3	15	60	75
4.5	II	SEC	04/BCA/SEC/154T	Hardware and Networking	3		3	45	3	3	15	60	75
5.5	V	SEC	04/BCA/SEC/305T	E-Commerce	3		3	45	3	3	15	60	75

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BACHELOR OF COMPUTER APPLICATIONS

Undergraduate Programme (Bachelor of Computer Applications)		
Session 2026-2027		
Part-A Introduction		
Subject	FUNDAMENTALS OF COMPUTERS	
Semester	First Semester	
Name of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MJR/101T	
Course Type:	MJR	
Level Of the Course(As per Annexure-I)	101-150	
Pre Requisite for the course (if any)	NA	
Course Learning Outcomes(CLO)	CLO1:Students will be able to understand the fundamentals of Computers. CLO2:Able to understand hardware,software, binary number system, etc.	
Credits	6	
Total Marks	30+120=150	
Part –B Contents of the Course		
Total Lecture per week	6HRS	
Unit	Topics	No. of Lecture/ Contact Hours
I	Computer system characteristics, Capabilities and limitations, Types of computers , Super Computers, Personal Computer (PCs) - configurations PCs specifications and main characteristics. Types of PCs- Desktop, Laptop, Notebook, Palmtop, Workstations etc. their characteristics. Basic components of a computer system - Control unit, ALU, Input/output functions and characteristics, Memory - RAM ROM, EPROM, PROM and other types of memory	18
II	Keyboard, Mouse, Scanners, Printers, Digital Camera, MICR, OCR, OMR, Bar-code Reader, Touch Screen, Monitors, Resolution, Refresh Rate, Interlaced / Non Interlaced, Dot Pitch, Types of Software - System software, Applications software, System Software - Operating System, Features of Linux Operating system Assemblers, Compilers and Interpreter, Operating Systems - Functions, Types- Batch, Single, Multiprogramming, Multiprocessing, Programming languages- Machine, Assembly, High Level,	18
III	Applications Software - Word-processing, Spreadsheet, working with word processing and spreadsheet, Presentation Graphics, Data Base Management Software, characteristics, Uses and examples and area of Applications of each of them.	18
IV	Data types and Number systems, Binary number system, Octal & Hexa-decimal number system, 1's&2's complement, Binary Fixed-Point Representation, Arithmetic operation on Binary numbers, Floating Point Representation, Codes, ASCII, EBCDIC codes, Logic Gates, AND, OR, NOT GATES and their Truth tables, NOR, NAND & XOR gates, Boolean Algebra, Demorgan'stheorem.	18

V	MAP Simplification, Minimization techniques, K-Map- 2,3 variable. Combinational circuits: Half Adder & Full Adder, Half sub tractor, Full sub tractor, Multiplexer, Demultiplexer, Encoder, Decoder, Sequential circuits: Flip Flops: RS, D using NAND and NOR Gates, Gated Flip Flops (latches), Registers: Shift Register, Buffer Register.	18
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Suggested Books

1. Fundamentals of Computers By R. Thareja, Oxford University Press.
2. Introduction to Information Technology - ITL Education solutions limited, PEARSON
3. Computer Fundamentals by P.K. Sinha, BPB Publication.
4. Fundamental of Computers by Anita Goel, Pearson Education.
5. Rajaraman V.- Fundamentals of Computers, Prentice Hall of India Pvt. Ltd.
6. Computer System Architecture by M. Morris Mano, Pearson
7. Computer System Architecture, by P. V. S. RAO , Eastern Economy edition

Undergraduate Programme(Bachelor of Computer Applications)	
Session 2026-2027	
Part-A Introduction	
Subject	PROGRAMMING WITH C
Semester	First Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/102T
Course Type:	MJR
Level Of the Course(As per Annexure-I)	101-150
Pre Requisite for the course (if any)	Problem-solving skills.
Course Learning Outcomes(CLO)	CLO1: Understand the fundamentals of C programming language. CLO2: Develop algorithms and implementation using C programs. CLO3: Use control structures and functions effectively. CLO4: Apply arrays, strings, pointers,etc.in programs
Credits	4
Total Marks	100 =(20+ 80)
Part –B Contents of the Course	
Total Lecture per week	4 HRS

Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction & features of C, Structure of C program, Variables, Expressions, Identifiers, Keywords, Data Types, Constants, Operator and expression Operator: Arithmetic, Logical, Relational, Conditional and Bit wise Operators, Precedence and Associativity of Operators, Type conversion in expression.	12
II	If statement, If.....Else statement, Nesting of If....Else Statement, else if ladder, The ?: operator, Switch statement, Compound statement, Loop controls, for, while, do-while	12

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	loops, break, continue, ARRAYS Single and Multi Dimensional arrays, Array declaration and initialization of arrays,	
III	The need and form of C functions, User defined and library functions, Function arguments, Return values and nesting of function, Recursion, Calling of functions, Basic input/output and library functions Single character input/output i.e. getch(), getchar(), getche(), putchar(), Formatted input/output i.e. printf() and scanf(), Library functions	12
IV	Strings : declaration, initialization, functions. Scope and life of variables - local and global variable, Storage class specified - auto, extern, static, register. Structure, Declaration of structure variable, accessing structure members, Union	12
V	Working with text files reading a text file and writing to a file. File pointer , Functions for file handling Understanding pointers, Declaration and initializing pointers, pointer expressions	12

Suggested Books :

1. The C Programming Language, Brian Kernighan and Dennis Ritchie, PHI Publications.
2. Let us C, Yashavant Kanetkar, BPB Publications.
3. Programming in C, Balaguruswamy, McGraw-Hill Education

Undergraduate Programme(Bachelor Of Computer Applications)	
Session 2026-2027	
Part-A Introduction	
Subject	C PROGRAMMING LABORATORY
Semester	First Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/102P
Course Type:	MJR
Level Of the Course(As per Annexure-I)	101-150
Pre Requisite for the course (if any)	Problem-solving skills.
Course Learning Outcomes(CLO)	CLO1: Understand the fundamentals of C programming language. CLO2: Develop algorithms and implement those using C programs. CLO3: Use control structures and functions effectively. CLO4: Apply arrays, strings, pointers, and structures in program development..
Credits	2
Total Marks	10+40=50
Part –B Contents of the Course	
Total Lecture per week	4 HRS

ASSIGNMENTS:

1. Program to read radius of a circle and to find area and circumference.
2. Program to read three numbers and find the biggest of three.
3. Program to check whether the given number is even or odd using ternary operator.

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4. Program to implement switch case for day of the week.
5. Program to print sum of 1st 10 numbers.
6. Program to check for prime number.
7. Program to check whether the given number is prime or not.
8. Program to print pyramid pattern.
9. Program to find the roots of quadratic equation (demonstration of switch Case statement).
10. Program to read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers.
11. Program to print prime number from 1 to 50.
12. Program to check whether the given number is palindrome or not.
13. Program to use Built-in string functions.
14. Program to read student's marks and find average of marks.
15. Program to find the length of a string without using built in function.
16. Program to create structure of records of students.
17. Program to swap two numbers using function call by pointer.
18. Program to read a file and write to a file.

Undergraduate Programme(Bachelor of Computer Applications)		
Session 2026-2027		
Part-A Introduction		
Subject	MATHEMATICS FOR COMPUTING	
Semester	First Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MNR/103T	
Course Type:	MNR	
Level Of the Course(As per Annexure-I)	Basic 101-150	
Pre Requisite for the course (if any)	Idea about fundamental rules of Mathematics	
Course Learning Outcomes(CLO)	CLO1 : To inculcate in students the fundamental mathematical background in Computer science. CLO 2: To gain knowledge about Sets, Relations Functions, Matrices and Determinants, permutation and combination binary operations basic idea of geometry,.. CLO 3: Develop analytical ability to solve real-world problems using these methodologies.	
Credits	4	
Total Marks	20+80= 100	
Part –B Contents of the Course		
Total Lecture per week	4 HRS	
Unit	Topics	No. of Lecture/ Contact Hours
I	Set, Relation and Functions: Sets, type of sets, Cartesian product of sets, Relations, type of relation, Domain and Range of a relation, Functions, Domain, co-domain and Range of a function, types of a function, composite of a function, Binary operations, type of	12

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	binary operations	
II	Cartesian system of rectangular coordinates: The number plane, distance formula area of a triangle, section formulae, slopes of a line, locus and equation. Straight line: To find equation of a straight line parallel to an axis: the point slope form, two-point form, intercept form, slope-intercept form, normal form, condition of concurrency for three straight lines, analytical proof of geometric theorems.	12
III	Circle and family of circles: Standard form of equation of a circle, its general form, condition of tangency. Polynomial: standard form of polynomial, notation, degree of polynomial, type of polynomial (monomial, binomial, trinomial only), polynomial operations (Addition, subtraction, multiplication), solving polynomial (linear and Quadratic).	12
IV	Quadratic equation: Solution of quadratic equations, symmetric functions of roots. Matrix: Definition and type of matrices, operation on matrices i.e. addition, subtraction and multiplication of a matrix, Properties and Applications, elementary transformation of a matrix, inverse of a matrix, normal form of a matrix, orthogonal matrices.	12
V	Determinants: Definition and expansion of determinants, determinant of a square matrix of order 2 and 3, minors and Cofactors, singular and non-singular matrix, Adjoint of matrix, Inverse of a matrix. Permutation and Combinations: Factorial notations, Value of nPr and nCr	12
1. M. Ray: A Text Book of Higher Algebra, S.Chand & Co., New Delhi. 2. A.R. Vasishtha and A.K. Vasishtha: Matrices, Krishna Prakashan Ltd. Meerut. 3. G.C. Sharma: Modern Algebra; Ram Prasad & Sons, Agra. 3. 4. Elements of Mathematics, ML Bhargava 5. R.J.T. Bell: Coordinate Geometry of Three dimensions; Macmillan India Ltd., New Delhi.		

Undergraduate Programme(Bachelor of Computer Applications)	
Session 2026-2027	
Part-A Introduction	
Subject	OFFICE TOOLS LABORATORY
Semester	First Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MNR/104P
Course Type:	MNR
Level Of the Course(As per Annexure-I)	101-150
Pre Requisite for the course (if any)	Basic knowledge of computers
Course Learning Outcomes(CLO)	CLO1: Students able to proficiently use productivity software (MS Office) to create professional document, analyzing data via spreadsheets, and manage information effectively. CLO2: Apply style, formatting, and templates using word processing software.
Credits	2
Total Marks	10+40=50

Part –B Contents of the Course

ASSIGNMENTS:

1. Working with Files, working on multiple documents. Working with Text-Formatting, Moving, Copying, and pasting text, bullets, find, replace.
2. Table Manipulations: Creating tables, merging, splitting, resizing, and adjusting width and height of a row, adjusting text in a cell.
3. Page Formatting: Page margins, page size and orientation, Header and footers, page numbers.
4. Mail Merge: sending a mail to many candidates.
5. Modifying a Worksheet: Moving through cells, Adding worksheets, rows and columns Resizing rows and columns.
6. Selecting cells, Moving and copying cells, copying same data in row/column. Auto-increment.
7. Cell addressing, absolute address, relative address.
8. Selecting data, Auto formatting, auto sum, Formula and Functions.

Second semester (2026-2027)

Undergraduate Programme(Bachelor of Computer Applications)		
Session 2026-2027		
Part-A Introduction		
Subject	OPERATING SYSTEM	
Semester	Second Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MJR/151T	
Course Type:	MJR	
Level Of the Course(As per Annexure-I)	151-199	
Pre Requisite for the course (if any)	NA	
Course Learning Outcomes(CLO)	CLO1: Student will be able to understand basic OS design principles and components. CLO2: Student will be able to explain process management, memory management and compare different OS.	
Credits	6	
Total Marks	30+120=150	
Part –B Contents of the Course		
Total Lecture per week	6HRS	
Unit	Topics	No. of Lecture/ Contact Hours
I	Operating Systems Definitions, Types of operating system, Functionalities and Characteristics of OS, Hardware Concepts related to OS, Operating system Services, and System Calls, System programs, System structure.Process Concepts, process state & process control block, Process Scheduling, FCFS, SJF, Priority Scheduling, Round robin, Algorithms, multiple level queue scheduling	18

II	Threads concepts, Critical Section Problem and Mutual Exclusion, Classical Problem of Synchronization, Semaphores, Deadlock – Methods for handling deadlocks, prevention, Avoidance, detection and Recovery	18
III	Memory Management, Logical v/s physical address space, Swapping, Contiguous and Non-contiguous Allocating, Paging, Segmentation, Demand Paging, Page Replacement Algorithm, FIFO, LRU, LIFO, Hit ratio Virtual Memory Concepts.	18
IV	Mass Storage system- Disk Structure-Disk Scheduling algorithms, Swap Space Management, Disk reliability, Stable Storage Implementation, File System-File concepts, Directories, File access methods, File system implementation, Allocation method.	18
V	Types of Mobile OS, Overview of Android OS, Applications of Mobile OS, Linux OS-introduction, History, Features, Overview of Linux, Shell – Features, Components, Types of Shell in Linux and Shell Scripting.	18

Suggested Books:

1. Silberschatz & Galvin: Operating System Concept, Wiley, Sixth Edition
2. Milan Malenkov's: Operating Systems, Tata McGraw-Hill, Second Edition.
3. William Stallings: Operating Systems, PHI, Fourth Edition
4. Yashavant Kanetkar: UNIX Shell Programming, BPB

Undergraduate Programme(Bachelor of Computer Applications)		
Session 2026-2027		
Part-A Introduction		
Subject	OBJECT ORIENTED PROGRAMMING WITH C++	
Semester	Second Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MJR/152T	
Course Type:	MJR	
Level Of the Course(As per Annexure-I)	151-199	
Pre Requisite for the course (if any)	Basic knowledge of programming concepts and familiarity with C language	
Course Learning Outcomes(CLO)	CLO1: Understand the principles of Object-Oriented Programming. CLO2: Use C++ syntax, data types, and control structures effectively. CLO3: Implement classes, objects, constructors, and destructors. CLO4: Apply inheritance, polymorphism, and dynamic binding concepts.	
Credits	4	
Total Marks	20+ 80=100	
Part –B Contents of the Course		
Total Lecture per week	4HRS	
Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction to OOP: Procedural vs Object-Oriented Approach, Features of OOP, Introduction to C++: Structure of C++ Program, Tokens, Data Types, Type Conversion and type casting, Operators, IOSTream: cin, cout, Looping and control constructs. Inline Function, reference variable, function call	12

II	Classes and Objects: Class Definition, Object Creation, Member Functions, Constructors, types of constructors and Destructors, friend function	12
III	Inheritance and Polymorphism: Types of Inheritance, Access specifiers, -public, private, protected, Function Overloading, Operator Overloading, Virtual Functions, Dynamic Binding	12
IV	Pointers and Memory Management: Pointers, new and delete Operators, Arrays of Objects, this Pointer, Static Members	12
V	File Handling and Exception Handling: File Operations, Reading, writing, Filepointer, Streams, Exception Handling, Template	12

Suggested Books:

1. E Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill, 2006
2. Rajaram R, Object Oriented Programming and C++", 2nd Edition, New Age International, 2013.
3. Yahwant Kanetkar, "C++ Programming", BPB Publication
4. C++: The Complete Reference, Herbert Schildt, McGraw Hill

Undergraduate Programme(Bachelor Of Computer Applications)	
Session 2026-2027	
Part-A Introduction	
Subject	C++ LABORATORY
Semester	Second Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/152P
Course Type:	MJR
Level Of the Course(As per Annexure-I)	151-199
Pre Requisite for the course (if any)	Basic knowledge of computers and problem-solving skills.
Course Learning Outcomes(CLO)	CLO1: Use C++ syntax, data types, and control structures effectively. CLO2: Implement classes, objects, constructors, and destructors.
Credits	2
Total Marks	10+40=50
Part –B Contents of the Course	
ASSIGNMENTS: 1. Write a program to read your name and display the name and its length 2. Write a program to implement a point class having p(x,y). Perform following: a) Swap the value of two point objects b) Pass a point object to a function and modify the value and return the object. 3. Write a program to create a time class. Perform the addition of time in hour and minute format. 4. Write a program to add two complex numbers using operator overloading. 5. Write a program for string addition and string comparison using operator overloading (use + & == operators). 6. Write a program that reads a text file and create a file that is identical to it except that every consecutive sequence of blank spaces is replaced by a single space. 7. Create a data file that will store the marks obtained by students in three subjects. Read the created file ,	

- find total of each student and create a new file with marks obtained in three subjects and total.
8. Write a program containing an exception. Use try and catch to handle the exception.
9. Write a program to implement Inheritance.

Undergraduate Programme(Bachelor of Computer Applications)		
Session 2026-2027		
Part-A Introduction		
Subject	DATA STRUCTURES AND ALGORITHMS	
Semester	Second Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MNR/153T	
Course Type:	MNR	
Level Of the Course(As per Annexure-I)	151-199	
Pre Requisite for the course (if any)	Nil	
Course Learning Outcomes(CLO)	COL1: Understand the basics of Data Structures. COL2: Describe the concept, operations, and Applications of linear data structures such as stacks and queues COL3: Implement and analyze linked list data structures, COL4: Understand tree, Graphs , sorting and searching algorithms.	
Credits	4	
Total Marks	20+80=100	
Part –B Contents of the Course		
Total Lecture per week	04	
Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction: Data Structure Definition, Basic Terminology and Concepts,. Classification of Data Structures. Primitive Data Structures, Non-Primitive Data Structures. Stack: Definition, Memory Representation, Algorithms for Stack Operations (Push, Pop), Applications of Stack.	12
II	Queue: Definition, Memory Representation, Linear Queue, Circular Queue, Enqueue, Dequeue. Applications of Queue.	12
III	Linked Lists: Definition, Types. Singly Linked List: Implementation, Insertion, Deletion At the Beginning, At the End. Doubly Linked List: Applications of Linked List.	12
IV	Tree: Definition, Memory Representation Using Array and Linked List. Binary Tree: Definition, Traversal Algorithms Pre-Order, In-Order, Post-Order, Graph: Definition, Memory Representation of Graph. Adjacency Matrix, Adjacency List. Graph Traversal Algorithms: Breadth-First Search (BFS), Depth-First Search (DFS).	12
V	Sorting & Searching Techniques: Insertion Sort, Selection Sort, Bubble Sort. Searching Techniques: Linear And Binary Search ,	12
Suggested Books:		
1. Data Structures Through C++ (4th Edition) Yashvant Kanetkar.		
2. Data Structures and Algorithm Analysis in C++" by Mark Allen Weiss.		

3. Data structure and Algorithms using C++ by SachiNandanMohanty, Pabitra Kumar Tripathy.
4. Data Structures and Algorithms in C++, Second Edition by Adam Drozdek.

Undergraduate Programme Bachelor of Computer Applications)	
Session 2026-2027	
Part-A Introduction	
Subject	DATA STRUCTURE AND ALGORITHMS LABORATORY
Semester	Second Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MNR/153P
Course Type:	MNR
Level Of the Course(As per Annexure-I)	151-199
Pre Requisite for the course (if any)	NA
Course Learning Outcomes(CLO)	COL2: Implementation of Stack, queue, Tree and Graph. COL3: Implementation of sorting and searching algorithms.
Credits	2
Total Marks	10+40=150
Part –B Contents of the Course	
Total Lecture per week	2HRS
Assignments. 1. Design and implement array and its operation. 2. Design and implement stack and its operation using arrays 3. Design and implement Queue and its operation using arrays 4. Design and implement linked list and its operations 5. Write a program to create a tree using linked list 6. Write a program to represent a graph using adjacency matrix 7. Write a program to implement linear search 8. Write a program to implement binary search 9. Write a program to implement selection sort 10. Write a program to implement Insertion sort	

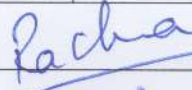
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Third semester (2027-2028)

Undergraduate Programme (Bachelor of Computer Applications)		
Session 2027-2028		
Part-A Introduction		
Subject	COMPUTER NETWORK AND WIRELESS TECHNOLOGIES	
Semester	Third Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MJR/201T	
Course Type:	MJR	
Level of the Course(As per Annexure-I)	200-250	
Pre Requisite for the course (if any)	NA	
Course Learning Outcomes(CLO)	CLO1: Students able to understand Networking, Ethernet, LAN, etc CLO2:Able to understand wireless communication	
Credits	6	
Total Marks	30+120=150	
Part –B Contents of the Course		
Total Lecture per week	6 HRS	
Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction to Data Communication and computer Networks:- Network Transmission media, twisted pair, coaxial cable, optical fiber, Network Devices-Hubs, Bridge, Switches, Router.	18
II	Principle of Layering Concept: - ISO-OSI Model, functions of each layer, TCP/IP Model. Concepts of circuit switching, packet switching and network switching.	18
III	Elements of LAN, WAN, MAN. LAN topologies: STAR, BUS and RING Network, LAN access techniques: ALOHA, CSMA/CD, CSMA/CA, token ring and token bus. Issues related with network reliability and security. Ethernet:-Ethernet Standards ZigBee, Wifi etc.	18
IV	Error detection and correcting codes: Hamming codes, parity generation and detection, single error detection and correction, double correction codes, CRC. IP Addressing:- Internet Protocol and IPv4 Packet format, logical Addresses, Physical addresses, Network Part, Host part, Network Masks. Introduction to IPv6.	18
V	Introduction to wireless communication: Bluetooth technology, WLAN architecture and components, wireless security and issues and challenges in wireless network, introduction to wireless Applications protocol (WAP). Satellite Network: GEO,MEO,LEO Satellites	18

Suggested Books:

1. Data & Communications, William Stallings, Prentice Hall,
2. Data Communications and Networking, Behrouz A. Forouzan, Tata McGraw-Hill
3. Computer Networks, A. S. Tanenbaum, Prentice-Hall,
4. Computer networks and internets, Douglas Comer, Prentice Hall


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Undergraduate Programme (Bachelor of Computer Applications)	
Session 2027-2028	
Part-A Introduction	
Subject	DATABASE MANAGEMENT SYSTEM
Semester	Third Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/202T
Course Type:	MJR
Level Of the Course(As per Annexure-I)	200-250
Pre Requisite for the course (if any)	Basic knowledge of computers, programming concepts, and data organization.
Course Learning Outcomes(CLO)	CLO1: Understand DBMS concepts and architecture. CLO2: Design efficient databases using ER modelling and normalization. CLO3: Learn SQL queries for database creation and manipulation.
Credits	4
Total Marks	20+ 80=100
Part –B Contents of the Course	

UNIT	Topics	No. of Lecture /Contact Hours
I	Purpose of the data base system, Structure of DBMS, data abstraction-physical, logical view level, data model, physical and logical data independence, data base administrator, Types of DBMS- Relational, Object Oriented, Hierarchical, Network.	12
II	ER Models, entities, mapping constrains, keys, E-R diagram, and reduction E-R diagrams to tables, generalization and aggregation, design of an E-R data base scheme.	12
III	Normalization: First, Second, Third, BCNF, Fourth and Fifth Normal Forms.	12
IV	SQL: commands and data types, data definition language commands, data manipulation commands, data query language commands, transaction language control commands, data control language commands. Joins, equi-joins, non-equi-joins, self joins, other joins, aggregate functions, math functions, string functions, group by clause,	12
V	Oracle RDBMS, architecture, kernel, system global area (SGA), data base writer, log writer, process monitor, database files, control files, PL/SQL, basics of pl/sql, data types, control structures, database access with PL/SQL, data base connections, transaction management, data base locking, cursor management.	12

Suggested Books

1. Korth, Database Systems Concepts, McGraw Hill.
2. Fundamentals of Database System, Shamkant B. Navathe, Ramez Elmasri, Pearson.
3. Date C.J., Database Systems, Addison Wesley

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Undergraduate Programme(Bachelor of Computer Applications)	
Session 2027-2028	
Part-A Introduction	
Subject	DATABASE MANAGEMENT SYSTEM LABORATORY
Semester	Third Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/202P
Course Type:	MJR
Level Of the Course(As per Annexure-I)	200-250
Pre Requisite for the course (if any)	Basic knowledge of computers, programming concepts, and data organization.
Course Learning Outcomes(CLO)	CLO1: Understand and Design databases. CLO3: Write SQL queries for database creation and manipulation. Apply transaction management and security concepts.
Credits	2
Total Marks	10+40=50
Part –B Contents of the Course	

ASSIGNMENTS:

Q1. Draw E-R diagram of a banking system

Q2 Convert the ER diagram of question 1 of a banking system into relation table.

Q3 Create a database of an organization with appropriate tables and perform the following

- ☐ Display all the employees' details that belong to department SALES
- ☐ Display employees name along with their Salary who are MANAGER.
- ☐ Display the employees who are getting Salary between 25000 and 50000.
- ☐ Display employees that are not managers.
- ☐ Display employees whose name begins with Character 'R'.
- ☐ Display employees that are analyst but getting salary greater than 30000.
- ☐ Display all the employees having 'A' in their names.
- ☐ Display all the employees having T and 'R' in their names.
- ☐ List the average salary for each department. Then find out the employees who are getting more than that average salary.

Q4 Perform following operations on the tables.

- ☐ ALTER
- ☐ DROP
- ☐ UPDATE

Q5 Perform following on a table of a database

- ☐ INSERT into
- ☐ SELECT
- ☐ DELETE
- ☐ Min max count
- ☐ like and between

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Undergraduate Programme (Bachelor of Computer Applications)		
Session 2027-2028		
Part-A Introduction		
Subject	JAVA PROGRAMMING	
Semester	Third Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MNR/203T	
Course Type:	MNR	
Level of the Course(As per Annexure-I)	200-250	
Pre Requisite for the course (if any)	Basic concept of programming	
Course Learning Outcomes(CLO)	CLO1:UnderstandJAVA concepts CLO2: Develop Java Applications CLO3: Learn exception handling, multithreading, and file handling	
Credits	4	
Total Marks	20+ 80=100	
Part –B Contents of the Course		
Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction Of OOP with Java Environment, Principles of OOP, data hiding, Encapsulation, inheritance, polymorphism, overloading, JAVA program structure, JAVA virtual machine, Constant & Variables, Data Types, Declaration of Variables, Scope of Variables, Symbolic Constants, Type Casting. Operators : Arithmetic, Relational, Logical Assignments, Increment and Decrement, Conditional, Bitwise	12
II	Control Statements: If statement, if...else... statement, Nesting of if...else... statements, else...if Ladder, Switch, Ternary Operators, Loops – While, Do, For, Jumps in Loops, Labelled Loops.	12
III	Exploring the concept of Class: Defining a Class, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Inheritance: Derived classes and Base class, public, private and protected access specifies, Extending a Class, Overriding Methods, Final Variables and Methods, Final Classes, Finalize Methods, Abstract methods and Classes,	12
IV	Introducing interface and its implementation: Defining Interface Extending Interface, Implementing Interface, Accessing Interface Variable,	12
V	Packaging and web enable browser Applet: System Packages, Using System Package, Adding a Class to a Package, Hiding Classes. Creating Threads, Extending the Threads Class, Exceptions, , Implementing the Run able Interface. Local and Remote Applets,Writing Applets, Applets Life Cycle, Creating an Executable Applet	12

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Suggested Books:

1. The complete reference Java 2, H. Schildt, Tata McGraw-Hill.
2. Programming with JAVA - A Primer, Balaguruswamy, McGraw-Hill
3. Head First Java: A Brain-Friendly Guide, Kathy Bert"O'Reilly Media.
4. Thinking in Java, Bruce, Prentice Hall Professional

Undergraduate Programme (Bachelor of Computer Applications)	
Session 2027-2028	
Part-A Introduction	
Subject	JAVA PROGRAMMING LABORATORY
Semester	Third Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MNR/203P
Course Type:	MNR
Level Of the Course(As per Annexure-I)	200-250
Pre Requisite for the course (if any)	Basic programming skills
Course Learning Outcomes(CLO)	CLO1: Understand JAVA concepts CLO2: Develop Java Applications CLO3: Learn exception handling, multithreading, and file handling
Credits	2
Total Marks	10+40=50
Part –B Contents of the Course	
Total Lecture per week	4 HRS
Assignments: 1. Write a program that prints all integers between 0 and 36. 2. Create an array of 4 random numbers. 3. Create a rectangle class that contains width and height fields also give it a getarea () method again. Make a few test cases. 4. Write a Java program to create a class called "Rectangle" with width and height attributes. Calculate the area and perimeter of the rectangle 5. Write a Java program to create a class called "Employee" with a name, salary, and hire date attributes, and a method to calculate years of service 6. Create a class with three different methods to calculate minimum, maximum and addition of integers 7. Create a class Fruit which has data members- color and taste. Create constructor to set the values of data members and a method Details () which prints the values of color and taste. Create a new class	

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Apple which inherits from Fruit class and has data members- size and condition.

8 Write and execute java program which create a shape class and derive circle and rectangle classes from shape class. All the classes in this program should have proper constructors and methods to display details of different shapes. Also use appropriate access specifies in your program

9. Create an interface Account having methods- deposit (), withdraw () and about Bank () (about Bank () is a static method). Create two classes Saving and Current which implement the Account interface. Call the methods of Saving and Current classes in main method

10. Write an Applet program to display the "Hello World "in the browser.

11. Write an Applet program that automatically displays the text with Font Style, Font type.

12. Write a program to illustrate usage of try/catch with finally clause.

13. Write a program to describe usage of throws clause.

14. Write a program for creation of user defined exception.

Undergraduate Programme(Bachelor of Computer Applications)		
Session 2027-2028		
Part-A Introduction		
Subject	INFORMATION TECHNOLOGY TRENDS	
Semester	Third Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MDC/204T	
Course Type:	MDC	
Level Of the Course(As per Annexure-I)	200-250	
Pre Requisite for the course (if any)	Nil	
Course Learning Outcomes(CLO)	CLO1: Equipping students with knowledge of cutting-edge technologies, their Applications. CLO2: In focus on equipping students with their social/organizational impact.	
Credits	3	
Total Marks	15+60=75	
Part –B Contents of the Course		
Total Lecture per week	3HRS	
Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction of E-Governance, E-Democracy, UIDI And Adhar, Digital Locker, Digital Library, Digilocker, Cybercrime, Types Of Cybercrime, Spyware, Malware, spam Mail, Fraud Mail, Phishing, Spoofing, Hacking. Ethical hacking, Defining	09

	hacker, Malicious users, Principles of Ethical Hacking, Data Privacy and General Data Protection and Regulation(GDPR)	
II	E-Commerce: Introduction, Advantages And Disadvantages of E-Commerce, Electronic Payment System, Types Of Electronic Payment System, RTGS, IMPS, NEFT, Payment Gateway, Debit Card And Credit Card, Internet Banking, Mobile Wallet, UPI BHIM, Paytm App, Online Shopping. Business Model B to B, B to C C to C C to B,B to G ,G to B	09
III	Introduction To Wireless Technology: Fundamental of Wireless Technology, Bluetooth, Wi-Fi, WiMAX, Li-fi, Mobile Technology 2G 3G, 4G, 5G Services, Mobile Switching Office, Hands Off Base Station. 4G and 5G characteristics and Applications areas.	09
IV	Introduction to Virtual Reality and multimedia: Introduction what VR, Why VR, Principle of VR, Components of VR System, Head Mounted Display, Audio Units , Gloves with Example VR Applications, Flight Simulator Project. Ultimate Display, Present uses of virtual reality in entertainment, education, Manufacturing, Medicine, Advantage and Disadvantages,	09
V	Multimedia Tools: Identifying Multimedia elements – Text, Images, Sound, Animation and Video, Making simple multimedia with PowerPoint, Object Linking and Embedding concept, Basics of font design, overview of some fonts editing and designing tools, Understanding & using various text effects Various Image file format – BMP, JPG, PNG and TIF format – their features and limitations, various sound file formats on PC – WAV, MP3, MP4 Introduction to digital video compression techniques and various file formats – AVI, MPEG	09

Suggested books:

- 1."The Coming Wave: Technology, Power, and the Twenty-first Century's Greatest Dilemma" by Mustafa Suleyman and Michael Bhaskar (2023)
2. AI 2041: Ten Visions for Our Future" by Chen Qiufan& Kai-Fu Lee (2021/2022).
3. Kevin Beaver CISSP, Hacking for Dummies, Wiley Publishing Inc. ISBN: 978-81-265-6554-2
4. Arshadeep Bahga,Vijay Madisetti,Internet Of Things-A Hands-on Approach, University Press, ISBN 978-8-17371-954-7
5. Rajneesh Aggarwal & B. B Tiwari, "Multimedia Systems", Excel Publication, NewDelhi.
6. Li & Drew, "Fundamentals of Multimedia", Pearson Education.

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Fourth semester (2027-2028)

Undergraduate Programme (Bachelor of Computer Applications)	
Session 2027-2028	
Part-A Introduction	
Subject	CLIENT SERVER AND CLOUD COMPUTING
Semester	Fourth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS

Course Code	04/BCA/MJR/251T
Course Type:	MJR
Level Of the Course(As per Annexure-I)	251-299
Pre Requisite for the course (if any)	Basic knowledge of computers, programming, computer networks and operating system.
Course Learning Outcomes(CLO)	CLO1: Understand client–server and cloud computing architectures. CLO2: Analyse communication, middleware, and server technologies. CLO3: Apply cloud service and deployment models. CLO4: Design basic cloud-based client–server solutions.
Credits	6
Total Marks	30+120=150

Part –B Contents of the Course

Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction to Client/Server computing - Basic Client/Server Computing Model. Server for Every Client- File Server, Print Server, Applications Server, Mail Server, Directory Services Server, Web Server, Database Server, Transaction Servers. Client/Server-Fat or Thin, Stateless or Stateful Servers.	18
II	Client and its functionality, Server and its functionality, Databases - Storing Data, Database System Architectures. Principles behind Client/Server Systems. Existing Client/Server Architectures. Client/Server topologies: Single Client/Single Server, Multiple Clients/Single Servers, Multiple Clients/Multiple Servers	18
III	Tiered Architecture: 2-Tier, 3-tier, N-tier. Model View Controller (MVC), Introduction: Cloud definition, cloud computing architecture, types of clouds, cloud platforms, cloud Services:	18
IV	Types of cloud services, Software as a Service, platform as a Service, Monitoring as a service, Infrastructure as a Service, Database as a Service, communication as services. Service Providers- Google, Amazon, Microsoft Azure, IBM, Sales force.	18
V	Cloud Security: Infrastructure Security, Network level security, Host level security, Applications level security, Data security, Authentication in cloud computing Introduction to Microservices, version control: Git, pull request, CI/CD Integration, platforms like GitHub	18

Suggested Books:

1. Patrick Smith & Steve Guengeric: Client-Server Computing
2. Dawna Travisdewire: Client-Server Computing
3. Derrick Rountree & Ileana Castrillo: The Basics of Cloud Computing

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Undergraduate Programme(Bachelor of Computer Applications)	
Session 2026-2027	
Part-A Introduction	
Subject	INTRODUCTION TO INTERNET TECHNOLOGY

Semester	Fourth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/252T
Course Type:	MJR
Level Of the Course(As per Annexure-I)	251-299
Pre Requisite for the course (if any)	NA
Course Learning Outcomes(CLO)	CLO1: Students shall be able to design website effectively. CLO2: Apply style, formatting, and templates using html and css tag.
Credits	4
Total Marks	20+80=100

Part –B Contents of the Course

Total Lecture per week

4 HRS

Unit	Topics	No. of Lecture/ Contact Hours
I	WORLD WIDE WEB (WWW) - Working, Web Browsers, Its functions, URLs, web sites, Domain names, Portals. Concept of Search Engines, Search engines types, searching the Web, Web Servers, TCP/IP and others main protocols used on the Web. E-Mail: Concepts, POP and WEB Based E-mail, merits, address, Basics of Sending & Receiving, E-mail Protocols, Mailing List, Free E-mail services, e-mail servers and e-mail clients programs.	12
II	Concepts of Hypertext, HTML introduction, features, uses & versions Using various HTML tags, Elements of HTML syntax, Head & Body Sections, Inserting texts, Text alignment, Using images in pages, Hyperlinks – text and images, bookmarks, Backgrounds and Color controls, ,	12
III	creating and using Tables in HTML, Working with Lists, Tables and Frames ,Working with Hyperlinks, Images and Multimedia ,Working with Forms and controls., Use of font size & Attributes, List types and its tags. Introduction of CSS, Concept of CSS, Creating Style Sheet , CSS Properties , CSS Styling(Background, Text Format, Controlling Fonts) , Working with block elements and objects , CSS Id	12
IV	Introduction to Web Publishing or Hosting ,Creating the Web Site ,Saving the site ,Working on the web site ,Creating web site structure , Creating Titles for web pages , Themes-Publishing web sites.	12
V	Electronic Payment Systems: Introduction, Types of Electronic Payment Systems, Digital Token-Based Electronic Payment Systems, Smart Cards and Electronic Payment Systems, Credit Card-Based Electronic Payment System.	12

Suggested Books:

1. Steven Holzner, "HTML Black Book" Dremtech press.
2. Web Technologies, Black Book, dreamtech Press
3. Web Applications : Concepts and Real World Design, Knuckles, Wiley-India
4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel. Pearson
5. Internet Technology and Web Design Paperback by R K Jain


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Undergraduate Programme(Bachelor of Computer Applications)	
Session 2026-2027	
Part-A Introduction	
Subject	INTERNET TECHNOLOGY LABORATORY
Semester	Fourth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/252P
Course Type:	MJR
Level Of the Course(As per Annexure-I)	251-299
Pre Requisite for the course (if any)	NA
Course Learning Outcomes(CLO)	CLO1: Students shall be able to design website. CLO2: Apply style, formatting, and templates using html and css tag.
Credits	2
Total Marks	10+40=50
Part –B Contents of the Course	
Total Lecture per week	4 HRS

Assignments:

1.Design a HTML document using basic elements like:

<HTML>, <body>, <head>, <title>,
, <hr>.

2.Design a HTML document which show the use of following Text formatting tag:

center, sup, em, ins, sub, font, h1 to h6.

3.Design a HTML document to demonstrate all computer output tag:

Code, kbd, samp, tt, var, pre, listing, xmp.

4.Design a HTML document which demonstrate the use of following tag:

Abbr, acronym, address, bdo, block quote,

Also apply these character entities in your HTML document:

Non-breaking space <, >, & ,

5. Demonstrate how to create a link in an HTML document.

6. Demonstrate how to use an image as a link in HTML document.

7. Demonstrate how to link to another page by opening a new window

8. Demonstrate how to use a link to jump to another part of same document.

9. Demonstrate how to make a vertical and horizontal frameset with three different documents.

10. Design a HTML document which does not allow a user to resize frame.

11. Demonstrate how to make a navigation frame. This navigation frame contains a list of links with the second frame as the target.

12.Design a HTML document having

- Colored background table.
- Table having image in background.
- Colored background cell.
- Table having image in only one cell.

13.Demonstrate how to use the “frame” attribute (with values like: box, void, above, below, hside, Vside, lhs, rhs) and border.

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14. Design how to make forms in html.
15 Design a web form using html and CSS.

Undergraduate Programme(Bachelor of Computer Applications)		
Session 2027-2028		
Part-A Introduction		
Subject	PYTHON PROGRAMMING	
Semester	Fourth Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MNR/253T	
Course Type:	MNR	
Level Of the Course(As per Annexure-I)	251-299	
Pre Requisite for the course (if any)	NA	
Course Learning Outcomes(CLO)	CLO1: Learn Python syntax and semantics CLO2:Develop problem-solving skills using Python CLO3: Understand Python data structures	
Credits	4	
Total Marks	20+80=100	
Part –B Contents of the Course		
Total Lecture per week	4HRS	
Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction to Python: Python variables, Python basic Operators, Understanding python blocks. Python Data Types, Declaring and using Numeric data types: int, float etc. Python Program Flow Control Conditional blocks: if, else and else if, Simple for loops in python	12
II	For loop using ranges, string, list and dictionaries. Use of while loops in python, Loop manipulation using pass, continue, break and else. Programming using Python conditional and loop blocks. Using string data type and string operations, string manipulation methods,	12
III	Python Complex data types:, Defining and creation of list, list slicing, Creation of tuple and use of Tuple data type. List, List Slicing, List comprehension, List manipulation. Creation of Dictionary, Dictionary manipulation, Accessing dictionary elements	12
IV	Functions & Modules: Python Functions, Organizing python codes using functions. Programming using string, list and dictionary built-in functions. User-defined Functions, Arguments & Return Types , Modules	12
V	File Handling & OOP: Python File Operations: Reading files, Writing files in python, Understanding read functions, read (), read line (), read lines (). Understanding write	12

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functions, write () and write lines () Manipulating file pointer using seek. Programming, using file operations.	
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Suggested books:

1. Dive into Python, Mark Pilgrim, Press.
2. Python: The Complete Reference, Martin C. Brown.
3. Fluent Python: Clear, Concise, and Effective Programming (1st Edition), Luciana Ramalho, O'Reilly.
4. Learning Python: Powerful Object-Oriented Programming, Mark Lutz, O'Reilly, Shroff Publishers

Undergraduate Programme (Bachelor of Computer Applications)	
Session 2027-2028	
Part-A Introduction	
Subject	PYTHON PROGRAMMING LABORATORY
Semester	Fourth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MNR/253P
Course Type:	MNR
Level Of the Course(As per Annexure-I)	251-299
Pre Requisite for the course (if any)	NA
Course Learning Outcomes(CLO)	CLO1: Develop problem-solving skills using Python CLO2: Understanding Python Data Structures
Credits	2
Total Marks	10+40=50
Part –B Contents of the Course	
Total Lecture per week	4HRS
Assignments:	
1 Read a list of numbers and writes a program to check whether a particular element is present or not using membership operators.	
2 Read your name and age and write a program to display the year in which you will turn 100 years old.	
3 Read width and length of a cone and write a program to find the area of a rectangle cone.	
4 Write a program to compute distance between two points taking input from the user (Hint: use Pythagorean theorem)	
5 Write a program to read a string and print the vowels present in the string	
6 Write a Python function that takes two lists and returns True if they have at least one common member.	
7 Write a Python program to get the largest number from a tuple	
8 Write a Python program to sum all the items in a list.	
9 Write a Python program to append a list to the second list.	
10 Use list to store [1, 2, 3... 12] and [Jan, Feb, Mar... Dec]. Create a dictionary using these lists where key values are 1, 2, 3... and value are Jan, feb, Mar,... Print the key and value elements of the created dictionary.	
11 Write a program to read and print all the lines of a text file.	

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Undergraduate Programme(Bachelor of Computer Applications)		
Session 2027-2028		
Part-A Introduction		
Subject	Emerging IT TECHNOLOGIES	
Semester	Fourth Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MDC/254T	
Course Type:	MDC	
Level Of the Course(As per Annexure-I)	251-299	
Pre Requisite for the course (if any)	Nil	
Course Learning Outcomes(CLO)	CLO1. Understand the core concepts, advantages, and challenges of key emerging technologies. CLO2. Analyse how these technologies impact businesses, industries, and society	
Credits	3	
Total Marks	15+60=75	
Part –B Contents of the Course		
Total Lecture per week	3HRS	
Unit	Topics	No. of Lecture/ Contact Hours
I	Concept of Artificial Intelligence (AI): History, types, and levels of Artificial intelligence, Applications in healthcare, education, agriculture, and business, Data privacy, accountability, and security, The impact of AI on jobs and society, Brain-Computer Interfaces.	9
II	Data Science and Big Data: Definition of data science and big data examples, Types of big Data, Data acquisition, curation, storage, and usage, Concepts of Big Data and analytics.	9
III	Data science fundamentals involve extracting actionable insights from data through a structured lifecycle: data collection, cleaning, exploratory data analysis (EDA), modelling, and visualization., Data science tools, Applications, Data Scientists, Types of Data, Big data	9
IV	Internet of Things (IoT), Definition, Characteristics of IoT, Features and Applications of IoT, Advantages and Disadvantages of IoT, IoT Protocols, Sensors and actuators used in IoT, Physical and logical design of IoT	9
V	Advanced emerging technology: smart homes, and smart farming, IoT platforms and hands-on simulation. Cloud Computing, Characteristics, Features of Cloud,Cloud services, Public Cloud Platforms: GAE, AWS and Azure, Google Cloud, Cloud Storage, pay per use, Types of Cloud computing services	9

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Suggested Books

- 1 The Coming Wave: Technology, Power, and the Twenty-first Century's Greatest Dilemma by Mustafa Suleyman: Focuses on the rapid development of AI and biotechnology.
- 2 AI Superpowers: China, Silicon Valley, and the New World Order by Kai-Fu Lee: Analyzes the competition and advancements in AI.
- 3 Soonish: Ten Emerging Technologies That'll Improve and/or Ruin Everything by Kelly Weinersmith & Zach Weinersmith: A humorous, deep dive into technologies like robot manufacturing and 3D printing.

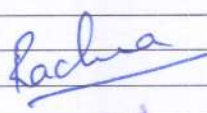
Fifth semester (2028-2029)

Undergraduate Programme(Bachelor of Computer Applications)		
Session 2028-2029		
Part-A Introduction		
Subject	VB.NET	
Semester	Fifth Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MJR/301T	
Course Type:	MJR	
Level Of the Course(As per Annexure-I)	300-350	
Pre Requisite for the course (if any)	NA	
Course Learning Outcomes(CLO)	CLO1: To develop Windows-based Applications using VB.NET CLO2: To learn event-driven and object-oriented programming concepts CLO3: To connect Applications with databases using ADO.NET	
Credits	4	
Total Marks	20+80=100	
Part –B Contents of the Course		
Total Lecture per week	4 HRS	
Unit	Topics	No. of Lecture/ Contact Hours

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I	Introduction to .NET and .NET Framework,CLR (Common Language Runtime),CTS and CLS,.NET Architecture,Introduction to Visual Studio IDE,Features of VB.NET,Structure of a VB.NET Program,Keywords, Identifiers, Comments.Data Types & Control Structures: Variables and Constants,Data Types in VB.NET,Type Conversion,	12
II	Operators (Arithmetic, Relational, Logical),ConditionalStatements,If... Then,If... Else,Select Case,Looping Statements,For...Next,While...End While,Do While / Do Until, Procedures, Arrays & Strings:Sub Procedures,Function Procedures,Passing Arguments (ByVal, ByRef),	12
III	Arrays,SingleDimensional,Multidimensional,String Handling,String Functions,Date and Time Functions,Working with Forms: Loading, showing and hiding forms, controlling One form within another. Designing menues :ContextMenu.	12
IV	GUI Programming :Windows Form: Textbox, Label, Button, Listbox, Combobox Checkbox, PictureBox, RadioButton,There Properties, Methods and events. OpenFileDialog, SaveFileDialog, FontDialog, ColorDialog, PrintDialog.	12
V	Database programming with ADO.NET – Overview of ADO, from ADO to ADO.NET, Accessing Data using Server Explorer. Creating Connection, Command, Data Adapter and Data Set with OLEDB and SQLDB. Display Data on data bound controls, display data on data grid.	12
Suggested Books:		
1. Visual Basic .NET Programming – Black Book, Steven Holzner 2. VB.NET Programming – Kogent Learning Solutions 3. Beginning VB.NET – Wrox Publications		

Undergraduate Programme(Bachelor of Computer Applications)	
Session 2028-2029	
Part-A Introduction	
Subject	VB.NET LABORATORY
Semester	Fifth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/301P
Course Type:	MJR
Level Of the Course(As per Annexure-I)	300-350
Pre Requisite for the course (if any)	Nil
Course Learning Outcomes(CLO)	CLO1: To develop Windows-based Applications using VB.NET CLO2: To learn event-driven and object-oriented programming concepts CLO3: To connect Applications with databases using ADO.NET
Credits	2
Total Marks	10+40=50
Part –B Contents of the Course	
Total Lecture per week	4HRS
Assignments:	
1. Design a form in vb.net using the following controls • 3 Textboxes • 4 Buttons 2. Perform the following : • Change the text of the buttons as	


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- Button1 “+”
- Button2 “-”
- Button3 “*”
- Button4 “/”

Input values on textbox1 and textbox2 and display the result on textbox3 according to the type of the button clicked.

3. Using the above form Display the result on textbox3 when any changes made on Textbox1 and Textbox2.

4. Design a simple Text Editor in vb.net to implement find and replace operation.

5. Design 2 List Boxes on a Form and perform following

- Add at least 5 Items on Listbox1
- Display the selected item on the Textbox
- Remove selected item from the ListBox1
- Move selected item of ListBox1 into ListBox2

6 Design a form using 1 List Box and 1 textbox and perform following

- Add 5 items on List Box

Highlight the item of the List Box, if typed character/s on TextBox1 is matched with the character/s of the List Box.

7. Design MDI (Multiple Document Interface) Form in vb.net that consists of Menu Bar and Toolbar.

8. Create a basic text editor that enables user to open the selected text file on TextBox. (Hint. Use OpenFileDialog control)

9 Design a form using checkboxes and radiobuttons and display the text of selected checked boxes and RadioButton

10. Create a database “**employee.mdb**” in Ms-access.

Create a table emp whose fields are as follows

- EmpId
- EmpName
- Emp_Dept
- Emp_salary

On the above tables perform following

- Establish the connection to employee.mdb
- Insert/Update/Delete data in the above tables using form
- Display the first record of emp on Textboxes used on form.

Display all the records on Data Grid View control

Undergraduate Programme(Bachelor of Computer Applications)	
Session 2028-2029	
Part-A Introduction	
Subject	MOBILE APPLICATIONS DEVELOPMENT
Semester	BCA Fifth Semester
Name Of the Course	Bachelor of Computer Applications
Course Code	04/BCA/MJR/302T
Course Type:	MJR
Level Of the Course(As per Annexure-I)	300-350
Pre Requisite for the course (if any)	Nil

Course Learning Outcomes(CLO)	CLO1:Able to understand outline the Mobile architecture CLO2: Understand API, JSON, APK and other terminologies.
Credits	4
Total Marks	20+80=100

Part –B Contents of the Course

Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction to Mobile Computing, Evolution of Mobile Devices, Mobile Operating Systems overview (Android and iOS), Introduction to Android, Android Architecture, Android SDK, Installing and Configuring Android Studio, Android Virtual Device (AVD), Emulators and Real Device Setup, Android Applications Components such as Activity, Service, Broadcast Receiver, Content Provider.	12
II	Android Project Structure, Android Manifest File, Activities and Activity Lifecycle, Intents (Explicit and Implicit), UI Layouts such as Linear Layout, Relative Layout, Constraint Layout, Views and Widgets, Event Handling, Toast Messages, Dialogs, Notifications, Resources including Strings, Colours, Styles, Dimensions.	12
III	Recycler View, List View, Adapters, Fragments and Fragment Lifecycle, Menus including Options Menu, Context Menu and Popup Menu, Shared Preferences, Internal Storage, External Storage, SQ Lite Database, Introduction to Room Persistence Library.	12
IV	Internet Permission and Networking Basics, REST APIs, JSON Parsing, Retrofit Library, Background Tasks, Services, Work Manager overview, Location Services, Sensors overview, Introduction to Material Design, Jetpack Components including Live Data and View Model (basic concepts).	12
V	Debugging Android Applications, Testing concepts including Unit Testing and UI Testing, APK and AAB (Android App Bundle), Google Play Store Publishing Process, App Performance and Security Basics, Introduction to iOS Development, Comparison between Android and iOS, Overview of Cross-Platform Development tools such as Flutter and React Native.	12

Undergraduate Programme (Bachelor of Computer Applications) Session 2028-2029

Part-A Introduction

Subject	MOBILE APPLICATIONS DEVELOPMENT LABORATORY
Semester	Fifth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/302P
Course Type:	MJR
Level Of the Course(As per Annexure-I)	300-350
Pre Requisite for the course (if any)	Basic Programming Language

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Course Learning Outcomes(CLO)	CLO1: Student will be able to design and develop android Applications.
Credits	2
Total Marks	10+40=50

Part –B Contents of the Course	
Assignments:-	
Q1 Installation of Android studio.	
Q2 Development of Hello World Applications.	
Q3 Create an Applications that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.	
Q4 Create a screen that has input boxes for User Name, Password, Address, Gender(radio buttons for male and female), Age (numeric), and a Submit button. On clicking the submit button, print all the data below the Submit Button (use any layout).	
Q5 Design an android Applications to create page using Intent and one Button and pass the Values from one Activity to second Activity.	
Q 6 Design an android Applications Using Radio buttons.	
Q7 Design a Registration form in Android.	
Q 8 Design an android Applications for menu.	
Q9 Design a calculator to perform addition, subtraction, multiplication and division.	
Q 10 Write a program in Android to display the multiplication table of a number.	

Undergraduate Programme(Bachelor of Computer Applications)	
Session 2028-2029	
Part-A Introduction	
Subject	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
Semester	Fifth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MNR/303T
Course Type:	MNR
Level Of the Course(As per Annexure-I)	300-350
Pre Requisite for the course (if any)	Nil
Course Learning Outcomes(CLO)	CLO1:Able to understand AI CLO2: create and analyse Machine Learning model
Credits	6

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Total Marks		30+120=150
Part –B Contents of the Course		
Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction and Definition, Historical background, Various branches of AI, AI Applications and Challenges, Intelligent behaviour of AI. The Turing test, Agents definition, Environment. The importance of perception and environmental interactions	18
II	Types of agents: Autonomous versus semi-autonomous, Reflexive, goal-based, and utility-based, Single versus multi-agent. Types of Environment: Environment, Types of environment: Rational versus non-rational reasoning, Fully versus partially observable, Deterministic versus stochastic, Static versus dynamic, Discrete versus continuous.	18
III	Uninformed search algorithms: breadth-first search, depth-first search , Iterative deepening depth first search; Informed search algorithms: greedy best first search, A* search , Perception & its types , Concept of Neural Network Learning – Feed Forward & Back Propagation	18
IV	Introduction to Machine Learning and its Applications, Types of Machine Learning: Supervised Learning - Regression and Classification, Logistic regression, Linear regression, Applications of supervised learning. Unsupervised Learning	18
V	Measuring accuracy, Confusion matrix, Domains and Applications of AI Domains in AI: Introduction to Machine Learning, Computer Vision, Robotics, Natural Language Processing, Deep Neural Networks, and their Applications. Expert Systems.	18
Suggested books:		
1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill. 2. Artificial Intelligence: A Modern Approach. Stuart Russell and Peter Norvig. Prentice Hall. 3. Machine Learning, C. Bishop T. M. Mitchell, McGraw-Hill 4. Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.		

Undergraduate Programme(Bachelor of Computer Applications)	
Session 2028-2029	
Part-A Introduction	
Subject	DIGITAL MARKETING
Semester	FIFTH SEMESTER
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MDC/304T
Course Type:	MDC
Level Of the Course(As per Annexure-I)	300-350

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Pre Requisite for the course (if any)		Nil
Course Learning Outcomes(CLO)		CLO1: To develop in students an understanding of Digital Marketing
Credits		3
Total Marks		15+60=75
Part –B Contents of the Course		
Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction to Digital Marketing, Digital vs. Traditional Marketing, 4P's and 4C's of Digital Marketing. Consumer Insights: Online Consumer Behaviour, The Customer Value Journey (5As Framework). Strategies: Setting Marketing Objectives (SMART Goals).	09
II	Web Setup: Introduction to WordPress/CMS, Choosing Domains, Hosting Fundamentals. SEO: Introduction to Search Engines (Crawling, Indexing), On-Page Optimization (keywords, Meta tags). Off-Page SEO: Backlinks, Link Building Tips, Local SEO & Google Mapping.	9
III	Content Marketing: Developing a Content Strategy, Storytelling, Content Strategy Formulation. Social Media Marketing (SMM): Social Media Platforms Overview (Facebook, Instagram, LinkedIn, YouTube), Community Building, Organic vs. Paid SMM. Emerging Trends: Using AI tools for content generation and research	9
IV	Search Engine Marketing (SEM): Pay-Per-Click (PPC) Advertising, Google AdWords, Understanding CPC and CPM. Display Advertising: Display Ad Networks, Banner Ads. Email Marketing: Types of Emails, Email Automation, Building Subscriber Lists.	9
V	Analytics: Introduction to Google Analytics 4, Measuring ROI, Social Media Metrics. Tools: Webmaster Tools, Using Data to Improve Performance.	9

Suggested books:

1. Digital Marketing, S. Gupta, McGraw-Hill
2. Marketing Strategies for Engaging the Digital Generation , D. Ryan
3. Basics of marketing and Digital marketing, Dr. Arpita Baijal, Preet M. Jain, Purva Shah, Rashi Bhutada, Rohan Gupta.
4. The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns by Ian Dodson (Wiley). ISBN-13: 978-8126564408
5. Understanding Digital Marketing: A Complete Guide to Engaging Customers and Implementing Successful Digital Campaigns by Damian Ryan (Kogan Page Ltd). ISBN-13: 978-1789666014

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Sixth Semester (2028-2029)

Undergraduate Programme(Bachelor of Computer Applications)		
Session 2028-2029		
Part-A Introduction		
Subject	R Programming	
Semester	Sixth Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MJR/351T	
Course Type:	MJR	
Level Of the Course(As per Annexure-I)	351-399	
Pre Requisite for the course (if any)	Basic Statistics, Fundamentals of Programming	
Course Learning Outcomes(CLO)	CLO1: Write efficient R programs for data analysis CLO2: Perform statistical operations and create visualizations CLO3: Handle data structures and perform data manipulation CLO4: Implement machine learning algorithms using R	
Credits	4	
Total Marks	20+80= 100	
Part –B Contents of the Course		
Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	History and features of R, Installing R and RStudio, R syntax and basic operations, Data types: numeric, character, logical, complex, Variables and operators, Input/Output operations, Comments and code formatting.	12
II	Vectors: creation, indexing, operations, Matrices and arrays,Lists and their manipulation, Data frames: creation, subsetting, merging, Factors for categorical data, Data structure conversions, Missing values (NA, NaN, NULL)	12
III	Conditional statements (if, if-else, ifelse), Loops: for, while, repeat, Break and next statements, Functions: built-in and user-defined, Function arguments and return values, Scope and environment, Apply family functions (apply, lapply, sapply, tapply).	12
IV	Reading and writing data (CSV, Excel, databases), Data cleaning and preprocessing, Data package: filter, select, mutate, arrange, Reshaping data: melt and cast, Base plotting system, Graphics parameters, ggplot2 package fundamentals, Creating: scatter plots, histograms, bar charts, box plots, Faceting and layering, Interactive visualizations with plotly.	12
V	Descriptive statistics, Probability distributions, Hypothesis testing, Correlation and regression, Classification algorithms (Decision Trees, Random Forest), Clustering (K-means, Hierarchical), Model evaluation and validation	12

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Suggested Books:

1. "R for Data Science" by Hadley Wickham and Garrett Grolemund
2. "The Art of R Programming" by Norman Matloff
3. "R in Action" by Robert Kabacoff

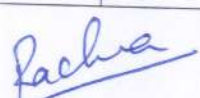
Undergraduate Programme(Bachelor of Computer Applications)	
Session 2028-2029	
Part-A Introduction	
Subject	R PROGRAMMING LABORATORY
Semester	Sixth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/351P
Course Type:	MJR
Level Of the Course(As per Annexure-I)	301-399
Pre Requisite for the course (if any)	NA
Course Learning Outcomes(CLO)	CLO1: Learn R syntax and semantics CLO2: Develop problem-solving skills CLO3: Perform statistical operations and create visualizations
Credits	2
Total Marks	10+40=50
Part –B Contents of the Course	
Total Lecture per week	4HRS

Assignments:

1. Write a R Program to print "Hello World".
2. Write a R Program to Add Two Vectors.
3. Find Sum, Mean and Product of Vector using R Programming.
4. Write a R Program to Take Input from User.
5. Write a R Program to Generate Random Number from Standard Distributions.
6. Write a R Program to Sample from a Population.
7. Write a R Program to Find Minimum and Maximum.
8. Write a R Program to Sort a Vector.
9. Implement data frames in R
10. Implement different data structures in R(Vectors ,Lists ,Data Frames)
11. Write a program to read a csv file and analyze the data in the file in R
12. Create pie charts and bar charts using R.
13. Write R program to build clustering model using K-mean algorithm.

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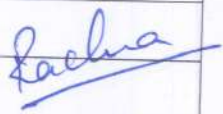
Undergraduate Programme(Bachelor of Computer Applications)		
Session 2028-2029		
Part-A Introduction		
Subject	PROJECT MANAGEMENT	
Semester	Sixth Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MJR/352T	
Course Type:	MJR	
Level Of the Course(As per Annexure-I)	351-399	
Pre Requisite for the course (if any)	Nil	
Course Learning Outcomes(CLO)	CLO1: Able to understand how to manage project CLO2: Understand Project life cycle	
Credits	4	
Total Marks	100 = (20+80)	
Part –B Contents of the Course		
Total Lecture per week	4 HRS	
Unit	Topics	No. of Lecture/ Contact Hours
I	Meaning and Definition of Project, Characteristics of a Project, Difference between Project and Operations, Project Management:- Concept and Importance, Role of Project Manager, Project Life Cycle, Project Stakeholders, Challenges in Project Management.	12
II	Project Planning Process, Project Scope and Scope Management, Work Breakdown Structure (WBS), Project Objectives and Deliverables, Project Assumptions and Constraints Feasibility Study, Project Charter, Requirement Analysis, Change Management Basics.	12
III	Project Time Management, Activity Definition and Sequencing, Project Scheduling Concepts, Introduction to MS Project, Project Cost Management, Budgeting Concepts, Project Quality Management, Quality Planning, Assurance and Control.	12
IV	Project Risk Management, Types of Risks in Projects, Risk Identification and Analysis, Risk Response Strategies, Human Resource Management, Team Formation and Motivation, Communication Management, Stakeholder Communication, Conflict Management in Projects.	12
V	Project Monitoring and Control, Performance Measurement Basics, Project Documentation, Project Closure Process, Success and Failure of Projects, Ethical Issues in Project Management, Recent Trends in Project Management	12
Suggested Books:-		
1.Project Management 2nd Edition - Adrienne Watt.		
2. Project Management — R. B. Khanna.PHI, ISBN-13: 978-8120342880		
3. Project Management – Oguz, second edition		
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Undergraduate Programme(Bachelor of Computer Applications)	
Session 2028-2029	
Part-A Introduction	
Subject	MINOR PROJECT
Semester	Sixth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/352P
Course Type:	MJR
Level Of the Course(As per Annexure-I)	351-399
Pre Requisite for the course (if any)	NA
Course Learning Outcomes(CLO)	CLO1: Understand design and develop projects using current tools and techniques. CLO2: Able to work in a team CLO 3: Enhances Report writing Ability
Credits	2
Total Marks	10+40=50
Part -B Contents of the Course	
Total Lecture per week	4HRS
Work to be carried out in Minor Project	
A minor project is to be created with the tools and techniques currently used in industry in a team of three/Four students. Presentation and demonstration of the project is to be carried out at various stages of the project under the guidance of Project Guide of the Department. A report of 30-40 pages is to be prepared by the team.	

Undergraduate Programme(Bachelor of Computer Applications)	
Session 2028-2029	
Part-A Introduction	
Subject	DATA SCIENCE
Semester	Sixth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MNR/353T
Course Type:	MNR
Level Of the Course(As per Annexure-I)	351-399
Pre Requisite for the course (if any)	Familiarity with artificial Intelligence and statistics.


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Course Learning Outcomes(CLO)	CLO1: Able to understand the fundamental concept of data science CLO2: Understand and handle datasets. CLO3: Understand Machine learning concepts		
Credits	4		
Total Marks	20+ 80=100		
Part –B Contents of the Course			
Total Lecture per week			
Unit	Topics	No. of Lecture /Contact Hours	
I	Introduction to Data Science: Definition, Advantages and Applications of data science and Big Data, Structured data, Unstructured data, network data, machine generated data,Semi structured data, Challenges of Big data, Use of Big data for industries	18	
II	Measures of central tendency-mean, mode, median, measures of dispersion, Inferential Statistics through confidence intervals, hypothesis tests: Null hypothesis, alternate hypothesis; Errors in Inferential Statistics: level of significance, Random variables, and Probability Distributions	18	
III	Basics and design principle of Pattern Recognition:Definition,core concept of Pattern Recognition, Working of Pattern Recognition System: Data Acquisition,Pre-processing,Feature Extraction, Feature selection, Training and Test datasets, validation dataset, Examples of Datasets, Applications and Limitations of Pattern Recognition	18	
IV	Fundamental of Machine Learning: Supervised Learning - Regression and Classification, Decision Trees, Support Vector Machines, Random Forest, Unsupervised Learning and Challenges: Clustering, K-means, Associative Rule Mining	18	
V	Introduction to Data Visualization: Definition and importance of Data Visualization, principles of effective data visualization, Types of data visualization: Graph, Charts, And Maps: Tools of Data visualization.	18	
Suggested Books:			
1. Joel Grus, "Data Science from Scratch", 2nd Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2019. 2. Foundations of Data Science. Avrim Blum, John Hopcroft and RavindranKannan 3.VijayKotu and BalaDeshpande, DataScience:concept and practice ,second edition Elsevier science publication 2018.			

Undergraduate Programme(Bachelor of Computer Applications)	
Session 2028-2029	
Part-A Introduction	
Subject	DATA SCIENCE LABORATORY
Semester	Sixth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MNR/353P
Course Type:	MNR



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Level Of the Course(As per Annexure-I)	301-399
Pre Requisite for the course (if any)	NA
Course Learning Outcomes(CLO)	CLO1: Understand and handle datasets. CLO2: Understand Machine learning concepts
Credits	2
Total Marks	10+40=50
Part –B Contents of the Course	
Total Lecture per week	4HRS
Implement the following machine learning programs. Use Machine Learning library wherever required and plot wherever possible 1. Study at least two different datasets. 2. Generate random linear data and plot the points (scatter plot). 3. Implement linear regression . Take random linear data with noise as input. Also, plot the graph. 4. Implement SVM for classifying using petal length and petal width (use iris dataset). 5. Implement Decision tree. 6. Generate 100 data of two classes, do modifications in a few data and plot initial data and data after modification. 7. Write a program to compute mean, median, mode, variance using any standard datasets.	

Seventh semester (2029-2030)

Undergraduate Programme(Bachelor o f Computer Applications)	
Session 2029-20230	
Part-A Introduction	
Subject	WEB TECHNOLOGIES
Semester	Seventh Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS(HONOURS)
Course Code	04/BCA/MJR/401T
Course Type:	MJR
Level Of the Course(As per Annexure-I)	400-450
Pre Requisite for the course (if any)	HTML, CSS, Database Management Systems
Course Learning Outcomes(CLO)	CLO1: Write PHP scripts for web development CLO2: Handle forms and manage sessions CLO3: Integrate MySQL databases with PHP CLO4: Develop complete web Applications
Credits	4
Total Marks	20+80=100
Part –B Contents of the Course	

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Total Lecture per week		
Unit	Topics	No. of Lecture/Contact Hours
I	Web technologies overview, Server-side vs client-side scripting, PHP features and architecture, Installing XAMPP/WAMP, PHP syntax and structure, Variables and constants, Data types: scalar, compound, special, Operators: arithmetic, comparison, logical, assignment, Type casting and type juggling, Comments and output statements	12
II	Conditional statements: if, if-else, elseif, switch, Looping: for, while, do-while, for each, break and continue statements, Functions: built-in and user-defined, Function parameters and return values, Variable scope: local, global, static, Anonymous functions and closures, Variable functions, Include and require statements, Date and time functions.	12
III	Indexed arrays, Associative arrays, Multidimensional arrays, Array functions:, Array manipulation:, String functions, string parsing, Regular expressions, Pattern matching, Explode and implode functions. Date and time functions, File upload and Download.	12
IV	HTML form creation, GET and POST methods, \$_GET, \$_POST, \$_REQUEST super globals, Form validation techniques, Sanitizing and validating input, File uploads: \$_FILES array, File handling functions, Directory operations, File permissions, Cookie handling, Session management.	12
V	MySQL basics and php MyAdmin, Connecting PHP to MySQL, MySQLi extension: procedural and OOP, PDO (PHP Data Objects), Creating databases and tables, INSERT, SELECT, UPDATE, DELETE operations Prepared statements, Handling result sets, Shopping cart mechanism	12
Suggested Books: 1. "PHP and MySQL Web Development" by Luke Welling and Laura Thomson 2. "Learning PHP, MySQL & JavaScript" by Robin Nixon 3. "Programming PHP" by Kevin Tatroe and Peter MacIntyre 4. "Modern PHP" by Josh Lockhart		

Undergraduate Programme (Bachelor of Computer Applications)	
Session 2029-2030	
Part-A Introduction	
Subject	WEB TECHNOLOGIES LABORATORY
Semester	seventh semester
Name Of the Course	Bachelor of Computer Applications
Course Code	04/BCA/MJR/401P
Course Type:	MJR
Level Of the Course(As per Annexure-I)	400-450

Pre Requisite for the course (if any)	NA
Course Learning Outcomes(CLO)	CLO1: Write PHP scripts for web development CLO2: Handle forms and manage sessions CLO3: Integrate My SQL databases with PHP CLO4: Develop complete web Applications with security features
Credits	2
Total Marks	10+40=50
Part –B Contents of the Course	
Total Lecture per week	4 HRS
Assignments: - Write a php program to get name of the user from a form and show greeting text. - Write a PHP program to display a digital clock which displays the current time of the server. - Write a PHP program to implement simple calculator operations. - Create a web page for an online quiz. Write 10 questions on any general topic with answers using radio buttons. Display the final score. - Create a user registration form and store the record of the user in a file. - Design a web page to set a cookie and retrieve the cookie - Design a simple website for cart mechanism. - Where a user can add/delete items from the displayed items. - User can select multiple numbers of items. - Website should display total cost for the selected items - write a program to perform CRUD operations in PHP - Create a PHP page for login system using session.	

Undergraduate Programme (Bachelor of Computer Applications)	
Session 2029-2030	
Part-A Introduction	
Subject	WEB PROGRAMMING USING ASP .NET
Semester	Seventh Semester
Name Of the Course	Bachelor of Computer Applications
Course Code	04/BCA/MJR/402T
Course Type:	MJR
Level Of the Course(As per Annexure-I)	400-450
Pre Requisite for the course (if any)	HTML, CSS, JavaScript, VB.NET/C#
Course Learning Outcomes(CLO)	CLO1: Design and develop web Applications using ASP.NET CLO2: Implement state management and navigation techniques CLO3: Create data-driven web Applications with database integration CLO4: Implement security and authentication mechanisms

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Credits		4	
Total Marks		20+80=100	
Part –B Contents of the Course			
Total Lecture per week			
Unit	Topics		No. of Lecture Contact Hours
I	Introduction to ASP.NET, Evolution of web technologies, ASP.NET framework overview,Web Forms vs MVC vs Web API, IIS (Internet Information Services) configuration,Visual Studio for web development,Page life cycle,Code-behind model,ASP.NET Applications.		12
II	ASP.NET Web Controls ,HTML controls vs Server controls,Standard controls: Label, TextBox, Button, LinkButton,List controls: DropDownList, ListBox, CheckBoxList, RadioButtonList,Rich controls: Calendar, AdRotator, FileUpload,Validation controls: RequiredFieldValidator, CompareValidator, RangeValidator, RegularExpressionValidator, CustomValidator, ValidationSummary,Master pages and content pages,User controls and custom controls		12
III	State Management,Client-side state management,ViewState,Cookies,Query strings,Hidden fields,Server-side state management,Session state, Applications state,Cache,State management best practices,Cross-page posting		12
IV	Data Access with ADO.NET ,ADO.NET in web Applications,SqlDataSource control,AccessDataSource control,DataList and Repeater controls,GridView: displaying, paging, sorting,DetailsView and FormView, Data binding expressions,CRUD operations with GridView,Master-detail relationships,LINQ to SQL and Entity Framework basics,Connection pooling.		12
V	Security and Deployment ,Authentication types: Windows, Forms, Passport,Forms authentication implementation, Login controls: Login, LoginView, LoginStatus, LoginName,Role-based authorization, Membership and role providers,SSL and HTTPS,SQL injection prevention,Cross-site scripting (XSS) protection, Applications deployment,Web Applications optimization		12

Suggested Books:

1. "Pro ASP.NET 4.5 in C#" by Adam Freeman
2. "Beginning ASP.NET 4.5 in C#" by Matthew MacDonald
3. "Professional ASP.NET 4.5" by Jason N. Gaylord
4. "ASP.NET Unleashed" by Stephen Walther

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Undergraduate Programme(Bachelor of Computer Applications)	
Session 2029-2030	
Part-A Introduction	
Subject	ASP .NET LABORATORY
Semester	Seventh Semester

Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/402P
Course Type:	MJR
Level Of the Course(As per Annexure-I)	400-450
Pre Requisite for the course (if any)	Nil
Course Learning Outcomes(CLO)	CLO1: Design and develop web Applications using ASP.NET CLO2: Implement state management and navigation techniques CLO3: Create data-driven web Applications with database integration
Credits	2
Total Marks	10+40=50

Part –B Contents of the Course

Total Lecture per week

4HRS

Assignments:

1.Design a form to create account in website using following fields

- First name
- Last name
- Username
- Password
- Confirm Password
- Gender

2.Validate the account form using validation control

- Required field Validation
- Range Validation
- Compare Validation
- Regular Expression Validation
- Summary Validation

3.Write a simple ASP.NET program to display the following Web Controls:

- A button with text “click me”. The button control must be in the center of the form.
- A label with a text hello
- A checkbox. The form name must be Web Controls
-

4.Create a database college and create following tables(consider appropriate fields):

login
Department
Staff
Student

5.Design web forms to input values in the above tables

6. Write a program to connect the web form to Database College and display following

- display all usernames in the login table
- display names of departments
- display names of students beginning with ‘A’

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Undergraduate Programme(Bachelor of Computer Applications)		
Session 2029-2030		
Part-A Introduction		
Subject	VISUAL COMPUTING	
Semester	Seventh Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MJR/403T	
Course Type:	MJR	
Level Of the Course(As per Annexure-I)	400-450	
Pre Requisite for the course (if any)	NA	
Course Learning Outcomes(CLO)	CLO1:Understand screen display system CLO2: Able to understand various transformations and Graphics CLO3:Understand image processing operation CLO4:Learn open problems in Computer Vision	
Credits	4	
Total Marks	20+80=100	
Part –B Contents of the Course		
Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	Visual Synthesis. Taxonomy of Computer Graphics – Raster & Vector Displays, Frame Buffer, Persistence, Resolution, Refresh Rate, Aspect Ratio. Input Modes & Methods. Basics of Coordinate Systems – Points, Lines, Planes and Curves. Color Generation – RGB, CMYK, HSV	12
II	Two-Dimensional Systems – 2D Objects Representation, 2-D Transformations, 2-D Viewing Pipeline, Clipping - Line clipping, Polygon clipping, Polygon Filling. Antialiasing. Three-Dimensional Systems, 3-D Transformations,	12
III	Parallel and Perspective Projection, Degrees of Freedom, 3-D Graphics Pipeline, 3-D Object Representation – Polygon Surfaces, Polygon Meshes. Visible Surface Detection - Back face, Z-buffer, painter algorithm. Concepts of Imaging Systems. The Pinhole Camera and its properties. Illumination Models – Ambient, Diffuse, Specular, Halftones and Dithering. Anatomy of a Digital Camera.	12
IV	Image Based Visual Computing. Color and Grey images, Processing in Spatial and Frequency Domain. Convolution operation, Image Filters - Convolution and Linear Filters. Blur, Sharpen and Edge Operations. Histogram, Color and Pixel level operations. Thresholding and Band Pass Filters.	12

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47

V	Non-Linear and Morphological Operations – Noise Filtering, Dilation, Erosion, Majority. Contour Properties & Applications. Definitions and Brief Introduction only – Image Segmentation, Registration, Restoration and Compression. Object Detection & Recognition. Open Problems in Computer Vision.	12
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Suggested Books:

Suggested Books:

1. Donald D Hearn, M. Pauline Baker, Computer Graphics C version, Pearson Education.
2. James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes, Computer Graphics: Principles & Practice in C, Addison Wesley Longman.
3. Digital Image processing and analysis, B. Chandra and D. Majumder
4. Fundamental of digital image processing, Anil K. Jain

Undergraduate Programme (Bachelor of Computer Applications)	
Session 2029-2030	
Part-A Introduction	
Subject	VISUAL COMPUTER LABORATORY
Semester	Seventh Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/403P
Course Type:	MJR
Level Of the Course(As per Annexure-I)	400-450
Pre Requisite for the course (if any)	NA
Course Learning Outcomes(CLO)	CLO1: Able to understand and implement transformations operations CLO2: Understand and implement image processing operation
Credits	2
Total Marks	10+40=50
Part –B Contents of the Course	
Total Lecture per week	4 HRS
Assignments	
Write programs using C (from Q1 to Q6) and from Q7 onwards write programs in python using openCV)	
1. Draw a figure having various shapes using library functions available in a programming language. 2. Draw a generic line with the following attributes (i/p to algorithm is type, width and color of the line): Type: Dotted, Dashed Width: single, double, three times	

Color: color1, color2, color3 etc.

3. Write a program to draw a polygon and fill it using
 - Boundary fill
 - Floodfill
 Use either 4-connected/8-connected neighbourhood
4. Draw a polygon and perform following 2-D transformations
 - Translation (by 30 pixels in x direction and 25 pixels in y direction)
 - Rotation (by angle 30 degree)
 - Scaling (reduce the size by half)
5. write a program to draw a square which increases to a maximum size and then decreases to its original size.(use scaling, maximum size is given by the user)
6. Write a program to plot histogram of a gray and a colored (R,G,B channel) image. Implement image enhancement using histogram equalization.
7. Apply cropping, rotation, scaling, and translation on an image.
8. Perform the following operations in an image.
 - (a) Blur, (b)sharpen, (c) edge detection
9. Perform object detection using background subtraction.

Undergraduate Programme(Bachelor of Computer Applications)		
Session 2029-2030		
Part-A Introduction		
Subject	COMPUTER SYSTEM ARCHITECTURE	
Semester	Seventh Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/DSE/404T	
Course Type:	DSE	
Level Of the Course(As per Annexure-I)	400-450	
Pre Requisite for the course (if any)	Nil	
Course Learning Outcomes(CLO)	CLO1: Able to understand basic of computer organization and CPU organization. CLO2: Learn working of microprocessor. CLO3: Understand and write assembly language programs.	
Credits	4	
Total Marks	20 + 80=100	
Part –B Contents of the Course		
Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	Basic Computer Organization and Design: Computer register, bus system, instruction set, timing and control, instruction cycle, Microprocessor Architecture & Operations, Memory reference, I/O Operations and interrupt, Types of interrupt.	12

II	CPU Organization: Data, Address & control bus, ALU, Instruction formats, Stack organization, Subroutines, Addressing modes-Direct, indirect, Immediate, Indexed and relative. Addressing formats one, two and three addresses, DMA.	12
III	Microprocessor 8085: Architecture of 8085 microprocessor, Registers, Pins of 8085 microprocessor. Instruction set of 8085, Mnemonics and operation codes of data transfer group, Arithmetic group, Logic group, Branches group and stack, I/O and Machine control group, assembly language, Assembler	12
IV	8086 microprocessor: Architecture, register organization, bus interface unit, execution unit, Instruction set and addressing mode, assembler directives.	12
V	Memory Hierarchy, Memory addressing, memory segmentation, Associative Memory: Hardware Organization, Match Logic, Read operation, and Write Operation. Cache Memory: Locality of Reference, Hit & Miss Ratio, Mapping, Write Policies. Simple programs in assembly language, Writing, Assembling & Executing A Program.	12

Suggested Books:

1. System Architecture, M. Morris R., Mano, PHI
2. Computer Computer Organization and Design, David A. Patterson and John L. Hennessy, Morgan Kauffman.
3. Microprocessor, Architecture, Programming, & Applications with the 8085 6/e (Ramesh Gaonkar)
4. Computer Architecture and Organization, John P. Hayes, TMH.

Undergraduate Programme(Bachelor of Computer Applications)	
Session 2029-2030	
Part-A Introduction	
Subject	COMPILER DESIGN
Semester	Seventh Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/DSE/405T
Course Type:	DSE
Level Of the Course(As per Annexure-I)	400-450
Pre Requisite for the course (if any)	Nil
Course Learning Outcomes(CLO)	CLO1: Understand phases of compiler. CLO2: Able to constructing symbol tables, generate intermediate code.
Credits	4

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Total Marks		20 + 80=100
Part –B Contents of the Course		
Total Lecture per week		4HRS
Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction to translators, compilers, interpreters, compilation process. Lexical analyzer, input buffering, specification and recognition of tokens, regular expressions to NFA, minimization of DFA, keywords, LEX - the lexical analyzer generator.	12
II	Syntax analyzer, context free grammars, top down parsing, Brute force parser, recursive descent parser, LL (1) parser. Bottom up parsing, operator precedence parsing, LR parser, LALR parser	12
III	Syntax directed translation schemes, implementation of syntax directed translators, construction of syntax trees, bottom up evaluation of S- attributed definitions, L- attributed definitions, top down translation of L - attributed definitions. Errors, lexical phase errors, syntactic phase errors.	12
IV	Intermediate languages, postfix notation, syntax trees, parse trees, three address code- quadruples, triples and indirect triples. Translation of assignment statements, boolean expressions, statements that alter flow of control, array references, procedure calls, declarations, case statement, record structures.	12
V	Symbol tables, operation on symbol tables, Code optimization, sources of optimization, loop optimization,, Code generation, a machine model	12
Suggested Books:		
1. Compilers, Principles, techniques and tools, Aho, Ullman and Sethi, Pearson Education.		
2. The Theory and Practice of Compiler Writing, Tremblay, Sorenson, BSP.		
3. Compiler Design in C, Holub, PHI.		

Undergraduate Programme (Bachelor of Computer Applications)	
Session 2029-2030	
Part-A Introduction	
Subject	ADVANCED DATA STRUCTURE
Semester	Seventh Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/DSE/406T
Course Type:	DSE
Level Of the Course(As per Annexure-I)	400-450
Pre Requisite for the course (if any)	Basic Concept Of C Programming, Data Structures, Object Oriented Programming through C++
Course Learning Outcomes(CLO)	CLO1: Understand the basic principles and operations of data structures. CLO2: Apply Hashing and String Matching techniques CLO3: Apply the concepts of advanced Trees and Graphs CLO4: Analyse the given scenario and choose appropriate Data Structure

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Credits		4
Total Marks		20+ 80=100
Part –B Contents of the Course		
Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	Trees, Tree Traversals, Preorder, inorder and post order, Spanning tree, Minimum spanning tree Prim's and Kruskal's Algorithms, finding all spanning trees, Cut-sets, Connectivity and Separability..	12
II	Tree: Search Trees – BST. Weight Balanced Trees – AVL and Red Black Trees. Applications of trees AVL: Single Rotation, Double Rotation, B-Trees, Red-Black Trees – Properties of red-black trees, Rotations, Insertion, Deletion	12
III	Introduction to Graphs, Representation of graphs – Performance Comparison, BFS and DFS, Walk, Paths and circuits. Isomorphism, connectedness, Euler graph, subgraph, operations on graph, Hamiltonian Paths and Circuits. Bipartite graphs	12
IV	Planar and Dual graphs, representations of planar graphs. Applications of Graphs, Coloring, covering and partitioning, chromatic number, Cyclomatic Complexity, Directed Graphs - binary relations, connectedness, Directed Acyclic Graphs	12
V	Hashing – General Idea, Hash Function, Separate Chaining, Hash Tables without linked lists: Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Hash Tables in the Standard Library	12
Reference Books:		
1. Data Structures Through C++ (4th Edition) Yashvant Kanetkar.		
2. Data Structures and Algorithm Analysis in C++ " by Mark Allen Weiss.		
3. Data structure and Algorithms using C++ by Sachi Nandan Mohanty, Pabitra Kumar Tripathy.		
4. Data Structures and Algorithms in C++, Second Edition by Adam Dr ozdek.		

Undergraduate Programme(Bachelor Of Computer Applications)	
Session 2029-2030	
Part-A Introduction	
Subject	BIG DATA
Semester	Seventh Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/DSE/407T
Course Type:	DSE
Level Of the Course(As per Annexure-I)	400-450
Pre Requisite for the course (if any)	NA
Course Learning Outcomes(CLO)	CLO 1: Understand Big Data concepts and architecture CLO 2 :Learn Big Data processing frameworks CLO 3: Gain hands-on exposure to Hadoop ecosystem CLO 4: Analyze real-world Big Data use cases

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Credits		4
Total Marks		20+80 =100
Part –B Contents of the Course		
Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction to Big Data: What is Big Data, Characteristics of Big Data (5Vs), Traditional Data vs Big Data, Challenges of Big Data, Applications of Big Data :Healthcare, Finance, E-commerce, Social Media, Big Data Analytics Lifecycle	12
II	Big Data Architecture: Big Data Architecture Overview, Distributed Computing Concepts, Cluster Computing, Data Storage Systems, CAP Theorem,	12
III	Hadoop Framework: Introduction to Hadoop, Hadoop Architecture, Hadoop Distributed File System (HDFS), HDFS Read/Write Mechanism, Hadoop YARN, Hadoop Ecosystem Components: Hive, Pig, HBase, Sqoop, Flume	12
IV	Big Data Processing :MapReduce Programming Model, MapReduce Architecture, Writing Simple MapReduce Programs, Data Ingestion and Processing, Introduction to Apache Spark, Spark vs Hadoop	12
V	Big Data Analytics & Security, Big Data Analytics Techniques, Structured vs Unstructured Data Analysis, Introduction to Machine Learning in Big Data, Data Privacy and Security Issues, Ethical Issues in Big Data, Future Trends in Big Data	12
Suggested books 1. Hadoop: The Definitive Guide by Tom White 2. Big Data Analytics by Seema Acharya & Subhashini Chellappan		


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Eighth semester (2029-2030)

Undergraduate Programme(Bachelor Of Computer Applications)		
Session 2029-2030		
Part-A Introduction		
Subject	INTERNET OF THINGS	
Semester	Eighth Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MJR/451T	
Course Type:	MJR	
Level Of the Course(As per Annexure-I)	451-499	
Pre Requisite for the course (if any)	NA	
Course Learning Outcomes(CLO)	CLO1: Learn about fundamentals of IoT CLO2:Understand working with help of Sensors CLO3:Learn use of IoT in Industry	
Credits	6	
Total Marks	30+120=150	
Part –B Contents of the Course		
Total Lecture per week		4HRS
Unit	Topics	No. of Lecture/ Contact Hours
I	The Internet of Things Today, Advantages and disadvantages of IOT, Various Applications of IOT,- Smart parking, smart home, smart health and smart city, Physical & Logical, IoT design Basics, IoT Enabling Technologies, IoT Stack, Energy Issues, IoT Related Standardization, IOT sensors, sensing and actuation.	18
II	Sensor working, Sensor, Characteristics, Types of sensors and working, principle, Sensors used in IoT, IEEE standards for IoT, IoT Protocol overview, MQTT, AMQP COAP,	18
III	IoT Architecture , Reference Model, Web development for IoT, IoT application, development for Mobile, Deployment and Operational View, Other Relevant architectural views.	18
IV	Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino. Introduction to Raspberry Pi. Implementation of IoT systems using Raspberry Pi. Connecting RPi to internet. Running Python programs on RPi.	18
V	Server Components – Client-Server and RESTful architectures. Introduction to SDN, SDN for IoT. Cloud Architectures - Sensor-Cloud, Fog & Edge Computing. Energy Efficiency, QoS, QoE and Everything as a Service (XaaS). Unstructured vs Structured Data Storage.	18

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Suggested Books:

1. Internet of Things, A hands-on approach Arshdeep Bahga, Vijay Madisetti, Universities Press,
2. Architecting the Internet of Things Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Springer.
3. The Internet of Things in the Cloud: A Middleware Perspective Honbo Zhou, CRC Press.
4. The Internet of Things, Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, Wiley.

Undergraduate Programme(Bachelor of Computer Applications)		
Session 2029-2030		
Part-A Introduction		
Subject	ADVANCED JAVA PROGRAMMING	
Semester	Eighth Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/MJR/452T	
Course Type:	MJR	
Level Of the Course(As per Annexure-I)	451-499	
Pre Requisite for the course (if any)	Java Programming	
Course Learning Outcomes(CLO)	CLO1: Implement multithreading and networking in Java CLO2: Develop web Applications using Servlets and JSP CLO3: Work with JDBC for database connectivity	
Credits	4	
Total Marks	20+80=100	
Part –B Contents of the Course		
Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	J2EE and J2SE.The birth of J2EE databases.The maturing of Java, Java Beans and Java Message Service. J2EE multi-tier architecture. Distributed systems, real time transmission, software objects webservices. The tier clients resources and components accessing services.	12
II	J2EE multi-tier architecture, Client tier implementation. Enterprise Java Beans tier implementation. Enterprise information system tier implementation, Enterprise Application strategy. The enterprise application clients, client presentation, client expert validation, client control, duplicate client requests. Session management, client–side session state, server-side session state.	12
III	WebTier and Java Server pages, presentation and processing, the inclusion strategy, style	12

55

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	sheets, simplify Error Handling. Enterprise Java Beans Tier, Entity to enterprise Javabeans relationship, efficient data exchange, enterprise Java Beans performance, The model view controller (MVC).	
IV	Interfaces and inheritance, potential problems with inheritance, maintainable classes, performance enhancements. J2EE Database Concepts, Data, Database tables, Database schemas, identifying information, decomposing attributes to data, decomposing by example defining data, the art of choosing a name normalizing data, the normalization process grouping data,	12
V	creating primary keys, functional dependency, transitive dependencies, foreign key, referential integrity, art of indexing, an index in motion, drawbacks using an index clustered keys, derived keys selective, exact matches and partial matches searching for phonetic matches. JDBC objects, JDBC and embedded SQL, Java and XML, Java Servlets, Java server pages, Enterprise Java Beans.	12

Suggested Books:

1. Marty Hall and Larry Brown, "Core Servlets and Java Server Pages", 2nd Edition, 2003.
2. Santosh Kumar K, "JDBC, Servlet, and JSP: Black Book", Kogent Solutions Inc., 2008.
3. Madhusudhan Konda, "Just Spring", 1st edition, O'Reilly, 2011.
4. E. Balagurusamy, "Programming with Java: A Primer", Tata McGraw-Hill, 2010.
5. Bryan Basham, Kathy Sierra & Bert Bates, "Head First Servlets and JSP" Paperback, 2008

Undergraduate Programme(Bachelor of Computer Applications)	
Session 2029-2030	
Part-A Introduction	
Subject	ADVANCED JAVA PROGRAMMING LABORATORY
Semester	Eighth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/MJR/452P
Course Type:	MJR
Level Of the Course(As per Annexure-I)	451-499
Pre Requisite for the course (if any)	Core JAVA
Course Learning Outcomes(CLO)	CLO1: Implement multithreading and networking in Java CLO2: Develop web Applications using Servlets and JSP CLO3: Work with JDBC for database connectivity
Credits	2
Total Marks	10+40=50
Part –B Contents of the Course	
Total Lecture per week	4HRS
Assignments:	
1. Write a Java program to demonstrate Multithreading using a) Thread class b) Runnable interface 2. Program to show Thread Synchronization using synchronized methods. 3. Write a program to implement Producer–Consumer problem. 4. Demonstrate Inter-thread communication using wait (), notify (). 5. Program to demonstrate Exception handling with custom exceptions.	

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6. Write a Java program to connect to MySQL database using JDBC.
7. Program to perform CRUD operations (Insert, Select, Update, Delete) using JDBC.
8. Use PreparedStatement to insert records into a database table.
9. Program to retrieve data using ResultSet and display in tabular format.
10. Demonstrate Transaction Management using JDBC.
11. Write a simple Servlet program to display "Hello BCA".
12. Program to handle GET and POST requests in Servlet.
13. Servlet program to read form data and display it.
14. Program to demonstrate Servlet life cycle.
15. Create a Servlet program for Login validation using database.
16. Write a JSP program to display current date and time.
17. JSP program using Scriptlet, Expression, and Declaration tags.
18. Program to demonstrate JSP implicit objects.
19. Create a JSP page to perform form validation.
20. JSP program to access database using JDBC.
21. Program to demonstrate Cookies in Servlet/JSP.

Undergraduate Programme(Bachelor of Computer Applications)		
Session 2029-2030		
Part-A Introduction		
Subject	BLOCKCHAIN	
Semester	Eighth Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/DSE/453T	
Course Type:	DSE	
Level Of the Course(As per Annexure-I)	451-499	
Pre Requisite for the course (if any)	Basic knowledge of Computer Networks, Databases, Cryptography, and Programming Concepts	
Course Learning Outcomes(CLO)	CLO1: Understand the fundamentals of blockchain technology CLO2: Explain cryptographic mechanisms used in blockchains CLO3: Analyse different blockchain platforms CLO4: Design and deploy basic smart contracts and decentralized Applications	
Credits	4	
Total Marks	20+80=100	
Part –B Contents of the Course		
Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	Definition and evolution of blockchain, Distributed ledger technology, Centralized vs Decentralized systems, Features of blockchain: transparency, immutability, decentralization, Blockchain architecture: blocks, transactions, Merkle tree, hashing, Genesis block	12
II	Cryptographic hash functions, Digital signatures, Public and private keys, Proof of Work (PoW), Proof of Stake (PoS), Proof of Authority (PoA), Byzantine Fault Tolerance, Mining process and block validation	12

III	Blockchain Platform: Bitcoin: architecture, transaction lifecycle, wallets, mining, limitations, Ethereum: Ethereum Virtual Machine (EVM), Gas concept, Accounts and transactions, Comparison of Bitcoin and Ethereum, Public, Private and Consortium blockchains	12
IV	Smart Contracts and Decentralized Applications: Smart contracts: concept and features, Solidity basics, Writing and deploying smart contracts, Introduction to DApps, Blockchain development tools (Remix, Ganache, MetaMask – overview), Use cases in finance, supply chain, healthcare	12
V	Blockchain Security, Applications and Future Trends: Security issues in blockchain: 51% attack, Sybil attack, Double spending, Scalability and privacy challenges, Blockchain Applications: cryptocurrency, banking, voting systems, IoT integration, Legal and regulatory issues in India, Future trends: Web3, DeFi, NFTs, CBDC	12
Suggested books:		
1. Mastering Blockchain by Imran Bashir 2. Blockchain Applications: A Hands-On Approach by Arshdeep Bahga & Vijay Madisetti 3. Mastering Bitcoin by Andreas M. Antonopoulos 4. Blockchain Basics by Daniel Drescher		

Undergraduate Programme(Bachelor of Computer Applications)		
Session 2029-2030		
Part-A Introduction		
Subject	SOFTWARE ENGINEERING	
Semester	Eighth Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/DSE/454T	
Course Type:	DSE	
Level Of the Course(As per Annexure-I)	451-499	
Pre Requisite for the course (if any)	NA	
Course Learning Outcomes(CLO)	CLO1: Focus on enabling students to apply systematic approaches. CLO2:Gains skills in SDLC modelling, design, testing and project management.	
Credits	4	
Total Marks	20 + 80=100	
Part –B Contents of the Course		
Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction to software process framework: Introduction to software process framework: The Evolving Role of Software, Software characteristics, Software Engineering as a Layered Technology, Software Process Framework and Umbrella Activities, Process Models. Software Development Life Cycle. Models – Waterfall, Spiral, Prototype, Agile, TSP, Extreme Programming.	12

II	Requirement Analysis: Requirement Analysis: Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modelling Techniques, Flow Oriented Modelling, Need for SRS, Characteristics and Components of SRS.	12
III	Software Project Management: Software Project Management: Estimation in Project Planning Process, Project Scheduling, Software Risks, Risk Identification, Risk Projection and Risk Refinement, Software Design: Identifying Actors, Use cases and Actions, Generalization, Specialization, Aggregation & Relationships, Class Diagrams, Sequence Diagrams.	12
IV	Software Engineering Tools: Software Engineering Tools: Tools of Design :Data Flow Diagrams, Data Dictionary, Decision Tree, Decision Tables, Modularization (Coupling)	12
V	Software Testing Fundamentals: Software Testing Fundamentals: Testing Strategies for Conventional Software, Validation Testing, System testing, Black-Box Testing, White-Box Testing and their type, Basis Path Testing.	12

Suggested Books:

1. Roger S Pressman, Bruce R Maxim, "Software Engineering: A Practitioner's Approach", 8th Edition, 2019
2. Ian Sommerville, "Software engineering", Addison Wesley Longman, 9th Edition, 2017.
3. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", 2nd Edition, 2017.
4. James Rumbaugh, Michael Blaha "Object oriented Modeling and Design with UML", 2011.

Undergraduate Programme(Bachelor of Computer Applications)	
Session 2029-2030	
Part-A Introduction	
Subject	DESIGN & ANALYSIS OF ALGORITHMS
Semester	Eighth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/DSE/455T
Course Type:	DSE
Level Of the Course(As per Annexure-I)	451-499
Pre Requisite for the course (if any)	Basic Knowledge of programming in C/C++ and Data Structures Fundamentals
Course Learning Outcomes(CLO)	CLO1: Understand the basic concepts and characteristics of algorithms. CLO2: Analyze algorithm complexity using asymptotic notation. CLO3: Apply standard algorithm design techniques. CLO4: Design efficient algorithms for common computational problem.
Credits	4
Total Marks	20+80=100
Part –B Contents of the Course	

Total Lecture per week		
Unit	Topics	No. of Lecture/Contact Hours
I	Introduction: Algorithm and its characteristics, Performance analysis, Time and Space Complexity, Asymptotic Notations.	12
II	Divide and Conquer algorithms: Binary Search, Merge Sort, Quick Sort, Analysis of Divide and conquer.	12
III	Horner's method of evaluation a polynomial at a given point, Strassen's Matrix Multiplication. Dynamic programming: Design and analysis, computing a Binomial Coefficient, Multistage graphs, Traveling salesman problem.	12
IV	Greedy approach: General method, Knapsack problem, Minimum cost Spanning trees, Job Sequencing.	12
V	Graph and Back tracking: Graph Traversal(BFS,DFS),shortest path(Dijkstra's Algorithm),Backtracking(N-Queen problem),Branch and Bound	12
Suggested Books		
1. Fundamentals of Computer Algorithms, E. Horowitz, S. Sahni, Galgotia Publications.		
2. Introduction to Algorithms, Charles Leiserson, Ronald Rivest, & Thomas H. Cormen, MIT Press		
3. Design & Analysis of Computer Algorithms, Av. Aho, J.E. Hopcroft, & J.D. Ullman,Addition Wesley.		
4. Design and Analysis of algorithms, S.K. Basu, PHI Publications		

Undergraduate Programme (Bachelor of Computer Applications)	
Session 2029-2030	
Part-A Introduction	
Subject	CYBER SECURITY
Semester	Eighth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/DSE/456T
Course Type:	DSE
Level Of the Course(As per Annexure-I)	451-499
Pre Requisite for the course (if any)	Nil
Course Learning Outcomes(CLO)	CLO1:Understand cyber security concepts, threats, and vulnerabilities CLO2:Analyze different types of cyber-attacks and malware CLO3:Explain cryptographic techniques used for data protection CLO4:Apply security concepts to networks, Applications, and cloud systems
Credits	4
Total Marks	20+80=100
Part –B Contents of the Course	
Total Lecture per week	

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Unit	Topics	No. of Lecture/ Contact Hours
I	Introduction to Cyber Security: Concept, scope, and importance, Information security goals: Confidentiality, Integrity, Availability, Types of cyber threats: Malware, Phishing, Spoofing, DoS/DDoS, Man-in-the-Middle attacks, Vulnerabilities and risk assessment Cyber-attacks: Passive and Active attacks	12
II	Malware and Network Security: Malware: Virus, Worm, Trojan Horse, Ransomware, Spyware, Adware Malware life cycle Network security fundamentals. Firewalls: Types and functions. Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS) Virtual Private Networks (VPNs). Basics of wireless security	12
III	Cryptography and Data Security: Objectives and Applications, Plain text, Cipher text, Encryption, Decryption. Symmetric key cryptography. Asymmetric key cryptography. Hash functions and digital signatures. Public Key Infrastructure (PKI). Secure communication protocols (SSL/TLS – overview)	12
IV	Applications, System and Cloud Security: Operating system security. Authentication and authorization mechanisms Secure software development practices. Web Applications security threats: SQL Injection, XSS, CSRF. Cloud computing: Overview and service models. Cloud security challenges and risks. Data protection and privacy in cloud environments	12
V	Cyber Laws, Ethics and Emerging Trends: Cyber laws: Overview of Information Technology Act, 2000. Cyber-crimes: Types and penalties. Digital evidence and cyber forensics (introductory). Ethical hacking: Concept and importance. Cyber ethics and professional responsibility. Emerging trends: Artificial Intelligence in cyber security, Blockchain security, IoT security	12

Suggested books

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole & Sunita Belapure –
2. Cryptography and Network Security by William Stallings
3. Security in Computing by Charles P. Pfleeger
4. Security+ Guide to Network Security Fundamentals by Mark Ciampa

Undergraduate Programme (Bachelor of Computer Applications)	
Session 2029-2030	
Part-A Introduction	
Subject	NATURAL LANGUAGE PROCESSING
Semester	Eighth Semester
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS
Course Code	04/BCA/DSE/457T
Course Type:	DSE
Level Of the Course(As per Annexure-I)	451-499
Pre Requisite for the course (if any)	Python Programming, Basic Statistics

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Course Learning Outcomes(CLO)		CLO1: Apply NLP techniques for text processing CLO2: Implement machine learning for language tasks CLO3: Build NLP Applications like chatbots and sentiment analysis	
Credits		4	
Total Marks		20+80=100	
Part –B Contents of the Course			
Total Lecture per week			
Unit	Topics		No. of Lecture/ Contact Hours
I	Introduction to Natural Language Processing, History and evolution of NLP, Applications: machine translation, chatbots, sentiment analysis, Challenges in NLP: ambiguity, context, sarcasm, NLP pipeline and architecture, Levels of NLP: phonological, morphological, syntactic, semantic, pragmatic		12
II	Text Preprocessing, Tokenization: word and sentence tokenization, Normalization techniques, Lowercasing and case folding, Stemming: Porter stemmer, Lancaster stemmer, Lemmatization, Stop word removal, Noise removal and cleaning, Spell checking and correction, Handling special characters and punctuation, Unicode and text encoding, N-grams: unigrams, bigrams, trigrams		12
III	Linguistic Fundamentals, Morphology: word formation, Part-of-Speech (POS) tagging, POS tagging algorithms: rule-based, stochastic, Hidden Markov Models for tagging, Syntax and parsing, Context-Free Grammars (CFG), Parse trees and dependency parsing, Constituency parsing, Chunking and shallow parsing, Word sense disambiguation		12
IV	Semantic Analysis, Lexical semantics, WordNet and semantic relations, Vector space models, Bag of Words (BoW), Word embeddings: Word2Vec, GloVe, FastText, Document similarity and cosine similarity, Topic modeling: LSA, LDA, Semantic role labelling, Coreference resolution		12
V	NLP Applications, Sentiment analysis and opinion mining, Text classification with machine learning, Naive Bayes classifier, Support Vector Machines for text, Text clustering, Information extraction, Information retrieval		12

Suggested books:

1. "Speech and Language Processing" by Daniel Jurafsky and James H. Martin
2. "Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper.
3. "Foundations of Statistical Natural Language Processing" by Christopher Manning and Hinrich Schütze
4. "Introduction to Natural Language Processing" by Jacob Eisenstein

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Undergraduate Programme(Bachelor of Computer Applications)
Session 2029-2030

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Part-A Introduction		
Subject	HUMAN COMPUTER INTERACTION	
Semester	Eighth Semester	
Name Of the Course	BACHELOR OF COMPUTER APPLICATIONS	
Course Code	04/BCA/DSE/458T	
Course Type:	DSE	
Level Of the Course(As per Annexure-I)	451-499	
Pre Requisite for the course (if any)	Nil	
Course Learning Outcomes(CLO)	CLO1: Learns to place users at the center of the design process. CLO2: Able to design, build, test user interfaces for various platforms.	
Credits	4	
Total Marks	20+80=100	
Part –B Contents of the Course		
Total Lecture per week		
Unit	Topics	No. of Lecture/ Contact Hours
I	HCI Fundamental: Definition, History, HCI Principles and Guidelines, Concept of Usability, User Centered, UserInterface, User Interaction Design, GOMSModel, Prototyping.	12
II	Basics of Interaction Design: Interactive Picture Construction Technique, Visual layouts and Design, Typography, sketches& Wireframes,UI design patterns, Multi Model Interaction.	12
III	Model based design:Formal, Cognitive, Syndeticmodel, Norman's Interaction Model,Fit'sLaw,Understanding Applications domain such as Healthcare, Government etc.	12
IV	User Interface Evolution: Definition,Key aspects of UI evaluation, Heuristic and Empirical Approaches, case study on user interface evaluation, object oriented modelling of user interface design.	12
V	HCI in SDLC:HCI life cycle, Separation of UI/UX and MVC Architectures, Animation and Motion graphics, BioSignals and HCI.	12
Suggested books:		
1. "Human Computer Interaction " Dix Finlay Abowd Beale		
2. "The human computer interaction handbook"Julie A Jacko,Andrew Sears..		
3."HCI" An Empirical Research Perspective",I.ScottMacKenzie.		

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Skill Enhancement course List (SEC)

Bachelor of Computer Applications	
Session 2026-2027	
Subject	PROGRAMMING FUNDAMENTALS AND SYSTEM SETUP
Semester	First Semester
Course Code	04/BCA/SEC/105T
Credits	3
Total Marks	15+60=75
UNIT	PROGRAMMING FUNDAMENTALS AND SYSTEM SETUP
I	Program Concept, Program Design, Programming aids: Algorithms, Flow Charts - Symbols, Rules for making Flow chart, Pseudocodes, Flowchart symbols, Flowchart with examples, Pseudocodes with examples, Assemblers, Compilers and Interpreters, Integrated Development Environments, Various IDEs and their major features, Using IDEs, Traditional Programming, Event Driven Programming
II	Constants and Variables, Identifiers, Keywords, Various Data types, Operators, expressions, operator precedence, Data type conversion, Modular Programming, Functions, Libraries, Packages
III	Structured programming, Object Oriented programming concepts and languages, OOPs features, classes, objects, Strings, Arrays, multidimensional arrays, Files, Databases, Exceptions
IV	Physical set-up of Printers- Performing test print out, Printing of document, Scanner setup, webcam, Bluetooth device, Task manager, compression utilities, WINZIP, PKZIP, antivirus, setting up Display and other features.
V	Study of BIOS Set-up- Advance set-up, Boot configuration, Boot Menu, Installation of operating system, control panel, installation and uninstallation of Applications software, setting system date and time, formatting and partitioning hard disk, installation of Device drivers.
Suggested books 1. Fundamentals of Programming Languages by Atul P Godse, . Deepali A Godse and Vithalrao Patil , ISBN 978-9355856890 2. Fundamentals of Programming Languages by T R Patil, S Kadam, M A Aher and A N Varade, Publisher Nirali Prakashan, ISBN 978-9383073368 3. Mark Minasi, "The complete PC Upgrade & Maintenance Guide", BPB Publications. 4. D Balasubramanian, "Computer Installation and Servicing", Tata McGraw Hill Education.	

Bachelor of Computer Applications	
Session 2026-2027	
Subject	HARDWARE AND NETWORKING
Semester	Second Semester
Course Code	04/BCA/SEC/154T
Credits	3
Total Marks	15+60=75
UNIT	HARDWARE AND NETWORKING
I	Definition and types of Operating Systems. Functions & Features of OS. Windows

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	OS, Linux, Linux directory structure, Basic Linux commands, Server, Ubuntu, Computer Management, Local Users and Groups. Dual operating system, partition of the HDD, SSD of a Computer System.
II	Primary and Secondary Memory, RAM, ROM, SSD, HDD , Different kinds of motherboards. RAM, different kinds of RAM. RAM upgradation. SMPS. BIOS. Computer Accessories: optical drive, keyboard, mouse, monitor, Printer and their types, CD/DVD, ISO image, Cables and connectors, USB, Device Drivers, Using webcam, Using scanners, Printer sharing
III	Hard Disk Drive: logical structure and file system, FAT, NTFS. Hard disk tools: Disk cleanup, error checking, defragmentation, scanning for virus, formatting, installing additional HDD. New trends in HDD, Driver installation
IV	Knowledge of Network Topologies, Networking and internetworking Devices, , Sharing of resources. IPv4, IPv6, Classes of IP address, Static and Dynamic IP, MAC addressing, Subnet mask
V	Network Interface Card, Transmission Media, Coaxial cable, Twisted Pair Cable, OFC network cabling, I/O Box, Switches, RJ 45 connectors, Patch panel, Patch cord, racks, Network Devices and their functions
Suggested Books: 1. Ajit Mittal, Ajay Rana, Mastering Pc Hardware And Networking, Khanna Book Publishing Company; First Edition 2. Manahar Lotia, Modern Computer Hardware Course, BPB Publication . Vikas Gupta , Comdex: Hardware and Networking Course Kit, DreamTech press 2. Ron Gilster , PC hardware: A beginners Guide, Tata McGraw Hill 3. Narasimha Karumanchi, Elements of Computer Networking, First edition, CareerMonk Publications	

Bachelor of Computer Applications	
Session 2028-2029	
Subject	E-COMMERCE
Semester	Fourth Semester
Course Code	04/BCA/SEC/305T
Credits	3
Total Marks	15+60=75
UNIT	E-COMMERCE
I	E - Commerce An introductions, Concepts, Advantages and disadvantages, differences between E-Commerce systems and traditional systems, ECommerce frameworks, Applications of E-commerce
II	Technology in E- Commerce, Internet & E-business, Applications, Feasibility & various constraints. E-Commerce Software Introduction, Web hosting, Basic functions of ECS – Catalog display, Shopping cart, Transaction Processing, Middleware, Web Services – What Web Services Can Do,How Web Services Work, Integration with ERP Systems, Electronic commerce software for small and midsize companies- Basic

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	Commerce Service Providers, Mall Style Commerce Service Providers, Estimated Operating Expense for a Small Web Business.
III	E-transition challenges for Indian corporate, the Information Technology Act 2000 and its highlights related to e-commerce. The information technology act, E-business Model Based on Relationship of Transaction Parties (B2C, B2B, C2C, C2B), Ebusiness Model Based on the Relationship of Transaction Types. Online Marketing, E-advertising, Internet Marketing Trends, E-branding, Customer Relationship Management
IV	Electronic Payment Systems: Introduction, Types of Electronic Payment Systems, Digital Token-Based Electronic Payment Systems, Introduction and types of Electronic payment systems, Digital token based EPS- Ecash, E-cheques, Smart cards- Credit card, debit card
V	Smart Cards and Electronic Payment Systems, Credit Card-Based Electronic Payment System. Current trends in E Commerce Electronic Wallets – paytm - paypal, cryptocurrency, online auctions, virtual communities, E-Marketing
Suggested books 1. Frontiers of Electronic Commerce: KalakotaWhinston Publisher: Pearson India : 1st edition (2008) 2. E Commerce Strategy, Technology & Implementation 12th Edition: Gary P Schnieder , Publisher: Cengage Learning (2017) 3. E Commerce The Cutting Edge of Business: Tata McGraw-Hill Publishing Company Limited, Kamlesh k Bajaj, Debjani Nag : 2nd edition (2005). 4. E-COMMERCE: A Managerial Perspective, P.T. Joseph, PHI, fifth printing	


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