

Scheme and Syllabus of Bachelor of Computer Applications (BCA)

Batch 2024 onwards

1st – 4th Semester



**Department of Computer Applications
Amritsar Group of Colleges, Amritsar**

BCA-1st Sem

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BCA24101	Multidisciplinary	Mathematics	4	0	0	40	60	100	4
BCA24102	Core Theory	Introduction to computer & information technology	3	0	0	40	60	100	3
BCA24103	Core Theory	Programming in C	3	0	0	40	60	100	3
BCA24104	Skill Enhancement	Workshop on Desktop Publishing	0	0	2	60	40	100	1
BCA24105	Core Practical/Laboratory	Programming in C Lab	0	0	4	60	40	100	2
BCA24106	Core Practical/Laboratory	Introduction to computer & information technology Laboratory	0	0	4	60	40	100	2
AEC24101	Ability Enhancement Compulsory Course (AECC)-I	Foundation course in English-I	2	0	0	40	60	100	2
VAC24101	Value Added Course (VAC)	Universal Human Values	3	0	0	40	60	100	3
TOTAL			15	0	10	380	420	800	20

BCA-2nd Sem

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BCA24201	Multidisciplinary	Fundamental of Statistics	3	0	0	40	60	100	3
BCA24202	Core Theory	Computer System Architecture	3	0	0	40	60	100	3
BCA24203	Core Theory	Object Oriented Programming using C++	3	0	0	40	60	100	3
BCA24204	Core Practical/Laboratory	Object Oriented Programming using C++Laboratory	0	0	4	60	40	100	2
BCA24205	Multidisciplinary	Fundamental of Statistics Laboratory	0	0	4	60	40	100	2
BCA24206	Core Practical/Laboratory	Computer System Architecture Laboratory	0	0	4	60	40	100	2
VAC 24201	Value Added Course(VAC)	Environmental Studies & Sustainability	3	0	0	40	60	100	3
BCA24207	Skill Enhancement Course	Designing Lab Photoshop	0	0	2	60	40	100	1
AEC 24201	Ability Enhancement	Foundation course in English-II	2	0	0	40	60	100	2
TOTAL			14	0	14	440	460	900	21

BCA-3rd Sem

Course Code	Course Type	Course Title	Load			Marks		Total Marks	Credits
			Allocation			Distribution			
			L	T	P	Internal	External		
BCA24301	Core Theory	Computer Networks	4	0	0	40	60	100	4
BCA24302	Core Theory	Data Structures	4	0	0	40	60	100	4
BCA24303	Skill Enhancement	Web Designing	3	0	0	40	60	100	3
BCA24304	Core Practical/ Laboratory	Computer Networks Laboratory	0	0	2	60	40	100	1
BCA24305	Core Practical/ Laboratory	Data Structures Laboratory	0	0	2	60	40	100	1
BCA24306	Skill Enhancement Practical/ Laboratory	Web Designing Laboratory	0	0	2	60	40	100	1
BCA24307	Value Added Course/ Theory	Introduction to Artificial Intelligence	3	0	0	40	60	100	3
	Professional Elective-I		3	0	0	40	60	100	3
TOTAL			17	0	6	380	420	800	20

Professional Elective-I	
BCA24308	S/W Engineering
BCA24309	Data Security and Privacy

BCA-4th Sem

Course Code	Course Type	Course Title	Load			Marks		Total Marks	Credits
			Allocation			Distribution			
			L	T	P	Internal	External		
BCA24401	Core Theory	Programming in Python	4	0	0	40	60	100	4
BCA24402	Core Theory	Database Management Systems	4	0	0	40	60	100	4
BCA24403	Core Theory	Operating Systems	4	0	0	40	60	100	4
BCA24404	Core Practical/Laboratory	Programming in Python Laboratory	0	0	2	60	40	100	1
BCA24405	Core Practical/Laboratory	Database Management Systems Laboratory	0	0	2	60	40	100	1
BCA24406	Core Practical/Laboratory	Operating Systems Laboratory	0	0	2	60	40	100	1
BCA24407	Skill Enhancement	Design Thinking and Innovation	2	0	0	40	60	100	2
	Professional Elective-II		3	0	0	40	60	100	3
TOTAL			17	0	6	380	420	800	20

Students will undergo 6 weeks Institutional Summer Training* after 4th semester. Examination will be conducted along with 5th semester practical.

Professional Elective-II	
BCA24408	Cloud Computing
BCA24409	Introduction to Biometrics

1st Semester	Mathematics				
BCA24101					
Internal Marks:	40		L	T	P
External Marks:	60		3	1	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:	
CO1	Understand different types of Sets and their applications in daily life
CO2	Understand the concept of relations and functions
CO3	Understand the concept of Propositional Logic and calculus
CO4	Understand how to represent real life data using Matrices
CO5	Understand the concept of finding the number of terms and their sum
CO6	To calculate how likely events could happen and so the risks could be determined and resolved professionally

Part	Content	CO
I	Set: Introduction, Objectives, Representation of Sets, Types of Sets (Null Set, Singleton Set, Finite Set, Infinite Set, Equal Set, Equivalent Set, Disjoint Set, Subset, Proper Subset, Power Set, Universal Set, Complement of a Set), Operation on Sets, Venn diagrams, Applications of Sets.	CO1
	Relations and Functions: Introduction, Ordered Pairs, Cartesian Product, Basic definition of Relation, Types and operations on Relations, Equivalence relations, introduction of functions, different types of functions and their Compositions	CO2
II	Logic Statement: Connectives, Basic Logic Operations (Conjunction, Disjunction, Negation) Logical Equivalence/Equivalent Statements, Tautologies and Contradictions.	CO3
III	Matrices: Introduction, Types of Matrix (Row Matrix, Column Matrix, Rectangular Matrix, Square Matrix, Diagonal Matrix, Scalar Matrix, Unit Matrix, Null Matrix, Comparable Matrix, Equal Matrix), Scalar Multiplication, Negative of Matrix, Addition of Matrix, Difference of two Matrix, Multiplication of Matrices, Transpose of a Matrix, inverse of matrix, solution of system of linear equations using matrices.	CO4
	Progressions: Progressions Introduction, Arithmetic Progression, Sum of Finite number of quantities in A.P, Arithmetic Means. Geometric Progression, Sum of and finite and infinite G.P. series, Geometric Mean	CO5
IV	Probability: Random Experiment, Sample space, Elementary events, Compound events, Mutually exclusive, Exhaustive events, Definition of Probability, Equally Likely Events, Complementary Events, Independent Events, Conditional Probability.	CO6

References:
<ul style="list-style-type: none"> Discrete Mathematics and its applications by Kenneth by H. Rosen, Mc Graw Hill, 6th Edition Elementary Mathematics, Dr. RD Sharma

- Comprehensive Mathematics, Parmanand Gupta

1st Semester	Introduction to Computer & Information Technology				
	BCA24102				
Internal max. marks	40		L	T	P
External max. marks	60		3	0	0
Total Marks	100		Credits	3	

Course outcomes: After studying the course, students will be able to:

CO1	Identify of input and output devices of Computers
CO2	Utilize the functioning of various components of computer system.
CO3	Explain the different levels of languages, Operating system and features of Wordprocessing
CO4	Prepare documents using Spreadsheet and Presentation Graphics Software's.
CO5	Illustrate the various e-payment systems.
CO6	Highlight the various computing techniques

Part	Detailed Contents	CO
I	Human Computer Interface Concepts of Hardware and Software; Data and Information. Functional Units of Computer System: CPU, registers, system bus, main memory unit, cache memory, Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors.	CO1
	Devices: Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter. Memory: Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks. Data Representation: Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT.	CO2
II	Concept of Computing, Types of Languages: Machine, assembly and High-level Language; Operating system as user interface, utility programs. Word processing: Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.	CO3
III	Spreadsheet: Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs. Presentation Graphics Software: Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.	CO4
IV	Electronic Payment System: Secure Electronic Transaction, Types of Payment System: Digital Cash, Electronic Cheque, Smart Card, Credit/Debit Card E-Money, Bit Coins and Crypto currency, Electronic Fund Transfer (EFT), Unified Payment Interface (UPI), Immediate Payment System (IMPS), Digital Signature and Certification Authority. [CO5]	CO5
	Introduction to Bluetooth, Cloud Computing, Big Data, Data Mining, Mobile Computing and Embedded Systems and Internet of Things (IoT) [CO6]	CO6

References:

1. "Introduction to Computers", Peter Norton
2. Computers Today, D. H. Sanders, McGraw Hill.
3. "Computers", Larry long & Nancy long, Twelfth edition, Prentice Hall.
4. Problem Solving Cases in Microsoft Excel, Joseph Brady & Ellen F Monk, Thomson Learning

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1st Semester	Problem Solving using C				
	BCA24103				
Internal max. marks	40		L	T	P
External max. marks	60		3	0	0
Total Marks	100		Credits	3	

Course outcomes: After studying the course, students will be able to:	
CO1	Design algorithms and choose the right data type and statements for programs.
CO2	Learn the implementation of simple 'C' program, operators and Console I/O function.
CO3	Learning concepts of control statements by writing programs control the sequence of the program and give logical outputs.
CO4	Understand the declaration and implementation of arrays and functions.
CO5	Learn the structures declaration, initialization and implementation.
CO6	Understand the file operations, file pointers and importance of pre-processor directives

Part	Detailed Contents	CO
I	Logic Development: Data Representation, Flowcharts, Problem Analysis, Decision Trees/Tables, Pseudo code and algorithms. Fundamentals: Character set, Identifiers and Key Words, Data types, Constants, Variables, Expressions, Statements, Symbolic Constants.	CO1
	Operations and Expressions: Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions. Data Input and Output: formatted & unformatted input output.	CO2
	Control Statements: While, Do-while and For statements, Nested loops, If-else, Switch, Break – Continue statements. Strings: String declaration, string functions and string manipulation Program Structure Storage Class: Automatic, external and static variables.	CO3
III	Functions: Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion. Arrays: Defining, processing arrays, passing arrays to a function, multi- dimensional arrays.	CO4
IV	Structures & Unions: Defining and processing a structure, user defined data types, structures and pointers, passing structures to functions, unions.	CO5
	Pointers: Understanding Pointers, Accessing the Address of a Variable, Declaration and Initialization of Pointer Variables, Accessing a Variable through its Pointer, Pointers and Arrays. [CO6] File Handling: File Operations, Processing a Data File	CO6

References:
1. Object Oriented Programming, Lafore R, Third Edition, Galgotia Publications
2. Let us C, Yashvant P Kanetkar, Seventh Edition, BPB Publications, New Delhi.
3. Programming in C, Byron S. Gottfried, Second Edition, McGraw Hills.
4. Problem Solving and Programming in C, R.S. Salaria, Second Edition
5. Programming in C, Atul Kahate.

1st Semester	Workshop on Desktop Publishing				
BCA24104					
Internal max. marks	60		L	T	P
External max. marks	40		0	0	2
Total Marks	100		Credits		1

Additional material required in ESE: Softcopy & Hardcopy of the exercises are to be maintained during the practical labs and to be submitted during the End Semester Examinations.

Course Outcomes: After studying this course, students will be able to:	
CO1	Outline the characteristics of desktop publishing tools.
CO2	Identify the right components for designing.
CO3	Apply knowledge in designing various documents.
CO4	Prepare different types of graphic related documents.
CO5	Express the messages through graphical content
CO6	Publish different types of content using various techniques.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Sno.	Assignments
1.	Design and print a <i>Title Page</i> of a Magazine/Book by identifying publishing tools. [CO1]
2.	Prepare multiple designs for a <i>Flex</i> by using different Tools. [CO2]
3.	Prepare <i>NSS Certificates</i> for appreciation using logos of University, College & NSS unit. [CO3]
4.	Prepare 5 different Designing of <i>Business Cards</i> . [CO3]
5.	Prepare <i>Envelops</i> displaying full address of the company by inserting graphical symbol/ logos of company. [CO4]
6.	Design and Print <i>Invoices</i> for three companies. [CO3]
7.	Prepare and print <i>News Letter Layouts</i> for any five activities of your college/ university. [CO3]
8.	Prepare <i>Invitation Cards</i> for cultural meet held in your college. [CO5]
9.	Design and print <i>Brochures</i> to advertise a “Blood Donation Camp” in your college. [CO5]
10.	Design <i>Logos</i> of your college, University & Govt. of Punjab also display these logos on black background as water mark. [CO5]
11.	Design, Print and Publish 5 motivations Playcards. [CO6]
12.	Design & Print assignment book of minimum 20 Pages an any Topic. [CO6]
13.	Design & print any five most important activities of your college in a collage.[CO6]
14.	Design & Print Question Paper of any Subject. [CO6]
15.	Assemble all the latest news cutting of your activities on a 10 X 8 size flex. [CO6]

References:
1. DTP Course, by Shirish Chavan published by Rapidex.
2. DTP Course Kit by Vikas Gupta published by Comdex.
3. CorelDraw 9 by David Karlins published by Techmedia.
4. Adobe Illustrator CC by Brian Wood published by Adobe Press.
5. Page Maker in Easy Steps - Scott Basham.

1st Semester	Problem Solving using C Laboratory				
BCA24105					
Internal max. marks	60		L	T	P
External max. marks	40		0	0	4
Total Marks	100		Credits		2

Course Outcomes: After studying this course, students will be able to:	
CO1	Understand basic Structure of the c programming, declaration and usage of variable.
CO2	Experiment with different input values.
CO3	Distinguish between various control statements and data types.
CO4	Learning concepts of pointers by Write C programs using pointersto access arrays, strings and functions.
CO5	Learn structures and unions through which derived data types can be formed
CO6	Understand and use file handling in the C programming language

Instructions: Develop all programs in C programming language.

Sno.	Assignments
1.	WRITE A PROGRAM to display your name. Write another program to print message with inputted name. [CO1]
2.	WRITE A PROGRAM to add two numbers. [CO1]
3.	WRITE A PROGRAM to find the square of a given number. [CO1]
4.	WRITE A PROGRAM to calculate the average of three real numbers. [CO1]
5.	Write a program to Find ASCII Value of a Character. [CO1]
6.	WRITE A PROGRAM to Find the Size of int, float, double and char.[CO1]
7.	WRITE A PROGRAM to Compute Quotient and Remainder.[CO2]
8.	WRITE A PROGRAM to accept the values of two variables. [CO2]
9.	WRITE A PROGRAM to find the simple interest, inputs are amount, period in years and rate of interest. [CO2]
10.	Basic salary of an employee is input through the keyboard. The DA is 25% of the basic salary while the HRA is 15% of the basic salary. Provident Fund is deducted at the rate of 10% of the gross salary(BS+DA+HRA). WRITE A PROGRAM to calculate the net salary [CO2]
11.	WRITE A PROGRAM to find area of a circle using PI as constant.[CO2]
12.	WRITE A PROGRAM to find volume of a cube using side as input from user. [CO3]
13.	WRITE A PROGRAM using various unformatted Input Functions [CO3]
14.	WRITE A PROGRAM to find area of rectangle and print the result using unformatted output Functions [CO3]
15.	WRITE A PROGRAM to find the larger of two numbers. [CO3]
16.	WRITE A PROGRAM to find greater of three numbers using Nested If. [CO3]
17.	WRITE A PROGRAM to find whether the given number is even or odd. [CO3]
18.	WRITE A PROGRAM to Generate Multiplication Table Using for loop [CO3]
19.	WRITE A PROGRAM to Generate Multiplication Table Using while loop [CO3]
20.	WRITE A PROGRAM to Make a Simple Calculator Using switch...case [CO3]
21.	WRITE A PROGRAM to find whether the given number is a prime number. [CO3]
22.	WRITE A PROGRAM using function to find the largest of three numbers [CO3]
23.	WRITE A PROGRAM using function to print first 20 numbers and its squares. [CO3]
24.	WRITE A PROGRAM to find the factorial of a given number. [CO4]
25.	WRITE A PROGRAM to print the sum of two matrices [CO4]

26.	WRITE A PROGRAM to Find the Length of a String [CO4]
27.	WRITE A PROGRAM to Copy String using strcpy().[CO4]
28.	WRITE A PROGRAM to compare a string [CO4]
29.	WRITE A PROGRAM to reverse a string [CO4]
30.	WRITE A PROGRAM to reverse a string [CO4]
31.	WRITE A PROGRAM to multiply two numbers using pointers. [CO4]
32.	WRITE A PROGRAM to display address of variable using pointers [CO5]
33.	WRITE A PROGRAM to show the memory occupied by Structure and Union [CO5]
34.	WRITE A PROGRAM to create Student I-Card using a Structure.[CO6]
35.	WRITE A PROGRAM to read data from a file from a file.[CO6]
36.	WRITE A PROGRAM to save Employee details in a file using File Handling. [CO6]

1st Semester	Introduction to computer & information technology Laboratory				
BCA24106					
Internal max. marks	60		L	T	P
External max. marks	40		0	0	4
Total Marks	100		Credits		2

Course Outcomes: After studying this course, students will be able to:	
CO1	Highlight the features of word processing,
CO2	Prepare documents and apply formatting using word.
CO3	MS-Excel as a tool for organizing data.
CO4	Use of PowerPoint as a graphic tool.
CO5	Apply Various operations using PowerPoint.
CO6	Understand the concept of Internet and its Applications.

Instructions:

Word Orientation: [CO1]	
The instructor needs to give an overview of word processor. Details of the four tasks and features that would be covered Using word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter.	
1.	Using word to create document. Features to be covered: - Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word. [CO1]
2.	Create Various documents using MS-Word Create Various documents like resume, assignment, Newsletter with the help of MS-Word Creating an Assignment Features to be covered: - Formatting Styles, inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes. [CO2]
3.	Creating a Newsletter Features to be covered: - Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs [CO2]
4.	Creating a Feedback form Features to be covered: - Forms, Text Fields, Inserting objects, Mail Merge in Word. [CO2]
Excel Orientation:	
The instructor needs to tell the importance of Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered Excel – Accessing, overview of toolbars, saving excel files,	
1.	Creating a Scheduler Features to be covered: - Gridlines, Format Cells, Summation, auto fill, Formatting Text
2.	Calculations Features to be covered: - Cell Referencing, Formulae in excel – averages. Deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP
3.	Performance Analysis Features to be covered: - Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting
4.	Game (like Cricket, badminton) Score Card

	Features to be covered: - Pivot Tables, Interactive Buttons, Importing Data, Data Protection, Data Validation [CO3]
Presentation Orientation: To give information for presentation work using MS-PowerPoint	
1.	Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered includes: - PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows
2.	This session helps students in making their presentations interactive. Topics covered includes: Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts
3.	Concentrating on the in and out of Microsoft power point. Helps them learn best practices in designing and preparing power point presentation. Topics covered includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background, textures, Design Templates, Hidden slides. Auto content wizard, Slide Transition, Custom Animation, Auto Rehearsing [CO4]
Implementation of MS-PowerPoint. To Create presentation with the help of power point by accessing its tools and functions	
1.	Power point test would be conducted. Students will be given model power point presentation which needs to be replicated [CO5]
Internet and its Applications The instructor needs to tell the how to configure Web Browser and to use search enginesby defining search criteria using Search Engines [CO6]	
1.	To learn to setup an e-mail account and send and receive e-mails
2.	To learn to subscribe/post on a blog and to use torrents for accelerated downloads
3.	Hands on experience in online banking and making an online payment for any domestic bill

References:	
1. IT Tools, R.K. Jain, Khanna Publishing House.	
2. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.	
3. Introduction to information technology, Turban, Rainer and Potter, John Wiley and Sons.	
4. Problem Solving Cases in Microsoft Excel, Joseph Brady & Ellen F Monk, Thomson Learning.	

1st Semester	Foundation Course in English-I				
AEC-24101					
Internal Marks:	40		L	T	P
External Marks:	60		2	0	0
Total Marks:	100		Credits		2

Course Outcomes: After studying the course, students will be able to:

CO1	Understand the Need and Purpose of Communication.
CO2	Recognize the different signals of nonverbal Communication.
CO3	Enhance and practice advance vocabulary in day-to-day life
CO4	Understand the word formation in different contexts
CO5	Develop proficiency in reading skills
CO6	Activate and reinforce the Writing and critical thinking skills

Part	Content	CO
I	Communication- Meaning, Process, Kinds and Barriers	CO1
	Verbal and Non-Verbal Communication- Body language, Kinesics, Para-language and Proxemics	CO2
II	Vocabulary Building- Building Vocabulary for everyday communication expanding academic and professional understanding	CO3
III	Prefix, Suffix and Collocation- Understanding and Usage in various contexts	CO4
IV	Reading- Meaning, Importance, Gears of Reading and Effective Reading Skills	CO5
	Reading Practice- Unseen Comprehension Passages	CO6

References

- Technical Communication (Paperback, Meenakshi Raman, Sangeeta Sharma)
- Essentials of English Grammar & Composition by N.K Aggarwal
- Black Book of English Vocabulary May 2024 by Nikhil Gupta

1st Semester	Universal Human Values				
VAC-24101					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:	
CO1	Understand the Need and Process of Value Education.
CO2	Identify and Analyse Basic Human Aspirations.
CO3	Analyse the Needs and Activities of Self and Body.
CO4	Harmony in the Self and Body
CO5	Identify and Understand the Comprehensive Human Goal.
CO6	Understand Existence as Co-existence at all levels

Part	Content	CO
I	Introduction to Value Education, Self-Exploration as the Process of Value Education	CO1
	Basic Human Aspirations and the Program to fulfil Basic Human Aspirations	CO2
II	Understanding the Human Being as Co-existence of SELF (I) and BODY	CO3
III	Understanding Harmony in the SELF and the BODY	CO4
	Harmony in the Family, Extending relationship from Family to Society.	CO5
IV	Harmony in Nature and the Holistic perception of Harmony in Existence	CO6

References:
<ul style="list-style-type: none"> • A Foundation Course in Human Values and Professional Ethics by R R Gaur, R Sangal & G P Bagaria • Ethics and Human Values by S. Abdul Sattar. • Human Values by Dr. Kshitiz Jain.

2nd Semester	Fundamentals of Statistics				
BCA24201					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:	
CO1	Comprehend the fundamental concepts of statistics, its importance, scope and Distrust of statistics
CO2	Understand the basic concepts of collection and Classification of data
CO3	Acquaint the students with the knowledge of presenting the data with different methods
CO4	Familiarize the students with the calculation of Arithmetic mean, median and mode
CO5	Enable the students with the basics of Dispersion and Range
CO6	Recall the concepts of Standard deviation, variation and its application

Unit	Detailed Contents	CO
I	Introduction to Statistics – Origin of Statistics, Features of Statistics, Scope of Statistics, Functions of Statics, Uses and importance of Statistics, Limitation of Statistics, Distrust of Statistics.	CO1
	Collection of Data: Introduction to Collection of Data, Primary and Secondary Data, Methods of Collecting Primary Data, Methods of Secondary Data, Statistical Errors, Rounding off Data (Approximation).	
II	Classification of Data Frequency Distribution: Introduction Classification of Data, Objectives of Classification, Methods of Classification, Ways to Classify Numerical Data or Raw Data.	CO2
	Tabular Presentation of Data: Introduction to Tabular Presentation of Data, Objectives of Tabulation, Components of a Statistical Table, General Rules for the construction of a Table, Types of Tables. Introduction to Graphical and Diagrammatic: Diagrammatic Presentation of Data, Advantage and Disadvantage of Diagrammatic Presentation, Types of Diagrams, Introduction to Graphic Presentation of Data, Advantage and Disadvantage of Graphic Presentation, Types of Graphs.	CO3
III	Measures of Central tendency: Introduction to Central Tendency, Purpose and Functions of Average, Characteristics of a Good Average, Types of Averages, Meaning of Arithmetic Mean, Calculation of Arithmetic Mean, Merit and Demerits of Arithmetic Mean, Meaning of Median, Calculation of Median, Merit and Demerits of Median, Meaning of Mode, Calculation of Mode, Merit and Demerits of Mode, Harmonic Mean- Properties, Merit and Demerits.	CO4
IV	Measures of Dispersion: Meaning of Dispersion, Objectives of Dispersion, Properties of a good Measure of Dispersion, Methods of Measuring Dispersion, Range - Introduction, Calculation of Range, Merit and Demerits of Range	CO5
	Standard Deviation -Meaning, Calculation of Standard Deviation, Merit and Demerits of Standard Deviation. [CO5] Mean Deviation, Calculation of Mean Deviation, Merit and Demerits of Mean Deviation, Coefficient of Variation, Calculation of Coefficient Variance, Merit and Demerits of Coefficient of Variation.	CO6

References:**Text Books:**

1. Statistics and Data Analysis, A.Abebe, J. Daniels, J.W.Mckean, December 2000.
2. Statistics, Tmt. S. EzhilarasiThiru, 2005, Government of Tamilnadu.
3. Introduction to Statistics, David M. Lane.
4. Weiss, N.A., Introductory Statistics. Addison Wesley, 1999.
5. Clarke, G.M. & Cooke, D., A Basic course in Statistics. Arnold, 1998.

Reference Books:

1. Banfield J.(1999), Rweb: Web-based Statistical Analysis, Journal of Statistical Software.
2. Bhattacharya,G.K. and Johnson, R.A.(19977), Statistical Concepts and Methods, New York, John Wiley & Sons.

E-Books/ Online learning material

1. http://onlinestatbook.com/Online_Statistics_Education.pdf
2. <https://textbookcorp.tn.gov.in/Books/12/Std12-Stat-EM.pdf>
3. <https://3lihandam69.files.wordpress.com/2015/10/introductorystatistics.pdf>

2nd Semester	Computer System Architecture				
BCA24202					
Internal max. marks	40		L	T	P
External max. marks	60		3	0	0
Total Marks	100		Credits		3

Course outcomes: After studying the course, students will be able to:	
CO1	Introduction of basics of digital circuits and logic gates.
CO2	Knowledge of boolean expression minimization with boolean algebra and k - map techniques
CO3	To be able to design combinational circuits.
CO4	Understanding the working of sequential circuits such as various types of flip - flops.
CO5	Identify the various internal and peripheral components of computer system.
CO6	To understand register transfer, micro - operations and common bus system in computer system.

Part	Detailed Contents	CO
I	Logic gates: AND, OR, NOT, NAND, NOR, XOR, XNOR, NAND & NOR as universal gates, Logic gates applications.	CO1
	Boolean algebra: Introduction, Theorems, Simplification of boolean expression using boolean algebra, SOP & POS forms, Realization of boolean expression using gates, K - maps, Simplification of boolean expression using K - maps.	CO2
II	Combinational logic circuits: Half adder & half subtractor, Full adder & full subtractor, Parallel binary adder, Binary adder / subtractor, Multiplexers & demultiplexers, Implementation of boolean equations using multiplexer and demultiplexer, Encoders & decoders.	CO3
III	Sequential logic circuits: Latch, Flip flops - R - S flip - flop, J - K flip - flop, Race around condition, Removing race around condition, Master - slave J - K flip - flop, D flip - flop, T flip - flop, Applications of flip - flops. [CO4]	CO4
IV	Introduction to computer organization: Introduction to computer and CPU (Computer organization, Computer design and Computer architecture), Stored program concept - Von neumann architecture, Harvard architecture, RISC and CISC architecture.	CO5
	Register transfer and micro - operations: Introduction to registers, Instruction format, Types of instructions - Memory reference instructions, Register reference instructions and Input - output instructions. Common bus system: Introduction to common bus system, Types of buses (Data bus, Control bus, Address bus), 16 - bit common bus system - Data movement among registers using bus.	CO6

References:
1. Computer Organization and Architecture, Stallings, Eighth Edition, PHI.
2. Computer Organization and Architecture, J.P.Hayes, Third Edition, TMH.
3. Digital and Electronic Circuits, T. C. Bartee, McGraw Hill.
4. Digital Fundamentals, Floyd, Ninth Edition, PHI.
5. Digital Integrated Electronics, Taub & Schilling, Eighth Edition, Mc-Graw Hill.

2nd Semester	Object Oriented Programming using C++				
BCA24203					
Internal max. marks	40		L	T	P
External max. marks	60		3	0	0
Total Marks	100		Credits		3

Course outcomes: After studying the course, students will be able to:	
CO1	Outline the role of programming for solving real world problems.
CO2	Able to Understand and Apply the concepts of Classes & Objects.
CO3	Understand dynamic memory management techniques using constructors and destructors.
CO4	To learn how containment and inheritance promote code reuse in C++.
CO5	To learn how to overload functions and operators in C++.
CO6	Understand polymorphism, virtual functions and I/O statements.

Part	Detailed Contents	CO
I	Principles of object oriented programming Introduction to OOP and its basic features, Basic components of a C++, Program and program structure, Compiling and Executing C++ Program. Difference between Procedure Oriented Language(C) and Object Oriented Language [CO1]	CO1
II	Classes & Objects and Concept of Constructors Defining classes, Defining member functions, Declaration of objects to class, Access to member variables from objects, Different forms of member functions, Access specifiers (Private, public, protected), Array of objects.	CO2
	Introduction to constructors, Parameterized constructors, Copy Constructor, Multiple constructors in class, Dynamic initialization of objects, Destructors	CO3
III	Inheritance and Operator overloading Introduction to Inheritance, Types of inheritance: - Single inheritance, Multiple inheritance, Multilevel inheritance, Hierarchical inheritance, Hybrid inheritance.	CO4
	Defining operator overloading, Overloading of Unary and Binary operators, Rules for overloading operators	CO5
IV	Polymorphism and File Handling Early Binding, Late Binding, Virtual Functions, pure virtual functions, Abstract Classes. File classes, Opening and Closing a file, File modes, Manipulation of file pointers, Functions for I/O operations.	CO6

References:
1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, Tata Mc-Graw Hill.
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications.
3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley Publishing Company.
4. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing.

2nd Semester	Object Oriented Programming using C++ Laboratory				
BCA24204					
Internal max. marks	60		L	T	P
External max. marks	40		0	0	4
Total Marks	100		Credits		2

Additional material required in ESE: Softcopy & Hardcopy of the exercises are to be maintained during the practical labs and to be submitted during the End Semester Examinations.

Course Outcomes: After studying this course, students will be able to:	
CO1	Design the classes.
CO2	Illustrate the concept of memory representation for objects
CO3	Demonstrate the significance of constructors and destructor.
CO4	Implement function and operator overloading using C++.
CO5	Select the right data types to represent class properties.
CO6	Implement file handling in C++

Instructions: Develop all program in C++

Assignments:

1.	Write a program to enter mark of 6 different subjects and find out the total mark (Using cin and cout statement). [CO1]
2.	Write a function using reference variables as arguments to swap the values of pair of integers. [CO1]
3.	Write a function to find largest of three numbers. [CO1]
4.	Write a program to find the factorial of a number.[CO1]
5.	Define a class to represent a bank account which includes the following members as Data members: a) Name of the depositor b) Account Number c) Withdrawal amount d) Balance amount in the account Member Functions: a) To assign initial values b)To deposit an amount c) To withdraw an amount after checking the balance d) To display name and balance. [CO2]
6.	Write the above program for handling n number of account holders using array of objects. [CO2]
7.	Write a C++ program to compute area of right angle triangle, equilateral triangle, isosceles triangle using function overloading concept. [CO2]
8.	Consider a publishing company that markets both book and audio cassette version to its works. Create a class Publication that stores the title (a string) and price (type float) of a publication. Derive the following two classes from the above Publication class: Book which adds a page count (int) and Tape which adds a playing time in minutes(float). Each class should have get_data() function to get its data from the user at the keyboard. Write the main() function to test the Book and Tape classes by creating instances of them asking the user to fill in data with get_data() and then displaying it using put_data().[CO3]
9.	Consider an example of declaring the examination result. Design three classes student, exam and result. The student has data members such as rollno, name. Create the lass exam by inheriting the student class. The exam class adds data members representing the marks scored in 5 subjects. Derive the result from exam-class and it has own data members like total, avg. [CO3]

10.	Write a program for overloading of Unary ++ operator. [CO4]
11.	Write a program for overloading of Binary + operator. [CO4]
12.	Write a program of Virtual Functions. [CO5]
13.	Write a program of Abstract Classes. [CO5]
14.	Write a program to read and write from file. [CO6]

References:

1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, Tata Mc-Graw Hill.
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications.
3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley Publishing Company.
4. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing.

2nd Semester	Fundamentals of Statistics Laboratory				
BCA24205					
Internal max. marks	60		L	T	P
External max. marks	40		0	0	4
Total Marks	100		Credits		2

Course Outcomes: After studying this course, students will be able to:	
CO1	Sort data to easily identify groups or trends.
CO2	Create Frequency table and Graphs for data representation.
CO3	Apply various statistical operations using statistical tool like excel.
CO4	Compute various statistical measures using statistical tool like excel.
CO5	Analyse real life data using statistical tool
CO6	Prepare data in different formats and styles

Instructions: Sample exercises are given below and Instructor can increase or decrease the experiments as per the requirement.

Assignments:

1	Calculate the addition, subtraction, multiplication. [CO1]
2	Display the Maximum and Minimum market data. [CO1]
3	Display the Count Function. [CO2]
4	Display year wise strength of the students of a college in Tabular form & Graphical form. [CO2]
5	Calculate the average marks of the students of your College. [CO3]
6	Print measure of Central Tendency using grouped and ungrouped data. [CO3]
7	Construct & print frequency distribution using data with the following Techniques: a) Histogram b) Frequency Polygon c) Frequency Curve c) Ogive curves. [CO4]
8	Find out & display the Median and Mode from the following series by using suitable method: Class 156-158 158-160 160-162 162-164 164-166 Frequency 4 8 28 51 89 [CO4]
9	Calculate an appropriate measure of dispersion using grouped and ungrouped data. [CO4]
10	Make an array and calculate range of the data. [CO5]
11	Represent the placement record of the students of your college. [CO5]
12	Calculate & display Letter Grade using spreadsheet. [CO6]
13	Represent the following data by suitable graphs; determine therefrom the number of children having IQ (i) Below 105 (ii) Above 124. IQ 75-84 85-94 95-104 105-114 115-124 125-134 No. of Children 8 20 45 54 28 16 [CO6]

2nd Semester	Computer System Architecture Laboratory				
BCA24206					
Internal max. marks	60		L	T	P
External max. marks	40		0	0	4
Total Marks	100		Credits		2

Course Outcomes: After studying this course, students will be able to:	
CO1	Introduction of basics of various logic gates and its verification.
CO2	To be able to design adder and subtractor combinational circuits.
CO3	Able to design encoder and decoder combinational circuits.
CO4	Verification of all logic gates implementation using universal gates.
CO5	Implementation of multiplexer and demultiplexer combinational circuits.
CO6	Able to implement various types of sequential circuits.

Sno.	Assignments
1.	To verify the Truth Table of Basic Logic Gates.[CO1]
2.	To verify the Truth Table of Combinational Logic Gates [CO1]
3.	To verify the Truth Table of Universal Logic Gates [CO1]
4.	To verify the Truth Table of Half Adder Combinational Circuit [CO2]
5.	To verify the Truth Table of Full Adder Combinational Circuit [CO2]
6.	To verify the Truth Table of Half Subtractor Combinational Circuit [CO2]
7.	To verify the Truth Table of Full Subtractor Combinational Circuit [CO2]
8.	To verify the Truth Table of Decoder Combinational Circuit [CO3]
9.	To verify the Truth Table of Encoder Combinational Circuit [CO3]
10.	To verify the Truth Table of Multiplexer Combinational Circuit [CO3]
11.	To verify the Truth Table of De Multiplexer Combinational Circuit [CO3]
12.	To verify the Truth Table of S-R Flip-Flop [CO4]
13.	To verify the Truth Table of J-K Flip-Flop [CO4]
14.	To verify the Truth Table of Master Slave J-K Flip-Flop [CO4]
15.	To verify the Truth Table of D Flip-Flop [CO5]
16.	To verify the Truth Table of T Flip-Flop [CO5]
17.	To verify the working of Asynchronous Up Counter [CO6]
18.	To verify the working of Asynchronous Down Counter [CO6]
19.	To verify the working of Asynchronous MOD-N Counter [CO6]
20.	To verify the working of Synchronous Up Counter [CO6]
21.	To verify the working of Synchronous Down Counter [CO6]
22.	To verify the working of Synchronous MOD-N Counter [CO6]
23.	To verify the working of Asynchronous Bidirectional Counter [CO6]
24.	To verify the working of Synchronous Bidirectional Counter [CO6]

References:
1. Computer Organization and Architecture, Stallings, Eighth Edition, PHI.
2. Modern Digital Electronics, R. P. Jain, Fourth Edition, TMH.
3. Digital Logic & Computer Design, D. Morris Mano, Second Edition, PHI.
4. Digital and Electronic Circuits, T. C. Bartee, McGraw Hill.
5. Digital Fundamentals, Floyd, Ninth Edition, PHI.

2 nd Semester		Environmental Studies & Sustainability			
VAC-24201					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Prerequisite: Students must have the basic understanding of the Environment

Course Outcomes: After studying the course, students will be able to:	
CO1	Attribute the knowledge of multidisciplinary nature of environmental studies.
CO2	Understand the Climatic conditions and its adaptation and mitigation techniques.
CO3	Evaluate the interlink between biotic and abiotic components of ecosystem.
CO4	Differentiate the terms of biodiversity and understand its role in society.
CO5	Apply the knowledge to understand the problems of pollution and its remedies by citing the case studies.
CO6	Relate the importance of environmental sciences for sustainable approach.

Part	Content	CO
I	Introduction to Environmental Studies: Multidisciplinary nature of Environmental Studies, Scope and Importance, Role of an individual and IT in protection, Need for public awareness.	CO1
	Climate Change: Climate change, it's causes and consequences, Adaptation and mitigation techniques for climate change, case studies on the survival of dolphins, IPCC and its laws, Economic conditions of the world related to climate change	CO2
II	Ecosystem: Structure and function of ecosystem, Energy flow, Food Chain and Food Web, Ecological Pyramids	CO3
III	Biodiversity: Levels of biodiversity, India as a mega-biodiversity nation, Hotspots of biodiversity, Threats to biodiversity, Conservation of biodiversity, Values of biodiversity.	CO4
	Environmental Pollution: Types, Causes, effects and controls (Air, Water, Soil, Noise and Nuclear Hazards) Human Health Risks, Solid Waste Management, Pollution case studies, study of various types of wastes produced and their dumping spots and the consequences	CO5
IV	Environmental and Social Issues: Climate change, Global Warming, Ozone layer Depletion, Acid Rain and impacts on Human communities and agriculture, Case Study of Taj Mahal, Wildlife Protection Act, Forest Conservation Act. Human Population and Environment: Human Population Growth; Impacts on the Environment, Human health and Welfare; Disaster Management: Floods, Earthquakes, Cyclone and Landslides. Environmental Communication and Public Awareness, Case Studies (e.g., CNG Vehicles in India)	CO6

Field Work

- Visit to a local polluted site- Urban/ Rural/ Industrial/ Agricultural
- Study of common Plants, Insects, Birds
- Study of simple ecosystem pond

References:

- Environmental Studies by S.M.Saxena
- Environmental Sciences by Jaswinder Kaur
- Introductory environmental studies by Dr. S.K. Bhasin, Dr. Varinder Kaur
- Climate Change Adaptation and Mitigation by James M.Vose

2nd Semester		Designing Lab Photoshop			
BCA24207					
Internal Marks:	40		L	T	P
External Marks:	60		2	0	0
Total Marks:	100		Credits		2

Course Outcomes: After studying the course, students will be able to:	
CO1	Introduction to basics of adobe Photoshop
CO2	The students will be able to learn photo editing
CO3	The students will understand the function of Photoshop
CO4	The students will understand various types of photo editing tasks
CO5	Understanding various layers and filling techniques.
CO6	Analyses various filter on different image format.

Part	Detailed Contents	CO
I	Introduction to Photoshop, Creating a New File, Main Selections, Picking color, Filling a selection with color, More ways to choose colors and fill selections, Painting with paintbrush tool, Using the magic wand tool and applying a filter, Saving your document Color Mode, Gray Scale Color Mode, RGB Color Mode, CMYK Color Mode, Bitmap Mode, Open a file, Preference.	CO1
II	Foreground & background, Changing Foreground and Background colors, Using the Large color selection Boxes and small color swatches, Using the Eyedropper tool to sample Image color, Changing the Foreground Color While using a Painting Tool.	CO2
	Using Brushes, Selecting the Brush Shape, Drawing a vertical and Horizontal Straight lines with any brush, Drawing connecting Straight Lines (at any angle) with any brush, Creating a New Brush, Saving Brushes, Loading Brushes, Creating a Custom Brushes, Using the Painting Modes, Fade, Airbrush Options, Pencil Options.	CO3
III	Rubber stamping an Aligned Clone, Rubber Stamping, Impressionist Style, Using line tool, Using the Editing Tool, The Smudge Tool, The Blur and Sharpen Tool, The Dodge / Burn Tool, Shadows, Mid,tones and Highlights, Selection Tools, Making Rectangular and Square Selections, Feathering a Selections, Lasso Features, Lasso Options, Making selections by color or Gray Scale value using the Magic Wand, Moving an anchor point or Direction point to change the shape of curve, Adding and Removing Anchor points, Moving Path, Saving, Loading and Creating New Path, Filling & Stroking Path.	CO4
IV	Introduction to layers, Creating & editing New layers, adding a background, Creating Layer Mask, Layer Masks, Adjustment Layers, Adding Fills and Gradients, filling with paint bucket tools, Filling type with grading Fills.	CO5
	Applying Filters, Blur Filters, Render Filters, Sharpen Filters, Sketch Filters, Texture Filters, Other Special Filters, Printing your document, Save your file, Save file as a JPEG, TIFF, GIF, PNG	CO6

Assignments:

1	Simple text effects
2	Image restoration
3	Image manipulation in Photoshop
4	Movie poster concept
5	Creating story board
6	Digital scenery creation
7	UI Design for smart phones
8	Creating website layout
9	Set extension in Photoshop
10	Digital Matte painting

References

- **Photoshop 7 - the ultimate reference by Barstow Bruce & Martin tony.**

2ndSemester	Foundation Course in English-II				
AEC 24201					
Internal Marks:	40		L	T	P
External Marks:	60		2	0	0
Total Marks:	100		Credits		2

Course Outcomes: After studying the course, students will be able to:	
CO1	Demonstrate effective listening skills to enhance communication
CO2	Apply fundamental grammar rules in writing and speaking
CO3	Summarize information from various sources to assess their understanding
CO4	Enhance their understanding of vocabulary in various contexts
CO5	Understand the fundamentals of business letter writing
CO6	Develop their ability to connect literary themes to real world contexts

Part	Content	CO
I	Developing Effective Listening Skills- Listening v/s Hearing, Poor Listening v/s Effective Listening, Advantages of Good Listening, Types of Listening, Barriers to Effective Listening	CO1
	Essentials of Grammar- Parts of Speech, Subject-Verb Agreement	CO2
II	The Art of Condensation- Forms of Condensation, Principles of the Art of the Condensation, Steps for Writing an Effective Precis, Writing Precis of given passages	CO3
III	Vocabulary Building- Idioms, One-word Substitution, Homonyms, Homophones	CO4
IV	Business Letters- Difference between Personal and Business Letter, Purposes of Business Letter, Layout of Business Letters, Components of Business Letter, Types of Business Letters	CO5
	Text- 'Where the Mind is without Fear' by Rabindranath Tagore and 'The School for Sympathy' by E.V. Lucas	CO6

References
<ul style="list-style-type: none"> • Technical Communication (Paperback, Meenakshi Raman, Sangeeta Sharma) • Communication Skills by Sanjay Kumar, Pushp Lata, Second Edition, Oxford University Press • Professional Communication by Aruna Koneru, The McGraw-Hill Companies

3rd Semester	Computer Networks				
BCA24301					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:	
CO1	Identify Hardware and software components for designing network.
CO2	Define different network technologies and their application.
CO3	Describe the role of network reference models.
CO4	Describe the different services that data link layer offers to network layer.
CO5	Explain the different transport layer functions.
CO6	Identify different applications in presentation layer and application layer.

Unit	Detailed Contents	CO
I	<p>Types of Networks: LAN, MAN, WAN</p> <p>Network Topologies: Bus, Star, Ring, Mesh, Tree, Hybrid Communication</p> <p>Channels: Wired transmissions: Telephone lines, leased lines, switch line, coaxial cables-base band, broadband, optical fibre transmission.</p> <p>Communication Switching Techniques: Circuit Switching, Message Switching, Packet Switching.</p>	CO1
II	<p>Data communications concepts: Digital and analogue transmissions- Modem, parallel and serial transmission, synchronous and asynchronous communication. Modes of communication: Simplex, half duplex, full duplex.</p> <p>MAC sub layer: CSMA/CD/CA, IEEE standards (IEEE802.3 Ethernet, Gigabit Ethernet, IEEE 802.4 Token Bus, IEEE 802.5 Token Ring) [CO2]</p> <p>Network Layer: Design Issues, Routing Algorithms: Optimality Principle, Shortest Path Routing, Congestion Control Policies, Leaky bucket and token bucket algorithm, Concept of Internetworking.</p>	CO2
	<p>Network Reference Models: OSI Reference Model, TCP/IP Reference Model, Comparison of OSI and TCP/IP Reference Models.</p> <p>Transmission impairments – Attenuation, Distortion, Noise. Multiplexing – frequency division, Time division, Wavelength division.</p>	CO3
III	<p>Data Link Layer Design Issues: Services provided to the Network Layer, Framing, Error Control (error detection and correction code), Flow Control, Data Link Layer in the Internet (SLIP, PPP).</p>	CO4
	<p>Transport Layer: Design issues, Elements of transport protocols– Addressing, Connection establishment and release, Flow control and buffering, Introduction to TCP/UDP protocols.</p>	CO5
IV	<p>Session, Presentation and Application Layers: Session Layer– Design issues, remote procedure call. Presentation Layer – Design issues, Data compression techniques, Cryptography. Application Layer–Distributed application (client/server, peer to peer, cloud etc.), World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), HTTP as an application layer protocol.</p>	CO6

References:**Text Books:**

1. Computer Networks, Tanenbaum, Andrew, Fifth Edition, PHI.
2. Data Communication and Networking, Behrouz A. Forouzan, Fourth Edition.
3. Computer Today, S.K. Basandra, First Edition, Galgotia.

Reference Books:

1. Data Communication System, Black, Ulysse, Third Edition, PHI.
2. Data and Computer Communications, Stalling, Ninth Edition, PHI.
3. James F. Kurose and Keith W. Ross, "Computer Networking", Pearson Education.
4. Douglas E. Comer, "Internetworking with TCP/IP", Volume-I, Prentice Hall, India.

3rd Semester	Data Structures				
BCA24302					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:	
CO1	Differentiate between various types of data structure.
CO2	Apply appropriate constructs of Programming language, coding standards for application development.
CO3	Select appropriate data structures for problem solving and programming.
CO4	Illustrate the outcome of various operations on data structures.
CO5	Illustrate concept of Graphs, Directed Graph & Weighted Graph.
CO6	Identify appropriate searching and/or sorting techniques for wide range of problems and data types.

Unit	Detailed Contents	CO
I	Introduction to Data Structures: Algorithms and Flowcharts, Basics Analysis on Algorithm, Complexity of Algorithm, Introduction and Definition of Data Structure, Classification of Data, Arrays, Various types of Data Structure, Static and Dynamic Memory Allocation, Function, Recursion.	CO1
	Arrays, Pointers and Strings: Introduction to Arrays, Definition, One Dimensional Array and Multi-Dimensional Arrays, Pointer, Pointer to Structure, various Programs for Array and Pointer. Strings. Introduction to Strings, Definition, Library Functions of Strings.	CO2
II	Stacks and Queue: Introduction to Stack, Definition, Stack Implementation, Operations of Stack, Applications of Stack and Multiple Stacks. Implementation of Multiple Stack. Queues: Introduction to Queue, Definition, Queue Implementation, Operations of Queue, Circular Queue, De-queue and Priority Queue.	CO3
III	Linked Lists and Trees: Introduction, Representation and Operations of Linked Lists, Singly Linked List, Doubly Linked List, Circular Linked List, And Circular Doubly Linked List. Trees: Introduction to Tree, Tree Terminology Binary Tree, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree, Tree Traversal, Threaded Binary Tree, AVL Tree B Tree, B+ Tree.	CO4
IV	Graphs, Searching, Sorting and Hashing: Introduction, Representation to Graphs, Graph Traversals Shortest Path Algorithms.	CO5
	Searching and Sorting: Searching, Types of Searching, Sorting, Types of sorting like quick sort, bubble sort, merge sort, selection sort. [CO6] Hashing: Hash Function, Types of Hash Functions, Collision, Collision Resolution Technique (CRT), Perfect Hashing	CO6

References:**Text Books:**

1. Brijesh Bakariya. Data Structures and Algorithms Implementation through C, BPB Publications.
2. Kruse R.L. Data Structures and Program Design in C; PHI
3. Aho Alfred V., Hopcroft John E., Ullman Jeffrey D., “Data Structures and Algorithms”, AddisonWesley

Reference Books:

1. Horowitz & Sahney: Fundamentals of Data Structures, Galgotia Publishers.
2. Yashwant Kanetkar, Understanding Pointers in C, BPB Publications.
3. Horowitz, S. Sahni, and S. Rajasekaran, Computer Algorithms, Galgotia Pub. Pvt. Ltd., 1998.

3rd Semester	Web Designing				
BCA24303					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:	
CO1	Understand the basics of Internet
CO2	Create pages with simple tags in HTML.
CO3	Design webpages with multiple sections or frames & Explain how to link webpages through hypertext.
CO4	Organise data in tabular form using HTML tables & Design forms with special controls using HTML.
CO5	Understand basic concepts of javascript.
CO6	Outline the key web designing concepts using javascript.

Unit	Detailed Contents	CO
I	Internet Basics Basic concepts, communicating on the internet, internet domains, internet server identities, establishing connectivity on the internet client IP address, Information Files Creation, Web Server, Web Client/Browser, Hyper Text Markup Language (HTML Tags, Paired Tags, Singular Tags).	CO1
II	Introduction to HTML Commonly Used Html Commands (Document Head, Document Body), Title and Footer, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines). Basic Formatting Tags HTML Basic Tags, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines), Text Styles (Bold, Italics, Underline), Other Text Effects (Centering (Text, Images etc.), Spacing (Indenting Text), HTML Color Coding. Type of Lists (Unordered List (Bullets), Ordered Lists (Numbering), Definition Lists. Adding Graphics To Html Documents Using The Border Attribute, Using The Width And Height Attribute, Using The Align Attribute, Using The Alt Attribute.	CO2
	Frames Introduction to Frames: The tag, Targeting Named Frames. DHTML: Cascading Style Sheets, Style Tag. Linking Documents Links (External Document References, Internal Document References), Image As Hyperlinks.	CO3
	Tables Introduction (Header, Data rows, The Caption Tag), Using the Width and Border Attribute, Using the Cell Padding Attribute, Using the Cell Spacing Attribute, Using the BGCOLOR Attribute, Using the COLSPAN and ROWSPAN Attributes.	CO4
III	Forms Used by a Web Site The Form Object, The Form Object's Methods (The Text Element, The Password Element, The Button Element, The Submit (Button) Element, The Reset (Button) Element, The Checkbox Element, The Radio Element, The Text Area Element, The Select and Option Element, The Multi Choice Select Lists Element).	CO4

IV	Introduction to JavaScript JS Introduction, Where To, Output, Statements, Syntax, Comments, Variables, Operators, Arithmetic, Assignment, Data Types, Conditions, Switch, Loop For, Loop While, Break, Booleans, Comparisons, Type Conversion, Bitwise, RegExp, Objects, Events, Functions, Function Definitions, Function Parameters, Function Invocation, Function Call, Function Apply, Function Closures	CO5
	Strings: String Methods, Numbers, Number Methods, Arrays, Array Methods, Array Sort, Array Iteration, Dates, Date Formats, Date Get Methods, Date Set Methods, Math, Random, Errors, Scope, Hoisting, Strict Mode, JSON, Forms, Forms API	CO6

References:

Text Books/Reference Books:

1. Internet for EveryOne: Alexis Leon, 1st Edition, Leon Techworld, Publication, 2009.
2. Greenlaw R; Heppe, "Fundamentals of Internet and WWW", 2nd Edition, Tata McGraw-Hill, 2007.
3. Raj Kamal, "Internet & Web Technologies", edition Tata McGraw-Hill Education. 2009.

E-Books/ Online learning material:

1. Bayross Ivan, "HTML, DHTML, JavaScript, PERL, CGI", 3rd Edition, BPB Publication, 2009.
2. Chris Payne, "Asp in 21 Days", 2nd Edition, Sams Publishing, 2003 PDCA.
3. A Beginner's Guide To Html [Http://www.Ncsa.Nine.Edit/General/Internet/w ww/Html.Prmter](http://www.Ncsa.Nine.Edit/General/Internet/w ww/Html.Prmter)
4. https://www.tutorialspoint.com/html/html_tutorial.pdf
5. <https://www.w3schools.com/js/>
6. <https://www.w3schools.com/html/>
7. https://www.cs.uct.ac.za/mit_notes/web_programming.html
8. http://www.pagetutor.com/table_tutor/index.html

3rd Semester	Computer Networks Laboratory				
BCA24304					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Familiarization with networking components and devices and implement resource sharing
CO2	Implement network configuration settings for an operating system
CO3	Prepare different types of cables for networking.
CO4	Design network model using network simulation tool
CO5	Implement various setting on FTP, Proxy and other servers.
CO6	Implement various troubleshooting commands

Sno.	List of Assignments:
1	Familiarization with networking components and devices: LAN Adapters, Hubs, Switches, Routers etc.[CO1]
2	Implementation of resource sharing (file, printer etc.) [CO1]
3	Configuration of TCP/IP Protocols in Windows and Linux.[CO2]
4	Designing and implementing class A, B and C networks.[CO2]
5	To configure dynamic IP address for a computer connected to a LAN.[CO2]
6	Subnet planning and its implementation.[CO2]
7	Familiarization with transmission media and tools: Coaxial cable, UTP cable, Crimping tool, Connectors etc. [CO3]
8	Preparing straight and cross cables.[CO3]
9	Study of various LAN topologies and their creation using network devices, cables and computers.[CO3]
10	Familiarization with network simulation tools. [CO4]
11	Installation of FTP server and client.[CO5]
12	To configure proxy server.[CO5]
13	Use of commands like ping, ipconfig for trouble shooting network related Problems.[CO6]

References:

Reference Books:

1. Data Communication and Networking, Behrouz A. Forouzan, Fourth Edition.
2. Douglas E. Comer, "Internetworking with TCP/IP", Volume-I, Prentice Hall, India.

3rd Semester	Data Structures Laboratory				
BCA24305					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:	
CO1	Implement Dynamic memory allocation.
CO2	Create different data structures in C/ C++
CO3	Implement various operations of all data structures
CO4	Illustrate the outcome of various operations with the help of examples.
CO5	Write programs to implement various types of searching and sorting algorithms
CO6	Analyze Graph Traversing with help of examples.

Instructions: Programs may be developed in C/C++/Python/Java language.

Sno.	List of Assignments
1	Write a program to create an Array. [CO1]
2	Write a program to Insert an element at the end of an array. [CO1]
3	Write a program to Delete an element of an array. [CO1]
4	Write a program to Insert an element in between of an array. [CO1]
5	Write a program to traverse an element from an array. [CO1]
6	Write a program to merge one dimensional array. [CO1]
7	Write a program for addition and subtraction of two matrices. [CO1]
8	Write a program for implementing multiplication of two matrices [CO1]
9	Write a program to implement linear search using one and two-dimensional array. [CO1]
10	Write a program to calculate length of the string using user defined function. [CO2]
11	Write a program to concatenate two strings using user defined function. [CO2]
12	Write a program to compare two strings using user defined function. [CO2]
13	Write a program to reverse a sentence by recursion. [CO2]
14	Write a program for using the concept of pointer to string. [CO2]
15	Write a program to delete all repeated words in string. [CO2]
16	Write a program to find the number of vowels, consonants, digits and white space in a string. [CO2]
17	Write a program to find the length of the longest repeating sequence in a string. [CO2]
18	Write a program to find highest and lowest frequency character in a string. [CO2]
19	Write a program for implementing Stack using array. [CO3]
20	Write a program for implementing Stack using pointer. [CO3]
21	Write a program for implementing multiple stack. [CO3]
22	Write a program to push an element in stack. [CO3]
23	Write a program to pop an element in stack. [CO3]
24	Write a program for converting infix to postfix form. [CO3]
25	Write a program for implementing Queue using array. [CO3]
26	Write a program to Insert and Delete an element in queue. [CO3]
27	Write a program for dynamic implementation of queue and dequeue. [CO3]
28	Write a program for implementing circular queue priority queue. [CO3]
29	Write a program for implementing Singly Linked list. [CO4]
30	Write a program for implementing Doubly Linked list. [CO4]
31	Write a program for implementing Linear Search Tree. [CO4]

32	Write a program for implementing Binary Search Tree. [CO4]
33	Write a program for Breadth First Search (BFS) for graph traversal. [CO4]
34	Write a program for Depth First Search (DFS) for graph traversal. [CO5]
35	Write a program for implementing selection sort. [CO5]
36	Write a program for implementing insertion sort. [CO5]
37	Write a program for implementing quick sort. [CO5]
38	Write a program for implementing merge sort. [CO5]
39	Write a program for implementing bubble sort. [CO6]

References:

Reference Books:

- | |
|---|
| 1. Brijesh Bakariya. Data Structures and Algorithms Implementation through C, BPB Publications. |
|---|

3rd Semester	Web Designing Laboratory				
BCA24306					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:	
CO1	Design pages with simple tags in HTML
CO2	Create web pages with Audio and Video content in it.
CO3	Depict the movement from one web page to another.
CO4	Illustrate the data in tabular form using tables.
CO5	Design webpages with multiple sections or frames.
CO6	Implement web designing concepts using java script & execute a small web-based project for the benefit of society.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Sno.	List of Assignments
1	Create a simple HTML page to demonstrate the use of different tags. [CO1]
2	Design index page of a book on web designing. [CO1]
3	Display Letter Head of your college on a web page. [CO1]
4	Display letter using different Text formatting Tags. [CO1]
5	Create a student Bio- Data. [CO1]
6	Design front page of hospital with different style sheets. [CO2]
7	Embed Audio and Video into your web page. [CO2]
8	Create a Hyperlink to move around within a single page rather than to load another page. [CO3]
9	Design Time Table of your department and highlights of most important periods. [CO4]
10	Use Tables to provide layout to your web page. [CO4]
11	Divide a web page vertically and horizontally and display logo of your college in left pane and logo of university in right pane. [CO5]
12	Design a web page and display two different pages at a time. [CO5]
13	Write a program to create a login form. On submitting the form, the user should get navigated to a profile page using JavaScript. [CO5]
14	Write a code to create a Registration Form. On submitting the form, the user should be asked to login with the new credentials using JavaScript. [CO6]
15	Write an HTML code to create your Institute website/Department website/ Tutorial website for specific subject. Also use Java Script for validation. [CO6]

References:
Reference Books:
1. Greenlaw R; Hepp E, “Fundamentals of Internet and www”, 2nd Edition, Tata. McGraw-Hill, 2007.
2. A Beginner’s Guide to HTML http://www.Ncsa.Nine.Edit/General/Internet/www/a.html.prmter .
Online Experiment material:
1. https://www.w3schools.com/html/html_examples.asp
2. https://www.cs.uct.ac.za/mit_notes/web_programming.html

3rd Semester	Introduction to Artificial Intelligence				
BCA24307					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:	
CO1	Understand the characteristics of rational agents, and the environment in which they operate, and gain insights about problem-solving agents.
CO2	Gain insights about Uninformed and Heuristic search techniques and apply them to solve search applications.
CO3	Apply adversarial search methods on various applications.
CO4	Appreciate the concepts of knowledge representation using Propositional logic and Predicate calculus and apply them for inference/reasoning.
CO5	Determine inference methods on various chaining techniques.
CO6	Obtain a basic understanding of the AI domains and their applications and examine the legal and ethical issues of AI.

Unit	Detailed Contents	CO
I	Introduction to AI: What is AI? Intelligent Agents: Agents and environment, the concept of Rationality, the nature of environment, the structure of Agents. Knowledge Based Agents: Introduction to Knowledge-Based Agents, Problem-solving: Problem-solving agents.	CO1
II	Advanced Search Techniques Uninformed Search: DFS, BFS, Iterative Deepening Search. Informed Search: Best First Search, A* search, AO* search.	CO2
	Adversarial Search & Games: Minimax Search, Alpha-Beta pruning. Constraints and Constraint Satisfaction Problems (CSPs), Backtracking search for CSP.	CO3
III	Logical Reasoning and Uncertainty Logic: Propositional logic, First-order predicate logic, Propositional versus first-order inference, Unification and lifting.	CO4
IV	Inference: Forward chaining, Backward chaining, Resolution, Truth maintenance systems. Introduction to Planning: Blocks World problem.	CO5
	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: The architecture and role of expert systems.	CO6

References:
Reference Books:
1. Artificial Intelligence-A New Synthesis, Nils J. Nilsson, Morgan Kaufmann Publishers.
Text Books:
1. Artificial Intelligence-A Modern Approach, Russel and Norvig, Prentice Hall.
2. Artificial Intelligence, Elaine Rich, Kevin Knight and SB Nair, 3 Ed., Tata McGraw-Hill.
3. Artificial Intelligence And Expert Systems, D.W.Patterson, Prentice Hall.
4. Artificial Intelligence Structures and Strategies for complex Problem Solving, George F. Luger, Pearson Addison Wesley.

3rd Semester	Software Engineering				
BCA24308					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:	
CO1	Highlight the need of software engineering.
CO2	Outline the phases and activities involved in the conventional software life cycle models.
CO3	Design documents for various phases of software life cycle.
CO4	Compute the complexity of the software based on multiple metrics.
CO5	Identify the tools needed for different types of documents required in software testing.
CO6	Identify the tools needed for different types of documents required in software metrics.

Unit	Detailed Contents	CO
I	The Nature of Software: Need of Software Engineering, Prescriptive Process Models, Specialized Process Models, The Unified Process.	CO1
II	Role of a system analyst: SRS, Properties of a good SRS document, functional and non- functional requirements. Decision tree and Decision table.	CO2
	Formal Requirements Specification: Software Cost Estimation.	CO3
III	Software design and its activities: Preliminary and detailed design activities, Characteristics of a good software design, features of a design document, Cohesion and Coupling, Structured Analysis, Function Oriented Design, Object-Oriented Design.	CO4
IV	Testing Fundamentals: Unit Testing, Integration Testing, Validation Testing, System Testing, Maintenance and Reengineering.	CO5
	Measures Metrics and Indicators: Software Measurement, Metrics for Requirements Model, Metrics for Design Model, Metrics for Testing, Metrics for Maintenance.	CO6

References:
Reference Books:
1. Software Engineering–A Practitioner’s Approach, Roger S.Pressman, Seventh Edition, McGrawHill, 2010.
Text Books:
1. An Integrated Approach to Software Engineering, Pankaj Jalota, Third Edition, Narosa Publishing House, 2005
2. Software Engineering, Ian Sommerville, Ninth Edition, Addison-Wesley, 2011

3rd Semester	Data Security & Privacy				
BCA24309					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:	
CO1	To learn the basic concepts related to data security and understand the different types of symmetric key ciphers.
CO2	To understand concepts of data encryption standards.
CO3	To understand the digital signature concept and data hiding in text.
CO4	To learn the basic concepts of Data Hiding in Images.
CO5	To understand the concepts of privacy, authentication, web and email security.
CO6	To understand the role of legal and ethical issues in computer security.

Unit	Detailed Contents	CO
I	Introduction: Security goals, Cryptographic Attacks, Services and Mechanism, Techniques. Traditional Symmetric Key Ciphers: Introduction, Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers. Introduction to Modern Symmetric-Key Ciphers: Modern Block Ciphers, Modern Stream Ciphers.	CO1
II	Data Encryption Standard (DES): Introduction, DES Structure, DES Analysis, Multiple DES, Security of DES. Advanced Encryption Standard (AES): Introduction, Transformations, Key Expansion, AES Ciphers, Analysis of AES. Asymmetric-Key Cryptography: Introduction, RSA Cryptosystem.	CO2
	Digital Signature: Comparison, Process, Services, Attacks on Digital Signature, Digital Signature Standard. Data Hiding in Text: Basic Features, Applications of Data Hiding, Watermarking, Intuitive Methods, Simple Digital Methods, Data Hiding in Text, Innocuous Text, Mimic Functions.	CO3
III	Data Hiding in Images: LSB Encoding, BPCS Steganography, Lossless Data Hiding, Spread Spectrum Steganography, Data Hiding by Quantization, Patchwork, Signature Casting in Images, Transform Domain Methods, Robust Data Hiding in JPEG Images, Robust Frequency Domain Watermarking, Detecting Malicious Tampering.	CO4
IV	Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, E-Mail Security, Impacts on Emerging Technologies.	CO5
	Legal and Ethical Issues in Computer Security: Protecting Programs and Data, Information and the Law, Rights of Employees and employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security.	CO6

References:
Reference Books:
<ol style="list-style-type: none"> 1. Information Security: Principles and Practice by Mark Stamp, Wiley Inter Science, 2011. 2. Computer Security: Art and Science by Matt Bishop, First Edition, Addison Wesley, 2002. 3. Cryptography and Network Security by William Stallings, Pearson Education, 7th edition, 2017.
Text Books:
<ol style="list-style-type: none"> 1. Cryptography and Network Security by Behrouz A. Forouzan, Dedeep Mukhopadhyay, TMH, 2nd edition, 2013. (Modules I, II, III) 2. Data Privacy and Security by Salomon, David, Springer, 2003. (Module III)

4th Semester	Programming in Python				
BCA24401					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:	
CO1	Compare Python with other programming languages.
CO2	Explain environment, data types, operators used in Python.
CO3	Outline the use of control structures and numerous native data types with their methods.
CO4	Knowledge to learn how to write user define function and modules and packages.
CO5	Illustrate files and exception handling methods.
CO6	Write solutions for Object Oriented Programming Concepts.

Unit	Detailed Contents	CO
I	Introduction to Python Programming Language: Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages.	CO1
	Python Data Types & Input/Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command. Operators and Expressions: Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators.	CO2
II	Control Structures: Decision making statements, Python loops, Python control statements. Python Native Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations).	CO3
III	Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables. Python Modules: Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages.	CO4
IV	Exception Handling: Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python. File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python.	CO5
	Classes and Objects: The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.	CO6

References:**Reference Books:**

1. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.

4th Semester	Database Management Systems				
BCA24402					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:

CO1	Define the basic concepts of DBMS.
CO2	Design SQL queries.
CO3	Design PL/SQL queries
CO4	Illustrate the concept of data normalization with the help of real life examples.
CO5	Explain the concept of transaction management.
CO6	Outline features of advanced database management systems.

Unit	Detailed Contents	CO
I	Introduction of DBMS: Data Modeling for a Database, Three level Architecture of DBMS, Components of a DBMS. Introduction to Data Models, Hierarchical, Network and Relational Model, Comparison of Network, Hierarchical and Relational Model, Entity Relationship Model.	CO1
II	Relational Database: Relational Algebra and Calculus, SQL Fundamentals, DDL, DML, DCL.	CO2
	PL/SQL Concepts: Cursors, Stored Procedures, Stored Functions, Database Triggers.	CO3
III	Introduction to Normalization: First, Second, Third Normal Forms, Dependency Preservation, Boyce-Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Domain-key normal form (DKNF).	CO4
IV	Database Recovery: Concurrency Management, Database Security, Integrity and Control.	CO5
	Distributed Database: Structure and Design of Distributed Databases.	CO6

References:

Reference Books:

1. "SQL, PL/SQL The Programming Language of Oracle", Ivan Bayross, BPB Publications, 4th Revised Edition (2009)
2. "An Introduction to Database Systems", C. J. Date, A. Kannan, S. Swamynathan, 8th Edition, Pearson Education, (2006).
3. Database Management Systems, Raghu Ramakrishnan, McGraw-Hill, Third Edition, 2014.

Text Books:

1. "An Introduction to Database System", Bipin C. Desai, Galgotia Publications Pvt Ltd-New Delhi, Revised Edition, (2012).
2. "Database System Concepts", Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Tata McGraw Hill, 6th Edition, (2013).

4th Semester	Operating Systems				
BCA24403					
Internal Marks:	40		L	T	P
External Marks:	60		4	0	0
Total Marks:	100		Credits		4

Course Outcomes: After studying the course, students will be able to:	
CO1	Discuss the evaluation of operating systems.
CO2	Explain different resource managements performed under CPU process and Thread.
CO3	Describe various CPU scheduling algorithm.
CO4	Describe the architecture in terms of functions performed by different types of operating systems.
CO5	Analyze the performance of different algorithms used in design of operating system components.
CO6	Compare the key properties of different types of Operating Systems.

Unit	Detailed Contents	CO
I	Fundamentals of Operating system: Introduction to Operating system, Functions of an operating system. Operating system as a resource manager. Structure of operating system (Role of kernel and Shell). Views of operating system. Evolution and types of operating systems.	CO1
	Process & Thread Management: Program vs. Process; PCB, State transition diagram, Scheduling Queues, Types of schedulers, Concept of Thread, Benefits, Types of threads, Process synchronization.	CO2
II	CPU Scheduling: Need of CPU scheduling, CPU I/O Burst Cycle, Pre-emptive vs. Non-pre-emptive scheduling, Different scheduling criteria's, scheduling algorithms (FCFS, SJF, Round-Robin, Multilevel Queue).	CO3
III	Memory Management: Introduction, address binding, relocation, loading, linking, memory sharing and protection; Paging and segmentation; Virtual memory: basic concepts of demand paging, page replacement algorithms.	CO4
IV	I/O Device Management: I/O devices and controllers, device drivers; disk storage. File Management: Basic concepts, file operations, access methods, directory structures and management, remote file systems; file protection.	CO5
	Advanced Operating systems: Introduction to Distributed Operating system, Characteristics, architecture, Issues, Communication & Synchronization; Introduction Multiprocessor Operating system, Architecture, Structure, Synchronization & Scheduling; Introduction to Real-Time Operating System, Characteristics, Structure & Scheduling. Case study of Linux operating system	CO6

References:
Reference Books:
1. Operating Systems by Sibsankar Haldar and Alex A. Aravind, Published by Pearson Education.
2. Operating system by Stalling, W., Sixth Edition, Published by Prentice Hall (India)
Text Books:
1. Operating System Principles by Abraham Silberschatz and Peter Baer Galvin, Seventh Edition, Published by Wiley-India.
2. Principals of Operating System by Naresh Chauhan, Published by OXFORD University Press, India.

4th Semester	Programming in Python Laboratory				
BCA24404					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:	
CO1	Outline various programming constructs with data types of Python.
CO2	Outline control structures programming constructs of Python.
CO3	Implement different data structures.
CO4	Implement modules and functions.
CO5	Illustrate concept of object oriented programming.
CO6	Implement file handling.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Sno.	List of Assignments
1	Compute sum, subtraction, multiplication, division and exponent of given variables input by the user. [CO1]
2	Compute area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram. [CO1]
3	Compute volume of following 3D shapes: cube, cylinder, cone and sphere. [CO1]
4	Compute and print roots of quadratic equation $ax^2+bx+c=0$, where the values of a, b, and c are input by the user. [CO1]
5	Print numbers up to N which are not divisible by 3, 6, 9,, e.g., 1, 2, 4, 5, 7,... [CO2]
6	Write a program to determine whether a triangle is isosceles or not? [CO2]
7	Print multiplication table of a number input by the user. [CO2]
8	Compute sum of natural numbers from one to n number. [CO2]
9	Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13.....n [CO2]
10	Compute factorial of a given number. [CO2]
11	Count occurrence of a digit 5 in a given integer number input by the user [CO2]
12	Print Geometric and Harmonic means of a series input by the user. [CO2]
13	. Evaluate the following expressions: a. $x-x^2/2!+x^3/3!-x^4/4!+\dots xn/n!$ b. $x-x^3/3!+x^5/5!-x^7/7!+\dots xn/n!$ [CO2]
14	Print all possible combinations of 4, 5, and 6. [CO2]
15	Determine prime numbers within a specific range. [CO2]
16	Count number of persons of age above 60 and below 90. [CO2]
17	Compute transpose of a matrix. [CO3]
18	Perform following operations on two matrices. [CO3] 1) Addition 2) Subtraction 3) Multiplication
19	Count total number of vowels in a word. [CO3]
20	Count occurrence of vowels. [CO3]
21	Determine whether a string is palindrome or not. [CO3]
22	Perform following operations on a list of numbers: 1) Insert an element 2) delete an element 3) sort the list 4) delete entire list. [CO3]
23	Display word after Sorting in alphabetical order. [CO3]
24	Perform sequential search on a list of given numbers. [CO3]
25	Perform sequential search on ordered list of given numbers. [CO3]
26	Maintain practical note book as per their serial numbers in library using Python dictionary. [CO3]

27	Perform following operations on dictionary 1) Insert 2) delete 3) change [CO3]
28	Check whether a number is in a given range using functions. [CO4]
29	Write a Python function that accepts a string and calculates number of upper case letters and lower case letters available in that string. [CO4]
30	To find the Max of three numbers using functions. [CO4]
31	Multiply all the numbers in a list using functions. [CO4]
32	Solve the Fibonacci sequence using recursion. [CO4]
33	Get the factorial of a non-negative integer using recursion. [CO4]
34	Write a program to create a module of factorial in Python. [CO4]
35	Design a Python class named Rectangle, constructed by a length & width, also design a method which will compute the area of a rectangle. [CO5]
36	Design a Python class named Circle constructed by a radius and two methods which will compute the area and the perimeter of a circle. [CO5]
37	Design a Python class to reverse a string 'word by word'. [CO5]
38	Write a Python program to read an entire text file. [CO6]
39	Design a Python program to read first n lines of a text file. [CO6]
40	Construct a Python program to write and append text to a file and display the text. [CO6]

References:

Reference Books:

1. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.

4th Semester	Database Management Systems Laboratory				
BCA24405					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:	
CO1	Differentiate between DDL, DML and DCL commands
CO2	Implement DDL, DML and DCL commands
CO3	Write integrity constraints on a database
CO4	Design Databases and Tables in relational model for some project related to society welfare
CO5	Implement PL/SQL.
CO6	Implement PL/SQL.(Cursor and Trigger)

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Sno.	List of Assignments
1	Used of CREATE, ALTER, RENAME and DROP statement in the database tables (relations) [CO1]
2	Used of INSERT INTO, DELETE and UPDATE statement in the database tables (relations) [CO1]
3	Use of simple select statement. [CO2]
4	Use of select query on two relations [CO2]
5	Use of nesting of queries. [CO2]
6	Use of aggregate functions. [CO2]
7	Use of substring comparison. [CO2]
8	Use of order by statement. [CO2]
9	<p>Consider the following schema for a Library Database: BOOK (<i>Book_id, Title, Publisher_Name, Pub_Year</i>) BOOK_AUTHORS (<i>Book_id, Author_Name</i>) PUBLISHER (<i>Name, Address, Phone</i>) BOOK_COPIES (<i>Book_id, Branch_id, No- of_Copies</i>) BOOK_LENDING (<i>Book_id, Branch_id, Card_No, Date_Out, Due_Date</i>) LIBRARY_BRANCH (<i>Branch_id, Branch_Name, Address</i>) Write SQL queries to</p> <ol style="list-style-type: none"> Retrieve details of all books in the library_id, title, name of publisher, authors, number of copies in each branch, etc. Get the particulars of borrowers who have borrowed more than 3 books between Jan 2018 to Jun 2018 Delete a book in BOOK table. Update the contents of other tables to reflect this datamanipulation operation. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. <p>Create a view of all books and its number of copies that are currently available in the Library. [CO3]</p>
10	<p>Consider the following schema for Order Database: SALESMAN (<i>Salesman_id, Name, City, Commission</i>) CUSTOMER (<i>Customer_id, Cust_Name, City, Grade, Salesman_id</i>) ORDERS (<i>Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id</i>) Write SQL queries to</p>

	<ol style="list-style-type: none"> 1. Count the customers with grades above Amritsar's average. 2. Find the name and numbers of all salesmen who had more than one customer. 3. List all salesmen and indicate those who have and don't have customers in their cities(Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted. [CO4]
11	Write a PL/SQL code to add two numbers and display the result. Read the numbers during run time. [CO5]
12	Write a PL/SQL code to find sum of first 10 natural numbers using while and for loop. [CO5]
13	Write a program to create a trigger which will convert the name of a student to upper case before inserting or updating the name column of student table. [CO6]
14	Write a PL/SQL block to count the number of rows affected by an update statement using SQL%ROWCOUNT [CO6]
15	Write a PL/SQL block to increase the salary of all doctors by 1000. [CO6]

References:

Reference Books:

- | |
|--|
| <ol style="list-style-type: none"> 1. "SQL, PL/SQL The Programming Language of Oracle", 4th Revised Edition, Ivan Bayross (2009). 2. "Oracle PL/SQL Programming", 5th Edition, Steven Feuerstein and Bill Pribyl (2009). |
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4th Semester	Operating Systems Laboratory				
BCA24406					
Internal Marks:	60		L	T	P
External Marks:	40		0	0	2
Total Marks:	100		Credits		1

Course Outcomes: After studying the course, students will be able to:

CO1	Implement the installation and configuration of different operating systems.
CO2	Write programs for different scheduling algorithms.
CO3	Execute various commands in Vi editor
CO4	Implement the dual boot installation
CO5	Execute commands in shell programming
CO6	Implement commands in shell programming with various control statement.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Sno.	List of Assignments
1	Installation of windows OS. [CO1]
2	Installation of Linux OS. [CO1]
3	Implementation of FCFS Scheduling algorithm. [CO2]
4	Implementation of SJF Scheduling algorithm. [CO2]
5	Implementation of Round-Robin Scheduling algorithm. [CO2]
6	Vi Editor & its commands. [CO3]
7	Shell Commands. [CO3]
8	Dual boot installation of Operating systems. [CO4]
9	Shell Scripting- Using variables. [CO5]
10	Shell Scripting- Input & Output. [CO5]
11	Shell Scripting- Data types. [CO5]
12	Shell Scripting- Use of arithmetic operators. [CO5]
13	Shell Scripting- if control statement programs. [CO6]
14	Shell Scripting- while control statement. [CO6]
15	Shell Scripting- for control statement. [CO6]

References:

Reference Books:

1. Linux: The complete reference by Richard Petersen, Published by Tata McGraw- Hill Publication.
2. Operating System Principles by Abraham Silberschatz and Peter Baer Galvin, Seventh Edition, Published by Wiley-India.

4th Semester	Design thinking and innovation				
BCA24407					
Internal Marks:	40		L	T	P
External Marks:	60		2	0	0
Total Marks:	100		Credits		2

Course Outcomes: After studying the course, students will be able to:	
CO1	Basics of Design Thinking.
CO2	Propose real-time innovative product designs and Choose appropriate frameworks, strategies, techniques during prototype development.
CO3	Learning to Empathize and Define the Problem.
CO4	Ideate, Prototype and Implement.
CO5	Feedback, Re-Design & Re-Create.
CO6	Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products.

Unit	Detailed Contents	CO
I	Basics of Design Thinking Understand the concept of innovation and its significance in business Understanding creative thinking process and problem solving approaches Know Design Thinking approach and its objective Design Thinking and customer centricity – real world examples of customer challenges, use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product.	CO1
	Discussion of a few global success stories: AirBnB, Apple, IDEO, Netflix etc. Explain the four stages of Design Thinking Process – Empathize, Define, Ideate, Prototype, Implement	
II	Know the importance of empathy in innovation process – how can students develop empathy using design tools Observing and assimilating information Individual differences & Uniqueness Group Discussion and Activities to encourage the understanding, acceptance and appreciation of individual differences. What are wicked problems, Identifying wicked problems around us and the potential impact of their solutions	CO3
III	Ideate, Prototype and Implement Know the various templates of ideation like brainstorming, systems thinking Concept of brainstorming – how to reach consensus on wicked problems Mapping customer experience for ideation Know the methods of prototyping, purpose of rapid prototyping. Implementation	CO4
IV	Feedback Feedback loop, focus on User Experience, address ergonomic challenges, user focused design	CO5
	Re-Design & Re-Create Final concept testing, Final Presentation – Solving Problems through innovative design concepts & creative solution	CO6

References:**Reference Books:**

1.Design Thinking by Nigel Cross, Bloomsbury

Text Books:

1. E Balaguruswamy (2023), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company

2. Tim Brown, (2008), “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, *Harvard Business Review*

3. 8 steps to Innovation by R T Krishnan & V Dabholkar, Collins Publishing

4th Semester	Cloud Computing				
BCA24408					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:	
CO1	Define the concept of cloud computing.
CO2	Outline the benefits if migrating to a cloud solution for different applications. Compare different virtualization technologies.
CO3	Fundamental of capacity planning and analysis.
CO4	Identify various resources needed to build cloud.
CO5	Explain various security threats to cloud.
CO6	Explore some important cloud computing driven commercial systems.

Unit	Detailed Contents	CO
I	Overview of Computing Paradigm: Recent trends in Computing - Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Introduction to Cloud Computing: Vision of Cloud Computing, Defining a Cloud, Cloud delivery Model, Deployment Model, Characteristics, Benefits of Cloud Computing, Challenges ahead. Cloud computing vs. Cluster computing vs. Grid computing.	CO1
	Migrating into a Cloud: Introduction, Broad approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud. Virtualization: Introduction, Characteristics of Virtualized environment, Taxonomy of Virtualization techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Hypervisor Technology Examples- Xen, VMware, Microsoft Hyper-V.	CO2
II	Capacity Planning: Elasticity vs Scalability, Introduction, Defining Baseline and Metrics-Baseline Measurements, System Metrics, Load Testing, Resource Ceilings, Server and Instance types; Network Capacity, Scaling.	CO3
III	SLA Management in Cloud Computing: Inspiration, Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA management in Cloud. Automated Policy-based management.	CO4
IV	Securing Cloud services: Cloud Security, Securing Data- Brokered Cloud Storage Access, Storage location and tenancy, Encryption, Auditing and compliance. Steps to ensure security over cloud.	CO5
	Cloud Platforms in Industry: Amazon Web Services-Compute Services, Storage Services, Communication Services, Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life Cycle. Cost Model. Microsoft Azure-Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.	CO6

References:**Reference Books:**

1. Cloud Computing for Dummies, Fern Halper, Hurwitz, Robin Bloor, Marcia Kaufman, Wiley India Pvt. Ltd, ISBN-13: 978-0-47-0597422, New Delhi, India, 2011.
2. Dr. Saurabh Kumar, Cloud Computing: Insights into New-Era Infrastructure, Wiley India Pvt. Ltd, ISBN-13: 978-8-12-6528837, New Delhi, India, 2011.
3. Cloud Computing: Principles and paradigms, Raj Kumar Buyya, James Broberg, Andrezei M. Goscinski, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-4125-6, New Delhi, India, 2011

Text Books:

1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Tata McGraw Hill, ISBN-13: 978-1-25-902995-0, New Delhi, India, Feb 2013.
2. Cloud Computing Bible, Barrie Sosinsky, Wiley India Pvt. Ltd, ISBN-13: 978- 81-265-2980-3, New Delhi, India, 2011.

E Books/ Online learning material

1. P.D. Kaur, I. Chana, Unfolding the distributed computing paradigm, in: Proceedings of the IEEE International Conference on Advances in Computer Engineering, ACE, Bangalore, Karnataka, India, 2010, pp. 339–342.
2. P. Mell and T. Grance, “The NIST definition of cloud computing (draft), NIST Spec. Publ. 800 (2011) 7.

4th Semester	Introduction to Biometrics				
BCA24409					
Internal Marks:	40		L	T	P
External Marks:	60		3	0	0
Total Marks:	100		Credits		3

Course Outcomes: After studying the course, students will be able to:

CO1	Understand the benefits of biometrics
CO2	Perceive fingerprint, face, and iris recognition
CO3	Explain retina and hand recognition
CO4	Analyze signature and handwriting technology, keyboard / keystroke dynamics
CO5	Examine multi biometrics and Voice recognition
CO6	To understand various applications of biometric system.

Unit	Detailed Contents	CO
I	Concepts - biometric recognition, biometrics, requirements for biometrics Biometric systems, their modes and architectures, Biometric system errors and evaluation	CO1
	Physiological Biometric Technologies: Fingerprints - Technical description – characteristics - Competing technologies - strengths – weaknesses – deployment. Facial scan - Technical description - characteristics - weaknesses-deployment. Iris scan - Technical description – characteristics - strengths – weaknesses – deployment	CO2
II	Overview: Comparison and evaluation of various biometrics, Unimodal biometric systems, their advantages, disadvantages and limits, Multimodal biometric systems, their modes of operation, levels of fusion	CO3
III	Signature and handwriting technology: Technical description – classification. Keyboard / keystroke dynamics. Voice – data acquisition - feature extraction - characteristics - strengths – weaknesses deployment	CO4
IV	Biometric: pattern recognition methods, Privacy protection and social acceptance, Biometric standardization, data formats	CO5
	Design and implementation of biometric systems: applications of biometric systems, biometric databases, security of biometric systems	CO6

References:

Reference Books:

1. Guide to Biometrics, Ruud M. Bolle, Jonathan H. Connell, Sharath Pankanti, Nalini K. Ratha, Andrew W. Senior, Springer

Text Books:

1. Biometrics: Concepts and Applications, GR Sinha, Sandeep B. Patil, Wiley.
2. Biometrics: A Very Short Introduction, Michael Fairhurst.