Semester II

BCA2CJ101 - Fundamentals of Programming (C Language)

Programme	BCA
Course Code	BCA2CJ101
Course Title	Fundamentals of Programming (C Language)
Type of Course	Major
Semester	II
Academic Level	100 – 199

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamentals of Algorithms and Flowcharts 2. BCA1CJ104 – Fundamentals of Computers and Computational Thinking				
Course Summary	The objectives of this course are to make the student understand programming language, programming, concepts of Loops, reading a set of Data, stepwise refinement, Functions, Control structure, Arrays, Structures, Unions, and Pointers. After completion of this course the student is expected to analyze the real-life problem and write a program in 'C' language to solve the problem. The main emphasis of the course will be on problem solving aspect i.e. developing proper algorithms.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Remember the program structure of C with its syntax and semantics	U	C	Instructor-created exams / Quiz
CO2	Use the various constructs of a programming language viz. conditional, iteration and recursion.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Implement the algorithms in C language.	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Use simple data structure like array in solving problems.	Ap	C	Practical Assignment / Observation of Practical Skills
CO5	Handling pointers and memory management functions in C.	Ap	P	Practical Assignment / Observation of Practical Skills
CO6	Develop efficient programs for solving a problem.	Ap	P	Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (45+30)	Marks
I	**Introduction to C Language**		**10**	
	1	History of C, Importance of C, and sample programs	2	
	2	Character set, Tokens, Constants, Variables, and Data types	2	
	3	Operators - Arithmetic, Relational, logical, assignment, increment, decrement, conditional, bitwise and special	3	

		operators. Arithmetic expressions, operator precedence, type conversions, mathematical functions		
	4	Managing Input and Output Operators: Reading and writing a character, formatted input, formatted output.	3	
II	**Decision Making Branching and Looping**		**10**	
	5	Decision making with If - simple If, If else, nested If else, else If ladder	3	
	6	Switch statement, conditional operator, Goto statement	2	
	7	Loops: while, do while, for statements and nested loops	3	
	8	Jumps in loops – break, continue	2	
III	**Arrays and Functions**		**15**	
	9	One dimensional array – declaration, initialization and accessing	2	
	10	Two-dimensional array – declaration, initialization and accessing	2	
	11	Multi dimensional array, dynamic array	1	
	12	Strings – Reading, Writing. Arithmetic operations on characters, Comparisons and string handling functions	2	
	13	Functions – Need, Elements of user defined functions and definition	2	
	14	Return values and their types, function call and declaration, call by value and call by reference	2	
	15	Categories of functions, Nesting of functions	1	
	16	Recursion and command line arguments	1	
	17	Passing arrays to functions and passing strings to functions	2	
IV	**Storage Classes, Structure and Union, Pointers**		**10**	
	18	Storage classes – The scope, visibility and lifetime of variables. Auto, Extern, Static and Register storage classes. Storage classes in a single source file and multiple source files	2	
	19	Structure and Union - Defining, giving values to members, initialization and comparison of structure variables, arrays of structure, arrays within structures, structures within structures, structures and functions, unions	2	
	20	Pointers definition, declaring and initializing pointers, accessing a variable through address and through pointer, pointer expressions, pointer increments and scale factor	2	
	21	Pointers and arrays, pointers and functions, pointers and structure	2	
	22	Dynamic memory allocation and memory management functions	2	
V	**Hands-on Problem-Solving Using C Practical Applications, Case Study and Course Project**		**30**	
	1	Implement the following: **1. Variables, Data types, Constants and Operators:** 1.Evaluation of expression ex: ((x+y) ^2 * (x+z))/w 2.Temperature conversion problem (Fahrenheit to Celsius) 3.Program to convert days to months and days (Ex: 364 days = 12 months and 4 days) 4. Salesman salary (Given: Basic Salary, Bonus for every item sold, commission on the total monthly sales)	30	

		2. Decision making (Branch / Loop) Statements: 5.Solution of quadratic equation 6.Maximum of three numbers 7.Calculate Square root of five numbers (using goto statement) 8.Pay-Bill Calculation for different levels of employee (Switch statement) 9. Fibonacci series 10.Armstrong numbers 11.Pascal 's Triangle **3. Arrays, Functions and Strings:** 12.Prime numbers in an array 13.Sorting data (Ascending and Descending) 14.Matrix Addition and Subtraction 15.Matrix Multiplication 16.Transpose of a matrix 17Function with no arguments and no return value 18. Functions with argument and return value 19.Functions with argument and multiple return values 20.Function that convert lower case letters to upper case 21. Factorial using recursion. 22. Perform String Operations using Switch Case 23. Largest among a set of numbers using command line argument **4. Structures and Union:** 24. Structure that describes a hotel (name, address, grade, avg room rent, number of rooms) Perform some operations (list of hotels of a given grade etc.) 25. Using Pointers in Structures. 26. Cricket team details using Union. **5. Pointers:** 27.Evaluation of Pointer expressions 28.Function to exchange two pointer values 29. Reverse a string using pointers 30.Insertion, deletion, and searching in an array		

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	1	1	-	-						
CO 2	-	1	2	2	-	-						
CO 3	-	1	3	3	-	-						
CO 4	-	1	2	2	-	-						
CO 5	-	2	2	2	-	-						
CO 6	-	1	3	3	1	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6			✓	

References:

1. Kernighan, B. W., & Ritchie, D. M. (1988). The C Programming Language (2nd ed.). Prentice Hall. ISBN: 978-0131103627
2. King, K. N. (2008). C Programming: A Modern Approach (2nd ed.). W. W. Norton & Company. ISBN: 978-0393979503
3. Schildt, H. (2000). C: The Complete Reference (4th ed.). McGraw-Hill. ISBN: 978-0072121247
4. Kochan, S. G. (2004). Programming in C (3rd ed.). Sams Publishing. ISBN: 978-0672326660
5. Griffiths, D., & Griffiths, D. (2012). Head First C. O'Reilly Media. ISBN: 978-1449399917
6. Kanetkar, Y. (2008). Let Us C (8th ed.). BPB Publications. ISBN: 978-1934015256
7. Prata, S. (2004). C Primer Plus (5th ed.). Sams Publishing. ISBN: 978-0672326967

BCA2CJ102/BCA2MN101 - Statistical Foundation for Computer Applications

Programme	BCA
Course Code	BCA2CJ102/BCA2MN101
Course Title	Statistical Foundation for Computer Applications
Type of Course	Major/Minor (A2)
Semester	II

Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. A strong foundation in algebra 2. Fundamentals of Set theory and logic				
Course Summary	The course on probability and statistics covers fundamental topics including descriptive statistics (measures of central tendency and dispersion), probability theory (events, sample spaces, probabilitylaws, random variables, and distributions), inferential statistics (regression analysis), and applications in various fields such as science, engineering, economics, and social sciences, emphasizing critical thinking, data analysis, and problem-solving skills.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Apply fundamental statistics concepts	Ap	C	Quizzes, Homework, Exams
CO2	Analyze data using descriptive statistics	An	P	Projects, Midterm, Exams
CO3	Perform regression analysis	An	P	Projects, Exams
CO4	Apply probability and statistics in real-world situations	Ap	C	Projects, Exams
CO5	Develop critical thinking and problem-solving skills	E	M	Homework, Projects
CO6	Communicate statistical findings effectively	E	M	Presentations, Reports

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (48+12)	Mark
I		**DESCRIPTIVE STATISTICS**	**10**	**15**
	1	Concept of primary and secondary data, Methods of collection	2	

	2	Measures of central tendencies (Mean, Median, Mode, HM, GM)	4	
	3	Measures of dispersion, Relative Measures and Absolute Measures	2	
	4	Range, Quartile deviation, Mean deviation, standard deviation, Variance	2	
II	**STATISTICAL INFERENCE AND REGRESSION ANALYSIS**		**10**	**15**
	5	Principles of Least Squares and Fitting of Stright Line	3	
	6	Point estimation: maximum likelihood estimation (MLE), method of moments. Confidence intervals for population parameters.	2	
	7	Pearson's Coefficient of Correlation and Rank Correlation	2	
	8	Simple linear regression and multiple linear regression. Logistic regression for classification problems.	3	
III	**PROBABILITY THEORY**		**12**	**20**
	9	Random experiment, Sample point, Sample Space	1	
	10	Events, Operation of events (Union, Intersection, Complement of Events)	2	
	11	Exclusive and exhaustive events, equally likely events with examples	1	
	12	Classical approach to probability, Axiomatic definitions of probability, Simple problems	2	
	13	Theorems of probability - Addition Theorem, Multiplication Theorem	2	
	14	Conditional probability	2	
	15	Inverse probability	1	
	16	Baye's Theorem	1	
IV	**ADVANCED PROBABILITY DISTRIBUTION**		**16**	**20**
	17	Discrete and continuous random variables and probability distribution	3	
	18	Binomial distribution: Definition, Expectation, Variance, Moment Generating Function and Problems	2	
	19	Poisson distribution: Definition, Expectation, Variance, Moment Generating Function and Problems	2	
	20	Normal distribution: Definition, Expectation, Variance, Moment Generating Function, Standard normal curve and Problems	3	
	21	Testing of Hypothesis: General principles of testing, Two types of errors	3	
	22	Type of Testing: T-Test, ANOVA-Test, Chi-square test (Concept Only)	3	
	Open Ended module- Application Level		**12**	
	1	Discuss topics from the following: • Reliability and Validity of Different Data Sources. • Highlighting the use of Measures Mean, Median and Mode in Real-World Scenarios.	10	

V		• Significance of Measures of Dispersion in Data Analysis. • Interpretation of EDA plots. • Importance of Correlation and Regression in numerous Computer fields. • Problem sets involving real-world applications of probability theorems. • Central Limit Theorem. • Real-world scenario of Binomial, Poisson and Normal Distribution. • Difference between of Binomial, Poisson and Normal Distribution. • Advanced Concept of T-Test, ANOVA-Test, Chi-square test, Z-Test. • Markov-Chain-Montee-Carlo Method and it's use.		
	2	Case Study	2	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	3	-	1	1	1						
CO 2	1	3	-	-	1	-						
CO 3	1	3	-	-	2	2						
CO 4	1	3	-	-	2	2						
CO 5	2	1	-	1	1	-						
CO 6	2	1	1	2	2	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		✓

References:

1. Introduction to Mathematical Statistics, Hogg R V Craig A T, Macmillan
2. Mathematical Statistics, Freund J E, Waple R E, Prentice Hall of India.
3. Probability and Statistics for Engineers, Miller I Freund J E, Prentice Hall of India.
4. Statistics for Management, Levin R I, Prentice Hall of India
5. Introduction to Mathematical Statistics, Hogg R V Craig A T, Macmillan
6. Mathematical Statistics, Freund J E, Waple R E, Prentice Hall of India.
7. Probability and Statistics for Engineers, Miller I Freund J E, Prentice Hall of India.
8. Gupta, S.P. Statistical Methods. Sultan Chand and Sons: New Delhi.
9. Mood, A.M., Graybill, F.A and Boes, D.C. Introduction to Theory of Statistics. 3rd Edition Paperback – International Edition.
10. Mukhopadhyay, P. Mathematical Statistics. New central Book Agency (P) Ltd: Calcutta
11. Probability and Statistics for Computer Scientists by Michael Baron

BCA2CJ103/BCA2MN102 - Numerical Analysis and ptimization Techniques

Programme	BCA				
Course Code	BCA2CJ103/BCA2MN102				
Course Title	Numerical Analysis and Operations Research				
Type of Course	Major/Minor (B2)				
Semester	II				
Academic Level	100 – 199				
Course Details	Credit	Lecture	Tutorial	Practical	Total

		per week	per week	per week	Hours
	4	4	-	-	60
Pre-requisites	1. Understanding of algebraic concepts, including solving equations and inequalities. 2. Familiarity with the concept of derivatives and integrals.				
Course Summary	This course covers foundational concepts in numerical methods and operations research, emphasizing error analysis and solution techniques for algebraic and transcendental equations. Students will develop skills in polynomial interpolation, numerical integration, and explore fundamental principles of operations research, including linear programming.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Develop a solid foundation in numerical methods, acquiring the skills to analyze and solve algebraic and transcendental equations, and gaining a practical understanding of the sources and management of errors in numerical computations.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO2	Cultivate both a comprehensive grasp and practical proficiency in polynomial interpolation techniques, alongside acquiring expertise in numerical methods for the solution of definite integrals.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO3	Establish a robust groundwork in Operations Research, nurturing a discerning capability to critically evaluate its applications across diverse problem-solving scenarios.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO4	Develop expertise in Linear Programming, mastering the art of employing sophisticated optimization techniques for the effective resolution of Linear Programming problems.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO5	Impart a comprehensive understanding of transportation problems and cultivate an appreciation for the methods used in finding basic feasible solutions.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO6	Develop proficiency in addressing assignment problems and employ the method to attain optimal solutions, providing a holistic skill set for logistical optimization.	Ap	P	Practical Assignment / Instructor-created exams / Quiz

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (48+12)	Marks
I		**Numerical Analysis I**	**10**	**15**
	1	Errors in numerical calculations - Sources of errors	1	
	2	Solution of Algebraic and Transcendental Equations - Bisection method	3	
	3	Method of false position	3	
	4	Newton Raphson method	3	
II		**Numerical Analysis II**	**12**	**15**
	5	Polynomial Interpolation - Lagrange interpolation	3	
	6	Newton's forward and backward difference interpolation	3	
	7	Numerical Solution of Definite Integral - Simpson's 1/3rd rule	2	
	8	Simpson's 3/8 Rule	2	
	9	Trapezoidal method	2	
III		**Operations Research I**	**13**	**20**
	10	Introduction to Operations Research – Definition, Advantages and Limitations of Operations Research	1	
	11	Linear Programming Problem – Definition, Formulation of LPP, Feasible solution and Optimal solution	2	
	12	Dual of LPP	2	
	13	Graphical solution of LPP	2	
	14	Simplex Method	3	
	15	Big-M method	3	
IV		**Operations Research II**	**13**	**20**
	16	Transportation Problem – Definition, Balanced and unbalanced Transportation problems	1	
	17	Finding basic feasible solutions – Northwest corner method	2	
	18	Least cost method	1	
	19	Vogel's approximation method	2	
	20	Optimized (MODI) method	3	
	21	Assignment model - Definition, Balanced and unbalanced Assignment problems	1	
	22	Hungarian method for optimal solution	3	
V		**Open Ended Module – Other Numerical Methods**	**12**	
	1	• Any other two methods to solve Algebraic and Transcendental Equations • Any other two methods for Polynomial Interpolation • Any other two methods to solve Solution of Definite Integral • Any other method to solve LPP	12	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	1	-	3	-						
CO 2	1	-	1	-	3	-						

CO 3	3	-	1	-	3	-						
CO 4	3	-	1	-	3	-						
CO 5	3	-	1	-	3	-						
CO 6	3	-	1	-	3	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		✓

References:

1. Sastry S.S., Introductory Methods of Numerical Analysis, Prentice Hall India.

2. E. Carl Froberg and Erik Carl Frhoberg, Introduction to Numerical Analysis, Addition Wesley.

3. Hamdy A. Taha, Operations Research an Introduction, Pearson Education Limited.

4. P. Sankara Iyer, Operations Research, Tata McGraw-Hill, 2008.

5. A.M. Natarajan, P. Balasubramani, A. Tamilarasi, Operations Research, Pearson Education, 2005.

BCA2FS112 – Data Analysis using Spread Sheet

Programme	BCA				
Course Code	BCA2FS112				
Course Title	Data Analysis using Spread Sheet				
Type of Course	SEC				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	2	-	2	60
Pre-requisites	1. Familiarity with Spreadsheet Software.				

	2. Understanding of Basic Mathematical and Statistical Concepts
Course Summary	After completing the course, students have a solid foundation in data analysis using spreadsheets, empowering them to analyze data with confidence, derive meaningful insights, and communicate their findings effectively to stakeholders.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Students will demonstrate proficiency in managing spreadsheets, including creating, formatting, and manipulating data within workbooks. They will be able to effectively navigate the spreadsheet interface and utilize toolbars.	Ap	P	Instructor-Create Exams or Quiz
CO2	Learners will understand the importance of data organization and cleansing in spreadsheets. They will be able to import, export, filter, sort, validate, and remove duplicates from datasets. Students will develop skills to ensure data integrity and consistency, enhancing their ability to work with clean and organized datasets.	U	C	Discussions and Quizzes
CO3	Participants will acquire advanced data analysis skills like pivot tables, what-if analysis, and goal seek. They will be able to apply various spreadsheet functions and tools to perform complex calculations, analyze trends, and make informed decisions based on data analysis.	An	P	Instructor created exams or Home assignments
CO4	Students will gain proficiency in data visualization techniques using spreadsheets. They will be able to create a variety of charts, design pivot charts, and dashboards for effective data analysis.	C	P	Discussions, Quizzes
CO5	Learners will be able to implement form controls for interactive data manipulation in their visualizations, enhancing their ability to present and explore data dynamically.	Ap	P	Viva Voce Observation of practical skills
CO6	Learners will develop skills in advanced features of spreadsheets such as macros, protecting data sheets and workbooks, utilizing split, freeze, and hide options	C	P	Instructor Created -Exams, Assignments

	effectively. They will also learn to incorporate add-ins for extended functionalities and manage printing options for the professional presentation of data.			

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (30+30)	Marks
I		**Introduction to Spreadsheet**	**7**	**10**
	1	Overview of spreadsheet software (e.g., Microsoft Excel, Google Sheets), Basic spreadsheet navigation and interface	1	
	2	Entering and formatting data, Data types and cell formatting, Sorting and filtering data	2	
	3	Arithmetic operations and basic formulas, Common functions (SUM, AVERAGE, MIN, MAX, COUNT)	2	
	4	Text functions (CONCATENATE, LEFT, RIGHT, MID, TEXT), Date and time functions	2	
II		**Data Cleaning and Visualization**	**8**	**15**
	5	Logical functions (IF, AND, OR, NOT, IFERROR, IFS, SWITCH), Lookup and reference functions (VLOOKUP, HLOOKUP, INDEX, MATCH)	2	
	6	Financial functions (NPV, IRR, PMT), Array formulas (SUMPRODUCT, SUMIF, AVERAGE, TRANSPOSE, Array Multiplication, FILTER, IMPORTRANGE)	2	
	7	Handling missing values and duplicates, Data transformation techniques (text to columns, merging cells)	2	
	8	Using advanced text functions for data cleaning, Data validation rules and error-checking	1	
	9	Creating and customizing charts (bar, line, pie, scatter, Histogram), Conditional formatting for data visualization	1	
III		**Pivot Tables and Pivot Charts**	**8**	**10**
	10	Sparklines and data bars, Advanced chart techniques (combination charts, dual-axis charts)	2	
	11	Creating and configuring pivot tables, Grouping and summarizing data in pivot tables	2	

	12	Creating and customizing pivot charts	2	
	13	Using slicers and timeline for interactive analysis	2	
IV	**Data Analysis Technique**		**7**	**15**
	14	Descriptive statistics (mean, median, mode, standard deviation)	1	
	15	Correlation and regression analysis with example, Data analysis tools (Solver, Analysis ToolPak)	2	
	16	Scenario analysis and what-if analysis (Goal Seek, Data Tables, Scenario Manager)	2	
	17	Introduction to DAX (Data Analysis Expressions) for complex calculations (Concept Only)	2	
V	**Practical Applications**		**30**	
	1	1. Implement filter and sort operations. 2. Perform basic Arithmetic operations (Sum, Difference, Product, Divides) 3. Using a dataset of student grades in different subjects, calculate the average grade, highest grade (MAX), lowest grade (MIN), and the total number of grades recorded (COUNT). 4. Create a spreadsheet with a list of full names in one column. Use text functions to separate the first names and last names into two new columns. 5. Create a spreadsheet with a list of dates of birth and names. Using the appropriate date and time functions, calculate each person's current age. 6. Perform Logical function on a given dataset. 7. Using a dataset of students' information, create a bar chart to visualize the data. Customize the chart with titles, axis labels, and different colours for each bar. 8. A list of 15 students with their hours of study per week and their corresponding exam scores, Use the CORREL function to Calculate the correlation coefficient.	**7**	

		9. Perform a simple linear regression to determine the relationship between advertising spend and sales. 10. Implement any one real life example.		

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	2	1	-	-						
CO 2	1	-	2	1	-	-						
CO 3	1	-	1	1	-	-						
CO 4	2	-	3	2	-	-						
CO 5	2	-	3	3	1	-						
CO 6	1	-	3	3	1	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓

CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		✓

References:

1. Alexander, M., Kusleika, R., & Walkenbach, J. (2018). Excel 2019 Bible. Wiley.
2. Winston, W. (2019). Microsoft Excel Data Analysis and Business Modeling. Microsoft Press.
3. Nigam, M. (2021). Data Analysis with Excel: Tips and Techniques. BPB Publications.
4. Alexander, M., & Kusleika, D. (2018). Excel 2019 Power Programming with VBA. Wiley.
5. McFedries, P. (2019). Excel Pivot Tables and Pivot Charts: Your visual blueprint for creating dynamic spreadsheets. Visual.