PRESTIGE
INSTITUTE OF MANAGEMENT & RESEARCH, GWALIOR
MBA PROGRAMME ACCREDITED BY NBA
UGC NAAC ACCREDITED 'A' GRADE AUTONOMOUS INSTITUTE

PROGRAM/ COURSE STRUCTURE AND SYLLABUS

as per the Choice Based Credit System (CBCS)
designed in accordance with
Learning Outcomes-Based Curriculum Framework
(LOCF)
of National Education Policy (NEP) 2020

for

BACHELOR OF COMPUTER APPLICATIONS (BCA)

w.e.f.

Academic Year 2022-26 and onwards

Prestige Institute of Management and Research Gwalior
BCA – Session 2022-26

PROGRAM STRUCTURE

Semester	Course Code	Course Category	Course Title	Teaching Hrs./ Week			Ins. Hrs. / Week	Credit	Examination Scheme (Max. Marks)		
				Lecture	Tutorial	Practical			Term End Examination	Internal Assessment	Total
I	BCA-101	Major	Programming in C	3	1	-	4	4	60	40	100
	BCA-102	Minor	Computer Organization & Architecture	3	1	-	4	4	60	40	100
	BCA-103	GEC	Mathematics-I (Discrete Mathematics)	3	1	-	4	4	60	40	100
	BCA-104	AEC	Communicative English Grammar	3	1	-	4	4	60	40	100
	BCA-105	Major	Programming in C Lab	-	-	4	4	2	30	20	50
	BCA-106	Minor	IT Lab	-	-	4	4	2	30	20	50
			Total				**24**	**20**			**500**
II	BCA-201	Major	Data Structure	3	1	-	4	4	60	40	100
	BCA-202	Minor	DBMS	3	1	-	4	4	60	40	100
	BCA-203	GEC	Mathematics-II (Calculus)	3	1	-	4	4	60	40	100
	BCA-204	AEC	Communication Techniques	3	1	-	4	4	60	40	100
	BCA-205	Major	Data Structure Lab	-	-	4	4	2	30	20	50
	BCA-206	Minor	DBMS Lab	-	-	4	4	2	30	20	50
			Total				**24**	**20**			**500**
III	BCA-301	Major	Introduction to Operating System	3	1	-	4	4	60	40	100
	BCA-302	Minor	Object Oriented Programming in C++	3	1	-	4	4	60	40	100
	BCA-303	GEC	Mathematics-III (Numerical Methods)	3	1	-	4	4	60	40	100
	BCA-304	SEC	Web Technologies	3	1	-	4	4	60	40	100
	BCA-305	Major	Project I on Web Technologies	-	-	4	4	2	30	20	50
	BCA-306	Minor	C++ Lab	-	-	4	4	2	30	20	50
			Total				**24**	**20**			**500**
IV	BCA-401	Major	Programming in Java	3	1	-	4	4	60	40	100
	BCA-402	Minor	Design and analysis of algorithms	3	1	-	4	4	60	40	100
	BCA-403	GEC	Mathematics-IV (Statistical Methods)	3	1	-	4	4	60	40	100
	BCA-404	SEC	Python Programming	3	1	-	4	4	60	40	100
	BCA-405	Major	Programming in Java Lab	-	-	4	4	2	30	20	50

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	BCA-406	Minor	Design and analysis of algorithms Lab	-	-	4	4	2	30	20	50
			Total				**24**	**20**			**500**

Semester	Course Code	Course Category	Course Title	Teaching Hrs./ Week			Ins. Hrs. / Week	Credit	Examination Scheme (Max. Marks)		
				Lecture	Tutorial	Practical			Term End Examination	Internal Assessment	Total
V	BCA-501	Major1	Programming in Advance Java	3	-	-	3	3	45	30	75
	BCA-502	Major 2	Software Engineering	3	-	-	3	3	45	30	75
	BCA-503	DSE1	Artificial Intelligence	3	1	-	4	4	60	40	100
	BCA-504	SEC	Oracle	3	1	-	4	4	60	40	100
	BCA-505	Intern	Internship/Field Project	-	-	-	6	6	75	75	150
			Total				**20**	**20**			**500**
VI	BCA-601	Major1	Computer Networks	3	-	-	3	3	45	30	75
	BCA-602	Major 2	Computer Graphics and Multimedia	3	-	-	3	3	45	30	75
	BCA-603	DSE2	Software Testing	3	1	-	4	4	60	40	100
	BCA-604	DSE 3	Machine learning	3	1	-	4	4	60	40	100
	BCA-605	Project	Major Project	-	-	-	6	6	75	75	150
VII			**Total**				**20**	**20**			**500**
	BCA-701	Major	Data Mining	3	1	-	4	4	60	40	100
	BCA-702	Minor	Research Methodology	3	1	-	4	4	60	40	100
	BCA-703	DSE4	Data science using Python	3	1	-	4	4	60	40	100
	BCA-704	Major	Data Mining Tutorial	-	-	4	4	2	30	20	50
	BCA-705	Project	Research project I	-	-	-	6	6	75	75	150
			Total				**20**	**20**			**500**
VIII	BCA-801	Major	Mobile Application Development	3	1	-	4	4	60	40	100
	BCA-802	Minor	Cloud Computing	3	1	-	4	4	60	40	100
	BCA-803	Major	Mobile Application Development Tutorial	-	-	4	4	2	30	20	50
	BCA-804	Project	Research project II	-	-	-	10	10	125	125	250
			Total				**22**	**20**			**500**

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PROGRAM OUTCOMES of BCA

PO1	Acquire Knowledge of mathematical foundations, computer application theory and algorithm principles in the design and modelling of computer based system.
PO2	Understand to design, analyze and develop solutions and evaluate system components/processes to meet specific need for various domains.
PO3	Create, select, adapt and apply appropriate technologies and tools to a wide range of computational activities while understanding their limitations
PO4	Communicate effectively by being able to comprehend effective documentation and presentations.
PO5	Ability to engage in independent learning for continuous self- development as a computer application professional.

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BCA – 101 Programming in C

Course Objectives: The course is designed to initiate the students into the discipline of Programming. It aims to start off the development of problem solving ability using computer programming.

Course Outcomes: At the end of the course, students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Understand the problem-solving constructs and techniques through flowcharts	2	1	1	-	3
CO1b: Understand various tokens and predefined functions of C language	2	2	2	-	3
CO2: Understand & apply control statements and arrays to solve problems	2	2	2	-	3
CO3: Create modular program using functions and utilize various storage class	2	2	2	-	3
CO4: Understand & apply pre-processor directives, structures, and union in solving problems	2	2	2	-	3

Course Contents:

Unit-I

Programming fundamentals: program concept, algorithms, flow charts - symbols, rules for making flow chart, types of flowchart, advantage & disadvantage, techniques of problem solving: programming techniques – top down, bottom up, modular, structured - features, merits & demerits, programming logic- simple, branching, looping. Testing & debugging & their tools.

Unit-II

Programming in c including features of 'c', c tokens, variables, identifiers, keywords, data types, constants, operator and expression, operators: arithmetic, logical, relational, conditional and bit wise operators, precedence and associativity of operators, type conversion in expression, basic input/output and library functions single character input/output i.e. getch(), getchar(). Getche(), putchar(),formatted input output i.e. printf() and scanf().

Unit-III

Branching constructs: If statement, if.....else statement, nesting of if....else statement, else if ladder, the ?: operator, switch statement, compound statement, loop controls: for, while, do-while loops, break, continue, goto statement, arrays : what is array, declaring initializing 1d, 2d and 3d array. String: declaration, string functions – strcat, strcpy, strcmp, strlen, strstr.

Unit-IV

Functions: Categories of functions user defined and library function, recursion, function arguments, return values and nesting of function, calling of functions, scope and life of variables - local and global variable, storage classes - auto, extern, static, pointers: operations on pointers, operators for pointers, pointers and function, array of pointers, pointer and strings.

Unit-V

Preprocessor directives: #define, defining functions like macros, include, conditional compilation directives. Structures: the concept of structure, initializing a structure, the structure

tag, dot operator, array of structure, structure and pointer, arrow operator and nesting of structure. Unions: initialization and use of it in a program. Command line arguments

Suggested Text Books:

1. Kanitkar Y. *Let us C.* BPB Publicatiuon.
2. *C Programming*. Schaum's series.
3. Balgurusuamy. *Programming in ANSI C*. Tata McGraw Hill

BCA – 105 Programming in C Lab

Course Objectives:

• To make the student learn a programming language.
• To learn problem solving techniques.
• To teach the student to write programs in C and to solve the problems.

Course Outcomes: After Completion of this course the student would be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Read, understand and trace the execution of programs written in C language.	1	3	1	-	3
CO1b: Write the C program for a given algorithm using control statements with input and output.	1	3	2	-	3
CO2: Write the modular program for given problem	1	3	2	-	3
CO3: Write the program to solve problem using array, structure, and pointers	1	3	2	-	3
CO4: Implement the solutions of real-world problems	1	3	2	-	3

Programming Exercises:

1. WAP to print the sum and product of digits of an integer.
2. WAP to reverse a number.
3. WAP to compute the sum of the first n terms of the following series S = 1/2+1/3+1/4+……
4. WAP to compute the sum of the first n terms of the following series S =1-2+3-4+5…….
5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.
6. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.
7. WAP to compute the factors of a given number.
8. Write a macro that swaps two numbers. WAP to use it.
9. WAP to print a triangle of stars as follows (take number of lines from user):

```
*
***
*****
*******
*********
```

10. WAP to perform following actions on an array entered by the user:

i) Print the even-valued elements ii) Print the odd-valued elements iii) Calculate and print the sum and average of the elements of array iv) Print the maximum and minimum element of array v) Remove the duplicates from the array vi) Print the array in reverse order The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.

11. WAP that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.
12. Write a program that swaps two numbers using pointers.
13. Write a program in which a function is passed address of two variables and then alter its contents.
14. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.
15. Write a program to find sum of n elements entered by the user. To write this program, allocate memory dynamically using malloc()/ calloc() functions .
16. Write a menu driven program to perform following operations on strings:
    a) Show address of each character in string b) Concatenate two strings without using strcat function. c) Concatenate two strings using strcat function. d) Compare two strings e) Calculate length of the string (use pointers) f) Convert all lowercase characters to uppercase g) Convert all uppercase characters to lowercase h) Calculate number of vowels i) Reverse the string
17. Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.
18. WAP to display Fibonacci series (i)using recursion, (ii) using iteration
19. WAP to calculate Factorial of a number (i)using recursion, (ii) using iteration
20. WAP to calculate GCD of two numbers (i) with recursion (ii) without recursion
21. Create Matrix class using templates. Write a menu-driven program to perform following Matrix operations (2-D array implementation): a) Sum b) Difference c) Product d) Transpose.
22. WAP to count frequency of each element of an array.
23. WAP to find encoded array from original array for any parameter.
24. WAP to perform following operation on string without using Library function:
    a) Length of a string
    b) Reverse of a String
    c) Check it is palindrome or not
25. WAP to count sum of each digit of string if string have only digits.
26. WAP to calculate sum of n number using command line argument.
27. WAP to convert lower to upper case or vice-versa of each character of string..
28. WAP to count vowel's in a string.
29. WAP to create a structure of student (ID, Name, Age) perform Insert and display operation.
30. WAP to perform operation on file handling:
    a) Write character into a file.
    b) Read character from a file.
    c) Create Copy a file.

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BCA – 102 Computer Organization and Architecture

Course Objectives: The course focus on structure and function of the computer system. Analyze and understand the Logic Gates, Boolean algebra, Combinational and sequential circuits, instruction set. Addressing modes, Memory hierarchy, I/O systems DMA Technique.

Course Outcomes: At the end of the course, students will be able to

	PO1	PO2	PO3	PO4	PO5
CO 1a- Understand the concepts of logic gates, Different Digital Circuit	2	1	1	-	3
CO 1b- Use of the data representation technique.	2	2	2	-	3
CO2- Understand the concepts of computer organization.	2	2	2	-	3
CO3- Understand central processor organization.	2	2	2	-	3
CO4- Understanding the various types of memories and I/O organization.	2	2	2	-	3

Course Contents:

Unit-I
Digital Logic Circuits: Logic gates Boolean algebra, map simplification, combinational circuits, and sequential circuits.

Unit-II
Data Representation: Representation signed and unsigned integer, fixed-point representation, floating – point representation, other binary codes.

Unit-III
Basic Computer Organization and Design: computer instruction, Instruction codes, timing and control, execution and instruction, input-output and interrupt, priority interrupt, design of computer.

Unit-IV
Central Processor Organization: Processor bus organization, arithmetic logic unit (ALU) instruction formats, addressing modes, data transfer and manipulation, program control, microprocessor organization.

Unit-V
Memory Organization: Auxiliary memory, microcomputer memory hierarchy, associative memory, virtual memory, cache memory. **Input-Output Organization:** Peripheral devices. Asynchronous and synchronous data transfer, direct memory access (DMA), input –output processor (IOP).

Suggested Text Books:

1. Williams S. *Computer Organization and Architecture*. PHI.
2. Mano, M.M. *Computer Organization and Architecture*, PHI.

Reference Book:

1. John P. Hayes, *Computer Architecture and Organization*, Tata McGrawHill.

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BCA-103 Discrete Mathematics

Course Objective: To understand the role of **'Discrete Mathematical Structures' in scientific computing and logic development** through practical exercises aspiring to be successful in the world of Computer Science.

Course Outcomes: Upon successful completion of this course students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Understand the key concept of propositions, set, relation and function and its operations	3	1	2	-	3
CO1b: Construct truth table of any compound proposition and use logically equivalent statements	3	1	2	-	3
CO2: Evaluate Boolean algebra expressions and functions; algebraic representations of the functioning of logic gates	3	1	3	-	3
CO3: Simplify the Boolean expression representing circuits	3	1	3	-	3
CO4: Demonstrate graph, path, cycles, complement of a graph, trees and its types	3	1	2	-	3

Course Contents

UNIT-I

Introduction and Preliminaries: Logical connectives, Truth tables, Tautologies and Contradiction, Logical equivalence, Algebra of propositions. **Set Theory:** Set, Singleton set, Finite and Infinite sets, Subsets, Proper subsets, Equality of sets, Union, Intersection and Difference of sets, Universal set, De Morgan laws, Symmetric difference of sets, Generalized De Morgan laws, Cartesian product of sets.

UNIT-II

Relations: Relation between two sets, Binary relation on a set, Types of binary relations, Equivalence relation, Equivalence class, Partition of a set, Fundamental theorem of equivalence relation, Composition of relations. **Functions:** Function or mapping, One-one, Many-one, into and onto mappings, Identity mapping, Constant mapping, Equality of mappings, Inverse of a mapping, Composition of mappings.

UNIT-III

Boolean algebra: Definition and properties of Boolean algebra, a brief introduction to the application of Boolean algebra to switching theory, conversion of complicated switching circuits to simple one, Disjunctive and Conjunctive normal forms. **Graph Theory:** Introduction to graph theory, Paths and Circuits, Trees, Spanning trees.

UNIT-IV

Matrices: Introduction, Expression of complex numbers in the form of a matrix, De Moivre's theorem, Elementary transformations, Elementary matrices, Equivalent matrices, Properties of equivalent matrices, Sub-matrix of a matrix, Rank and Nullity of a matrix, Row equivalence and canonical form, Normal form of a matrix.

UNIT-V

Solution of Homogeneous and Non-homogeneous system of linear equations, Characteristic roots and Characteristic vectors of a matrix, Caley-Hamilton theorem, to find the inverse of a non-singular matrix using Caley-Hamilton theorem.

Suggested Readings

Main Text Books

1. Tremblay, J. P., & Manohar, R. (1975). *Discrete mathematical structures with applications to computer science*. McGraw-Hill, Inc.
2. Deo, N. (2017). *Graph theory with applications to engineering and computer science*. Courier Dover Publications.

Reference Books

1. Liu, C. L. (1987). *Elements of discrete mathematics*. Tata McGraw-Hill Education.
2. Johnsonbaugh, R. (2005). *Discrete Mathematics*. Pearson Education.
3. Bernard, K., Robert, B., & Sharon, R. (1996). *Discrete mathematical structures*. Prentice Hall of India.

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BCA – 104 Communicative English Grammars

Course Objective: To enable students to learn General English Grammar and its use in daily life.

Course Outcomes: On successful completion of this course students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: To give an overview of basic English Grammar & Communication Skills	-	-	-	3	2
CO1b: To understand tenses	-	-	-	3	2
CO2: To understand English Grammar Terminology	-	-	-	3	2
CO3: To understand synthesis of sentences in English Language	-	-	-	3	2
CO4: To compose short narrative paragraph to describe daily activities	-	-	-	3	2

Course Contents:

Unit-I

Sentence- its kinds, subject and predicate. Parts of Speech- Noun, Pronoun, Adjective, Verb and Adverb, Preposition, Conjunction, Interjection in detail.

Unit-II

The Structure of Sentences- Clauses (subordinate and coordinate) and Phrases, Simple, Complex and Compound Sentences.

Unit-III

Tenses- Present, Past and Future (Indefinite, Continuous, Perfect, Perfect Continuous) Conditional Sentences, Subject Verb Agreement (Concord), Active and Passive Voice, Direct and Indirect Narration.

Unit-IV

Infinitive and the Ing form, Participles and Gerund, Relative Clauses, Articles, Determiners, Punctuation.

Unit-V

Letters and Application, Writing, Newspaper Reports, Paragraph Writing, Precis Writing, Seminar Presentation, Writing a CV/ Resume.

Suggested Text Books:

1. Leech, G. N., Leech, G., & Svartvik, J. (2002). *A communicative grammar of English*. Pearson Education.
2. Thomson, A. J., & Martinet, A. V. (1980). *A practical English grammar*. Oxford University Press.
3. Wood, F. T. (1965). *A remedial English grammar for foreign students*. Macmillan.

Reference Books:

1. Lewis, N. (1991). *Word power made easy*. Simon and Schuster.
2. Swan, M. (2005). *Practical english usage*. Oxford Univ. Press.
3. Allen, W. S. (1954). *Living English structure: a practice book for foreign students and key*. Longmans, Green.

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BCA – 106 IT Labs

Course Objectives: The main objective of this course is to introduce the students about basics of computers and application software such as MS Word, MS Power Point, and MS Excel.

Course Outcomes: On completion of this course, students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1: Understand the basics of computers and develop intuitive understanding of software applications.	1	-	-	1	2
CO2: Use various feature of MS Word for preparing documents (Such as reports, letters, etc.)	-	-	-	1	2
CO3: Use features of MS Power Point for preparing prestation as per the need	-	-	-	1	2
CO4: Use features of MS Excel for performing calculation and analysis on tabular data	-	-	-	1	2

Practical Questions:

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.

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

6. Create the following documents:
(a) A newsletter with a headline and 2 columns in portrait orientation, including at least one image surrounded by text.
(b) Use a newsletter format to promote upcoming projects or events in your classroom or college.

7. Convert following text to a table, using comma as delimiter. Type the following as shown (do not bold).

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

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

Salesperson	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
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:
Then 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.

9. Wrapping of text around the image.
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

MS Excel

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	Bhajan	56	

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

If Marks	Then Grade
>= 80	A+
>= 60 < 80	A
>= 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	10500			
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	**JAN**	**FEB**	**MARCH**	**QUARTER TOTAL**	**QUARTER 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					

Calculate Quarter total and Quarter average.

(a) Calculate Monthly total.
(b) Surplus = Monthly income - Monthly total.
(c) What would be total surplus if monthly income is 1500.

(d) How much does telephone expense for March differ from quarter average.
(e) Create a 3D column graph for telephone and utilities.
(f) 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

Prestige Institute of Management and Research Gwalior
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BCA – 201 Data Structure

Course Objectives: The goal of this subject is to introduce the theory and develop the algorithm of different types of data structure. Understanding the operation of different data structure and implement in C.

Course Outcomes: At the end of the course, students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Understand the basic concepts of data structure & articulate linear data structures and permitted operations	2	1	1	-	3
CO1b: Understand and apply linked list data structure for solving problems	2	1	1	-	3
CO2: Articulate and Implement the tree data structures and permitted operations	3	1	1	-	3
CO3: Articulate and implement the graph data structures and permitted operations	3	1	1	-	3
CO4: Implement Searching and Sorting algorithms & understand the concepts of file organization techniques	2	1	1	-	3

Course Contents:

Unit-I
Introduction To Data Structure, Array, Records, Stacks Introduction to Stack & Primitive Operation on Stack, Stack as an Abstract Data Type, Multiple Stack, Stacks Application: Infix, Post Fix, Prefix and Recursion, Introduction to Queues, Primitive Operations on the Queues, Queue as an Abstract Data Type, Circular Queue, Dequeue, Priority Queue, Applications of Queue.

Unit-II
Pointer, It's Limitation and Operation. Linked List & their type: linear, circular & Doubly linked list, Operations on various type of linked list, application of Linked list: Polynomial manipulation.

Unit-III
Tree: General & Binary Tree. Conversion of General to Binary Tree. Binary Search Tree (BST) & It's Representation And Operation. Traversal Methods- In Order, Preorder & Post Order, Application of Binary Tree: Manipulation of Arithmetic Expression. Multiway Search Tree, Balance Tree & Their Types.

Unit-IV
Graph: Graph & Their Category & Representations, Traversing Technique: Breadth First & Depth First Search. Spanning Trees (St), Technique of Minimun Spanning Tree (MST), Application of Graphs: Pert & Related Techniques.

Unit-V
Heaps and Hash Table. Introduction to file organization; Sequential, Indexed sequential, Relative & Direct file organization. Searching : Linear & Binary Search. Sorting: Concept, selection sort, Bubble sort merge Sort, Tree sort & Partition - Exchange sort.

Suggested Text Books:

1. Trembley & Sorrenson. *Data Structure*. Tata Mcgraw Hill.
2. Salaria R.S. *Data Structures and Algorithms using C++*. Khanna Publishing.
3. Lipschuists. *Data Structure*. Schaum's Outline Series. Mcgraw Hill Publication.

Reference Books:

1. Kruse R.L. *Data Structure and Program design in C*. PHI
2. Sahni S. & Horowitz E. *Fundamentals of Data Structure*. Galgotia Publication.

BCA – 205 Data Structure Lab

Course Objectives:

To make the student to learn to develop solutions of problems by implementing various data structures, searching and sorting algorithms

Course Outcomes: After Completion of this course the student would be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Implement and apply different linear data structure algorithms(Stack, Queues)	1	3	1	-	3
CO1b: Implement the various operations like insertion, deletion, and traversing different linked lists	1	3	2	-	3
CO2: Demonstrate various operations like traversal, insertion, deletion on tree data structure	1	3	2	-	3
CO3: Demonstrate various operations like traversal, insertion, deletion on Graph data structure	1	3	2	-	3
CO4: Implement various Sorting and Searching Algorithms on different Data Structures	1	3	2	-	3

Programming Exercises:

1. Write a program to search an element from a list. Give user the option to perform Linear or Binary search. Use Template functions.
2. WAP using templates to sort a list of elements. Give user the option to perform sorting using Insertion sort, Bubble sort or Selection sort.
3. Implement Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list and concatenate two linked lists (include a function and also overload operator +).
4. Implement Doubly Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list.
5. Implement Circular Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list.
6. Perform Stack operations using Linked List implementation.
7. Perform Stack operations using Array implementation. Use Templates.
8. Perform Queues operations using Circular Array implementation. Use Templates.
9. Perform Queue operations using Linked List implementation.
10. WAP to scan a polynomial using linked list and add two polynomial.
11. WAP to perform following operation on BST:
    (a) Insert a Node
    (b) Delete a Node

(c) Search a Node
(d) Traversing BST using (Inorder, Preorder, Postorder)
(e) Find Max Node
(f) Find Min Node
(g) Count Internal Node
(h) Count External Node
(i) Count Total Node.

12. WAP to perform following operation on Graph:
(a) Insert a Node
(b) Insert a Edge
(c) Search a Node
(d) Traversing(BFS, DFS)

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BCA – 202 Data Base Management System (DBMS)

Course Objective: This course covers fundamentals of database architecture, database management systems, and database systems. Principles and methodologies of database design, and techniques for database application development.

Course Outcomes: on completion of the course the students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Understand the Database concepts, DBMS software and supported architecture.	1	1	-	-	3
CO1b:Understand to design and implement databases using concepts of data models	2	1	1	-	3
CO2:Understand and analyze databases using normalization concepts.	2	1	1	-	3
CO3:Apply SQL and relational algebra expressions to retrieve and manage database.	2	1	1	-	3
CO4:Understand transaction processing and concurrency control concepts.	2	1	1	-	3

Course Contents:

Unit-I
Introduction: Database system concepts, Data base system, Advantages of database systems; Data Architecture of data system: View/Schema, logical, conceptual and physical and their interrelationship DDL, DML and data dictionary, Data base administrator. Entity Relationship Model as a tool of conceptual design: Entities &Entity set, Relationship & Relationship set, Attributes, Mapping Constraints, Keys, Entity-Relationship diagram (E-R diagram): Strong & weak entities, Generalization, Specialization, Aggregation, Reducing ER diagram to tables.

Unit-II
Relational, Hierarchical and Network Model their advantages and disadvantages, storage organization for Relations. Rational Model: Structure tupple Attributes, Normalization: First, Second, Third & BCNF Normal Forms, key, primary key, Candidate key, Integrity rules: Entity integrity, Referential integrity rule.

Unit-III
Relational Algebra: Select, Project, Cross Product, Different types of Joins i.e. Theta Join, Equi Join, Natural join, Outer Join, Set Operations, Definition of Union, Set Difference, Cartesian Product, Selection, Intersection, Relational Query Language.

Unit-IV
Functional Protection and Crash Recovery: Protection, against crashes, Different types of crashes, Backup, Journal, Rollback, Committed and Uncommitted transactions, Security on Database.

Unit-V
Transaction concept, Transaction state, serializability security or Database: user identification. Physical Protection and maintenance, Transmitted of Rights. Integrity: Integrity violation, Implementation of check's in enforcing integrity; Concept of Distributed database.

Suggested Text Books:

1. Ullman. *Principles of Database Systems, 2e*. Galgotia Publications.
2. Silberschatz, Korth, & Sudershan. *Database System Concepts, 5e.* McGraw Hill.
3. Desai, Bipin C. *An Introduction to Database System.* Galgotia Publications.

Reference Books

1. Date, C.J. *An Introduction to Data Base Systems, 8e*. Narosa Publications.
2. Patric, O`neil, & Elizabeth, O`neil. *Database Principles, Programming and Performance, 2e.* Margon Kaufmann Publishers Inc.
3. Ramez, Elmasri, & Shamkant. B. *Fundamentals of Database Systems, 6e.* Navathe Addison-Wesley.

BCA – 206 Data Base Management System (DBMS) Lab

Course Objectives: To make the student to learn writing SQL queries

Course Outcomes: on completion of the course the students will be able to

Course Outcomes	PO1	PO2	PO3	PO 4	PO5
CO 1: Design relational databases that meet specific application requirement.	2	2	2	-	3
CO 2: Write the SQL statement for creating databases in RDBMS	1	1	1	-	3
CO2: Write SQL statements for insert, update, and delete data from databases	1	1	1	-	3
CO3: Write SQL statements for fetching desired data from databases	1	1	1	-	3

Practical Exercises:

Create and use the following database schema to answer the given queries.

Employee Schema

Field	**Type**	**NULL**	**KEY**	**DEFAULT**
Eno	Char(3)	NO	PRI	NIL
Ename	Varchar(50)	NO		NIL
Job_type	Varchar(50)	NO		NIL
Manager	Char(3)	Yes	FK	NIL
Hire_date	Date	NO		NIL
Dno	Integer	YES	FK	NIL
Commission	Decimal(10,2)	YES		NIL
Salary	Decimal(7,2)	NO		NIL

DEPARTMENT **Schema**

Field	**Type**	**NULL**	**KEY**	**DEFAULT**

Dno	Integer	No	PRI	NULL
Dname	Varchar(50)	Yes		NULL
Location	Varchar(50)	Yes		New Delhi

Query List

1. Query to display Employee Name, Job, Hire Date, Employee Number; for each employee with the Employee Number appearing first.
2. Query to display all the data from the Employee Table. Separate each Column by a comma and name the said column as THE_OUTPUT.
3. Query to display the Employee Name and Salary of all the employees earning more than $2850.
4. Query to display Employee Name and Department Number for the Employee No= 7900.
5. Query to display Employee Name and Salary for all employees whose salary is not in the range of $1500 and $2850.
6. Query to display Employee Name and Department No. of all the employees in Dept 10 and Dept 30 in the alphabetical order by name.
7. Query to display Name and Hire Date of every Employee who was hired in 1981.
8. Query to display Name and Job of all employees who don't have a current Manager.
9. Query to display the Name, Salary and Commission for all the employees who earn commission.
10. Sort the data in descending order of Salary and Commission.
11. Query to display Name of all the employees where the third letter of their name is 'A'.
12. Query to display Name of all employees either have two 'R's or have two 'A's in their name and are either in Dept No = 30 or their Manger's Employee No = 7788.
13. Query to display Name, Salary and Commission for all employees whose Commission Amount is 14 greater than their Salary increased by 5%.
14. Query to display the Current Date.
15. Query to display Name, Hire Date and Salary Review Date which is the 1st Monday after six months of employment.
16. Query to display Name and calculate the number of months between today and the date each employee was hired.
17. Query to display the following for each employee <E-Name> earns < Salary> monthly but wants < 3 * Current Salary >. Label the Column as Dream Salary.
18. Query to display Name with the 1st letter capitalized and all other letter lower case and length of their name of all the employees whose name starts with 'J', 'A' and 'M'.
19. Query to display Name, Hire Date and Day of the week on which the employee started.
20. Query to display Name, Department Name and Department No for all the employees.
21. Query to display Unique Listing of all Jobs that are in Department # 30.
22. Query to display Name, Dept Name of all employees who have an 'A' in their name.
23. Query to display Name, Job, Department No. And Department Name for all the employees working at the Dallas location.
24. Query to display Name and Employee no. Along with their Manger's Name and the Manager's employee no; along with the Employees' Name who do not have a Manager.
25. Query to display Name, Dept No. And Salary of any employee whose

department No. and salary matches both the department no. And the salary of any employee who earns a commission.

26. Query to display the Highest, Lowest, Sum and Average Salaries of all the employees
27. Query to display the number of employees performing the same Job type functions.
28. Query to display the Department Name, Location Name, No. of Employees and the average salary for all employees in that department.
29. Query to display Name and Hire Date for all employees in the same dept. as Blake.
30. Query to display the Employee No. And Name for all employees who earn more than the average salary.

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BCA – 203 Mathematics –II (Calculus)

Course Objective: The objective of this course is to familiarize the students with core concepts of calculus.

Course Outcomes: Upon successful completion of this course students will be able to

	PO1	PO2	PO3	PO4	PO5
CO-1(a): Understand the key concept of successive differentiation and apply them to solve various Problems.	2	-	-	-	2
CO-1(b): Understand concepts of limit and continuity and differentiability and learn the concept of partial derivatives in different theorems.	1	-	-	-	1
CO-2: Analyse the concept of Envelope Evolutes, maxima, and minima for the function of two variables.	2	-	-	-	1
CO-3: Understand the basic concept of differential equation and learn the various methods of differential equation of first order and first degree	1	-	-	-	1
CO-4: Analyse the concept of linear differential equations of higher order with constant coefficient	1	-	-	-	1

Course Contents:

Unit-I

Successive, Leibnitz Theorem, Taylor's & Maclaurin's series, Tests for Concavity and Convexity, Points of Inflexion, Asymptotes, Tracing of Curves in Cartesian co-ordinates.

Unit-II

Partial differentiation: Function of several variables, Limits, continuity and differentiability, Partial derivatives, Euler's Theorem, Mean value theorem & Taylor's theorem for functions of two variables.

Unit-III

Envelope, Maxima, Minima and saddle points of functions of two variables, Lagrange's multiplier method.

Unit–IV

Differential Equations of First Order and First Degree: Separation of variables, Homogeneous Differential Equations, Reducible to Homogeneous Differential Equations, Linear Differential Equations, Reducible to Linear Differential Equations, Bernoulli's Equation, Exact Differential Equations, Change of Variables.

Unit–V

Linear Differential Equations of Higher order with constant coefficients, Differential Equations reducible to Linear Differential Equations with Constant Coefficients, Simultaneous differential equation of first order.

Suggested Text Books:

1. Agrawal, D.C. *Advanced Calculus*. Shree Sai Prakashan, Meerut
2. Apostol, Tom M. *One-Variable Calculus with an Introduction to Linear Algebra, Vol (1), 2e*. Wiley Eastern.
3. Raisinghania, M. D. *Ordinary and Partial Differential Equations*. S. Chand & Company Ltd.

Reference Books:

1. Stewart, J. *Calculus with Early Transcendental Functions, 7e*. Cengage Learning India
2. Hallett H. *Calculus – Single and Multivariable, 6e*. John-Wiley and Sons.

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BCA – 204 Communication Techniques

Course Objective: The course is designed to enable students to enhance ability to comprehension of spoken and written English (and use English) required for effective communication in their professional work.

Course Outcomes: On successful completion of this course students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: To give an overview of basic English Grammar & Communication Skills	-	-	-	3	2
CO1b: To understand & Implement effective listening , reading, writing & Speaking Skills in a day to day activities	-	-	-	3	2
CO2: To enable students with effective presentation skills with basic concepts in communication	-	-	-	3	2
CO3: To explain students with the process of formal communication	-	-	-	3	2
CO4: To illustrate various formats used in business writing & the use of external aids involved in effective presentation	-	-	-	3	2

Course Contents:

Unit-I

Language Skills (Listening, Speaking, Reading, Writing): An introduction, Communication: Its Process, Types and Significance, Media, Channels, Role of Communication. Communication: Principles of Communication, Barriers to Communication, Seven C'S, Verbal and Non Verbal Communication, Body Language.

Unit-II

Listening: Effective and efficient listening in various situations (discussions, lectures, news, seminars, speech, telephone calls etc.); Strategies for effective listening, Difference between Listening and Hearing.

Reading: Purpose; Comprehension; Tactics and strategies for good reading; Writing: Guidelines for good writing; various writing styles (General and Technical writing styles).

Unit-III

Presentation and delivery; role of speaker and audience; style and body language. Business Reports, Business letters, Memos, Presentation Skills, Press management, Meetings, Agenda, Notices, Minutes, Seminars, Conferences, Workshops.

Unit-IV

Group Discussion, Interview Process, Frequently asked questions, Writing Emails, PPT Presentations, Telephone Etiquettes, Negotiation Skills.

Unit-V

General and Technical documents (correspondence (applications, letters, Resumes), drafts, proposals, précis, synopsis,)

References:

1. Ajmani, J. C. (2011). *Good English: getting it right*. Rupa Publications.
2. Hasson, G. (2012). *Brilliant communication skills: What the best communicators know, do and say*. Pearson UK.

3. Raman, M., & Sharma, S. (2015). *Technical communication: Principles and practice*. Oxford University Press.

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BCA – 301 Introduction to Operating System

Course Objectives: This course aims to familiarize the students with components of a operating system along with their functions and interactions with other components.

Course Outcomes: On successful completion of this course, the students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: To learn the fundamentals of OS, gain the knowledge on the basics of instruction execution, processor registers and how components of system communicate with each other.	-	2	2	-	2
CO1b: To learn the concept of process and how OS manages processors and memory.	2	3	2	-	3
CO2: To gain knowledge about the mechanisms of OS for synchronizing processes and understanding various problems of synchronization.	2	3	3	-	2
CO3: To learn the concept of deadlocks and various algorithms for handling deadlocks.	2	2	2	-	3
CO4: To understand various memory management techniques implemented by OS.	2	2	3	-	3

Course Contents:

Unit-I

Computer System Overview, Basic Components of Computer System, Operating System Services, Functions of Operating System, Types of Operating Systems: Instruction Execution Cycle, Interrupts & System Calls, Interrupt Processing, Processor Registers, I/O Communication techniques

Unit-II

Process Management: Concept of Process, Creation & Termination of Process, Process Attributes; Process Control Block, Process State Models- Two State, Five State, and Seven State. CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real-Time Scheduling.

Unit-III

Process Synchronization: The Critical Section Problem, Peterson's Solution, Semaphores, Classical Problems of Synchronization, Monitors, Atomic Transactions.

Unit-IV

Deadlocks: System Model, Deadlock Characterization: Necessary Conditions for Deadlock, Resource Allocation Graph; Method for Handling Deadlocks: Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Unit-V

Memory Management Strategies: Memory Hierarchy, Cache Memory, Swapping, Loading and Linking, Information Protection, Memory Allocation, Fixed partitioning, dynamic

partitioning, Paging, Segmentation, Segmentation with Paging, Virtual Memory, Demand Paging, Performance of Demand Paging, Page Replacement, Page Replacement Algorithms

Suggested Textbooks:

1. Silberschatz, Abraham, Peter Baer Galvin, Greg Gagne (2009). *Operating System Concepts, 8e.* Wiley Publications
2. Stallings, W. (2013). *Operating Systems: Internals and Design Principles,7e.* Pearson Education India

Reference Books:

1. Tanenbaum, Andrew S. (2016). *Modern Operating Systems, 4e.* Pearson Education India
2. Bach, Maurice J. (2015). *Design of the UNIX Operating System, 1e.* Pearson Education India
3. Arpaci-Dusseau, Remzi H. & Andrea C. Arpaci-dusseau (2018). *Operating Systems: Three Easy Pieces.* Amazon Digital Services

Prestige Institute of Management and Research Gwalior
BCA – Session 2022-26
BCA – 302 Object Oriented Programming in C++

Course Objectives:

1. To introduce features of an object-oriented approach and their advantages.
2. Demonstrate adeptness of object-oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.
3. To introduce C++ language features for implementation of object-oriented concepts.

Course Outcomes: At the end of the course, students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Understand and identify potential benefits of Object-oriented programming over other approaches.	3	3	2	-	3
CO1b: Understand and apply object-oriented programming concept(class, object and their storage)	3	3	2	-	3
CO2: Understand and apply polymorphism by overloading the operator and functions	2	2	3	-	3
CO3: Understand and apply the concept of inheritance to achieve modularity by reusing the exiting code	2	2	3	-	3
CO4: Introduce and apply the concept of file handing to store and retrieve data	-	-	1	-	3

Course Contents:

Unit-I

Introduction, OOP languages, characteristics of OOP's languages, application of OOP's, OOP's paradigm, concepts, benefits of OOP's, disadvantage of OOP's. Application of OOP's., Classes & Objects: Specifying a Class, Creating Objects, Accessing Class members, Defining member function, Outside Member Functions as inline, Accessing Member Functions within the class, Static data member, Access Specifiers: Private, Protected and Public Members. Passing objects to function, Returning objects, Object assignment, This pointer.

Unit-II

Constructor & Destructor: Introduction, Constructor, Parameterized constructor, Multiple constructor in a class, Constructor with default argument, Copy constructor, Default Argument, Destructor.

Array, Pointers, and references: Array of objects, Pointers to object, , Pointer to class members. References: Reference parameter, Passing references to objects, Returning reference, Independent reference, The Dynamic Allocation operators, Initializing allocated memory, Allocating Array, Allocating objects.

Unit-III

Function & operator overloading : Function overloading, Overloading constructor function finding the address of an overloaded function, Operator Overloading: Creating a member operator function, Creating Prefix & Postfix forms of the increment & decrement operation, Overloading the shorthand operation (i.e. +=,-= etc), Operator overloading restrictions, Operator overloading using friend function, Overloading New & Delete, Overloading some special operators, Overloading [ ], ( ), -, comma operator, Overloading << and >> .

Unit-IV

Inheritance: Base class Access control, Inheritance & protected members, Protected base class inheritance, Inheriting multiple base classes, Constructors, destructors & Inheritance, When constructor & destructor function are executed, Passing parameters to base class constructors, Granting access, Virtual base classes. Virtual functions & Polymorphism: Virtual function, Pure Virtual functions, Early Vs. late binding

Unit-V

The C++ I/O system basics: C++ streams, The basic stream classes: C++ predefined streams, Formatted I/O: Formatting using the ios members, Using manipulators to format I/O, Creating your own manipulators, -File Management: Introduction – File handling, File structure, File handling function, File types, Streams, Text, Binary, File system basics, The file pointer, Opening a file, Closing a file, Reading and Writing File.

Suggested Text Books:

1. R. Subburaj. *Object Oriented Programming With C++*. Vikas Publishing House, New Delhi.
2. E. Balguruswamy. *C++*. TMH Publication.

Reference Books:

1. Schildt H. *C++ The complete reference*. TMH Publication.
2. Stroustrup B. *The C++ Programming Language*. Addison-Wesley.

BCA – 306 Object Oriented Programming in C++ Lab

Course Objectives: To make the student to learn programming in C++

Course Outcomes: At the end of the course, students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1: Create C++ program by using classes and objects	2	1	1	-	3
CO2: Write constructor and destructor functions for initializing objects	2	1	2	-	3
CO3: Write overloaded functions and overload operators on user defined types	2	2	1	-	3
CO4: Implement object-oriented solutions of real-life problems in C++	2	2	2	-	3

Programming Exercises:

Practical No.: 1

Objective: To illustrate the use of simple Input and output using cout, cin and to use arithmetic operators.

1. Write a program which calculates the salary by given basic salary.Hra is 20 % of basic and da is 40% of basic.
2. Write a program, which converts temperature in degree to Fahrenheit.
3. Write a program which calculates the Bill from given qty. and price and 10% discount.

Practical No.: 2

Objective: To Illustrate the Control statements (Branching and Looping).

1. Write a program to print the following output.
   *
   * *
   * * *
   * * * *
2. Write a program which prints the grade of a student according to give percentage.
   100 to 70 % HONOURS
   69 to 60 % First
   59 to 50 % Second
   else Fail.
   Using nested IF.
3. Write a program to find greatest among three numbers.

Practical No.: 3

Objective: To Implement Function Overloading, Inline function and the advantages of using them.

1. Write a program which defines three overloaded functions
   Sum(int , int)
   Sum(int , float)
   Sum(int ,float,int)
   Calculates the sum of given parameters.
2. Write a program which defines following Overloaded functions
   Max(int , int ,int)
   Max(int , float)
   Max(float ,float ,float)
   Max(float ,int ,float ,int)
   The above functions prints the maximum number of given parameters.
3. Write an Inline function **square (float)** which prints the square of the given parameter.
4. Write a CPP program to represent Default Arguments.

Practical No.: 4

Objective: To Implement the Classes and Objects. Use of public and private access specifiers. To implement the Constructors and Destructors.

1. Write a program which defines a Class **Employee** with member variables **name , address , basic, netsal**. And following functions **getdata(), calculatesal() , display().**
2. Write a program which defines a Class **Employee** with member variables **name , address , basic, netsal**. And following functions **getdata(), calculatesal() , display().**Define a constructor which initialize basic and netsal to 0 (Zero).Define a Destructor .

Practical No.: 5

Objective: To implement Operator Overloading unary and binary operator.

1. Write a program which overloads ++ operator (pre and post) which increments the

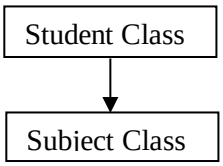
object.

2. Write a program that overloads – operator, which changes all the variables of class to negative.
3. Write a program to overload binary operator + which perform following operations.
   Obj + 100.
   Obj3 = Obj1+Obj2;
4. Write a program that Concatenates two string by overloading + operator.
5. Write a program that adds polar coordinates by overloading + operators.

Practical No.: 6

Objective: To implement simple ,multiple Inheritance

1. WAP to calculate students grade using Inheritance show in figure like:

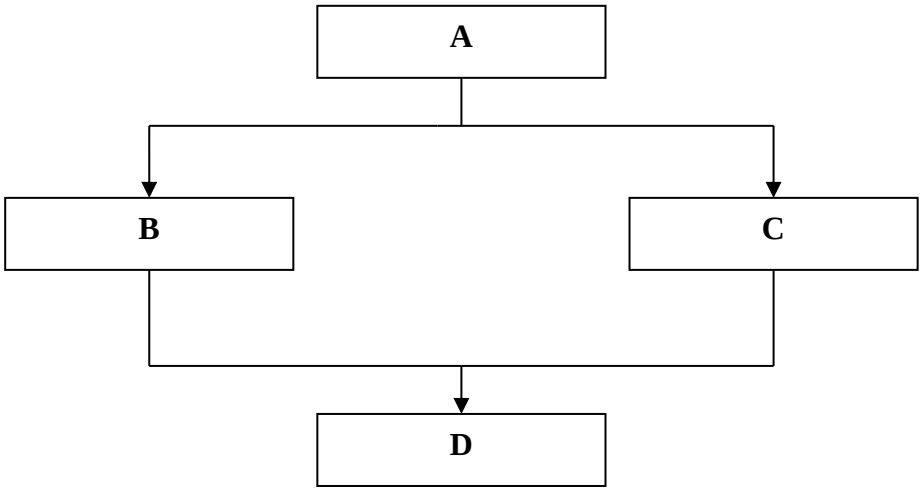


2. WAP to implement Multiple Inheritance by using any example.
3. WAP to implement Hierarchical inheritance.

Practical No.: 7

Objective: Implementation of Pointers Virtual function and Dynamic binding.

1. Create following structure of classes.



Define a variables I in class A**.** In main assign the value 10 to I using object of D using virtual inheritance.

2. Define a class Media with members title ,price.define two derived classes Book (with member pages ,read(),display()) and Tape (with member runtime ,read() and display() Declare a pointer type object of class Media .Read the type of media from user and call corresponding functions. Hint: Use dynamic polymorphysm.

Practical No.: 8

Objective: To read and write data to File using Files and Streams.

1. Write a program which defines a class Emp with members name, age, sal, read() write the data to a file Data.dat .Then read the data from that file and display the data.
2. Define a Class Person with members **Name, Age, Sal and address** and function get() which read these members and a function put() which writes these members to a file **Data.dat.**

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BCA – 303 Numerical Methods

Course Objective

To introduce the concept of Computer Oriented Numerical Methods.

Course Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1a: Able to understand the concept of approximate numbers, errors in numbers, representation of number in computer's memory and zeroes or roots of polynomial and/or transcendental equations.	2	-	-	-	2
CO1b: To understand and learn various iterative techniques to solve simultaneous linear equations.	1	-	-	-	1
CO2: To develop mathematical relationships for given observations of the variable using Interpolation techniques.	2	-	-	-	1
CO3: Able to understand the concept concerning numerical differentiation and Integration for a class of equidistant and unequal arguments.	1	-	-	-	1
CO4: To learn and understand numerical solution of ODE by techniques of Iterative methods.	1	-	-	-	1

Course Contents

UNIT – I

Floating point representation and computer arithmetic, Normalization and their consequences, Emphasis on computational Algorithms, Numerical Errors, Iterative methods, Zeros of a single transcendental equation and zeros of polynomials using Bisection, False position, Newton-Raphson and Secant methods, convergence of solutions.

UNIT – II

Simultaneous linear equations, Solution of simultaneous linear equations: Gauss elimination method with pivoting, Gauss – Jordan method, Jacobi's iteration method and Gauss – Seidel iteration method, Ill-conditioned equations and refinement of solutions.

UNIT – III

Difference Operators and Interpolation: Definition of Forward, Backward, Shifting, Divided difference, Central and Averaging Operators and their relationships, Newton's forward difference, backward difference and divided difference interpolation formulae, Lagrange's Interpolation formula.

UNIT – IV

Numerical Differentiation and Integration:

Numerical Differentiation using Newton's forward difference, backward difference and divided difference interpolation formulae, General Quadrature formula, Newton Cote's integration, Trapezoidal rule, Simpson's one – third and three – eight rules.

UNIT – V

Numerical Solution of Ordinary Differential equations by Euler's Method, Modified Euler's method, Taylor's series method, Picard's method, Runge Kutta, second order and fourth order methods, Predictor-corrector methods.

Suggested Readings:

Main Text Books

1. Numerical Methods for Scientific & Engg. Computer by Jain & Iyenger. New Age International Publishers
2. Numerical Method by E Balaguruswamy. TMH
3. Computer Oriented Numerical Method by R S Salaria. Khanna Publishers

Reference Books

1. Numerical Methods by B.S.Grewal. Khanna Publishers
2. Computer Oriented Numerical Methods by V.Rajaraman. PHI
3. Numerical Analysis by S.S.Sastry. PHI

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BCA – 304 Web Technologies

Course Objective:
To introduce the web technologies (HTML, JavaScript, PHP, MYSQL etc..) for developing web applications.

Course outcomes: Upon successful completion of this course students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Understand the use key concept of HTML, CSS, JavaScript	3	3	2	-	3
CO1b: Understand and apply features of JavaScript and Jquery for event handling	3	3	2	-	3
CO2: Understand and apply features of PHP for creating dynamic webpages	2	2	3	-	3
CO3: Understand and apply control statement, array, regular expression of PHP in webpage creation.	2	2	3	-	3
CO4: Understand and apply features of MySQL for managing database of web applications	1	-	1	-	3

Course Contents

Unit-I
Overview of HTML: Concept of Hypertext, Versions of HTML, Elements of HTML, Formatting Tags, Links, Hyperlinks, Image & Image map, List, Tables, Frames, Forms, Style sheets, Background and Color Controls, Cascading Style Sheets (CSS): CSS Properties, Creating Classes and IDs, Generating External Style Sheets, Types of styles, specifying class within HTML document, Style placement: Inline style, Span & div tags, header styles, Text and font attributes: Font Vs CSS, changing fonts, text attributes, Advance CSS properties: Backgrounds, Box properties and Positioning.

Unit-II
Introduction to scripting: overview of Java Script, advantages, client side java Script, capturing user input, writing JavaScript into HTML; Basic JavaScript Techniques: Data types, literals, variables and operators, Java Script arrays, dense array, operators, expressions; Java Script Programming Construct: Assignment, data declaration, if, switch, while, for, do while, label, break, Continue, function call, return, with, delete, method invocation.
JQuery Introduction: What is jQuery, Structure of jQuery, Using jQuery and including .js file to HTML, Type of Selectors, Handling Events with jQuery

Unit-III
PHP introduction, inventions and versions, important tools and software requirements (like Web Server, Database, Editors etc.), PHP with other technologies, scope of PHP, Basic Syntax, PHP variables and constants, Types of data in PHP, Expressions, scopes of a variable (local, global); PHP Operators: Arithmetic, Assignment, Relational, Logical operators, Bitwise , ternary and MOD operator, PHP operator Precedence and associativity;
Handling HTML form with PHP: Capturing Form Data, GET and POST form methods, Dealing with multi value fields, Redirecting a form after submission;

Unit-IV

PHP conditional events and Loops: PHP IF Else conditional statements (Nested IF and Else), Switch case, while, For and Do While Loop, goto, Break, Continue and exit; PHP Functions: Function, Need of Function, declaration and calling of a function, PHP Function with arguments, Default Arguments in Function, Function argument with call by value, call by reference, Scope of Function Global and Local; String Manipulation and Regular Expression: Creating and accessing String, Searching & Replacing String, Formatting, joining and splitting String , String Related Library functions, Use and advantage of regular expression over inbuilt function, Use of preg_match(), preg_replace(), preg_split() functions in regular expression, Array: Anatomy of an Array ,Creating index based and Associative array ,Accessing array, Looping with Index based array, with associative array using each() and foreach(), Some useful Library function.

Unit-V

Introducing MySQL; database design concepts; the Structured Query, Language (SQL); communicating with a MySQL backend via the PHP.

Suggested Text Books:

1. Fuller, R. G., & Ulrich, L. A. (2004). *HTML in 10 Simple steps or Less*. John Wiley & Sons.
2. Gilmore, W. J. (2010). *Beginning PHP and MySQL: from novice to professional*. Apress.
3. Holzner, S. (2007). *PHP: the complete reference*. Tata McGraw-Hill Education.

Reference Books:

1. Psinas, M. E. (2008). *PHP and MySQL: Create-modify-reuse*. John Wiley & Sons.
2. Nixon, R. (2014). *Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5*. " O'Reilly Media, Inc.".
3. Welling, L., & Thompson, L. (2008). *PHP and MySQL Web Development, 4e*. Addison-Wesley Professsional, 2008.

BCA – 305 Project I on Web Technologies

Course Objectives: The objective of this course is to provide the necessary knowledge to design and develop dynamic, database-driven web applications using HTML, CSS, JS, jQuery, PHP and MySQL.

Course Outcomes: At the end of this course, students will be able to develop web-based solutions to real world problems by

	PO1	PO2	PO3	PO4	PO5
CO1: Designing the usable web-based user interface for applications	-	3	2	3	3
CO2: Designing server-side web pages for implementing business logic	-	3	2	3	3
CO3: Implement database operations as per requirements.	-	3	2	3	3
CO4: Designing application which are scalable and maintainable.	-	3	2	3	3

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BCA – 401 Programming in Java

Course Objectives: This course intends to impart knowledge about basic Java language syntax and semantics to write Java programs. The course will cover the use of fundamentals of object-oriented programming in Java along with various concepts related to String creation and management, Java multithreaded model, and GUI programming using AWT & Swing.

Course Outcomes: On successful completion of this course, the students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Explain the basics of java language	1	1	1	-	2
CO1b: Apply OOPs concept in solving the real problem	3	3	2	-	3
CO2: Able to Use of package and collection frame work for solving the problem	2	2	2	-	2
CO3: To develop the robust and high performance system	1	2	3	-	3
CO4: Develop GUI and Event handling application	1	2	3	-	3

Course Contents:

Unit-I

Introduction to Java: Versions of Java, Features of java, C++ V/s Java, Setting up Java environment, Java virtual machine. Constants & Variables, Declaration of Variables, Types of Variables, Scope of Variables,Data Types in Java, Operators in Java, Control Statements in Java. **Arrays:** Creating One Dimensional & Two Dimensional Arrays

Unit-II

Basic concepts of OOPS: OOPS terminology, Classes, Methods, Creating Instance & Class Variables, Accessing Class Members, Constructors, Method Overloading, Inheritance and its Types in Java, Method Overriding, Final Variables, Methods and Classes, finalize method, Abstract Methods & Classes, Visibility Control in Java, **Interfaces**: Defining Interfaces, Implementing and Inheriting Interfaces.

Unit-III

Concept of Package: In-built Packages, Using In-Built Packages, Creating User Defined Packages, Accessing a User-Defined Package, Adding a Class to a Package, **Working with Strings:** String, StringBuffer, and StringBuilder. **Collections Framework:** Set, List, Queue, Maps.

Unit-IV

Exception Handling in Java: Types of Exceptions in Java, Try-Catch-Finally, Using Multiple Catch Blocks, Nested Try, Throw and Throws Keyword. **Multithreading in Java:** Java Thread Model, Life Cycle Of a Thread, Creating Threads, Extending Thread Class, Stopping & Blocking A Thread, Thread Exceptions, Thread Priority, Thread Synchronization, Implementing Runnable Interface, Inter Thread Communication.

Unit-V

Introduction to GUI Programming in Java: AWT: Basic GUI Components of AWT, Event Handling, Java Swing: Basic GUI Components of Swing, Difference between AWT and Swing

Suggested Textbooks:

1. Schildt, H. (2017). *Java- The Complete Reference Tenth Edition*. McGraw Hill Education
2. Balaguruswamy, E. (2019). *Programming with Java Sixth Edition*. McGraw-Hill Publications

Reference Books:

1. Sierra, Kathy & Bert Bates (2009). *Head First Java*. O'Reilly Publications
2. Horstmann, Cay S. & Gary Cornell (2007). *Core Java, Volume I—Fundamentals*. Prentice Hall Publications
3. Horstmann, Cay S. (2017). *Core Java Volume II - Advanced Features*. Pearson Education

BCA – 405 Programming in Java Lab

Course Objectives: The course objective of this course is to write object-oriented program in java by implementing its various features for solving real life problems

Course Outcomes: On successful completion of this course, the students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1: Write programs in java for simple problems	1	1	1	-	2
CO2: Write programs using classes, interfaces and objects	2	2	2	-	2
CO3: Write programs using packages and collection framework	1	2	3	-	3
CO4: Write GUI based object-oriented program in JAVA with exception handling	1	2	3	-	3

Programming Exercises:

1. Write a Java program that prints all real solutions to the quadratic equation ax2 +bx + c = 0. Read in a, b, c and use the quadratic formula. If the discriminate b2 -4ac is negative, display a message stating that there are no real solutions
2. The Fibonacci sequence is defined by the following rule: The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a Java program that prints the nth value in the Fibonacci sequence
3. Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer. (use Scanner class to read input)
4. Write a Java program to multiply two given matrices
5. Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use String Tokenizer class of java.util)
6. Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome
7. Write a Java program for sorting list of names. Read input from command line
8. Write a Java program to create a Student class with following fields
    a. Hall ticket number
    b. Student Name
    c. Department

   Create 'n' number of Student objects where 'n' value is passed as input to constructor
9. Write a Java program to demonstrate String comparison using == and equals method
10. Write a java program to create an abstract class named Shape that contains an empty method named numberOfSides(). Provide three classes named Trapezoid, Triangle and Hexagon such that each one of the classes extends the class Shape. Each one of the classes contains only the method numberOfSides() that shows the number of sides in the given geometrical figures

11. Write a Java program that creates three threads. First thread displays "Good Morning" everyone second, the second thread displays "Hello" every two seconds and the third thread displays "Welcome" every three seconds
12. Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication
13. Write a GUI java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be on at a time No light is on when the program starts
14. Write a Java program that allows the user to draw lines, rectangles, and ovals.
15. Develop an GUI application for calculator.

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BCA – 402 Design and analysis of algorithms

Course objective: The primary objective of this course is to introduce the concept of algorithm as a precise mathematical concept, and study how to design algorithms using various techniques, establish their correctness, study their efficiency and memory needs.

Course outcomes: At the end of this course students will be able to:

	PO1	PO2	PO3	PO4	PO5
CO1a: Understand the fundamental concepts of Algorithm and Analysis of algorithms in terms of time and space complexity.	3	2	3	-	3
CO1b: Understand and analyze the divide and conquer technique of algorithm design.	3	2	3	-	3
CO2:Understand and analyze the Greedy method technique of algorithm design.	3	2	3	-	3
CO3 Understand and analyze the Dynamic Programming technique of algorithm design.	3	2	3	-	3
CO4 Understand and analyze the Backtracking and Branch and Bound technique of algorithm design.	3	2	3	-	3

Course Contents:

Unit-I

Introduction: Algorithm, pseudo code for expressing algorithms, performance analysis-space complexity, time complexity, asymptotic notation- big (O) notation, omega notation, theta notation and little (o) notation, recurrences, probabilistic analysis, disjoint set operations, union and find algorithms.

Unit - II

Divide and conquer: General method, applications-analysis of binary search, quick sort, merge sort, AND OR Graphs.

Unit - III

Greedy method: General method, Applications-job sequencing with deadlines, Fractional knapsack problem, minimum cost spanning trees, Single source shortest path problem.

Unit- IV

Dynamic programming: General method, applications - optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.

Unit- V

Backtracking: General method, Applications- n-queen problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles.

Suggested Textbooks:

1. Ellis Horowitz, Satraj Sahni, Rajasekharam (2007), Fundamentals of Computer Algorithms, 2nd edition, University Press, New Delhi.

Reference books:

1. R. C. T. Lee, S. S. Tseng, R.C. Chang and T. Tsai (2006), Introduction to Design and Analysis of Algorithms A strategic approach, McGraw Hill, India.
2. Allen Weiss (2009), Data structures and Algorithm Analysis in C++, 2nd edition, Pearson education, New Delhi.
3. Aho, Ullman, Hopcroft (2009), Design and Analysis of algorithms, 2nd edition, Pearson education, New Delhi

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PAPER CODE BCA – 403
Statistical Methods

Course Objective: The objective of this course is to acquaint the students with basic concept of statistics that are useful in decision making problems.

Course Outcomes: By completing this course the student will learn to perform the following

	PO1	PO2	PO3	PO4	PO5
CO1a: Understand the meaning and use of statistical terms.	3	-	-	-	2
CO1b: Understand and apply descriptive statistical measures to model situations.	2	-	-	-	2
CO2: Understand and apply correlation and simple linear regression analysis.	3	-	-	-	2
CO3: Understand and apply probability distributions to model different types of situations.	3	-	-	-	2
CO4: Understand and apply statistical inference techniques (including statistical estimation and hypothesis testing)	2	-	-	-	2

Course Contents

UNIT-I

Introduction: Frequency distribution and Frequency charts, Histogram, Frequency polygons, Frequency curves and Cumulative frequency distribution, Ogive curves. **Measures of Central Tendency:** Arithmetic mean, weighted arithmetic mean, median, mode, Partition values. **Measures of Dispersion:** Range, mean deviation, semi-inter quartile range for quartile deviation, absolute and relative dispersion, coefficient of variation, Moments, Skewness and Kurtosis.

UNIT-II

Probability Theory: Sample space, events, classical definition of probability, theorems on total and compound probability, independent and dependent events, mutually exclusive events, mathematical expectation.

UNIT-III

Probability Distributions: Discrete and continuous probability distributions, basic concepts and applications of Binomial, Poisson, Rectangular, Exponential and Normal distributions, their properties and uses.

UNIT-IV

Regression and Correlation: Regression analysis, Least square fit, polynomial and curve fitting, Linear correlation, measures of correlation, coefficient of correlation, rank correlation, multiple and partial correlation for three variables.

UNIT-V

Testing of Hypotheses: Simple and composite hypothesis, errors of kind-I and kind-II, critical region, level of significance. **Tests of Significance:** Tests for simple hypotheses, Chi-square, t, F and Z-statistics.

Suggested Readings:

Main Text Books

1. **C.B. Gupta** - An Introduction to Statistical Methods. Vikas Publ. House
2. **S.C. Gupta** - Fundamental of Statistics. Sultan Chand & Sons
3. **H.C Saxena and J.N Kapoor**- Mathematical Statistics. S. Chand and Company

Reference Books

1. **Ken Black** - Business Statistics. Wiley India
2. **Render and Stair JR -** Quantitative Analysis for Management. Prentice Hall Publ.
3. **Beri G.C. -** Business Statistics. Tata McGraw Hill Education

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BCA – 404 Python Programming

Course Objectives: This course aims to make the students familiar with the programming paradigms brought in by Python programming language along with a focus on file handling and regular expressions

Course Outcomes: On successful completion of this course, the students will be able to:

	PO1	PO2	PO3	PO4	PO5
Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements	1	2	2	-	3
Express proficiency in the handling of strings and functions	1	2	2	-	3
Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples, and sets	1	2	2	-	3
Identify the commonly used operations involving file systems and regular expressions	1	2	2	-	3
Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python	1	2	2	-	3

Course Contents:

Unit-I

History & Features of Python; Introduction to Python: Python Interpreter, Python shell, Indentation. Atoms: Identifiers and keywords, Literals; Variables & Data Types: Numeric types, Sequence types, Mapping types, Set types, Boolean type, Binary types; Operators: Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, precedence of operators; Comments in Python

Unit-II

Input and Output Statements; Conditional statements: conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: while, for, nested loop, state iteration in python, break, continue, pass; String Manipulation: Accessing string, Basic operations, String slices, String functions and methods

Unit-III

Python Collections: Lists: Accessing List, List Operations, Working with Lists, List Functions & Methods; Tuples: Accessing Tuples, Tuple Operations, Working with Tuples, Tuple Functions & Methods; Dictionaries: Accessing Values in dictionaries, Dictionary Operations, Working with Dictionary, Dictionary Properties, Dictionary Functions & Methods; Sets: Working with Set & Frozen Set

Unit-IV

Functions: Defining & Calling a function, Types of functions, Default Arguments, Why Default Arguments?, Default Function Object Argument Example, Variable-length Arguments, Non-keyword Variable Arguments (Tuple), Keyword Variable Arguments

(Dictionary), Anonymous functions, Global & Local variables
Exception handling: Exception classes hierarchy, try, except, finally, Raising an exception, user defined exceptions

Unit-V
Object Oriented Programming in Python; Regular Expressions; Importing & Exploring Data using Python Modules: Introduction of numpy module, numpy operations, Working with

Arrays using numpy; Introduction of pandas module, pandas operations

Suggested Text Book and Reference Books:

1. Chun, J Wesley, Core Python Programming, Second Edition, Pearson, 2007 Reprint 2010
2. Barry, Paul, Head First Python, 2nd Edition, O Rielly, 2010
3. Lutz, Mark, Learning Python, 4th Edition, O Rielly, 2009

BCA – 406 Design and Analysis of Algorithm Lab

Course Objectives: To introduce asymptotic notations for analysis of algorithm performance of algorithms and make the students to design and implement algorithms using various algorithm designing techniques.

Course Outcomes: On successful completion of this course, the students will be able to:

	PO1	PO2	PO3	PO4	PO5
CO1: Implement and analyze algorithms for solving problems by divide and conquer approach	-	2	1	-	3
CO2: Implement and analyze algorithms for solving problems by greedy approach application	-	2	1	-	3
CO3: Implement and analyze algorithms for solving problems by dynamic programming approach	-	2	1	-	3
CO4: Implement and analyze algorithms for solving problems by branch and bound and backtracking approaches	-	2	1	-	3

Practical Assignments:

1. Write a program to perform operation count for a given pseudo code
2. Write a program to perform Bubble sort for any given list of numbers.
3. Write a program to perform Insertion sort for any given list of numbers.
4. Write a program to perform Quick Sort for the given list of integer values.
5. Write a program to find Maximum and Minimum of the given set of integer values.
6. Write a Program to perform Merge Sort on the given two lists of integer values.
7. Write a Program to perform Binary Search for a given set of integer values recursively and non-recursively.

8. Write a program to find solution for knapsack problem using greedy method.
9. Write a program to find minimum cost spanning tree using Prim's Algorithm.
10. Write a program to find minimum cost spanning tree using Kruskal's Algorithm.
11. Write a program to perform Single source shortest path problem for a given graph.
12. Write a program to find solution for job sequencing with deadlines problem.
13. Write a program for all pairs shortest path problem.
14. Write a program to solve N-QUEENS problem.
15. Write a program to solve Sum of subsets problem for a given set of distinct numbers.

BCA – 501 Programming in Advance Java

Course Objectives: This course is designed with intent to acquaint the students with tools and techniques for creating a dynamic web application that can interact with databases using Java technologies like JDBC, Servlets, JSP and JavaBeans.

Course Outcomes: On successful completion of this course, the students will be able to:

	PO1	PO2	PO3	PO4	PO5
CO1a: To understand and build web application using MVC model	3	2	2	-	2
CO1b: To write code for database operations (CRUD) in web application through JDBC	2	2	2	-	3
CO2: Apply servlet API to develop dynamic web application	2	3	3	-	3
CO3: Apply JSP API to develop dynamic web application	2	3	2	-	3
CO4: Use java beans in web application development	2	2	2	-	3

Course Contents:

Unit-I

Starting with Web Applications in Java: Introduction to web applications, Benefits of web applications, Web Architecture Models- Model 1 Architecture, Model 2 Architecture, Introduction to MVC Architecture: Model component, View component, Controller component.

Unit-II

Introduction to JDBC: Introducing JDBC, Communicating with Database: Obtaining Connection, Creating JDBC Statement Object, Types of Statement Objects: Statement, Prepared Statement, Callable Statement, Executing SQL Statement, Closing a Database Connection, Creating DSN and Understanding Various JDBC Drivers; Creating Table by Using JDBC, Working With ResultSet Object.

Unit-III

Introduction to Servlets: Need for Server Side Programming, What is a Servlet, Advantages of using Servlets, Understanding the Servlet API, Generic Servlet Class, Servlet Life Cycle, Servlet Request, Redirection, Servlet Config, Servlet Context, Session Tracking with Servlets, deploying a Servlet Application,.

Unit-IV

Introduction to JSP: Understanding JSP, JSP Architecture, Advantages of JSP, JSP Life Cycle, JSP Scripting Elements: Scriptlet, Expression, Declaration; JSP Implicit Objects, Directive Elements: Page, Include, Taglib; JSP Action Elements: Forward, useBean, Include, setProperty & getProperty, JSTL

Unit-V

Introduction to JavaBeans: Concept of JavaBeans, Advantages of using JavaBeans, Components of JavaBeans: Properties, Methods and Events; JavaBean API

Suggested Textbooks:

1. Schildt, Herbert (2017). *Java- The Complete Reference.* McGraw Hill Education

Reference Books:

1. Sierra, Kathy & Bert Bates (2009). *Head First Java*. O'Reilly Publications
2. Sierra, Kathy & Bert Bates (2011). *Head First Servlets & JSP*. O'Reilly Publications

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BCA – 502 Software Engineering

Course Objectives: The objectives of this course Software Engineering Program are to produce graduates who, within three years after graduation, are able to:

1. Be employed in industry, government, or entrepreneurial endeavours to demonstrate professional advancement through significant technical achievements and expanded leadership responsibility;
2. Demonstrate the ability to work effectively as a team member and/or leader in an ever-changing professional environment; and
3. Progress through advanced degree or certificate programs in computing, science, engineering, business, and other professionally related fields.

Course Outcomes: On successful completion of this course, the students will be able to:

	PO1	PO2	PO3	PO4	PO5
CO1a: Explain SE Life cycle models	2	3	3	1	2
CO1b: Create SRS and asses the efforts required to develop software	2	2	2	1	3
CO2: Understand software design fundamentals	2	3	2	1	3
CO3: Design software by applying different techniques	2	3	3	1	3
CO4: Explain concepts of software measures, Software testing, reverse engineering, UML	2	3	2	1	3

Course Contents:

Unit-I

Introduction: Evolving Role of Software, Software characteristics, Software Designing Processes: Software Engineering, Software Process and Characteristics, Need of Software Development Life Cycle Models, Waterfall, Prototype, Spiral Model, RAD Model;

Unit-II

Software Requirement Analysis and Specification: Requirement Elicitation Technique: Interview, Form Analysis, SRS and its Characteristics. Software Project Planning: Issues involved in Software Estimation, Size Estimation like lines of code and Function point method, Cost Estimation Model: COCOMO, Risk Management.

Unit-III

Software Project Management Process: Feasibility Study, Project Planning, Project Execution, Project Termination. System Models: Data-flow models, Semantic data models, Object models, Inheritance models, Object aggregation, Service usage models, Data Dictionaries. Basics Software Design: Design Process, Design Fundamentals, Software Design Levels: Architectural Design, High Level design, detail design, Design Notations, Specification and Modularization, Design Structure Chart, Pseudo Codes, Flow charts, Coupling and Cohesion measures.

Unit-IV

Design Strategies: Function Oriented Design, Object Oriented Design, Basic concept of object-oriented analysis & Design. Traditional paradigm versus object oriented paradigm, software design approaches: Top-Down and Bottom-Up Design. Object-oriented design: Object aggregation; Service Usage; Object Interface Design: Design evolution, Function oriented

design: Data –flow design; Structural Decomposition: Detailed design.

Unit-V

Software Metrics: Software measurements What & Why, Token Count, Halstead Software Science Measures, Design Metrics, software testing. Test cases. Software Maintenance: Types of software Maintenance, Software maintenance model, Concept of Software Re- engineering & Software Reverse engineering- Definition, purposes and objectives. Introduction to UML class diagram object diagram, use case diagram, sequence diagram, activity diagram, component diagram, collaboration diagram.

Suggested Text Books:

1. Software Engineering - A practitioner's approach"- R.S.Pressman,5th Ed., McGraw Hill Int.
2. Software Engineering (Principle & Practices Waman S. Jawadekar), Tata Mccraw Hill
3. An Integrated approach to software Engineering, - Pankaj Jalote , Narosa Publication

Reference Books:

Software Engineering- Shari Lawrence, Pfleeger. Pearson edu.

Prestige Institute of Management and Research Gwalior
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BCA – 503 Artificial Intelligence

Course Objectives: This course is designed to familiarize the students with basic principles, techniques, and applications of Artificial Intelligence.

Course Outcomes: On successful completion of this course, the students will be able to:

	PO1	PO2	PO3	PO4	PO5
CO1a: Demonstrate fundamental understanding of the AI history and its foundations.	2	1	1	-	3
CO1b: Understand elements constituting problems and learn to solve it by various uninformed and informed (heuristics based) searching techniques	2	2	2	-	3
CO2: Understand and apply different methods of knowledge representation and reasoning.	2	2	2	-	3
CO3: To describe and apply the artificial neural network models and their learning algorithms in solving problems	2	2	2	-	2
CO4:To able to describe different activation function, regularization techniques, Fuzzy Sets and Fuzzy Logic	2	2	2	-	2

Course Contents:

Unit-I

Introduction: Introduction to Artificial Intelligence, Historical Backdrop, what is Intelligence, The bottom line. Defining the problem as state space search, production system and their types, characteristics of problem and production system.

Unit-II

State Space Search: Generate and test, Simple search, Depth First Search (DFS), Breadth First Search (BFS), Comparison of BFS and DFS, Quality of solution, Depth Bounded DFS (DBDFS), Depth First Iterative Deepening(DFID). Heuristic Search: Heuristic Functions, Best First Search, Hill Climbing, Local Maxima, Solution Space Search, Variable Neighborhood Descent, Beam Search, Tabu Search, Peak to Peak Methods.

Unit-III

Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, comparison of propositional and predicate logic, Resolution, refutation, deduction, theorem proving, inferencing, monotonic and no monotonic reasoning.

Unit-IV

Learning: Introduction to learning, Neural Networks: Introduction, Model Representation, Gradient Descent vs. Perceptron Training, Stochastic Gradient Descent, Multilayer Perceptrons, Multiclass Representation, Backpropagation Algorithm, Learning rate and it's significance.

Unit-V

Activation functions: sigmoid, tanh, relu, softmax, etc; problems of overfitting in neural networks; regularization techniques: L1 and L2 regularization, dropout, data augmentation, early stopping.

Fuzzy Sets and Fuzzy Logic: Introduction to Classical Sets and Fuzzy Sets. Classical set and Fuzzy sets – Operations and Properties. Fuzzy Relations – Equivalence & Tolerance. Membership Functions, Fuzzification, Membership Value Assignment. Fuzzy to Crisp

Conversion.

Suggested Textbooks:

1. Patterson, Dan W. (2007). *Introduction to AI and ES*. Pearson Education
2. Rich, Elaine & Kevin Knight. *Artificial Intelligence*. Tata McGraw Hill
3. Russel, Stuart & Peter Norvig (2007). *AI- A Modern Approac, 2e.* Pearson Education

Reference Books:

1. Clocksin, W.F. & Mellish (2001). *Programming in PROLOG, 3e.* Narosa Publishing House
2. Bratko, Ivan (2000). *Prolog Programming for Artificial Intelligence,3e.* Addison-Wesley, Pearson Education

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PAPER CODE BCA - 504
Oracle 8i

Course Objective

To enhance the knowledge and understanding of Database analysis and design. Enhance the knowledge of the processes of Database Development and Administration using SQL and PL/SQL. Use the Relational model and how it is supported by SQL and PL/SQL. Use the PL/SQL code constructs of IF-THEN-ELSE and LOOP types as well as syntax and command functions. Solve Database problems using Oracle 9i SQL and PL/SQL. This will include the use of Procedures, Functions, Packages, and Triggers.

Course Outcomes: On successful completion of this course, the students will be able to:

	PO1	PO2	PO3	PO4	PO5
CO1a: Understand the concepts of Oracle RDBMS Architecture and Role of DBA to solve the real-world problem of Data and Storage	3	3	2	-	3
CO1b: Understand and apply the concept Database creation and manipulation of Data to communicate.	3	3	2	-	3
CO2: Apply the concept of joining the tables to visualize data and provide controlled access to the data	2	3	3	-	3
CO3: Understand and apply the PL SQL block to perform data base Communication.	2	2	3	-	3
CO4: Understand and apply the concept of compiled statement using function, Procedure and Exception handing to make the database solution more robust	2	2	3	-	3

Course Contents

UNIT- I

RDBMS COMPONENTS – Kernel, Data Dictionary, Client-Server Architecture, Oracle Architecture, Oracle files and processes, Role of DBA

UNIT- II

Introduction: SQL*Plus and SQL, Data types in Oracle, DDL Statements, Computations on Table Data, Oracle Dual Table, Oracle Functions, Data Constraints, Grouping Data from Tables, Manipulating Dates, Pattern matching, Range Searching, Study of the clauses: Union, Intersect, Minus clause.

UNIT- III

Joining Multiple Tables (Equi Joins), Joining a Table to itself (self Joins), subqueries Creating views, Renaming the Column of a view. Updation, Selection, destroying views, Permission on the objects created by the user, GRANT statement, Object privileges, Referencing a table belonging to another user, Revoking the permission given, Sequences, lndexes.

UNIT- IV

Data Control Language (DCL), Data Security, Grant and Revoke, PL/SQL, Variables and type declarations, Loop structure, PL/SQL Blocks, Cursor/ Cursor loops, Types of stored PL/SQL Blocks, Exceptions

UNIT- V

Procedures & Functions - Concept, creation, execution, advantages, syntax, deletion, Triggers - Concept. use, how to apply database triggers, type of triggers, syntax, deleting, import, export.

Suggested Readings:

Main Text Books

1. SQL,PL/SQL The programming - Lang. of Oracle Ivan Bayross - BPB
2. Oracle Database 12c The Complete Reference (Oracle Press) by Bob Bryla , Kevin Loney – Oracle Press

Reference Books:

1. Oracle Database 12c SQL – Jason Price – Oracle Press
2. Oracle Database 12c PL/SQL Programming by McLaughlin – Oracle Press

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BCA – 601 Computer Networks

Course Objectives:

1. Build an understanding of the fundamental concepts of computer networking.
2. Familiarize the student with the basic taxonomy and terminology of the computer networking area.
3. Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
4. Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Course Outcomes: At the end of the course, students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Define and understand basic working of computer network and its components	-	1	1	-	2
CO1b: Understand and describe the Analog and Digital data transmission and transmission impairments	2	3	1	-	2
CO2: Understand the basic concept of OSI and TCP reference model	2	3	2	-	3
CO3: Understand, define and analyse the basics of ISDN, ATM data link services and standard data link layer protocols	2	2	2	-	2
CO4: Understand, identify and adapt the basic concept of IEEE standards protocols and networking devices for communications.	2	2	3	-	3

Course Contents:

Unit-I

Data Communication System: Purpose, Components: Source, transmitter, transmission System, receiver, and destination. Data transmission: Frequency, Spectrum and Bandwidth. Time-domain and frequency domain Concepts. Relationship between data-rate and Bandwidth. Network topology with advantages and disadvantages.

Unit-II

Analog and digital data transmission. Data and signal. Analog and digital signaling of analog and digital data. Modem, modulation techniques, codec, digital transmitter etc. Transmission impairments: attenuation and attenuation distortion, delay distortion, noise.

Unit-III

Introduction to Network, OSI reference model, TCP/IP reference model. Transmission Media: Magnetic Media, Twisted-Pair cables, Baseband & Broadband Coaxial cables, Fiber Optics. Wireless Transmission: Radio Transmission, Microwave Transmission, Bluetooth, Infrared, Virtual LAN.

Unit-IV

ISDN; ATM; data link layer: services, framing, error control, error-detecting & correcting codes. Data link protocols: stop-and-wait protocol, sliding window protocol. HDLC; static & dynamic channel allocation in LANS & MANS, FDDI.

Unit-V

Multiple Access Protocols: ALOHA, CSMA/CD; IEEE standards 1002.3 and Ethernet, 1002.4: Token Bus; 1002.5: Token Ring. Bridges, Routers, Gateways, Routing Algorithm, Congestion

control Algorithm, Internetworking, The TCP/IP Protocol, IP Addressing, Subnets, Supernets, IPv6.

Suggested Text Books:

1. Tanenbaum A. *Computer Networks*. Prentice Hall- publisher.
2. Forouzan. *Data Communication & Networking*. Mc Graw Hill Publisher.

Reference Books:

1. Stallins W. *Data & Computer Communications*. PHI- Publisher.

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BCA – Session 2022-26
BCA – 602 Computer Graphics & Multimedia

Course Objectives: The goal of this course is to introduce the theory and practice of computer graphics.

Course Outcomes: on completion of the course the students will be able to:

	PO1	PO2	PO3	PO4	PO5
CO1a: Understand the working of different display device and input device	1	2	1	-	2
CO1b: To implement line drawing algorithm and fill algorithms	3	2	2	-	1
CO2: To implement different clipping algorithm	3	2	2	-	1
CO3: To understand and apply geometric transformations	2	2	1	-	1
CO4: to describe the concept of multimedia	1	1	1	-	2

Course Contents:

Unit-I

Basics of Graphics Systems Applications, Display Devices: Video Displays, Raster- Scan Displays, Random Scan Displays, DVST, Flat- Panel Displays. Input Devices: Keyboards, Mouse, Trackball, and Space Ball, Joysticks, Digitizers, Image Scanner, Touch Panel, Light Pens, Voice Systems etc.

Unit-II

Line Drawing Algorithms: DDA Algorithm, Bresenham's line Algorithm. Bresenham's Circle drawing algorithm, Mid-Point Circle Algorithm, Scan-line Polygon Fill Algorithm, Inside-Outside test, Boundary Fill algorithm, Flood-Fill algorithm. Pixel, Pixel addressing, Antialiasing.

Unit-III

Clipping: COHEN-SUTHERLAND Line Clipping Algorithm, Line Clipping Using Non Rectangular Clip Windows, Polygon Clipping, Text Clipping.

Unit-IV

Two-dimensional Geometric Transformation: Translation, Rotation, Scaling, Reflection, Shear, Matrix representation and Homogeneous coordinates. Composite transformation: Translations, Rotations, Scaling, General Pivot-Point Rotation and Scaling.

Unit-V

Introduction to Multimedia: Review of Multimedia, Multimedia Applications, Multimedia Systems Architecture, Multimedia Hardware, Multimedia Software, Representation and

Operations on Various Multimedia Data Types: Text, Images, Graphics, Video and Audio, Introduction to Multimedia Authoring.

Suggested Text Books:

1. Gomes, J., & Velho, L. (1997). *Image processing for computer graphics*. Springer Science & Business Media.

2. Hearn, D., & Baker, M. P. (2004). *Computer graphics with OpenGL*. Upper Saddle River, NJ: Pearson Prentice Hall.
3. Rogers, D. F., & Earnshaw, R. (Eds.). (2001). *Computer graphics techniques: Theory and practice*. Springer Science & Business Media.

Reference Books:

1. Rajaraman, A. *Computer Graphics with Multimedia*. Narosa Publication.
2. Newman, W. S., & Sproul, R. S. (1981). *Principles of interactive computer graphics*. McGraw-Hill International.

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BCA – 603 Software Testing

Course Objectives: The Objective of this course is to learn and apply basic skills needed to create and automate the test plan of a software project, to know how to plan, develop, and execute an automated test plan. Students should learn testing concepts, Test planning, Creating a test plan in Test Director, Breaking the test plan into manageable components, Designing test cases and test steps, Analyzing the test plan, understanding of Automation testing, Creating a script through recording.

Course Outcomes: At the end of the course, students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Understand the fundamental concepts of software testing	2	2	3	-	3
CO1b: Design the test cases though different black box testing techniques	2	2	3	-	3
CO2: Design the test cases though different white box testing techniques	2	2	3	-	3
CO3: Understand and appreciate the importance of different levels of testing	2	2	3	-	3
CO4: Carry out testing of software though automation testing tools	2	2	3	-	3

Course Contents:

Unit-I

Introduction: Testing as an Engineering Activity, Testing as a process, testing axioms, basic Definitions Software Testing Principles, The Tester's Role in a software Development organization, The Defect Repository and Test Design, Developer/Tester Support for Developing a Defect Repository. Defect Prevention Strategies.

Unit-II

Test Case Design : Test Case Design Strategies, Using Black Box Approach to Test case design, Random Testing, Requirements based testing, Boundary Value Analysis, Decision tables, Equivalence class partitioning, State-based testing, Cause-effect graphing, Error guessing, Compatibility Testing.

Unit-III

Using White Box Approach to Test design, Test Adequacy Criteria, static testing vs. structural testing, code functional testing, Coverage and Control flow Graphs. Covering Code Logic, paths, their role in White box Based Test Design, Evaluating Test Adequacy Criteria.

Unit-IV

Levels Of Testing : The Need for Levels of Testing, Unit Test, Unit Test planning, Designing the Unit tests, The Test harness, Running the unit tests and Recording results, Integration tests, Designing integration Tests, Integration Test Planning, scenario testing, Defect bash elimination. System Testing, Acceptance testing, Performance testing, Regression testing, testing OO systems, testing the documentation.

Unit-V

Introduction to automatic testing & tools: Drawback of manual testing, Benefits of automatic testing, demerits of automatic testing, functional testing tools. Performance testing tools. Overview of automatic tool QTP: history, benefits, anatomy, main parts of QTP.

Suggested Text Books:

1. Srinivasan Desikan and Gopalaswamy Ramesh, Software Testing ' Principles and Practices', Pearson education.

2. Renu Rajani, Pradeep Oak, Software Testing - Effective Methods, Tools and Techniques, TataMcGraw Hill.

Reference Books:

1. Boris Beizer, Software Testing Techniques, Second Edition, Dreamtech.
2. Elfriede Dustin, Effective Software Testing, First Edition, Pearson Education.

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BCA – 604 Machine Learning

Course Objective

The main objective of this course is to help students learn and understand the concept of machine learning approaches with the help of Supporting Programming Language.

Course Outcomes- On successful completion of this course, students will be able to -

	PO1	PO2	PO3	PO4	PO5
CO-1a: Understand the concept of machine learning and it's various forms	2	1	1	-	2
CO-1b: Acquire knowledge about matrix operations for machine learning using python.	2	1	3	-	2
CO-2: Understand and develop linear regression-based machine learning models.	3	2	1	-	2
CO-3: Understand and develop logistic regression-based machine learning models.	3	2	1	-	2
CO-4: Understand and apply regularization techniques for avoiding overfitting of machine learning models.	3	2	1	-	2

Unit-I

Introduction: Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs. Unsupervised Learning, Statistical Learning: Bayesian Method, The Naive Bayes Classifier.

Unit-II

Software for Machine Learning and Linear Algebra Overview: Plotting of Data, Vectorization, Matrices and Vectors: Addition, Multiplication, Transpose and Inverse using available tool such as Python.

Unit-III

Linear Regression: Prediction using Linear Regression, Gradient Descent, Linear Regression with one variable, Linear Regression with multiple variables, Polynomial Regression, Feature Scaling /Selection.

Unit-IV

Logistic Regression: Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one variable and with multiple variables.

Unit-V

Regularization: Regularization and its utility: The problem of Overfitting, Application of Regularization in Linear and Logistic Regression, Regularization and Bias/Variance.

Reference Books

1. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.
2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007.
4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.

BCA – 605 Major Project

Course Objective- Major Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project.

Learning Outcomes- Upon completion of the major project, a successful student will be able to:

1.

	PO1	PO2	PO3	PO4	PO5
CO1: Implement a solution for a problem using appropriate programming techniques.	2	1	1	-	3
CO2: Create a design for a software system using appropriate design principles and patterns.	2	2	2	-	3
CO3: Utilize appropriate process and collaborative tools to contribute to a software project.	2	2	1	-	3
CO4: Work with their peers, building teamwork and group skills.	3	3	2	-	3

BCA – 701 Data Mining

Course Objectives:

1. Be familiar with mathematical foundations of data mining tools.
2. Understand and implement classical models and algorithms in data warehouses and data mining.
3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
4. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes: At the end of the course, students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Understand the functionality of the various data mining and data warehousing component.	2	1	1	-	1
CO1b: Appreciate the strengths and limitations of various data mining and data warehousing models.	2	2	2	-	1
CO2: Explain the analyzing techniques on various data mining primitives.	2	2	1	-	1
CO3: Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.	3	3	2	-	2
CO4: Develop skill in selecting the appropriate data mining algorithm for solving practical problems.	2	2	3	-	2

Course Contents:

Unit-I

Introduction: Data Mining – Motivation, Importance of DM Functionalities, Basic Data Mining Tasks, DM Applications, and Social Implications

Unit-II

Data Warehousing: Differences between Operational Database and Data Warehouse – Multidimensional Data Model - From Tables to Data Cubes. Schemas, Measures, DW Implementation – Efficient Computation of Data Cubes.

Unit-III

Data Reprocessing, Data Mining Primitives, Languages: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and concept of Hierarchy Generation, Task relevant Data, Background Knowledge, Presentation and Visualization of Discovered Patterns.

Unit-IV

Data Mining Algorithms: Association Rule Mining, Classification and Prediction – Decision Tree, Bayesian Classification Back Propagation, Cluster Analysis, Outlier Analysis.

Unit-V

Web, Temporal and Spatial Data Mining: Web Content Mining, Web Structure Mining, Web Usages Mining, Spatial Mining, Generalization and specialization, Spatial Rules, Spatial Classification and Clustering Algorithms, Temporal Mining, Modeling Temporal Events, Times Series, Pattern Detection, Sequences.

Reference Text Books:

1. Jiawei I-lan & Micheline Kambler, "Data Mining: Concepts and Techniques", Harcourt India Pvt. Ltd., First Indian Reprint, 2001
2. Margaret H. Dunham, "Data Mining : Introduction and Advance Topics", Pearson Education, First Indian Reprint, 2003
3. Arun K. Pujari, "Data Mining Techniques", University Press (India) Limited, First edition, 2001 4. Efrem O, Mallach, "Decision Support and Data Warehousing Systems", Mcgraw-Hill International Edition, 2000

BCA – 702 Research Methodology

Course Objective:

The primary objective of this course is to equip students with a comprehensive understanding of research methodology, enabling them to plan, conduct, and report on research effectively and ethically.

Course Outcomes: After Completion of this course the student would be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Demonstrate comprehensive understanding of the meaning and significance of research, its objectives and motivations	1	3	1	-	3
CO1b: To carry out the literature review by using methods.	1	3	2	-	3
CO2: Develop Proficiency in research design, experimental components, hypothesis testing, measurement principles, and measurement levels, is essential for effective research.	1	3	2	-	3
CO3: Understand the concept of sampling, data collecting and processing, and analyze the data according to need of research	1	3	2	-	3
CO4: Understand the concepts of writing reports of research.	1	3	2	-	3

Course Contents:

Unit-I

Introduction to Research Methodology: Meaning of Research, Objectives of Research, Motivations in Research, types of Research, Significance of Research, Research Process, Criteria of Good Research, Problem Identification & Formulation – Research Question – Investigation Question, Research Ethics and Integrity.

Unit-II

Literature Review Development, Argumentation and Synthesis, Referencing, Setting Objectives, Hypothesis, Qualities of a good Hypothesis, Types of Hypothesis, Null Hypothesis & Alternative Hypothesis.

Unit-III

Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables. Hypothesis Testing- Logic & Importance. Measurement: Concept of measurement: Problems in measurement in research – Validity and Reliability, Levels of measurement – Nominal, Ordinal, Interval, Ratio.

Unit-IV

Sampling: Concepts of Statistical Population, Sampling plan, Sampling Techniques- Probability & Non-probability Sampling. Data Preparation- Coding, Editing, Data Analysis: Univariate analysis (frequency tables, bar charts, pie charts, percentages), Testing Reliability, Tests of Association: Bivariate/Mutivariate analysis –Correlations and Regression,

Unit-V

Tests of Differences: t-tests, ANOVA, Interpretation of Data and Report Writing, Types and Layout of Research Report, Precautions in preparing the Research Report, Bibliography, Footnotes and Annexure in the Report. Plagiarism Issues.

Note: The course has to be taught with the help of MS Excel and IBM SPSS wherever needed.

Suggested Text Books:

1. Chapman, C. (2015). R for marketing research and analytics. New York, NY: Springer Science Business Media, LLC.
2. Cooper,R.,&Schindler,P.S.(2014).Businessresearchmethods(Twelfthedition).New York, NY: McGraw-Hill/Irwin.
3. Malhotra, N.K., & Birks, D.F.(2007). MarketingResearch:AnAppliedApproach(3ed).Harlow: Financial Times Prentice Hall.
4. Poynter, R. (2010). The handbook of online and social media research: tools and techniques for market researchers. New York: Wiley.
5. Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2013). Business research methods. Cengage Learning.

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BCA – 703 Data science using Python

Course Objective:

By the end of this course, students will be able to demonstrate a comprehensive understanding of data science principles and practices, including data collection, pre-processing, exploratory data analysis, model development, and evaluation.

Course Outcomes: After Completion of this course the student would be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: Acquire the knowledge for the evolution of data science and its various roles.	2	3	1	-	3
CO1b: Implement the data handling and data preprocessing on gathered data.	2	2	2	-	3
CO2: Use statistics, and implement different plotting models.	3	2	3	-	3
CO3: Implement models on analyzed data to predict and make decisions.	2	3	2	-	3
CO4: Learn to validate models using cross validation and using multiple parameters.	2	3	2	-	3

Unit – I: Introduction
Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

Unit – II: Data Collection and Data Pre-Processing
Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

Unit – III: Exploratory Data Analytics
Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

Unit – IV: Model Development
Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

Unit – V: Model Evaluation
Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

Suggested Text Books:

1. Jojo Moolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016.
2. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
4. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.

BCA – 705 Research Project-I

Course Objectives: Enable students to conceive, design, execute, and present an original research project in the field of computer science, fostering critical thinking, problem-solving, and advanced technical skills while contributing to the body of knowledge within the discipline.

	PO1	PO2	PO3	PO4	PO5
CO1a: Demonstrate proficiency in conducting independent research in the field of computer science	-	1	-	2	3
CO1b: Identify research problems or questions relevant to the field and clearly define them.	-	1	-	1	3
CO2: Conduct comprehensive literature review and analyzing existing research to identify gaps and opportunities for further investigation.	-	1	-	2	3
CO3: Apply critical thinking skills to solve complex research problems and adapt their approaches as needed.	-	1	-	1	3
CO4: Develop a well-structured research proposal that outlines the research objectives, methodologies and expected outcome	-	1	-	3	3

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BCA – 801 Mobile Application Development

Course Objectives: The goal of this subject is to understand the different types of command use for different purpose in Linux. Understanding the mobile application technology using Android and develop the mobile apps by Android Studio.

Course Outcomes: At the end of the course, students will be able to

	PO1	PO2	PO3	PO4	PO5
CO1a: To Describe Lunix features and use basic commands	2	3	1	-	3
CO1b:To understand concept of mobile application	2	2	2	-	3
CO2: To understand architecture of android OS	2	2	3	-	3
CO3: To apply android framework and their components	2	3	2	-	3
CO4: To develop mobile app for real world problems	2	3	2	-	3

Course Contents:

Unit-I

Linux introduction and file system - Basic Features, Advantages, Installing requirement, Basic Architecture of Unix/Linux system, Kernel, Shell., Linux standard directories. Commands for files and directories cd, ls, cp, md, rm, mkdir, rmdir, pwd, file, more, less, creating and viewing files using cat, file comparisons – cmp & comm, View files, disk related commands, Filters, Redirection Operator and File permission command.

Unit-II

An Introduction to Mobile Computing- mobile Application Programming, Different Platforms. Operating systems-Architecture and working of Android, iOS and Windows phone, Comparison of Android, iOS and Windows phone, Android Development Environment - Advantages and Future of Android, Android Origin, Version and API level, Use of Android Studio.

Unit-III

Android Software Development Platform - Understanding Java SE and the Dalvik Virtual Machine, The Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder Leveraging Android XML, Screen Sizes, Launching Your Application, Configure Virtual Device/Real Device for execute Android Apps.

Unit-IV

Android Framework Overview- The Foundation of OOP: The APK File, Android Application Components, And Android Activities: Defining the UI, Android Services: Processing in the Background, Broadcast Receivers: Announcements and Notifications, Activity Life Cycle, Fragment and Intents.

Unit-V Working with the User Interface Using Views and ViewGroups, Different Layouts, Handling UI Events, Handling Pictures and Menu with Views, Storing the Data Persistently.

Suggested Text Books:

1. Cinar O. *Beginning Android 4*. Apress Publication.
2. Meier R. *Professional Android 4 Application Development.* Wrox Publication.

Reference Books:

1. Kothari P. *Android Application Development*. Black Book. Dream Tech Publication.
2. Novák I., Arvai Z., Balássy G., Fulop D. *Beginning Windows 8 Application Development*. Wrox Publication.

BCA – 803 Mobile Application Development Tutorial

1. Develop android application to print welcome message on a screen?
2. Develop android application to show the output of activity life cycle?
3. Develop android application to calculate simple Arithmetic Operation on Android?
4. Develop android application to show the fragment?
5. Develop android application to pass parameter from one activity into another activity?
6. Develop android application to perform operation through intent object?
   (i) Open Google website
   (ii) Dial a number
   (iii)Sending message
7. Develop SMS APPLICATION on Android?
8. Develop android application to show the different layout?
9. Develop android application to create menus?
10. Develop android application for image gallery?
11. Develop android application to perform following operation?
    (i) Display of progress bar
    (ii) Use of dialogue box
    (iii)Set the time
    (iv)Set the date
12. Develop android application for Creating Dialog box?
13. Develop android application for login Screen?

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BCA – 802 Cloud Computing

Course Objectives

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
- To enable students exploring some important cloud computing driven commercial systems and applications.
- To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

Course Outcomes: On successful completion of this course, the students will be able to:

	PO1	PO2	PO3	PO4	PO5
CO1a: Understand various service delivery models of a cloud computing architecture.	3	3	2	-	1
CO1b: Understand the ways in which the cloud can be programmed and deployed.	3	2	3	-	3
CO2: Understand cloud service providers	3	3	2	-	1
CO3: Apply virtualization techniques.	3	3	2	-	1
CO4: Create a cloud computing environment.	3	3	2	-	2

Unit-I

Cloud Computing Overview – Origins of Cloud computing – Cloud components - Essential characteristics On- demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity, Measured service. Cloud scenarios – Benefits: scalability, simplicity, vendors, security. Limitations – Sensitive information - Application development – Security concerns - privacy concern with a third party - security level of third party - security benefits

Unit-II

Cloud Computing Architecture: Cloud computing stack - Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services Service Models (XaaS) - Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS)

Unit-III

Cloud Computing Architecture: Deployment Models – Public cloud, Private cloud, hybrid cloud, Community cloud; Cloud security: Infrastructure security, data security and storage, Identity and access Management, Access control.

Unit-IV

Virtualization: Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations; Types of hardware virtualization: Full virtualization - partial virtualization - para virtualization; Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services, choosing a Cloud platform for an organization based on application requirements, economic constraints

and business needs

Unit-V

Setting up your own Cloud: How to build private cloud using open source tools, understanding various cloud plugins, setting up your own cloud environment- Auto provisioning, Custom images, Integrating tools like Nagios; Integration of Public and Private cloud. Future Directions: Cloud Domain and scope of work, Cloud Computing Programming Introduction, Trends and market of cloud

Text Books

1. Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications [ISBN: 978-0521137355]
2. Cloud computing a practical approach - Anthony T.Velte, Toby J. Velte Robert Elsenpeter TATAMcGraw- Hill , New Delhi – 2010 [ISBN: 0071626948]
3. Dimitris N. Chorafas, Cloud Computing Strategies [ISBN: 1439834539]
4. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online -Michael Miller - Que 2008

Reference Books

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M.Goscinski Wile, 2011
3. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam,Springer, 2012.
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell DeanVines, Wiley-India, 2010

BCA – 804 Research Project-II

Course Objectives: Develop advanced research skills and cultivate a deep understanding of cutting-edge technologies and methodologies within the field of computer science through the successful completion of a research project

	PO1	PO2	PO3	PO4	PO5
CO1a Demonstrate the ability to collect and analyse data or conduct experiments, as per the requirement of research project	-	1	-	2	3
CO1b Acquire and demonstrate technical competence in using technical tools and software for research.	-	1	-	2	3
CO2Demonstrate innovation and creativity in proposing novel solutions and ideas in research	-	1	-	2	3
CO3 Students should be able to effectively communicate their research findings through written reports, oral presentations, and visual aids.	-	1	-	2	3
CO4 Demonstrate the ability to work collaboratively and effectively communicate research findings through written reports and visual aids.	-	1	-	2	3