

KAKATIYA UNIVERSITY

WARANGAL - 506009



Bachelor of Computer Applications (BCA) Syllabus

Under the
CHOICE BASED CREDIT SYSTEM
(With effect from 2025-26)

Department of Computer Science
University College, KU, Warangal
506009

BCA I YEAR I SEMESTER

Code	Paper Title / Subject	Workload Per Week	M A R K S			Credits
			External	Internal	Total	
BCA11	Mathematical foundations to Computer Science - I	T (4)	70	30	100	4
BCA12	Fundamentals of Information Technology	T (4)	70	30	100	4
BCA13	Problem Solving Techniques with C	T (4)	70	30	100	4
BCA14	Computer Architecture	T (4)	70	30	100	4
BCA15	General English - I	T (4)	70	30	100	4
BCA16	Fundamentals of Information Technology laboratory	L (4)	50	0	50	2
BCA17	Programming with C laboratory	L (4)	50	0	50	2
Grand Total (Marks and Credits)					600	24

BCA I YEAR II SEMESTER

Code	Paper Title / Subject	Workload Per Week	M A R K S			Credits
			External	Internal	Total	
BCA21	Mathematical Foundations to Computer Science - II	T (4)	70	30	100	4
BCA22	Object Oriented Programming with C++	T (4)	70	30	100	4
BCA23	Data Structures with C	T (4)	70	30	100	4
BCA24	Constitution of India	T (4)	70	30	100	4
BCA25	Computer Networks	T (4)	70	30	100	4
BCA26	Object Oriented Programming with C++ laboratory	L (4)	50	0	50	2
BCA27	Data Structures with C laboratory	L (4)	50	0	50	2
Grand Total (Marks and Credits)					600	24

BCA II YEAR I SEMESTER

Code	Paper Title / Subject	Workload Per Week	M A R K S			Credits
			External	Internal	Total	
BCA31	Probability and Statistics	T (4)	70	30	100	4
BCA32	Object Oriented Programming using Java	T (4)	70	30	100	4
BCA33	Software Engineering	T (4)	70	30	100	4
BCA34	Design And Analysis of Algorithms	T (4)	70	30	100	4
BCA35	Operating Systems	T (4)	70	30	100	4
BCA36	Object Oriented Programming using Java laboratory	L (4)	50	0	50	2
BCA37	Operating Systems laboratory	L (4)	50	0	50	2
Grand Total (Marks and Credits)					600	24

BCA II YEAR II SEMESTER

Code	Paper Title / Subject	Workload Per Week	M A R K S			Credits
			External	Internal	Total	
BCA41	Web Technologies	T (4)	70	30	100	4
BCA42	Database Management Systems	T (4)	70	30	100	4
BCA43	Artificial Intelligence	T (4)	70	30	100	4
BCA44	Theory of Computation	T (4)	70	30	100	4
BCA45	Data Mining & Warehousing	T (4)	70	30	100	4
BCA46	Web Technologies laboratory	L (4)	50	0	50	2
BCA47	Database Management Systems laboratory	L (4)	50	0	50	2
Grand Total (Marks and Credits)					600	24

BCA III YEAR I SEMESTER

Code	Paper Title / Subject	Workload Per Week	M A R K S			Credits
			External	Internal	Total	
BCA51	Python Programming	T (4)	70	30	100	4
BCA52	Web Development using PHP	T (4)	70	30	100	4
BCA53	Cryptography and Network Security	T (4)	70	30	100	4
BCA54	E-Commerce	T (4)	70	30	100	4
BCA55	Digital Image Processing	T (4)	70	30	100	4
BCA56	Python Programming laboratory	L (4)	50	0	50	2
BCA57	Web Development using PHP laboratory	L (4)	50	0	50	2
Grand Total (Marks and Credits)					600	24

BCA III YEAR II SEMESTER

Code	Paper Title / Subject		Workload Per Week	M A R K S			Credits
				External	Internal	Total	
BCA61	Elective A1/B1/C1		T (4)	70	30	100	4
	A1	Machine Learning					
	B1	Neural Network					
	C1	Natural Language Processing					
BCA62	Elective A2/B2/C2		T (4)	70	30	100	4
	A2	Big Data Analytics					
	B2	Distributed Systems					
	C2	NoSQL Data Bases					
BCA63	Major Project (including Seminars)			300	100	400	16
Grand Total (Marks and Credits)						600	24

BCA I YEAR I SEMESTER

Code	Paper Title / Subject	Workload Per Week	M A R K S			Credits
			External	Internal	Total	
BCA11	Mathematical Foundations to Computer Science - I	T (4)	70	30	100	4
BCA12	Fundamentals of Information Technology	T (4)	70	30	100	4
BCA13	Problem Solving Techniques with C	T (4)	70	30	100	4
BCA14	Computer Architecture	T (4)	70	30	100	4
BCA15	General English - I	T (4)	70	30	100	4
BCA16	Fundamentals of Information Technology laboratory	L (4)	50	0	50	2
BCA17	Programming with C laboratory	L (4)	50	0	50	2
Grand Total (Marks and Credits)					600	24

BCA11		PPW : 04
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MFCS-I	MATHEMATICAL FOUNDATIONS TO COMPUTER SCIENCE – I	Internal : 30 External : 70
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UNIT-I: Set, Relation and Function: Set, Set Operations, Properties of Set operations, Subset, Venn Diagrams, Cartesian Products. Relations on a Set, Properties of Relations, Representing Relations using matrices and digraphs, Types of Relations, Equivalence Relation, Equivalence relation and partition on set, Closures of Relations, Warshall's algorithm. Functions, properties of functions (domain, range), composition of functions, surjective (onto), injective (one-to-one) and bijective functions, inverse of functions. Some useful functions for Computer Science: Exponential and Logarithmic functions, Polynomial functions, Ceiling and Floor functions.

UNIT-II: Counting and Recurrence Relation: Basics of counting, Pigeonhole principle, permutation, combination, Binomial coefficients, Binomial theorem. Recurrence relations, modelling recurrence relations with examples, like Fibonacci numbers, the tower of Hanoi problem. Solving linear recurrence relation with constant coefficients using characteristic equation roots method.

UNIT-III: Elementary Graph Theory: Basic terminologies of graphs, connected and disconnected graphs, subgraph, paths and cycles, complete graphs, digraphs, weighted graphs, Euler and Hamiltonian graphs. Trees, properties of trees, concept of spanning tree. Planar graphs. Definitions and basic results on the topics mentioned.

UNIT-IV: Matrix Algebra: Types of matrices, algebra of matrices–addition, subtraction, and multiplication of matrices, determinant of a matrix, symmetric and skew-symmetric matrices, orthogonal matrix, rank of a matrix, inverse of a matrix, applications of matrices to solve system of linear equations, Eigen values and Eigen vectors, Caley-Hamilton theorem.

Text Books

1. Garg, Reena, Engineering Mathematics, Khanna Book Publishing Company, 2024. (AICTE Recommended Textbook)
2. Garg, Reena, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2023.
3. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
4. Deo Narsingh, Graph Theory with Application to Engineering and Computer Science, Prentice Hall, India, 1979.
5. Vasishtha A. R. and Vasishtha A. K., Matrices, Krishna Prakashan, 2022.

Reference Books

1. Grimaldi Ralph P. and Ramana B. V., Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education, 2007.
2. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
3. West Douglas B., Introduction to Graph Theory, Second Edition, Pearson Education, 2015

Web Resources

1. <https://nptel.ac.in/courses/106103205>
2. <https://nptel.ac.in/courses/11110111>

BCA12	FUNDAMENTALS OF INFORMATION TECHNOLOGY	PPW : 04
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FIT		Internal : 30 External : 70
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UNIT-I: Introduction to Computer: Introduction, Digital and Analog Computers, Characteristics of Computer, History of Computer, Generations of Computer, Classification of Computer, The Computer System, Application of Computers. **The Computer System Hardware:** Introduction, Central Processing Unit, Memory Unit, Instruction Format, Instruction Set, Instruction Cycle, Microprocessor, Interconnecting the Units of a Computer, Performance of a Computer, Inside a Computer Cabinet. **Computer Memory :** Introduction, Memory Representation, Memory Hierarchy, CPU Registers, Cache Memory, Primary Memory, Secondary Memory, Access Types of Storage Devices, Magnetic Tape, Magnetic Disk, Optical Disk, Magneto-Optical Disk, Using the Computer Memory.

UNIT-II: Input and Output Devices: Introduction, Input-Output Unit, Input Devices, Human Data Entry Devices, Source Data Entry Devices, Output Devices, I/O Port, Working of I/O System. **Data Representation:** Introduction, Number System, Conversion from Decimal to Binary, Octal, Hexadecimal, Conversion of Binary, Octal, Hexadecimal to Decimal , Conversion of Binary to Octal, Hexadecimal, Conversion of Octal, Hexadecimal to Binary, Binary Arithmetic, Signed and Unsigned Numbers, Binary Data Representation, Binary Coding Schemes, Logic Gates. **Interaction of User and Computer:** Introduction, Types of Software, System Software, Application Software, Software Acquisition.

UNIT-III: Operating System: Introduction, Objectives of Operating System, Types of OS, Functions of OS, Process Management, Memory Management, File Management, Device Management, Protection and Security, User Interface, Examples of Operating Systems. **Computer Programming Fundamentals:** Introduction, Program Development Life Cycle, Algorithm, Control Structures, Flowchart, Pseudo Code, Programming Paradigms. **The Internet and Internet Services:** Introduction, History of Internet, Internetworking Protocol, the Internet Architecture, Managing the Internet, Connecting to Internet, Internet Connections, Internet Address, Internet Services, Uses of Internet.

UNIT-IV: Information Systems: Introduction, Data, Information and Knowledge, Characteristics of Information, Information System (IS), Computer-Based Information System (CBIS), Need for Efficient Information System, Categories of Information System, Operations Support System, Management Support System, Specialized Information System, Careers in Information Systems. **Computer Security:** Introduction, Security Threat and Security Attack, Malicious Software, Hacking, Security Services, Security Mechanisms, Cryptography, Digital Signature, Firewall, Users Identification and Authentication, Other Security Measures, Security Awareness, Security Policy. **Emerging Computer Technologies:** Distributed Networking, Peer-to-Peer Computing, Grid Computing, Cloud Computing, Utility Computing, On-demand Computing, Wireless Network, Bluetooth, and Artificial Intelligence.

Text Books:

1. A. Goel, Computer Fundamentals, Pearson Education, 2010.
2. Reema Thareja, Fundamentals of Computers, Oxford 2015.

References:

1. Spoken Tutorial on “Linux (Ubuntu), LibreOffice (Writer, Calc, Impress), Firefox”, as E-resource for Learning. <http://spoken-tutorial.org>

BCA13	PROBLEM SOLVING TECHNIQUES WITH C	PPW : 04
PSTC		Internal : 30 External : 70

UNIT-I: Introduction to programming- from algorithms to program, getting started with C Language, characteristics, basic building blocks, Arithmetic Expressions and Precedence- operators, expressions, precedence and associativity, Library functions. Conditional Branching and Loops- introduction, Conditional Branching, Looping, Jumping Statements (ch1, ch2 and ch3)

UNIT-II: Arrays- introduction, one-dimensional arrays, two-dimensional arrays, character arrays and strings, **Functions**-introduction, advantages, types of functions, calling functions, return statement, concept of local and global data, passing arguments to a function, **Recursion**-introduction, recursive functions, recursion and iterations. (ch4, ch6, ch7)

UNIT-III: Pointers- introduction, idea of pointers, accessing address of a variable, declaring a pointer, assigning address to a pointer, accessing variable using a pointer, pointer arithmetic, pointers as function arguments, dynamic memory allocation. **Structures-** introduction, defining a Structure, declaring structure variables, initializing structures, assigning of structures, reading/writing structures, arrays of structures, passing structure to a function, function returning a structure, pointer and structures. (ch8, ch9)

UNIT-IV: Unions and enumerations- unions, enumeration constants, anonymous structures and unions, (textbook-2). **File Handling-** introduction, types of files, steps in processing a file, file positioning functions, file status functions (textbook-1).

Text Book

1. AICTE's Programming for Problem Solving (with Lab Manual), Khanna Book Publishing Company, 2024.
2. Harvey Deitel and Paul Deitel, C How to Program, 9th edition, Pearson India, 2015.

Reference Books

1. Programming with C, Dr. B. Rama, Dr. P. Praveen, Professional Books Publisher, ISBN Number 9789385506284, 2017

BCA14	COMPUTER ARCHITECTURE	PPW : 04
CA		Internal : 30 External : 70

UNIT-I : Digital Principles: Definition for Digital signals, Digital logic, Digital computers, Von Neumann Architecture, Boolean Laws and Theorems, K-Map: Truth Tables to K-Map, 2, 3 and 4 variable K Map, K-Map Simplifications, Don't Care Conditions, SOP and POS. **Number Systems:** Decimal, Binary, Octal, Hexadecimal, Number System Conversions, Binary Arithmetic, Addition and subtraction of BCD, Octal Arithmetic, Hexadecimal Arithmetic, Binary Codes, Decimal Codes, Error detecting and correcting codes, ASCII, EBCDIC, Excess3 Code, The Gray Code.

UNIT-II: Combinational Circuits: Half Adder and Full Adder, Subtractor, Decoders, Encoder, Multiplexer, Demultiplexer. **Sequential Circuits:** Flip-Flops- SR Flip- Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop. Register: 4 bit register with parallel load, Shift Registers- Bidirectional shift register with parallel load Binary Counters-4 bit synchronous and Asynchronous binary counter.

UNIT-III : Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input Output Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator logic. **Central Processing Unit:** Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer(RISC), RISC Vs CISC.

UNIT-IV: Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline. **Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input-Output Processor(IOP). **Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Text Books:

1. Donald P Leach, Albert Paul Malvino, Goutam Saha- "Digital Principles & Applications" , Tata McGraw Hill Education Private Limited,2011Edition.
2. M. Morris Mano- "Computer System Architecture", Pearson/Phi, Third Edition.

Reference Books:

- 1 William Stallings- "Computer Organization and Architecture", Pearson/PHI, Sixth Edition,
- 2 Andrew S. Tanenbaum- "Structured Computer Organization", PHI /Pearson 4th Edition,
- 3 M.V .Subramanyam, "Switching Theory and Logic Design", Laxmi Publications (P) Ltd.

BCA15	GENERAL ENGLISH – I	PPW : 04
GE-I		Internal : 30 External : 70

UNIT- I: Vocabulary Building : The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.

UNIT-II: Basic Writing Skills: Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, creating coherence, organizing principles of paragraphs in documents, Techniques for writing precisely.
Identifying Common Errors in Writing: Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, and Redundancies.

UNIT- III: Nature and Style of Sensible Writing: Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion, Module V: Writing Practices, Comprehension, Précis Writing, Essay Writing.

UNIT-IV: Oral Communication (This Module involves interactive practice sessions in Language Lab) Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Every day. **Situations:** Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations

Text/Reference Books:

- 1 AICTE's Prescribed Textbook: Communication Skills in English (with Lab Manual),
- 2 Anjana Tiwari, Khanna Book Publishing Co., 2023.
- 3 Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
- 4 Practical English Usage. Michael Swan. OUP. 1995.
- 5 Remedial English Grammar. F.T. Wood. Macmillan.2007
- 6 On Writing Well. William Zinsser. Harper Resource Book. 2001
- 7 Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- 8 Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- 9 Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

BCA16	FUNDAMENTALS OF INFORMATION TECHNOLOGY LABORATORY	PPW : 04
FITL		External : 50

NOTE:

- All the concepts of programs from Text Book including exercises must be practice, execute and write down in the practical record book.
- Faculty must take care about UG standard programs it should be minimum 25 – 30.
- In the external lab examination student has to execute at least three programs with compilation and deployment steps are necessary.
- External Viva-voce is compulsory.

Example programs: The practical assignment must include connecting parts of a computer and assembling it to an extent, media formatting and installation of some software. Practical exercises based on Open Office tools using document preparation and spreadsheet handling packages.

Text Editor

1. Prepare a grocery list having four columns (Serial number, The name of the product, quantity and price) for the month of April, 06.
 - Font specifications for Title (Grocery List): 14-point Arial font in bold and italics.
 - The headings of the columns should be in 12-point and bold.
 - The rest of the document should be in 10-point Times New Roman.
 - Leave a gap of 12-points after the title.
2. Create a telephone directory.
 - The heading should be 16-point Arial Font in bold
 - The rest of the document should use 10-point font size
 - Other headings should use 10-point Courier New Font.
 - The footer should show the page number as well as the date last updated.
3. Design a time-table form for your college.
 - The first line should mention the name of the college in 16-point Arial Font and should be bold.
 - The second line should give the course name/teacher's name and the department in 14-point Arial.
 - Leave a gap of 12-points.
 - The rest of the document should use 10-point Times New Roman font.
 - The footer should contain your specifications as the designer and date of creation.
4. BPB Publications plans to release a new book designed as per your syllabus. Design the first page of the book as per the given specifications.

- The title of the book should appear in bold using 20-point Arial font.
- The name of the author and his qualifications should be in the center of the page in 16-point Arial font.
- At the bottom of the document should be the name of the publisher and address in 16-point Times New Roman.
- The details of the offices of the publisher (only location) should appear in the footer.

5. Create the following one page documents.

- Compose a note inviting friends to a get-together at your house, Including a list of things to bring with them.
- Design a certificate in landscape orientation with a border around the document.
- Design a Garage Sale sign.
- Make a sign outlining your rules for your bedroom at home, using a numbered list.

6. Create the following documents:

- A newsletter with a headline and 2 columns in portrait orientation, including at least one image surrounded by text.
- Use a newsletter format to promote upcoming projects or events in your classroom or college.
- Convert following text to a table, using comma as delimiter
- Type the following as shown (do not bold).

Color, Style, Item
 Blue, A980, Van
 8Red, X023, Car
 Green, YL724, Truck
 Name, Age, Sex
 Bob, 23, M
 Linda, 46, F
 Tom, 29, M

7. Enter the following data into a table given on the next page.

Sales person	Dolls	Trucks	Puzzles
Kennedy, Sally	1327	1423	1193
White, Pete	1421	3863	2934
Pillar, James	5214	3247	5467
York, George	2190	1278	1928
Banks, Jennifer	1201	2528	1203
Atwater, Kelly	4098	3079	2067

Add a column Region (values: S, N, N,S,S,S) between the Salesperson and Dolls columns to the given table Sort your table data by Region and within Region by Salesperson in ascending order:

In this exercise, you will add a new row to your table, place the word "Total" at the bottom of the Salesperson column, and sum the Dolls, Trucks, and Puzzles columns.

8. Wrapping of text around the image.
9. Create your resume by incorporating most of the options learned till now.
10. Following features of menu option must be covered

FILE	Complete menu
EDIT	Complete menu
VIEW	Complete menu
INSERT	Complete menu
FORMAT	Complete menu
TABLE	Complete menu
WINDOW	Complete menu
HELP	Complete menu
TOOLS	All options except Online collaboration, Tools on Macro, Templates

Spreadsheet

1. Enter the Following data in Excel Sheet

REGIONAL SALES PROJECTION							
State	Qtr1	Qtr2	Qtr3	QTR4	Qtr Total	Rate	Amount
Delhi	2020	2400	2100	3000		15	
Punjab	1100	1300	1500	1400		20	
U.P.	3000	3200	2600	2800		17	
Haryana	1800	2000	2200	2700		15	
Rajasthan	2100	2000	1800	2200		20	
TOTAL							
AVERAGE							

(a) Apply Formatting as follow:

- I. Title in TIMES NEW ROMAN
- ii. Font Size - 14
- iii. Remaining text - ARIAL, Font Size -10
- iv. State names and Qtr. Heading Bold, Italic with Gray Fill Color.
- v. Numbers in two decimal places.
- vi. Qtr. Heading in center Alignment.
- Vii. Apply Border to whole data.

- (b) Calculate State and Qtr. Total
- (c) Calculate Average for each quarter
- (d) Calculate Amount = Rate * Total.

2. Given the following worksheet

A	B	C	D	
1	Roll No.	Name	Marks	Grade
2	1001	Sachin	99	
3	1002	Sehwag	65	
4	1003	Rahul	41	
5	1004	Sourav	89	
6	1005	Har Bhajan	56	

Calculate the grade of these students on the basis of following guidelines:

If Marks Then Grade

≥ 80 A+

$10 \geq 60 < 80$ A

$\geq 50 < 60$ B

< 50 F

3. Given the following worksheet

A	B	C	D	E	F	G
1	Salesman	Sales in (Rs.)				
2	No.	Qtr1	Qtr2	Qtr3	Qtr4	Total Commission
3	S001	5000	8500	12000	9000	
4	S002	7000	4000	7500	11000	
5	S003	4000	9000	6500	8200	
6	S004	5500	6900	4500	0500	
7	S005	7400	8500	9200	8300	
8	S006	5300	7600	9800	6100	

Calculate the commission earned by the salesmen on the basis of following Candidates:

If Total Sales Commission

< 20000 0% of sales

> 20000 and < 25000 4% of sales

> 25000 and < 30000 5.5% of sales

> 30000 and < 35000 8% of sales

≥ 35000 11% of sales

The total sales is sum of sales of all the four quarters.

4. A company XYZ Ltd. pays a monthly salary to its employees which consists of basic salary, allowances & deductions. The details of allowances and deductions are as follows:

Allowances

- HRA Dependent on Basic

30% of Basic if Basic ≤ 1000

25% of Basic if Basic > 1000 & Basic ≤ 3000

20% of Basic if Basic > 3000

- DA Fixed for all employees, 30% of Basic
- Conveyance Allowance
 - Rs. 50/- if Basic is ≤ 1000
 - Rs. 75/- if Basic > 1000 & Basic ≤ 2000
 - Rs. 100 if Basic > 2000
- Entertainment Allowance NIL if Basic is ≤ 1000
- Rs. 100/- if Basic > 1000

Deductions

- Provident Fund 6% of Basic
- Group Insurance Premium Rs. 40/- if Basic is ≤ 1500
 - Rs. 60/- if Basic > 1500 & Basic ≤ 3000
 - Rs. 80/- if Basic > 3000

Calculate the following:

Gross Salary = Basic + HRA + DA + Conveyance + Entertainment

Total deduction = Provident Fund + Group Insurance Premium

Net Salary = Gross Salary – Total Deduction

5. Create Payment Table for a fixed Principal amount, variable rate of interests and time in the format below:

No. of Instalments	5%	6%	7%	8%	9%
3	XX	XX	XX	XX	XX
4	XX	XX	XX	XX	XX
5	XX	XX	XX	XX	XX
6	XX	XX	XX	XX	XX

6. Use an array formula to calculate Simple Interest for given principal amounts given the rate of Interest and time

Rate of Interest	8%
Time	5 Years
Principal	Simple Interest
1000	?
18000	?
5200	?

7. The following table gives year wise sale figure of five salesmen in Rs.

Salesman	2000	2001	2002	2003
S1	10000	12000	20000	50000
S2	15000	18000	50000	60000
S3	20000	22000	70000	70000
S4	30000	30000	100000	80000
S5	40000	45000	125000	90000

(a) Calculate total sale year wise.

- (b) Calculate the net sale made by each salesman
 - (c) Calculate the maximum sale made by the salesman
 - (d) Calculate the commission for each salesman under the condition.
 - (i) If total sales >4,00,000 give 5% commission on total sale made by the salesman.
 - (ii) Otherwise give 2% commission.
 - (e) Draw a bar graph representing the sale made by each salesman.
 - (f) Draw a pie graph representing the sale made by salesman in 2000.
8. Enter the following data in Excel Sheet

PERSONAL BUDGET FOR FIRST QUARTER

Monthly Income (Net): 1,475

EXPENSES QUARTER	JAN	FEB	MARCH	QUARTER TOTAL	AVERAGE
Rent	600.00	600.00		600.00	
Telephone	48.25	43.50		60.00	
Utilities	67.27	110.00		70.00	
Credit Card	200.00	110.00		70.00	
Oil	100.00	150.00		90.00	
AV to Insurance	150.00				
Cable TV	40.75	40.75		40.75	

Monthly Total

- (a) Calculate Quarter total and Quarter average.
- (b) Calculate Monthly total.
- (c) Surplus = Monthly income - Monthly total.
- (d) What would be total surplus if monthly income is 1500?
- (e) How much does telephone expense for March differ from quarter average?
- (f) Create a 3D column graph for telephone and utilities.
- (g) Create a pie chart for monthly expenses.

9. Enter the following data in Excel Sheet

TOTAL REVENUE EARNED FOR SAM'S BOOKSTALL

Publisher name	1997	1998	1999	2000	Total
A	Rs. 1,000.00	Rs. 1100.00	Rs. 1,300.00	Rs.800.00	
B	Rs. 1,500.00	Rs. 700.00	Rs. 1,000.00	Rs. 2,000.00	
C	Rs. 700.00	Rs. 900.00	Rs. 1,500.00	Rs.600.00	
D	Rs. 1,200.00	Rs. 500.00	Rs. 200.00	Rs. 1,100.00	
E	Rs 800.00	Rs. 1,000.00	Rs. 3,000.00	Rs.560.00	

- (a) Compute the total revenue earned.
- (b) Plot the line chart to compare the revenue of all publisher for 4 years.

(b) Chart Title should be 'Total Revenue of sam's Bookstall (1997-2000)'

(c) Give appropriate categories and value axis title.

10. Generate 25 random numbers between 0 & 100 and find their sum, average and count. How many no. are in range 50-60

BCA17	PROBLEM SOLVING TECHNIQUES WITH C LABORATORY	PPW : 04
FITL		External : 50

NOTE:

- All the concepts of programs from Text Book including exercises must be practice, execute and write down in the practical record book.
- Faculty must take care about UG standard programs it should be minimum 25 – 30.
- In the external lab examination student has to execute at least three programs with compilation and deployment steps are necessary.
- External Viva-voce is compulsory.

1. Write a program to find the largest two (three) numbers using if and conditional operator.
2. Write a program to print the reverse of a given number.
3. Write a program to print the prime number from 2 to n where n is given by user.
4. Write a program to find the roots of a quadratic equation using switch statement.
5. Write a program to print a triangle of stars as follows (take number of lines from user):

```

      *
     * *
    * * *
   * * * *
  * * * * *
 * * * * * *

```

6. Write a program to find largest and smallest elements in a given list of numbers.
7. Write a program to find the product of two matrices.
8. Write a program to find the GCD of two numbers using iteration and recursion.
9. Write a program to illustrate use of storage classes.
10. Write a program to demonstrate the call by value and the call by reference concepts.
11. Write a program that prints a table indicating the number of occurrences of each alphabet in the text Entered as command line arguments.
12. Write a program to illustrate use of data type enum.
13. Write a program to demonstrate use of string functions string.h header file.
14. Write a program that opens a file and counts the number of characters in a file.
15. Write a program to create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
16. Write a program that opens an existing text file and copies it to a new file with lower case letters Changed to capital letters and all other characters unchanged.

BCA I YEAR II SEMESTER

Code	Paper Title / Subject	Workload Per Week	M A R K S			Credits
			External	Internal	Total	
BCA21	Mathematical Foundations to Computer Science - II	T (4)	70	30	100	4
BCA22	Object Oriented Programming with C++	T (4)	70	30	100	4
BCA23	Data Structures with C	T (4)	70	30	100	4
BCA24	Constitution of India	T (4)	70	30	100	4
BCA25	Computer Network	T (4)	70	30	100	4
BCA26	Object Oriented Programming with C++ laboratory	L (4)	50	0	50	2
BCA27	Data Structures with C- 1 laboratory	L (4)	50	0	50	2
Grand Total (Marks and Credits)					600	24

BCA21	MATHEMATICAL FOUNDATION TO COMPUTER SCIENCE – II	PPW : 04
MFCS-II		Internal : 30 External : 70

UNIT I:

Logic and Methods of Proofs: Propositions, logical operations (basic connectives), compound statements, construction of truth table, quantifiers, conditional statements, tautology, contradiction, contingency, logical equivalence. Conjunctive Normal Forms (CNF) and Disjunctive Normal Forms (DNF). **Methods of proofs:** Rules of inference for propositional logic, modus ponens, modus tollens, syllogism, proof by contradiction, Mathematical Induction.

UNIT II:

Algebraic Structures: Semi-group, Monoid, Group, Subgroup, Cyclic group.

UNIT III:

Numerical Methods: Concept and importance of errors in numerical methods. Solution of algebraic and transcendental equations: Bisection method and Newton-Raphson methods. **Numerical Interpolation:** Newton's Forward and Newton's Backward interpolation formula and Lagrange's formula. **Numerical Integration:** Trapezoidal rule and Simpson's 1/3 rule only formula and problem solving for all the topics mentioned above.

UNIT IV:

Optimization Techniques: Linear programming: Introduction, LP formulation, Graphical method for solving LPs with two variables, Special cases in graphical methods, Simplex method, Duality. **Transportation Problem:** Definition, Linear form, North-west corner method, Least cost method, Vogel's approximation method for finding feasible solution, MODI method for finding optimum solution.

Text Books:

1. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
2. Sastry S. S., Introductory Methods of Numerical Analysis, Fifth Edition, PHL, 202
3. Taha Hamdy A., Operations Research: An Introduction, Eighth Edition, Pearson Prentice Hall, 2003.
4. S.B. Singh, Discrete Structures, Khanna Book Publishing, 2023 (AICTE Recommended Textbook)

BCA22	OBJECT ORIENTED PROGRAMMING WITH C++	PPW : 04
OOPWCPP		Internal : 30 External : 70

UNIT-I : Introduction to OOP: Procedure oriented programming, object oriented programming, basic concepts of OOP, benefits and applications of OOP, simple C++ program, namespace scope, structure of C++ Program, creating, compiling and linking a file. **Tokens:** Keywords, identifiers, constants, basic data types, user defined data types, storage classes, derived data types, dynamic initialization of variables, reference variables, operators in C++, scope resolution operator, member dereferencing operators, memory management operators.

UNIT - II: Control Structures: if, if..else, elseif ladder, nested if, switch, for, while, do..while, break, continue, exit, goto. **Classes and Objects:** Specifying a class, defining member functions, C++ program with class, private member functions, arrays within class, memory allocation for objects, static data members, static member functions, arrays of objects, returning objects. **Functions in C++:** Main function, function prototyping, call by reference, return by reference, inline functions, default arguments.

UNIT-III: More about Functions: Function overloading, friend function, a function friendly to two classes, objects as function arguments. **Constructors & Destructors:** Constructors, parameterized constructors, multiple constructors in a class, constructors with default arguments, copy constructors, dynamic constructors, destructors. **Inheritance:** Introduction to inheritance, single inheritance, multi-level inheritance, multiple inheritance, hierarchical inheritance, hybrid inheritance. **Operator Overloading:** Rules for overloading operators, overloading unary operators, and overloading binary operators.

UNIT-IV : Pointers: Introduction to pointers, declaring and initializing pointers, arithmetic operations on pointers, pointers with arrays, arrays of pointers, pointers to objects, 'this' pointer. **Polymorphism and Virtual Functions:** Compile-time polymorphism, runtime polymorphism, virtual functions. **Templates:** Introduction, function templates, class templates. **Exception Handling:** Introduction, exception handling mechanism, throwing mechanism, catching mechanism

Textbook:

1. E. Balagurusamy, Object Oriented Programming with C++, 6/e, McGraw Hill, 2013.
2. Behrouz A. Forouzan and Richard F. Gilberg, Computer Science : A Structured Approach Using C++, 2/e, Cengage Learning, 2003.
3. Ashok N. Kamthane, Object Oriented Programming with ANSI and Turbo C++, 1/e, Pearson Education, 2006

BCA23	DATA STRUCTURES WITH C	PPW : 04
DSWC		Internal : 30 External : 70

UNIT-I: Introduction and Overview: Definition, Classification and Operations of Data Structures. Algorithms: Complexity, Time-Space Tradeoff. Arrays: Definition and Classification of Arrays, Representation of Linear Arrays in Memory, Operations on Linear Arrays: Traversing, Inserting, Deleting, Searching, Sorting and Searching. Searching: Linear Search and Binary Search, **Comparison of Methods. Sorting:** Bubble Sort, Selection Sort, and Insertion Sort. Two-Dimensional Arrays, Representation of Two-Dimensional Arrays in Memory, Matrices and Sparse Matrices, Multi-Dimensional Arrays.

UNIT-II: Linked Lists: Definition, Comparison with Arrays, Representation, Types of Linked lists, Traversing, Inserting, Deleting and Searching in Singly Linked List, Doubly Linked List and Circular Linked List. **Applications of Linked Lists:** Addition of Polynomials. **Hashing and Collision:** Hashing, Hash Tables, Types of Hash Functions, Collision, Collision Resolution with Open Addressing and Chaining.

UNIT-III: Stacks: Definition, Representation of Stacks using Arrays and Linked List, Operations on Stacks using Arrays and Linked List, Application of Stacks: Arithmetic Expressions, Polish Notation, Conversion of Infix Expression to Postfix Expression, Evaluation of Postfix Expression. **Recursion:** Definition, Recursive Notation, Runtime Stack, Applications of Recursion: Factorial of Number, GCD, Fibonacci Series and Towers of Hanoi. **Queues:** Definition, Representation of Queues using Array and Linked List, Types of Queues: Simple Queue, Circular Queue, Double-Ended queue, Priority Queue, Operations on Simple Queues and Circular Queues using Array and Linked List, Applications of Queues.

UNIT-IV: Graphs: Definition, Terminology, Representation, Traversal. **Trees:** Definition, Terminology, Binary Trees, Traversal of Binary Tree, Binary Search Tree, Inserting, Deleting and Searching in Binary Search Tree, Height Balanced Trees: AVL Trees, Insertion and Deletion in AVL Tree.

Text Books

1. R.B. Patel, "Expert Data Structures with C", Khanna Book Publishing Company, 2023 (AICTE Recommended Textbook)
2. Seymour Lipschutz, "Data Structures with C", Schaum's Outlines, Tata McGraw-Hill, 2011.
3. Yashavant Kanetkar, "Data Structures Through C", 4th Edition, BPB Publications, 2022.

Reference Books

1. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2014.
2. Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, Universities Press, 2007.

BCA24	CONSTITUTION OF INDIA	PPW : 04
COI		Internal : 30 External : 70

UNIT-I

1. Making of Indian Constitution - Constituent Assembly.
2. Historical Perspective of the Constitution of India.
3. Salient Features and characteristics of the Constitution of India.

UNIT-II

1. The Fundamental Rights.
2. The Fundamental Duties and their Legal Status.
3. The Directive Principles of State Policy – Their Importance and Implementation

UNIT-III

1. Federal Structure and Distribution of Administrative, Legislative and Financial Powers between the Union and the States.
2. Parliamentary Form of Government in India – The Constitutional Powers and Status of the President of India.
3. Amendment of the Constitutional Provisions and Procedure.

UNIT-IV

1. The Judiciary.
2. Constitutional and Legal Frame Work for Protection of Environmental in Global and National Level.
3. Corporate Social Responsibility (CSR) International and National Scenario.

Text Books:

1. D.D. Basu: An Introduction of Indian Constitution.
2. Greanvile Austin: The Indian Constitution.
3. Paras Diwan: Studies on Environmental cases.

References:

1. Khannna Justice.H.R: Making of India's Constitution, Eastern Book Companies.
2. Rajani Kothari: Indian Politics.
3. Ghosh Pratap Kumar: The Constitution of India. How it has been Formed, World Press.
4. A.Agrawal (Ed): Legal Control of Environmental Pollution.d & Co., New Delhi

BCA25	COMPUTER NETWORK	PPW : 04
CN		Internal : 30 External : 70

UNIT-I: Data Communication, Data Networking and the Internet: A communication model, data communications, networks, and the internet. **Protocol Architecture:** Need for protocol architecture, TCP/IP protocol architecture, OSI model, TCP/IP Vs OSI model.

UNIT-II: Data transmission: Concepts and terminology, analog and digital data transmission, transmission impairments. Transmission Media: Guided and unguided. **Signal encoding techniques:** Digital data to digital signals, digital data to analog signals, analog data to digital signals, and analog data to analog signals.

UNIT- III: Digital Data Communication Techniques: Asynchronous and synchronous transmission, types of errors, error detection techniques. **Data Link Control Protocols:** Flow control, error control, high level data link control (HDLC) protocol.

UNIT-IV: Multiplexing: Frequency division multiplexing, characteristics, synchronous time division multiplexing, and characteristics. Statistical time division multiplexing, characteristics.

Text Books:

1. William Stallings, Data and Computer Communications, 8/e, Pearson Education., 2013.
- 2 Fred Harshall, Data Communications, Computer Networks and Open Systems, 4/e, Pearson Education, 2005.
3. Behrouz A Forouzan, Data Communications and Networking, 4/e, McGraw Hill, 2012

BCA26	OBJECT ORIENTED PROGRAMMING USING CPP LABORATORY	PPW : 04
OOPwCPPLab		External : 50

1. Write a program that contains a function to exchange (swap) values of two arguments by using pointers and References parameters.
2. Write a program to check the given string is palindrome or not using a private member function.
3. Write a program to find transpose of 2-D matrix by allocating memory dynamically to the matrix. Initialize and display contents of the matrix and deallocate memory.
4. Write a program to add corresponding elements of two 2-D matrices using friend function. Create two classes each capable of storing one 2-D matrix. Declare the matrices under private access specifier and access them outside the class.
5. Write a program for finding area of different geometric shapes (Circle, Rectangle and Cube) using function overloading.
6. Write a Program to generate Fibonacci Series by using Constructor to initialize the Data Members.
7. Write a program to add two matrices of same copy. Create two objects of the class and each of which refers to one 2-D matrix. Use constructor to allocate memory dynamically and use copy constructor to allocate memory when one array object is used to initialize another.
8. Write a program to demonstrate single inheritance distinguishing public and private derivation.
9. Write a program to illustrate the implementation of both Multilevel and Multiple (Hybrid) inheritance.
10. Write a program to find transpose of a given matrix of mxn size using unary operator overloading.
11. Write a program to add two matrices of mxn size using binary operator overloading.
12. Write a program to demonstrate the usage of virtual functions.
13. Write a program to sort a given set of elements using function template.
14. Write a program to search a key element in a given set of elements using class template.
15. Write a program to find average marks of the subjects of a student. Throw multiple exceptions and define multiple catch statements to handle division by zero as well as array index out of bounds exceptions.

BCA27	DATA STRUCTURES WITH C LABORATORY	PPW : 04
DSWCLab		External : 50

1. Write a program for insertion and deletion operations in an array.
2. Write a program to search for an element in an array using Linear Search and Binary Search.
3. Write a program to sort an array using Bubble Sort, Selection Sort and Insertion Sort.
4. Write a program to merge two arrays.
5. Write a program to add and subtract two matrices.
6. Write a program to multiply two matrices.
7. Write a program to insert an element into a Singly Linked List:
 - (a) At the beginning (b) At the end (c) At a specified position
8. Write a program to delete an element from a Singly Linked List:
 - (a) At the beginning (b) At the end (c) A specified element
9. Write a program to perform the following operations in a Doubly Linked List:
 - (a) Create (b) Search for an element
10. Write a program to perform the following operations in a Circular Linked List:
 - (a) Create (b) Delete an element from the end
11. Write a program to implement stack operations using an array.
12. Write a program to implement stack operations using a linked list.
13. Write a program to add two polynomials using a linked lists.
14. Write a program to evaluate a postfix expression using a stack.
15. Write a program to perform the following using recursion:
 - (a) Find the factorial of a number
 - (b) Find the GCD of two numbers
 - (c) Solve Towers of Hanoi problem
16. Write a program to implement simple queue operations using an array.
17. Write a program to implement circular queue operations using an array.
18. Write a program to implement circular queue operations using a linked list.
19. Write a program to perform the following operations on a binary search tree.
 - (a) Preorder Traversal (b) Inorder Traversal (c) Postorder Traversal
20. Write a program to perform insertion operation in a binary search tree.

BCA II YEAR I SEMESTER

Code	Paper Title / Subject	Workload Per Week	M A R K S			Credits
			External	Internal	Total	
BCA31	Probability and Statistics	T (4)	70	30	100	4
BCA32	Object Oriented Programming using Java	T (4)	70	30	100	4
BCA33	Software Engineering	T (4)	70	30	100	4
BCA34	Design and Analysis of Algorithms	T (4)	70	30	100	4
BCA35	Operating System	T (4)	70	30	100	4
BCA36	Object Oriented Programming using Java laboratory	L (4)	50	0	50	2
BCA37	Operating Systems laboratory	L (4)	50	0	50	2
Grand Total (Marks and Credits)					600	24

BCA31	PROBABILITY AND STATISTICS	PPW : 04
PAS		Internal : 30 External : 70

UNIT-I: Basic concepts of Statistics, qualitative and quantitative data, classification of data, construction of frequency distribution, diagrammatic representation of data. **Measures of Central Tendency:** Arithmetic mean, median and mode—their properties **Measures of Dispersion:** Range, mean deviation, quartile deviation, variance and standard deviation.

UNIT-II: Correlation: Definition, scatter diagram, types of correlation, measures—Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient. **Regression:** Linear regression-fitting by least square method and interpretation.

UNIT-III: Concepts of probability: Experiment and sample space, events and operations with events, probability of an event, basic probability rules, applications of probability rules, conditional probability. **Random Variables:** Discrete and continuous random variable, probability distribution of a random variable, probability mass function, probability density function, expectation and variance of a random variable. **Standard Probability Distributions:** Binomial probability distribution, Poisson probability distribution, Normal probability distribution.

UNIT IV: Sampling Distribution: Concept of Population and Sample, parameter and statistic, sampling distribution of sample mean and sample proportion. **Statistical Inference:** Estimation and Hypothesis Testing (only concept). **Hypothesis Testing for a Single Population:** Concept of a hypothesis testing, tests involving a population mean and population proportion (z test and t test). **Chi square test for independence of attributes and goodness of fit.**

Text Books

1. Manish Sharma, Amit Gupta, The Practice of Business Statistics, Khanna Book Publishing Company, 2010 (AICTE Recommended Textbook)
2. Das N. G., Statistical Methods, Combined Edition, Tata McGraw Hill, 2010.
3. Ross Sheldon M., Introduction to Probability and Statistics for Engineers and Scientists, 6th Edition, Elsevier, 2021.
4. Miller Irwin and Miller Marylees, Mathematical Statistics with Applications, Seventh Edition, Pearson Education, 2005

Reference Books

1. Pal Nabendu and Sarkar Sahadeb, Statistics: Concepts and Applications, Second Edition, PHI, 2013
2. Montgomery Douglas and Runger George C., Applied Statistics and Probability for Engineers, Wiley, 2016.
3. Reena Garg, Engineering Mathematics, Khanna Publishing House, 2024.

Web Resources

1. <https://nptel.ac.in/courses/111106112>
2. <https://nptel.ac.in/courses/111105041>

BCA32	OBJECT ORIENTED PROGRAMMING USING JAVA	PPW : 04
OOPJava		Internal : 30 External : 70

UNIT-I: Fundamentals of Object-Oriented Programming: Basic Concepts of Object Oriented Programming (OOP), Benefits and Applications of OOP. **Java Evolution:** Java Features, Difference between Java, C and C++, Java and Internet, Java Environment. **Overview of Java Language:** Introduction to Simple Java Program, Use of Comments and Math function, Application of two classes, Java Program Structure, Java Tokens and statements, Implementing Java program and JVM, Command Line Arguments.

UNIT-II: Constants, Variables and Data Types: Constants, Variables, Data Types, Declaration of Variables, Giving values to Variables, Symbolic Constants, Typecasting. **Operators & Expressions:** Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment & Decrement operators, conditional operators, Bitwise operators, Arithmetic Expressions, Evaluation of Expressions, Type Conversions in Expressions, Operator Precedence & Associativity. **Decision Making, Branching & Looping:** Decision Making with Control Statements, Looping Statements, Jump in loops, Labelled loops.

UNIT-III: Classes, Objects and Methods: Defining Class, Methods Declaration, Constructors, Methods Overloading, Overriding Methods, Inheritance. **Arrays, Strings and Vectors:** 1D arrays, Creating an Array, 2D arrays, Strings, Vectors, Wrapper Classes, Enumerated Types. **Inheritance:** Defining, extending classes, and Implementing Interfaces. Multiple inheritance and polymorphism.

UNIT IV: Packages: Basics of packages, System packages, Creating and accessing packages, Creating user defined packages, Adding class to a package. **Exception Handling:** Using the main keywords of exception handling: try, catch, throw, throws and finally; Nested try, Multiple catch statements, Creating user defined exceptions.

Text Books:

1. Balaguruswamy E. (2023). Programming with JAVA: A Primer. 7th edition. India: McGraw Hill Education
2. Schildt, H. (2022). Java: The Complete Reference. 12th edition. McGraw-Hill Education.

Reference Books:

1. Arunesh Goyal, The Essentials of JAVA, Khanna Book Publishing Company Private Limited, 2012.
2. Tanweer Alam, Core JAVA, Khanna Book Publishing Company Private Limited, 2015.
3. Y. Daniel Liang, Introduction to Java Programming, 7th Edition, Pearson, 2008.
4. S. Malhotra and S. Choudhary, Programming in Java, 2nd Edition, Oxford University Press, 2014.

Web Resources:

1. <https://www.w3schools.com/java/>.
2. <http://www.java2s.com/>.
3. https://onlinecourses.nptel.ac.in/noc22_cs47/preview

BCA33	SOFTWARE ENGINEERING	PPW : 04
SE		Internal : 30 External : 70

UNIT-I: The evolving role of software, changing nature of software, layered technology, a process framework, Process models: The waterfall model, incremental process models, evolutionary process models, the unified process. **Agile software development:** Agility Principles, Agile methods, Plan-driven and agile development, Extreme programming, Scrum, A Tool Set for the Agile Process.

UNIT-II: Software Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management. **Risk Management:** Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan. Project planning- Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques.

UNIT-III: Design: Design process and design quality, design concepts, the design model, software architecture, data design, architectural design, Basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams. **Testing Strategies:** A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging. **Product metrics:** Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

UNIT-IV: Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability. **Release Management:** Release planning, development and build plans, release strategies, risk management, and post-deployment monitoring. **Product sustenance:** Maintenance, updates, End of life, migration strategies.

Text Books:

1. Software Engineering, Ian Somerville, 9th edition, Pearson education.
2. Software Engineering A practitioner's Approach, 8th edition, Roger S Pressman,
Bruce R. Maxim. McGraw Hill Education, 2015.
3. Software Engineering, N.S. Gill, Khanna Publishing House, 2023 (AICTE Recommended Textbook)

Reference Books

1. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007
2. Software Engineering: Principles and Practice Hans van Vliet

BCA34	DESIGN AND ANALYSIS OF ALGORITHMS	PPW : 04
DDA		Internal : 30 External : 70

UNIT-I: What is an algorithm? Design and performance analysis of algorithms, time complexity, space complexity. Asymptotic notations (O , Ω , Θ) to measure growth of a function and application to measure complexity of algorithms. Analysis of sequential search, bubble sort, selection sort, insertion sort, matrix multiplication. **Recursion:** Basic concept. Analysis of recursive algorithms, Master's theorem.

UNIT-II: The Divide & Conquer Design Technique: The general concept. Binary search, finding the maximum and minimum, merge sort, quick sort. Best- and worst-case analysis for the mentioned algorithms. Strassen's matrix multiplication. Lower bound for comparison-based sorting. The **Greedy Design Technique:** The general concept. Applications to general Knapsack problem, finding minimum weight spanning trees: Prim's and Kruskal's algorithms, Dijkstra's algorithm for finding single source shortest paths problem.

UNIT-III: The Dynamic Programming Design Technique: The general concept. Computation of Fibonacci series and Binomial coefficients, all pair shortest paths problem (Floyd-Warshall's Algorithm), 0/1 Knapsack problem. **Algorithms on Graphs:** Breadth First Search, Depth First Search, finding connected components, depth first search of a directed graph, topological sorting.

UNIT-IV: Limitations of Algorithmic Power: Backtracking Method: n-Queen problem; sum of subsets problem/ Hamiltonian circuit problem/vertex cover problem. **Computational Intractability:** Overview of non-deterministic algorithms, P, NP, NP-Complete and NP-hard problems.

Text Books

1. Gajendra Sharma, Design and Analysis of Algorithms, Khanna Publishing House
AICTE Recommended Textbook)
2. Cormen Thomas H., Leiserson Charles E., Rivest Ronald L. and Stein Clifford, Introduction to Algorithms, PHI publication, 3rd Edition, 2009.
3. Horowitz Ellis, Sahni Sartaj and Rajasekaran Sanguthevar, Fundamentals of Computer Algorithms, University Press (I) Pvt. Ltd., 2012.
4. Levitin Anany, Introduction to Design and Analysis of Algorithms, 3rd Edition, Pearson, 2012.

Reference Books

1. Aho Alfred V., Hopcroft John E. & Ullman Jeffrey D., The Design & Analysis of
Computer Algorithms, Addison Wesley Publications, Boston, 1983.
2. Kleinberg Jon & Tardos Eva, Algorithm Design, Pearson Education, 2006.

Web Resources

1. <https://nptel.ac.in/courses/106101060>
2. <https://www.cs.umd.edu/~mount/451/Lects/451lects.pdf>

BCA35	OPERATING SYSTEM	PPW : 04
OS		Internal : 30 External : 70

UNIT-I: Operating Systems Overview: Definition, Evaluation of O.S, Components & Services of OS, Structure, Architecture, types of Operating Systems, Batch Systems, Concepts of Multiprogramming and Time Sharing, Parallel, Distributed and real time Systems. **Operating Systems Structures:** Operating system services and systems calls, system programs, operating system structure, operating systems generations.

UNIT-II: Process Management: Process Definition, Process states, Process State transitions, Process Scheduling, Process Control Block, Threads, Concept of multithreads, Benefits of threads, Types of threads. **Process Scheduling:** Definition, Scheduling objectives, Scheduling algorithms, CPU scheduling Preemptive and Non-preemptive Scheduling algorithms (FCFS, SJF and RR), Performance evaluation of the scheduling Algorithms

UNIT-III: Process Synchronization: Introduction, Inter-process Communication, Race Conditions, Critical Section Problem, Mutual Exclusion, Semaphores, Monitors. **Deadlocks:** System model, deadlock characterization, deadlock prevention, avoidance, Banker's algorithm, Deadlock detection, and recovery from deadlocks.

UNIT-IV: Memory Management: Logical and Physical address map, Swapping, Memory allocation, MFT, MVT, Internal and External fragmentation and Compaction, Paging, Segmentation. Virtual Memory: Demand paging, Page Replacement algorithms, Allocation of frames, thrashing. **I/O Management:** Principles of I/O Hardware: Disk structure, Disk scheduling algorithms.

Text Books:

1. Ekta Walia, Operating Systems Concepts, Khanna Publishing House, 2022 (AICTE Recommended Textbook)
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition OR Later edition, Wiley India Private Limited, New Delhi.
3. Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.

Reference Books:

1. Andrew S Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall India.
2. Sumitabha Das, UNIX Concepts and Applications, 4th Edition, Tata McGraw-Hill.

BCA36	OBJECT ORIENTED PROGRAMMING USING JAVA LABORATORY	PPW : 04
OOPJLAB		External : 50

List of Experiments

1. Write a program to read two numbers from user and print their product.
2. Write a program to print the square of a number passed through command line arguments.
3. Write a program to send the name and surname of a student through command line arguments and print a welcome message for the student.
4. Write a java program to find the largest number out of n natural numbers.
5. Write a java program to find the Fibonacci series & Factorial of a number using recursive and non recursive functions.
6. Write a java program to multiply two given matrices.
7. Write a Java program for sorting a given list of names in ascending order.
8. Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome.
9. Write a java program to read n number of values in an array and display it in reverse order.
10. Write a Java program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from AddSub class to use the member data of the super class. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.
11. Create a JAVA class called Student with the following details as variables with in it.
 - a. USN, NAME, BRANCH, PHONE, PERCENTAGE
 - b. Write a JAVA program to create n Student objects and print the USN, Name, Branch, Phone, and percentage of these objects with suitable headings.
12. Write a Java program that displays the number of characters, lines and words in a text.
13. Write a Java program to create a class called Shape with methods called getPerimeter() and getArea(). Create a subclass called Circle that overrides the getPerimeter() and getArea() methods to calculate the area and perimeter of a circle.
14. Write a Java program to create a class Employee with a method called calculateSalary(). Create two subclasses Manager and Programmer. In each sub class, override the calculateSalary() method to calculate and return the salary based on their specific roles.
15. Write a Java program using an interface called 'Bank' having function 'rate_of_interest()'. Implement this interface to create two separate bank classes 'SBI' and 'PNB' to print different rates of interest. Include additional member variables, constructors also in classes 'SBI' and 'PNB'.
16. Write a Java package program for the class book and then import the data from the package and display the result.

17. Write a Java program for finding the cube of a number using a package for various data types and then import it in another class and display the results.
18. Write a Java program for demonstrating the divide by zero exception handling.
19. Write a Java program that reads a list of integers from the user and throws an exception if any numbers are duplicates.
20. Create an exception subclass UnderAge, which prints "Under Age" along with the age value when an object of UnderAge class is printed in the catch statement. Write a class exceptionDemo in which the method test() throws UnderAge exception if the variable age passed to it as argument is less than 18. Write main() method also to show working of the program.

BCA37	OPERATING SYSTEMS LABORATORY	PPW : 04
OSLAB		External : 50

List of Experiments

- 1 Write C program to simulate the FCFS CPU Scheduling algorithm.
- 2 Write C program to simulate the SJF CPU Scheduling algorithm.
- 3 Write C program to simulate the Round Robin CPU Scheduling algorithm.
- 4 Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.
- 5 Write a C program to implement the Producer – Consumer problem using semaphores.
- 6 Write a C program to illustrate the IPC mechanism using Pipes.
- 7 Write a C program to illustrate the IPC mechanism using FIFOs.
- 8 Write a C program to simulate Paging memory management technique.
- 9 Write a C program to simulate Segmentation memory management technique.
- 10 Write a C program to simulate the Best Fit contiguous memory allocation technique.
- 11 Write a C program to simulate the First Fit contiguous memory allocation technique.
- 12 Write a C program to simulate the concept of Dining-Philosophers problem.
- 13 Write a C program to simulate the MVT algorithm.
- 14 Write a C program to implement FIFO page replacement technique.
- 15 Write a C program to write a C program for implementing sequential file allocation method.

BCA II YEAR II SEMESTER

Code	Paper Title / Subject	Workload Per Week	M A R K S			Credits
			External	Internal	Total	
BCA41	Web Technologies	T (4)	70	30	100	4
BCA42	Database Management System	T (4)	70	30	100	4
BCA43	Artificial Intelligence	T (4)	70	30	100	4
BCA44	Theory of Computation	T (4)	70	30	100	4
BCA45	Data Mining & Warehousing	T (4)	70	30	100	4
BCA46	Web Technologies Laboratory	L (4)	50	0	50	2
BCA47	Database Management Systems laboratory	L (4)	50	0	50	2
Grand Total (Marks and Credits)					600	24

BCA41	WEB TECHNOLOGIES	PPW : 04
WT		Internal : 30 External : 70

UNIT-I: HTML- Basic HML, the document body, Text, Hyperlinks, Adding More Formatting, Lists, Using Color and Images, Images, Tables, Frames, Forms-Toward Interactivity. Cascading Style sheets - Introduction, Inline Styles, Embedded Style Sheets, Linking external sheets, Backgrounds, text flow and box model.

UNIT-II: JavaScript- Introduction, simple programming, Obtaining User Input with prompt Dialogs, Operators (arithmetic, Decision making, assignment, logical, increment and decrement). Control Structures - if... else selection statement, while, do... while repetitions statement, for statement, switch statement, break and continue statements.

UNIT-III: Functions - program modules in JavaScript, programmer defined functions, function definition, Random-number generator, scope rules, global functions, recursion. **JavaScript:** Arrays, JavaScript: Objects - Math Object, String Object, Date Object, Boolean & Number Object, document and window Objects.

UNIT-IV: Event Model - on click, on load, onerror, onmouseover, onmouseout, onfocus, onblur, onsubmit, onreset, more DHTML events. **XML** - Introduction, XML Basics, Structuring Data, XML Namespaces, Document Type Definitions (DTDs), W3C XML Schema Documents, XML Vocabularies, MathML, Other Markup Languages, Extensible Style sheet Language and XSL Transformations, Document Object Model (DOM).

Text Book:

1. Internet& World Wide Web- H. M. Deitel, P.J. Deitel, A. B. Goldberg-Third Edition
2. Laura Lemay, Mastering HTML, CSS & Java Script Web Publishing, BPB Publications, 2016
3. Thomas A. Powell, The Complete Reference HTML & CSS, Fifth Edition, 2017

Reference Books:

1. Silvio Moreto, Bootstrap 4 By Example, ebook, 2016.
2. Tanweer Alam, Web Technologies, Khanna Book Publishing, 2011.

Web Resources

1. www.javatpoint.com
2. www.w3schools.com
3. <https://www.geeksforgeeks.org/web-technology/>

BCA42	DATABASE MANAGEMENT SYSTEM	PPW : 04
DBMS		Internal : 30 External : 70

UNIT-I: Introduction to Databases: Definition of Data, Database, and DBMS, Overview of Database Applications, Advantages and Disadvantages of DBMS, Roles of Database Users and Administrators. Data Models: Introduction to Data Models, Types of Data Models (Hierarchical, Network, Relational, Object-oriented), Importance of Data Models in DBMS Database Design: Keys: Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key, Alternate Key, Unique Key, Surrogate Key, Constraints in a table: Primary Key, Foreign Key, Unique Key, NOT NULL, CHECK, Entity-Relationship (ER) Model, Entities and Entity Sets, Attributes and Relationships, ER Diagrams, Key Constraints and Weak Entity Sets, Extended ER Features, Introduction to the Relational Model and Relational Schema.

UNIT-II: Relational Algebra and Calculus: Introduction to Relational Algebra, Operations: Selection, Projection, Set Operations, Join Operations, Division, Tuple and Domain Relational Calculus. **Structured Query Language (SQL):** SQL Basics: DDL and DML, Aggregate Functions (Min(), Max(), Sum(), Avg(), Count()), Logical operators (AND, OR, NOT), Predicates (Like, Between, Alias, Distinct), Clauses(Group By, Having, Order by, top/limit), Inner Join, Natural Join, Full Outer Join, Left Outer Join, Right outer Join, Equi Join.

UNIT-III: Advanced SQL: Analytical queries, Hierarchical queries, Recursive queries, Views, Cursors, Stored Procedures and Functions, Packages, Triggers, **Dynamic SQL Normalization and Database Design:** Functional Dependencies: Armstrong's Axioms, Definition, Properties (Reflexivity, Augmentation, Transitivity), Types (Trivial, Non-Trivial, Partial and Full Functional Dependency), Closure of Functional Dependencies, Normal Forms (1NF, 2NF, 3NF, BCNF), Denormalization.

UNIT-IV: Transaction Management: ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control, Performance of Locking, Transaction Support in SQL, Introduction to Crash Recovery, 2PL, Serializability, and Recoverability, Introduction to Lock Management, **Dealing with Deadlocks Database Storage and Indexing:** Data on External Storage, File Organizations and Indexing, Index Data Structures, Comparison of File Organizations, Indexes and Performance Tuning, Guidelines for Index Selection, Basic Examples of Index Selection

Text Books:

- 1.Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", third edition, McGraw – Hill, 2018
- 2.Benjamin Rosenzweig, Elena Rakhimov, "Oracle PL/SQL by Example", fifth edition, Prentice Hall, 2015

Reference Books:

1. Korth, Silbertz, Sudarshan," Database System Concepts", Seventh Edition, McGraw Hill.(2019).
2. R.P. Mahapatra, Govind Verma, "Database Management Systems", Khanna Publishing House, 2025.

BCA43	ARTIFICIAL INTELLIGENCE	PPW : 04
AI		Internal : 30 External : 70

UNIT-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, The Wumpus World as an Example World. Problem-solving: Problem-solving agents.

UNIT-II: Advanced Search Techniques: Uninformed Search: DFS, BFS, Iterative Deepening Search. Informed Search: Best First Search, A* search, AO* search. **Adversarial Search & Games:** Two-player zero-sum games, Minimax Search, Alpha-Beta pruning. Constraints and Constraint Satisfaction Problems (CSPs), Backtracking search for CSP. Evolutionary Search Techniques: Introduction to evolutionary algorithms, Genetic algorithms, Applications of evolutionary search in AI.

UNIT-III: Logical Reasoning and Uncertainty: Logic: Propositional logic, First-order predicate logic, Propositional versus first-order inference, Unification and lifting. Inference: Forward chaining, Backward chaining, Resolution, Truth maintenance systems. **Introduction to Planning:** Blocks World problem, Strips; Handling Uncertainties: Non-monotonic reasoning, Probabilistic reasoning, Introduction to Fuzzy set theory.

UNIT-IV: 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 include two case studies. Legal and Ethical Issues: Concerns related to AI.

Text Books:

- 1.M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Book Publishing Company, 2024 (AICTE Recommended Textbook).
- 2.Nilsson Nils J, Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4.
- 3.Dan W Patterson, Introduction to Artificial Intelligence & Expert Systems, PHI Learning 2010.
- 4.Rajiv Chopra, Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Khanna Book Publishing Company, 2024.

Reference Books:

1. M.C. Trivedi, Introduction to AI and Machine Learning, Khanna Book Publishing Company, 2024.
2. Russell, S. and Norvig, P., "Artificial Intelligence - A Modern Approach", 3rd edition, Prentice Hall
3. Van Hirtum, A. & Kolski, C. (2020). Constraint Satisfaction Problems: Algorithms and Applications. Springer
4. Rajiv Chopra, Machine Learning and Machine Intelligence, Khanna Book Publishing Company, 2024

BCA44	THEORY OF COMPUTATION	PPW : 04
TOC		Internal : 30 External : 70

UNIT-I: Computer Hardware and System Software: Introduction, Computer Hardware and Types of System Software, Man-machine Communication Spectrum. **Introduction to Compilers:** Introduction, Theory of Computer Languages, Design of a Language, Evolution of Compilers, Stages of Compilation.

UNIT-II: Lexical Analysis: Introduction, Alphabets and Tokens in Computer Languages, Representation of Tokens and Regular Expression, Token Recognition and Finite State Automata, Lexical Analysis Tool. **Syntax Analysis:** Introduction, Context-free Grammar and Structure of Language, Parser and its Types, Top-down Parser, Bottom-up Parser, Parser Generator Tool (Yacc),

UNIT-III: Intermediate Code Generation: Introduction, Need for Intermediate Code, Types of Intermediate Code, Semantic Analysis. **Optimization:** Introduction, Hints on Writing Optimized Code at User Level, Construction of Basic Blocks and Processing.

UNIT-IV: Code Generation: Introduction, Issues in Code Generation, Target Machine Architecture **Compiler Writing Tools:** Introduction, Lexical Tools, Syntactic Tools,

Test Book:

1. K. Muneeswaran, Compiler Design (with CD), Oxford university press, 2012

Reference Books

1. Santanu Chattopadhyaya, Systems Programming, PHI, 2011.
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques, and Tools, 2nd edition, Prentice Hall, 2006.
3. D. M. Dhamdhere, Systems Programming, Tata McGraw Hill, 2011.
4. Leland Beck, D. Manjula, System Software: An Introduction to System Programming, 3rd edition, Pearson Education, 2008.
5. Grune D, Van Reeuwijk . K, Bal H. E, Jacobs C J H, Langendoen K, Modern Compiler Design, 2nd edition, Springer, 2012

BCA45	DATA MINING & WAREHOUSING	PPW : 04
DMW		Internal : 30 External : 70

UNIT-I: Introduction to Data Mining: Data mining, Functionalities, **Data Preprocessing:** Preprocessing the Data, Data cleaning, Data Integration and Transformation, Data reduction, Discretization and Concept hierarchies.

UNIT-II: Data Warehouse Fundamentals: Introduction to Data Warehouse, OLTP Systems, OLAP, Differences between OLTP and OLAP, Characteristics of Data Warehouse, Functionality of Data Warehouse, Advantages and Applications of Data Warehouse, Advantages, Applications, Top- Down and Bottom-Up Development Methodology, Tools for Data warehouse development, Data Warehouse Types, Data cubes

UNIT-III: Mining Association Rules: Basics Concepts – Single Dimensional Boolean Association Rules from Transaction Databases, Multilevel Association Rules from transaction databases, Multi dimension Association Rules from Relational Database and Data Warehouses. Apriori Algorithm, FP-Tree algorithm.

UNIT-IV: Classification and Prediction: Introduction, Issues, Decision Tree Induction, Naïve Bayesian Classification, Classification based on Concepts from Association Rule Mining, Classifier Accuracy.

Text Books:

1. J. Han and M. Kamber, Data Mining Concepts and Techniques, Elsevier, 2011

Reference Books:

1. K.P. Soman ,Shyam Diwakar, V.Ajay ,2006, Insight into Data Mining Theory and Practice, Prentice Hall of India Pvt. Ltd - New Delhi.
2. Data Mining Techniques, Arun K. Pujari, Universities Press, 2006
3. Modern Approaches of Data Mining: Theory & Practice, M. Panda, S. Dehuri, M. R. Patra, Narosa Publishing House, 2018

BCA46	WEB TECHNOLOGIES LABORATORY	PPW : 04
WTLAB		External : 50

PART – A

1. Create your class time table using table tag.
2. Design a Webpage for your college containing description of courses, department, faculties, library etc. using list tags, href tags, and anchor tags.
3. Create web page using Frame with rows and columns where we will have header frame, left frame, right frame, and status bar frame. On clicking in the left frame, information should be displayed in right frame.
4. Create Your Resume using HTML, use text, link, size, color and lists.
5. Create a Web Page of a super market using (internal CSS)
6. Use Inline CSS to format your resume that you have created.
7. Use External CSS to format your time table created.
8. Use all the CSS (inline, internal and external) to format college web page that you have created.
9. Write a HTML Program to create your college website using for mobile device.

PART – B

1. Write an HTML/JavaScript page to create login page with validations.
2. Develop a Simple calculator for addition, subtraction, and multiplication and division operation using JavaScript.
3. Use Regular Expressions for validations in Login Page using JavaScript.
4. Write a Program to retrieve date from a text file and displaying it using AJAX.
5. Create XML file to store Student Information like Register Number, Name, Mobile Number, DOB, and Email-Id.
6. Create a DTD for (0).
7. Create XML scheme for (0).
8. Create XSL file to convert XML file to XHTML file.
9. Write a JavaScript program using Switch case.
10. Write a JavaScript program using any 5 events.
11. Write a JavaScript program using built in JavaScript objects.
12. Write program for populating values from JSON text.
13. Write a program to transform JSON text to a JavaScript object

BCA47	DATABASE MANAGEMENT SYSTEMS LABORATORY	PPW : 04
DBMSLAB		External : 50

List of Practical's

1. Draw an ER Diagram of Registrar Office
2. Draw an ER Diagram of Hospital Management System
3. Reduce The ER diagram in question no 1 into tables
4. Reduce the ER diagram of question no 2 into tables

Consider the following Schema

Supplier(SID, Sname, branch, city, phone)

Part(PID, Pname, color, price)

Supplies(SID, PID, qty, date_supplied)

DDL Commands

5. Create the above tables
6. Add a new attribute state in supplier table
7. Remove attribute city from supplier table
8. Modify the data type of phone attribute
9. Change the name of attribute city to address
10. Change a table's name, supplier to sup
11. Use truncate to delete the contents of supplies table
12. Remove the part table from database.

DML Commands

1. Insert at least 10 records in tables supplier, part and supplies
2. Show the contents in tables supplier, part and supplies
3. Find the name and city of all suppliers
4. Find the name and phoneno of all suppliers who stay in 'Delhi'
5. Find all distinct branches of suppliers
6. Delete the record of the supplier whose SID is 204001
7. Delete all records of supplier table
8. Delete all records of suppliers whose city starts with capital A.
9. Find the supplier names which have 'lk' in any position
10. Find the supplier name where 'R' is in the second position
11. Find the name of supplier whose name starts with 'V' and ends with 'A'
12. Change the city of all suppliers to 'BOMBAY'
13. Change the city of supplier 'Vandana' to 'Goa'

Queries with Constraints

1. Create the supplier table with Primary Key Constraint
2. Create supplies table with Foreign key Constraint
3. Create a part table with UNIQUE Constraint
4. Create supplier Table with Check Constraints
5. Create Supplier table with Default Constraint

Queries on TCL

1. Create Savepoints
2. Rollback to SavePoints
3. Use Commit to save on

Aggregate Functions:

1. Find the minimum, maximum, average and sum of costs of parts
2. Count the total number of parts present
3. Retrieve the average cost of all parts supplied by 'Mike'

Queries on GROUP BY, HAVING AND ORDER BY Clauses

1. Display total price of parts of each color
2. Find the branch and the number of suppliers in that branch for branches which have more than 2 suppliers.
3. Find all parts sorted by pname in ascending order and cost in descending order
4. Find the branch and the number of suppliers in that branch.

Join Operators

1. Perform Inner join on two tables
2. Perform Natural Join on two tables
3. Perform Left Outer Join on tables
4. Perform Right Outer join on tables
5. Perform Full Outer Join on tables.

Set Theory Operators

1. Show the use of UNION operator with union compatibility
2. Show the use of intersect operator with union compatibility
3. Show the use of minus operator with union compatibility
4. Find the cartesian product of two tables.

Queries on Set Theory Operators

1. List all parts except 'NUT' and 'BOLT' in ascending order of costs
2. display all parts that have not been supplied so far
3. To display the supplier names who have supplied 'green' part with cost 500 Rupees AND 'red' part with cost 400 Rupees.
4. To display the supplier names who have supplied 'green' part with cost 500 Rupees OR 'red' part with cost 400 Rupees.
5. To Display the name of suppliers who have supplied all parts that are 'red' in color.

PL/SQL Programs

1. Write a PL/SQL Code to add two numbers
2. Write a PL/SQL code for Fibonacci series
3. Write a PL/SQL Code for greatest of 3 numbers
4. Write a PL/SQL code for area and circumference of a circle.

PL/SQL Programs on Cursors

1. Write a Program using CURSOR to display SID and city of 1st record of supplier
2. Write a program using cursors to display the SID and City of all suppliers and then print the count of suppliers.

PL/SQL Programs on Triggers, Procedures and Functions

1. Write a Program using TRIGGER on UPDATE.
2. Write a command to See the effect of trigger
3. Write a Program using PROCEDURE to increase the cost by Rs.1000 for part whose PID is passed as an argument.
4. Write a procedure to update the city of an supplier whose SID and city are passed as arguments and the procedure returns the name of supplier whose city is updated.
5. Write a function to return the total number of suppliers
6. Write a function to return the PID of part, for which the part name is passed
7. Write a function to find the sum total of costs of all parts.

BCA III YEAR I SEMESTER

Code	Paper Title / Subject	Workload Per Week	M A R K S			Credits
			External	Internal	Total	
BCA51	Python Programming	T (4)	70	30	100	4
BCA52	Web Development using PHP	T (4)	70	30	100	4
BCA53	Cryptography and Network Security	T (4)	70	30	100	4
BCA54	E-Commerce	T (4)	70	30	100	4
BCA55	Digital Image Processing	T (4)	70	30	100	4
BCA56	Python Programming laboratory	L (4)	50	0	50	2
BCA57	Web Development using PHP laboratory	L (4)	50	0	50	2
Grand Total (Marks and Credits)					600	24

BCA51	PYTHON PROGRAMMING	PPW : 04
PYPRO		Internal : 30 External : 70

UNIT-I: Introduction: History and Application areas of Python; Structure of Python Program; Identifiers and Keywords; Operators and Precedence; Basic Data Types and type conversion; Statements and expressions; Input/Output statements. **Strings:** Creating and Storing Strings, Built-in functions for strings; string operators, String slicing and joining; Formatting Strings. Control Flow Statements: **Conditional Flow statements;** Loop Control Statements; Nested control Flow; continue and break statements, continue, Pass and exit.

UNIT-II: Functions: Built-In Functions, Function Definition and call; Scope and Lifetime of Variables, Default Parameters, Command Line Arguments; Lambda Functions; Assert statement; Importing User defined module, **Mutable and Immutable objects:** Lists, Tuples and Dictionaries; Commonly used Functions on Lists, Tuples and Dictionaries. Passing Lists, tuples and Dictionaries as arguments to functions. Using Math and Numpy module for list of integers and arrays.

UNIT-III: Modules and Packages: Built-in modules, creating modules, import statement, locating modules, namespaces and scope, packages in python, date and time modules. **Object Oriented Programming:** class definition, creating objects, Built-in-Attribute methods, Built-in class attributes, destructors, encapsulation, data hiding, inheritance, method overriding, polymorphism.

UNIT-IV: Files: Types of Files; Creating, Reading and writing on Text and Binary Files; The Pickle Module, Reading and Writing CSV Files. Reading and writing of csv and JSON files. **Exception Handling:** Try-except-else-finally block, raise statement, hierarchy of exceptions, adding exceptions. **Data visualization:** Plotting various 2D and 3D graphics; Histogram; Pi charts; Sine and cosine curves.

Text Books:

- 1.Venkatesh, Nagaraju Y, Introduction to Python Programming, Khanna Publishing House, 2021.
- 2.Jeeva Jose, Introduction to Computing & Problem Solving With PYTHON, Khanna Publishing House, 2023.
- 3.Sheetal Taneja & Naveen kumar: Python Programming a Modular approach – A Modular approach with Graphics, Database, Mobile and Web applications, Pearson, 2017.

Reference Books:

1. Think Python, by Allen Downey, 2 nd edition, 2015, O'Reilly.
https://drive.google.com/file/d/1p9Pul6d5UvnQrO9-Q-E2_p4YvMk5cIg/view
2. An introduction to Python for absolute beginners, by Bob Dowling, Cambridge Univ.
3. Introduction to Computation and Programming using Python, by John Guttag, 2 nd edition, 2016, PHI India.

Web Resources:

1. <https://www.learnpython.org/>
2. <https://www.w3schools.com/python/default.asp>

BCA52	WEB DEVELOPMENT USING PHP	PPW : 04
WDPHP		Internal : 30 External : 70

UNIT-I: Introduction to PHP, History of PHP, Versions of PHP, Features of PHP, Advantages of PHP over Other Scripting Languages, software requirements, Installation and Configuration of PHP, Installing and Configuring Apache to use PHP on Windows, Basic HTML, Embedding PHP in HTML, PHP Basic syntax, data types, comments, variables and constants, scope of variables, **PHP arrays**: creating array and accessing array elements, PHP String, PHP operators, precedence of operators, expressions, creating a PHP Script, running a PHP script.

UNIT-II: PHP conditional statements, switch case, PHP looping statements, while, for and do while loop, break, continue, exit, **PHP functions**: built-in and user defined function, declaration and calling of a function, function argument with call by value, call by reference, string manipulation, mathematical, date and time functions.

UNIT-III: Introduction to a web form: processing a web form, capturing form data, passing information between pages, PHP \$_GET, PHP \$_POST, with multi value fields, validating a web form, input validation, introduction to cookies and session handling. **Working with database**: PHP supported databases, using **PHP & MySQL**: Installation and configuration of MySQL on windows, checking configuration, connecting to database, selecting a database, adding table and altering table in a database, inserting, deleting and modifying data in a table, retrieving data, performing queries, processing result sets.

UNIT-IV: Code re-use, require(), include(), and the include path, PHP file permissions, **working with files**: opening, closing, reading, writing a file, file system functions and file input and output, working with directory: creating, deleting, changing a directory, file uploads, introduction to object oriented programming with PHP.

Reference Books:

1. Steven Holzner, The Complete Reference PHP, TM
2. Steve Suehring, Tim Converse and Joyce Park, Wiley-India Pvt Ltd
3. Matt Doyle, Beginning PHP, Wiley-India Pvt Ltd
4. Joel Murach and Ray Harris, Murach's PHP & MySQL, SPD Pvt Ltd.

BCA53	CRYPTOGRAPHY AND NETWORK SECURITY	PPW : 04
CNS		Internal : 30 External : 70

UNIT-I: Introduction: Security Trends, Security Attacks, Security Services, Security Mechanisms, Model for Network Security, **Symmetric Ciphers:** Classical Encryption Techniques, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography.

UNIT-II: Data Encryption Standard: Block Cipher Principles, The Data Encryption Standard, The Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles. **Advanced Encryption Standard:** Evaluation Criteria For AES, The AES Cipher.

UNIT-III: Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems, the RSA Algorithm, **Public-Key Cryptosystems:** Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

UNIT-IV: Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and Macs. **Digital Signatures and Authentication Protocols:** Digital Signatures, Kerberos, X.509 Authentication Service, Public-Key Infrastructure.

Text Book:

1. W. Stallings, Cryptography and Network Security Principles and Practices, 4th Ed., Prentice-Hall of India, 2006.

Book Recommended:

1. C. Pfleeger and S.L. Pfleeger, Security in Computing, 3rd Ed., Prentice-Hall of India, 2007.
2. M.Y. Rhee, Network Security, John Wiley and Sons, NY, 2002.

BCA54	E-COMMERCE	PPW : 04
ECOM		Internal : 30 External : 70

UNIT-I: Introduction to E-Commerce: Definition and scope of E-Commerce and M-Commerce, E-Commerce trade cycle, Electronic Markets, Internet Commerce, Benefits and Impacts of E-Commerce. **Elements of E-Commerce:** Various elements, e-visibility, e-shops, Delivery of goods and services, Online payments, After- sales services, Internet E-Commerce security.

UNIT-II: EDI and Electronic Payment Systems: Introduction and definition of EDI, EDI layered Architecture, EDI technology and standards, EDI communications and transactions, Benefits and applications of EDI with example, **Electronic Payment Systems:** credit/debit/smart cards, e-credit accounts, e-money.

UNIT-III: Introduction to EC models: Inter-organization and intra-organization E-Commerce E-Commerce Models: B2B, B2C, C2B, C2C, G2C, C2G. **E-Business:** Introduction to Internet bookshops, Grocery Suppliers, Software Supplies and support, Electronic newspapers, Virtual auctions, Online share dealing, e-diversity.

UNIT-IV: E-Security and Legal Issues: Security concerns in E-Commerce, Privacy, integrity, authenticity, non-repudiation, confidentiality, SSL, Digital Signatures and fire walls, IT Act 2000, Cyber-crimes and cyber laws Mobile Commerce and Future of E-Commerce: Introduction to Mobile Commerce, Benefits of Mobile Commerce, Impediments of M-Commerce, M-Commerce framework, Emerging and future trends.

Text Books:

1. G.S.V.Murthy, E-Commerce Concepts, Models, Strategies, Himalaya Publishing House.
2. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, "E-Commerce Fundamentals and Applications", Wiley Student Edition.

Reference Books:

1. Gray P. Schneider, Electronic commerce, International Student Edition.

BCA55	DIGITAL IMAGE PROCESSING	PPW : 04
DIP		Internal : 30 External : 70

UNIT-I: FUNDAMENTALS OF IMAGE PROCESSING: Fundamental steps in digital image processing, Components of image processing system, A simple image formation model, Image sampling and quantization, Basic relationships between pixels, Introduction to Fourier Transform and DFT – properties of 2D Fourier Transform, FFT.

UNIT-II: IMAGE ENHANCEMENT IN THE SPATIAL AND FREQUENCY DOMAINS: Basic gray – level transformations, Histogram processing, Basics of spatial filtering, smoothing spatial filters, sharpening spatial filters, the basics of filtering in the frequency domain, Image smoothing in frequency domain filters, Image sharpening in frequency domain filters.

UNIT-III: IMAGE SEGMENTATION: Fundamentals, Point, Line and edge detection, Thresholding, Region-based segmentation, Segmentation using morphological watersheds, The use of motion in segmentation. **IMAGE RESTORATION:** A model of image degradation/restoration, Noise models, inverse filtering, wiener filtering, Constrained Least Squares Filtering, Geometric Mean Filter. **IMAGE COMPRESSION:** Fundamentals, Huffman coding, Arithmetic coding, Golomb coding, LZW coding, Run-length coding.

UNIT-IV: MORPHOLOGICAL IMAGE PROCESSING: Erosion, Dilation, Opening, Closing, The hit-or-miss transformation; Basic morphological algorithms - boundary extraction, hole filling, extraction of connected components, thinning, thickening, skeletons, pruning. **FEATURE EXTRACTION:** Background, Boundary preprocessing, Boundary Feature Descriptors, Region Feature Descriptors, Whole-image features.

TEXT BOOKS:

1. Rafeal C Gonzalez and Richard E.Woods, –Digital Image Processing, 4th edition, Pearson Education/ PHI, 2018.

REFERENCE BOOKS:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle, –Image Processing, Analysis and Machine Vision, 4th edition, Cengage, 2015.
2. Alasdair McAndrew, –Introduction to Digital Image Processing with Matlab, Thomson Course Technology, 2004 Course Technology Press, Boston, MA, United States, 2004.
3. William K. Prat, –Digital Image Processing, 4th edition, Wiley-Interscience, A John Wiley & Sons, Inc., Publication, 2007

BCA56	PYTHON PROGRAMMING LABORATORY	PPW : 04
PYPROLAB		External : 50

- Write a program to find whether a number is a prime number.
- Write a program to print m raise to power n, where m and n are read from the user.
- Write a program having a parameterized function that returns True or False depending on whether the parameter passed is even or odd.
- Write a program to print the summation of the following series up to n-terms:
1-2+3-4+5-6+7 - - - - -n
- Write a menu driven program to perform the following operations on strings using string built in functions.
 - Find the frequency of a character in a string.
 - Replace a character by another character in a string.
 - Remove the first occurrence of a character from a string.
 - Remove all occurrences of a character from a string.
- Write a program that accepts two strings and returns the indices of all the occurrences of the second string in the first string as a list. If the second string is not present in the first string, then it should return -1
- Using Numpy module write menu driven program to do following
 - Create an array filled with 1's.
 - Find maximum and minimum values from an array
 - Dot product of 2 arrays.
 - Reshape a 1-D array to 2-D array.
- Write a function that takes a sentence as input from the user and calculates the frequency of each letter. Use a variable of dictionary type to maintain the count.
- Consider a tuple t1=(1,2,5,7,9,2,4,6,8,10). Write a program to perform following operations:
 - Print contents of t1 in 2 separate lines such that half values come on one line and other half in the next line.
 - Print all even values of t1 as another tuple t2.
 - Concatenate a tuple t2=(11,13,15) with t1.
 - Return maximum and minimum value from t1..
- Write a function that reads a file file1 and copies only alternative lines to another file file2. Alternative lines copied should be the odd numbered lines.
- Write a Python program to handle a ZeroDivisionError exception when dividing a number by zero.
- Write a program that reads a list of integers from the user and throws an exception if any numbers are duplicates.
- Write a program that makes use of a function to display sine, cosine, polynomial and exponential curves.
- Take as input in the months and profits made by a company ABC over a year. Represent this data using a line plot. Generated line plot must include X axis label name = Month Number and Y axis label name = Total profit.

BCA57	WEB DEVELOPMENT USING PHP LABORATORY	PPW : 04
WDPHPLAB		External : 50

NOTE:

1. All the concepts of syllabus and exercises from Text Book must be translated into programs which must be practiced, executed and write down in the practical record book.
2. In the external lab examination, the student must compile and execute at least two programs.
3. External Viva-voce is compulsory.

1. Write a PHP program to print 'Your Address' with neat format.
2. Write a PHP program to get the PHP Environment details.
3. Write a PHP program to print the Current System Date & Time.
4. Write a PHP program to demonstrate All Conditional Statements.
5. Write a PHP program to demonstrate All Control Statements.
6. Write a PHP program demonstrate any each three in Array, Cal, Math and String functions.
7. Write a PHP program 'Your Academic Rank' as Associative Array implements it.
8. Write a PHP program to create a File (test.txt); get the contents of File with its Size.
9. Write a PHP program on (test.txt) File demonstrate COPY, REN, DEL operations.
10. Write a PHP program to demonstrate fgets () and fgetc () operations.
11. Write a PHP program to implement \$_GET() and \$_POST() with Form Support.
12. Write a PHP program to Insert Records into FACULTY (fno, fname, qual, design, exp, dept) table in MySQL with Form Support appropriate controls/form tags.
13. Write a PHP program to print the Faculty details with Tabular Format using **Open DataBase Connectivity** with MS-Access database faculty table.
14. Write a PHP program to perform UPDATE & DELETE operations on FACULTY table in MySQL with appropriate Form Support.
15. Write a PHP program to demonstrate Transaction Maintenance (Web/Hit Count) of particular web site / page.

BCA III YEAR II SEMESTER

Code	Paper Title / Subject		Workload Per Week	M A R K S			Credit s
				Exte rnal	Internal	Total	
BCA61	Elective A1/B1/C1		T (4)	70	30	100	4
	A1	Machine Learning					
	B1	Neural Network					
	C1	Natural Language Processing					
BCA62	Elective A2/B2/C2		T (4)	70	30	100	4
	A2	Big Data Analytics					
	B2	Distributed Systems					
	C2	NoSQL Data Bases					
BCA63	Major Project (including Seminars)			300	100	400	16
Grand Total (Marks and Credits)						600	24

BCA61	A1. MACHINE LEARNING	PPW : 04
ML		Internal : 30 External : 70

UNIT-I: Introduction to Machine Learning: what is machine learning, how machine learning works, applications of machine Learning, types of Machine Learning, challenges in machine Learning. **Regression:** introduction, types of regression, Linear Regression, Multiple linear regression, non-linear regression, logistic Regression.

UNIT-II: Decision Tree Learning: Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT-III: Bayesian learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting Probabilities, minimum description length principle. Bayes optimal classifier, Gibbs algorithm, Naïve Bayes classifier, Bayesian belief networks, the EM algorithm.

UNIT-IV: Artificial Neural Networks: Introduction, neural network representation, appropriate problems for Neural network learning, perceptions, multilayer networks and the back-propagation algorithm. **Instance-Based Learning:** Introduction, k-nearest neighbour algorithm, locally weighted regression, Radial basis functions, case-based reasoning, remarks on lazy and eager learning.

Text Books:

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997
2. Jeeva Jose (2023), Introduction to Machine Learning, Khanna Publishing House

BCA61	B1. NEURAL NETWORK	PPW : 04
NN		Internal : 30 External : 70

UNIT-I: The Neural Network – Limits of Traditional Computing – Machine Learning – Neuron–FF Neural, Networks–Types of Neurons –Soft max output layers. Tensor flow–Variables–Operations–Placeholders– Sessions–Sharing Variables – Graphs–Visualization.

UNIT-II: Convolution Neural Network – Feature Selection–Max Pooling- Full Architectural Description of Convolution Networks–Filters and Feature Maps– Convolution Layer–Applications.

UNIT-III: Embedding and Representation Learning- Learning Lower-Dimensional Representations, Principal Component Analysis, Implementing an Autoencoder in TensorFlow. Recurrent Neural Network –Memory cells–sequence analysis–LSTM— TensorFlow Primitives for RNN Model

UNIT-IV: Memory augmented Neural Networks–NTM- DNC—Application Reinforcement Learning –MDP–Q Learning– Applications.

Text Books:

1. Nikhil Buduma, Nicholas Locascio, –Fundamentals of Deep Learning: Designing Next

Generation Machine Intelligence Algorithms|| O'Reilly Media, 2017.

Reference Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning (Adaptive computation and Machine Learnings eries ||, MITPress,2017.

2. Goodfellow, Ian, Deep Learning, MIT Press, 2016.

3. Gibson, Adam, and Patterson, Josh,Deep dearning: A Practitioner's Approach, O'Reilly, 2017.

4. Charniak, Eugene, Introduction to Deep Learning, MIT Press, 2019.

5. Locascio, Nicholas, and Buduma, Nikhil, Fundamentals of Deep Learning:

6. Designing Next-Generation Machine Intelligence Algorithms, O'Reilly Media, 2017

BCA61	C1. NATURAL LANGUAGE PROCESSING	PPW : 04
NLP		Internal : 30 External : 70

UNIT-I: Introduction of Elementary Probability Theory, Essential Information Theory. Linguistic Essentials

UNIT-II: Statistical Inference: Bins: Forming Equivalence Classes, Reliability vs. Discrimination, ngram models, Building n-gram models. **Word Sense Disambiguation:** Methodological Preliminaries, Supervised and unsupervised learning, Pseudo words, Upper and lower bounds on performance, Supervised Disambiguation, Bayesian classification.

UNIT-III: Evaluation Measures, Markov Models: Hidden Markov Models, Use, General form of an HMM Part-of-Speech Tagging.

UNIT-IV: Probabilistic Context Free Grammars: Introduction of Clustering, **Information Retrieval:** Background, The Vector Space Model.

Text Books:

1. Christopher D. Manning, Hinrich Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.
2. James Allan, Natural Language Understanding, Pearson Education, 1994.
3. Tanveer Siddiqui, US Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

BCA62	A2. BIG DATA ANALYTICS	PPW : 04
BDA		Internal : 30 External : 70

UNIT-I: Getting an overview of Big Data: Introduction to Big Data, Structuring Big Data, Types of Data, Elements of Big Data, Big Data Analytics, and Advantages of Big Data Analytics. **Introducing Technologies for Handling Big Data:** Distributed and Parallel Computing for Big Data, Cloud Computing and Big Data, Features of Cloud Computing, Cloud Deployment Models, Cloud Services for Big Data, Cloud Providers in Big Data Market.

UNIT-II: Understanding Hadoop Ecosystem: Introducing Hadoop, HDFS and MapReduce, Hadoop functions, Hadoop Ecosystem. Hadoop Distributed File System- HDFS Architecture, Concept of Blocks in HDFS Architecture, Namenodes and Datanodes, Features of HDFS. MapReduce. Introducing HBase- HBase Architecture, Regions, Storing Big Data with HBase, Combining HBase and HDFS, Features of HBase, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie.

UNIT-III: Understanding MapReduce Fundamentals and HBase: The MapReduceFramework, Exploring the features of MapReduce, Working of MapReduce, Techniques to optimize MapReduce Jobs, Hardware/Network Topology, Synchronization, File system, Uses of MapReduce, Role of HBase in Big Data Processing- Characteristics of HBase. **Understanding Big Data Technology Foundations:** Exploring the Big Data Stack, Data Sources Layer, Ingestion Layer, Storage Layer, Physical Infrastructure Layer, Platform Management Layer, Security Layer, Monitoring Layer, Visualization Layer.

UNIT-IV: Storing Data in Databases and Data Warehouses: RDBMS and Big Data, Issues with Relational Model, Non – Relational Database, Issues with Non Relational Database, Polyglot Persistence, Integrating Big Data with Traditional Data Warehouse, Big Data Analysis and Data Warehouse. NoSQL Data anagement: Introduction to NoSQL, Characteristics of NoSQL, History of NoSQL, Types of NoSQL, Data Models- Key Value Data Model, Column Oriented Data Model, Document Data Model, Graph Databases, Schema-Less Databases, Materialized Views, CAP Theorem.

Text Book:

1. BIG DATA, Black Book TM, DreamTech Press, 2016 Edition.

Reference Books:

1. Seema Acharya, SubhasniChellappan , “BIG DATA and ANALYTICS”, Wiley Publications, 2016.
2. Nathan Marz and James Warren, “BIG DATA- Principles and Best Practices of Scalable RealTime Systems”, 2015.

BCA62	B2. DISTRIBUTED SYSTEMS	PPW : 04
DS		Internal : 30 External : 70

UNIT-I: Characterization of Distributed Systems-Introduction, Examples of Distributed systems, Resource sharing and web, challenges, System models - Introduction, Architectural and Fundamental models, Networking and Internetworking, Inter - process Communication, Distributed objects and Remote Invocation - Introduction, Communication between distributed objects, RPC, Events and notifications, Case study - Java RMI.

UNIT-II: Operating System Support - Introduction, OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture, Distributed File Systems - Introduction, File Service architecture.

UNIT-III: Peer to Peer Systems - Introduction, Napster and its legacy, Peer to Peer middleware, Routing overlays, Overlay case studies-Pastry, Tapestry, Application case studies - Squirrel, OceanStore. Time and Global States - Introduction, Clocks, events and Process states, Synchronizing physical clocks, logical time and logical clocks, global states, distributed debugging.

UNIT-IV: Distributed Transactions- Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. **Replication**- Introduction, System model and group communication, Fault tolerant services, Transactions with replicated data. Distributed shared memory, Design and Implementation issues, and Consistency models.

Text Books:

1. Distributed Systems Concepts and Design, G Coulouris, J Dollimore and T Kindberg, 4th Edition, Pearson Education.
2. Distributed Systems, S.Ghosh, Chapman & Hall/ CRC, Taylor & Francis Group, 2010.

Reference Books:

1. Distributed Systems - Principles and Paradigms, A.S. Tannenbaum and M.V. Steen, Pearson Education.
2. Distributed Computing, Principles, Algorithms and Systems, Ajay D. Kshemakalyani and Mukesh Singhal, Cambridge, rp 2010.

BCA62	C3. NoSQL DATABASES	PPW : 04
NOSQLDB		Internal : 30 External : 70

UNIT-I: Why NoSQL: The Value of Relational Databases, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL. **Aggregate Data Models:** Aggregates, Column-Family Stores, Summarizing Aggregate Oriented Databases. **More Details on Data Models:** Relationships, Graph Databases, Schemaless Databases, Materialized Views, Modeling for Data Access.

UNIT-II: Distribution Models: Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. **Consistency:** Update Consistency, Read Consistency, Relaxing Consistency, Relaxing Durability, Quorums. **Version Stamps:** Business and System Transactions, Version Stamps on Multiple Nodes. **Map-Reduce:** Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations

UNIT-III: Key-Value Databases: What Is a Key-Value Store, Key-Value Store Features, Suitable Use Cases, When Not to Use. **Document Databases:** What Is a Document Database, Features, Suitable Use Cases, When Not to Use.

UNIT-IV: Column-Family Stores: What Is a Column-Family Data Store, Features, Suitable Use Cases, When Not to Use. **Graph Databases:** What Is a Graph database, Features, Suitable Use Cases, When Not to Use .

Reference:

1. Pramod J. Sadalage, Martin Fowler. NoSQL Distilled, Addison Wesley 2013

Suggested Reading:

1. Luc Perkins, Eric Redmond, Jim R. Wilson. Seven Databases in Seven Weeks. The Pragmatic Bookshelf, 2018

2. Guy Harrison. Next Generation Databases: NoSQL, NewSQL, and Big Data. Apress, 2015.

BCA63	Major Project (including Seminars)	Internal : 100
MP		External : 300

PROJECT GUIDE LINES

1. Maximum 2 students shall be allowed to take up a project.
2. Guiding one project shall be considered as 4 hours of practical per week as the work load for the concerned internal guide.
3. Each student shall submit his/her project synopsis to the concerned guide within 15days in consultation with internal guide from the commencement of the respective semester.
4. Each student has to carry out 2 project seminars compulsorily in project duration.
5. Each seminar will be considered for their internal assessment (IA).

Scheme of valuation - 400 Marks

Internal Evaluation – 100 Marks

- Synopsis - 20 Marks
- Seminar 1 - 40 Marks
- Seminar 2 - 40 Marks

External Evaluation (Dissertation) – 300 Marks

- Documentation - 150 Marks
- Presentation / Demonstration - 100 Marks
- Viva- 50 Marks.

FACULTY OF SCIENCES
Bachelor of Computer Application (BCA)
CBCS Pattern in Semester System (with effect from 2025-26)

SCHEME OF QUESTION PAPER

BCA (Faculty of Sciences)
I/II/III/IV/V/VI Semesters
I -Internal Assessment Examination
Code: Name of the Paper
(Under CBCS Scheme)

Time: 90 Min

Marks: 30

Answer ALL questions

- | | |
|----------------|------------------|
| 1. From Unit-I | 6. From Unit-II |
| 2. From Unit-I | 7. From Unit-II |
| 3. From Unit-I | 8. From Unit-II |
| 4. From Unit-I | 9. From Unit-II |
| 5. From Unit-I | 10. From Unit-II |

BCA (Faculty of Sciences)
I/II/III/IV/V/VI Semesters
II -Internal Assessment Examination
Code: Name of the Paper
(Under CBCS Scheme)

Time: 90 Min

Marks: 30

Answer ALL questions

- | | |
|------------------|------------------|
| 1. From Unit-III | 6. From Unit-IV |
| 2. From Unit-III | 7. From Unit-IV |
| 3. From Unit-III | 8. From Unit-IV |
| 4. From Unit-III | 9. From Unit-IV |
| 5. From Unit-III | 10. From Unit-IV |

Note: The internal marks will be calculated on the average of two internal tests

FACULTY OF SCIENCES
Bachelor of Computer Application (BCA)
CBCS Pattern in Semester System (with effect from 2025-2026)

SCHEME OF QUESTION PAPER

BCA (Faculty of Sciences)
I/II/III/IV/V/VI Semesters
KAKATIYA UNIVERSITY, WARANGAL
Code: Name of the Paper
(Under CBCS Scheme)

Time: 3 hrs
Marks: 70

Total

Section - A

1. Answer any six from the following
(5 = 30)

(6 X

- a. from unit I
- b. from unit I
- c. from unit II
- d. from unit II
- e. from unit III
- f. from unit III
- g. from unit IV
- h. from unit IV

Section - B

Answer all questions
(X 10 = 40)

(4

- 2. (a) (OR) (b) from UNIT -I
- 3. (a) (OR) (b) from UNIT -II
- 4. (a) (OR) (b) from UNIT -III
- 5. (a) (OR) (b) from UNIT -IV