CA-C2T: STATISTICS-I	
Total Teaching Hours: 48	No. Of Lecture Hours/Week: 3
Max Marks:60	Credit : 3
Summative Assessment Marks: 60	Formative (internal) Assessment Marks: 40

Course Objective:
To enable Students to understand basic theoretical and applied principles of statistics needed to enter the job force, which can help them to communicate key statistical concepts to non-statisticians.

Course Outcome:

- Organize, manage and present data.
- Analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
- Analyze statistical data using measures of central tendency, dispersion and location.
- To identify relationships between variables.

UNIT 1- Introduction	**Teaching Hours:12**

Introduction

Population and sample, Types of data – Qualitative, Quantitative, Univariate, Multivariate, Cross-sectional, Time, Series, Discrete, Continuous, Primary, Secondary, Scales of measurement – Nominal, Ordinal, Interval, Ratio, Variables and attributes, Organization and presentation of data, Construction of frequency distributions (Univariate and bivariate), Presentation of data through diagrams (bar and pie) and graphs (frequency curve, histogram, cumulative frequency curves), Stem and leaf plot.

UNIT 2- Measures of Central Tendency	**Teaching Hours:12**

Measures of Central Tendency

Measures of location or central tendency – Arithmetic mean, Median, Mode, Geometric mean, Harmonic mean – Properties, Positional averages or quartiles – Quartiles, Deciles, and Percentiles

UNIT 3- Measures of Dispersion	**Teaching Hours:12**

Measures of dispersion

Absolute measures – Range, Mean deviation, Quartile deviation, Standard deviation – Statement of properties, Coefficient of variation, Skewness and Kurtosis – Concept and measures. Discussions on the suitability of the different measures in practical situations

UNIT 4- Correlation and Regression	**Teaching Hours:12**

Correlation and Regression

Linear correlation – Scatter diagram, Product moment correlation coefficient – Properties, Spearman's rank correlation coefficient, Simple regression, Prediction.

Text Books:

1. A.M. Goon, M.K. Gupta, and B. Das Gupta, Fundamentals of Statistics, Vol. 1, Sixth Edition, World Press, Calcutta.
2. Gupta and Kapoor, Fundamentals of Mathematical Statistics, Tenth Revision Edition
3. Pal, Sarkar, Statistics Concepts and Applications, Second Edition, PHI.
4. Sheldon M. Ross, Introductory Statistics, Second Edition, Academic Press.

Reference Text Books:

1. Introduction to the theory of statistics, A.M Mood, F.A Graybill and D.C Boes, Tata McGraw-Hill, 3rd Edition (Reprint), 2017.
2. B.L. Agarwal, Basic Statistics (2013), New Age Publishers.
3. J. Medhi, Statistical Methods – An Introductory Text, New Age Publishers.
4. G.W. Snedecor, Cochran, Statistical Methods, Eighth Edition, Wiley.

Web Resources:

NPTEL: Introduction to Probability and Statistics

CA-C2T: PROGRAMMING IN C

Total Teaching Hours: 48	No. Of Lecture Hours/Week: 3
Max Marks:60	Credit: 3

Course Objectives:

On completion of the course, the student will be able to

- ✓ To study about algorithms, flowcharts and programs.
- ✓ To solve problems through logical thinking.
- ✓ To clearly understand the logic of the problem.
- ✓ To analyze the given problem and write the algorithm, flowchart.
- ✓ To write structured C programs, this is the foundation of any programming language.

Course Outcome:

- Demonstrate an understanding of computer programming language concepts.
- To write structured C programs, this is the foundation of any programming language.
- Be able to write and interpret one-dimensional array expressions.
- To understand importance of data structures in context of writing efficient programs and to learn how to perform various FILE I/O

UNIT 1: INTRODUCTION TO PROGRAMMING CONCEPTS — Teaching Hours 12

Software, Classification of Software, Modular Programming, Structured Programming, Algorithms and Flowcharts with examples. Overview of C Language: History of C, Character set, C tokens, Identifiers, Keywords, Data types, Variables, Constants, Symbolic Constants , Operators in C, Hierarchy of Operators, Expressions, Type Conversions and Library Functions.

UNIT 2: MANAGING INPUT AND OUTPUT OPERATION — Teaching Hours 12

Formatted and Unformatted I/O Functions, Decision making, branching and looping: Decision Making Statements - if Statement, if–else statement, nesting of if-else statements, else–if ladder, switch statement,?: operator, Looping - while, do-while, for loop, Nested loop, break, continue, and goto statements.

UNIT 3: FUNCTIONS & ARRAYS — Teaching Hours 12

Function Definition, prototyping, types of functions, passing arguments to functions, Nested Functions, Recursive functions.

Declaring and Initializing, One Dimensional Arrays, Two Dimensional Arrays, Multi Dimensional Arrays - Passing arrays to functions. Strings: Declaring and Initializing strings, Operations on strings, Arrays of strings, passing strings to functions. Storage Classes - Automatic, External, Static and Register Variables.

UNIT 4 : STRUCTURES & FILES	Teaching Hours 12

Declaring and Initializing, Nested structure, Array of Structure, Passing Structures to functions, Unions, typedef, enum, Bit fields. Pointers – Declarations, Pointer arithmetic, Pointers and functions, Call by value, Call by reference, Pointers and Arrays, Arrays of Pointers, Pointers and Structures. Meaning of static and dynamic memory allocation, Memory allocation functions.

File modes, File functions, and File operations, Text and Binary files, Command Line arguments. C

Preprocessor directives, Macros – Definition, types of Macros, Creating and implementing user defined header files.

Text Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd edition, The MIT Press Cambridge, Massachusetts London, England. 2008.
2. Brain M. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd edition, Princeton Hall Software Series, 2012.
3. "Let Us C", Yashavant Kanetkar, 17th edition, BPB Publications

Reference Books:

1. Ashok N. Kamthaneet. al., "Computer Programming and IT", Pearson Education, 2011
2. Mahapatra, "Thinking In C", PHI Publications, 1998.
3. Greg Perry and Dean Miller, "C Programming Absolute Beginner's Guide", 3rd edition, Pearson Education, Inc, 2014.

Web Resources:

1. http://algorithmsforinterviews.com "Algorithms for Interviews".
2. NPTEL:: Computer Science and Engineering – NOC: Introduction to programming in C

CA-C4L: C PROGRAMMING LAB	
Total Teaching Hours:	No. Of Lecture Hours/Week: 4
Max Marks:25	Credit : 2

Course Outcome:

- To study about algorithms, flowcharts and programs. To solve problems through logical thinking.
- Develop confidence for self-education and ability for life-long learning needed for Computer language.
- To develop logics which will help them to create programs, applications in C.

Write, and execute C program for the following:

1. To read radius of a circle and to find area and circumference
2. To read three numbers and find the biggest of three
3. To check whether the number is prime or not
4. To read a number, find the sum of the digits, reverse the number and check it for palindrome
5. To read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers
6. To read percentage of marks and to display appropriate message (Demonstration of else-if ladder
7. To find the roots of quadratic equation
8. To read marks scored by n students and find the average of marks (Demonstration of single dimensional array)
9. To remove Duplicate Element in a single dimensional Array
10. To perform addition and subtraction of Matrices
11. To find factorial of a number
12. To generate fibonacci series
13. To remove Duplicate Element in a single dimensional Array
14. To find the length of a string without using built in function
15. To demonstrate string functions
16. To read, display and add two m x n matrices using functions
17. To read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
18. To Swap Two Numbers using Pointers
19. To demonstrate student structure to read & display records of n students
20. To demonstrate the difference between structure & union.

CA-C5L: STATISTICS LAB	
Total Teaching Hours:	No. Of Lecture Hours/Week: 4
Max Marks:25	Credit : 2

Course Outcome:

- Install, Code and Use R Programming Language in R Studio IDE to perform basic tasks on Vectors, Matrices and Data frames.
- Explore and understand how to use the R documentation.
- Able to appreciate and apply the R programming from a statistical perspective
- Understand the different data types in R.

Write, and execute R program for the following:

1. Create vectors to support all the data types in R
2. Vector element recycling [Addition / Subtraction operations on two vectors]
3. Accessing vector elements
4. Vector manipulation operations
5. Sorting a vector in R
6. Extracting elements from list
7. Combining two list
8. String operations in R
9. Accessing of Matrix elements
10. Arithmetic operations in matrix
11. Determinant of matrix
12. Table creation and data visualization with bar chart
13. Measures of central tendency and measures of dispersion
14. Presentation of data through graphs [Bar graph, Pie Chart, Histogram, Line graph, Scatterplot]
15. Product moment coefficient of correlation and rank correlation
16. Sampling
17. Data frame creation

CA-C6T: STATISTICS -II	
Total Teaching Hours: 48	No. Of Lecture Hours/Week: 3
Max Marks:60	Credit : 3
Summative Assessment Marks: 60	Formative (internal) Assessment Marks: 40

Course Objective:
To help students to have a thorough knowledge of descriptive basic probability and samplings and thus frame problems using multiple mathematical and statistical representations of relevant structures and relationships and solve using standard techniques.

Course Outcome:

- Use the basic probability rules, including additive and multiplicative laws, using the terms, independent and mutually exclusive events.
- To expose the students to the basics of probability theory and random processes essential for their subsequent study
- To derive the probability density function of the transformation of random variables.
- Understand the basic concept of sampling distributions

UNIT 1: PROBABILITY	Teaching Hours :12

Probability
Introduction to probability, Sample space and events, Axiomatic approach to probability, Addition theorem, Conditional probability, Multiplication theorem, Independent events and Baye's theorem, Rule of total probability.

UNIT 2: RANDOM VARIABLES	Teaching Hours :12

Random Variables
Concept of a random variable, Discrete and continuous random variable and their probability functions, Distribution function and its properties, Expectation of a random variable – Mean Variance, Bivariate probability distribution, Marginal and conditional distributions, Covariance, Independence, Conditional expectation and variance, Mean and variance of linear combination of random variables.

UNIT 3: PROBABILITY DISTRIBUTIONS	Teaching Hours: 9

Probability Distributions
Bernoulli, Binomial, Poisson, Uniform, Exponential, Normal distributions – Definition through probability function, Statement of properties and applications.

UNIT 4: SAMPLING AND SAMPLING DISTRIBUTIONS	Teaching Hours :15

Sampling and Sampling distributions

Types of sampling – Purposive, Random and mixed samples, Sampling Methods – Simple, Random, Stratified, Cluster, Relative merits and limitations of the different methods. Concepts of populations, Parameter, Random sample, Statistic, Sampling distribution and standard error, Distribution of sample mean and variance. Chi-square, t and F distributions – Definition through their probability functions, Statement of their properties, Applications, Central limit theorem and its applications.

Text Book:

1. Hogg & Tanis, Probability & Statistical Inference – Sixth Edition, Pearson Education.
2. S.M. Ross, Introduction to Probability and Statistics, John Wiley and Sons.
3. Gupta and Kapoor, Fundamentals of Mathematical Statistics, Tenth Revision Edition
4. Vijay K. Rohatgi, A.K. Md. Ehsanes Saleh, An Introduction to Probability and Statistics, Second Edition, Wiley Series in Probability and Statistics.

Reference Text Books:

1. K.C. Bhuyan, Probability, Distribution theory and statistical inference – NCBA.
2. Introduction to the theory of statistics, A.M Mood, F.A Graybill and D.C Boes, Tata McGraw-Hill, 3rd Edition (Reprint), 2017.
3. Walpolw, Myers, Probability and Statistics for Engineers and Scientists, Eighth Edition, Pearson Education.

Web Resources:

NPTEL: Probability and Statistics

CA-C7T: DATA STRUCTURES	
Total Teaching Hours: 48	No. Of Lecture Hours/Week: 3
Max Marks:60	Credit 3

Course Objective:

- To be able to practically implement the data structures like stack, queue, array etc.
- To understand and implement different searching and sorting techniques.
- Ability to analyze algorithms and algorithm correctness.

Course Outcome:

- To introduce the fundamental concept of data structures and to emphasize the importance of data structures in developing and implementing efficient algorithms.
- Describe common applications for arrays
- Ability to describe stack, queue and linked list operation.
- Ability to summarize searching and sorting techniques
- Ability to have knowledge of tree and graphs concepts.

UNIT 1: INTRODUCTION	Teaching Hours :8

Introduction and Overview: Definition, Elementary data organization, Data Structures, data Structures operations, Abstract data types, algorithms complexity, time-space trade off. Preliminaries: Mathematical notations and functions, Algorithmic notations, control structures, Complexity of algorithms, asymptotic notations for complexity of algorithms.

UNIT 2: ARRAYS & LINKED LIST	Teaching Hours :8

Arrays: Definition, Linear arrays, arrays as ADT, Representation of Linear Arrays in Memory, Traversing Linear arrays, Inserting and deleting String Processing: Definition, Storing Stings, String as ADT, String operations, word/text processing, Pattern Matching algorithms.

Linked list: Definition, Representation of Singly Linked List in memory, Traversing a Singly linked list, Searching in a Singly linked list, Memory allocation, Garbage collection, Insertion into a singly linked list, Deletion from a singly linked list; Doubly linked list, Header linked list, Circular linked list.

UNIT 3: STACKS	Teaching Hours :8

Stacks – Definition, Array representation of stacks, Linked representation of stacks, Stack as ADT, Arithmetic Expressions: Polish Notation, Application of Stacks, Recursion, Towers of Hanoi, Implementation of recursive procedures by stack. Queues – Definition, Array representation of queue, Linked list representation of queues Types of queue: Simple queue, Circular queue, Double ended queue, Priority queue, Operations on Queues, Applications of queues.

UNIT 4: SORTING & TREE	Teaching Hours: 8
Sorting- Bubble sort, Insertion sort, Selection sort, Searching: Linear Search, Binary search, Multidimensional arrays, Matrices and Sparse matrices. Tree – Definitions, Binary trees, Representing binary trees in memory, Traversing Binary Trees, Binary Search Trees, Searching, Inserting and Deleting in a Binary Search Tree, Heap Tree.	
Text Books: 1. Seymour Lipschutz, "Data Structures with C", Schaum's outLines, Tata Mc Graw Hill, 2011. 2. Robert Kruse, C.L.Tondo, Bruce Leung,Shashi Mogalla,"Data Structures and Program Design using C", Pearson Education, 2009.	
Reference Text Books: 1. Mark Allen Weiss," Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2013. 2. Forouzan,"A Structured Programming Approach using C",2nd Edition, Cengage LearningIndia,2008.	

CA-C9L STATISTICS LAB

Total Teaching Hours:	No. Of Lecture Hours/Week: 4
Max Marks:25	Credit : 2

Course Outcome:

- Install, Code and Use R Programming Language in R Studio IDE to perform basic tasks on Vectors, Matrices and Data frames.
- Explore and understand how to use the R documentation.
- Able to appreciate and apply the R programming from a statistical perspective
- Understand the different data types in R.

NOTE: Write, and execute R program for the following:

1. Write an R program to create a sequence of numbers from 20 to 50 and find the mean of numbers from 20 to 50 and sum of numbers from 51 to 91.
2. The numbers below are the first ten days of rainfall amounts in 1996. Read them into a vector using the c() function.
3. Create a matrix 3X3 by row-wise.
4. Write an R program to create three vectors a, b, c with 3 integers. Combine the three vectors to become a 3×3 matrix where each column represents a vector. [Hint: use cbind() function]
5. Repeat and Paste function in R
6. Importing datasets in R environment
7. Plotting's in R
8. Simple linear regression with residual plot
9. Probability distributions [Univariate and Bivariate probability distributions, Generation of observations from different distributions etc…]
10. Probability distributions (various probability distributions and evaluation of probabilities)
11. Construction of sampling distribution of sample mean and sample variance
12. Application of central limit theorem
13. Identification of different hypothesis and evaluation of probability of type I and type II error and power of test
14. Test concerning population variance and equality of two population variances.

CA-C10L: DATA STRUCTURES LAB

Total Teaching Hours:	No. Of Lecture Hours/Week: 4
Max Marks:25	Credit : 2

Course Outcome:

- To describe stack, queue and linked list operation.
- To summarize searching and sorting techniques
- To have knowledge of tree and graphs concepts.

NOTE: For all the programs write the output, flowchart and number of basic operations performed.

1. Given {4,7,3,2,1,7,9,0} find the location of 7 using Linear and Binary search and also display its first occurrence.
2. Given {5,3,1,6,0,2,4} order the numbers in ascending order using Bubble Sort Algorithm
3. Perform the Insertion and Selection Sort on the input {75,8,1,16,48,3,7,0} and display the output in descending order.
4. Write a program to insert the elements {61,16,8,27} into singly linked list and delete 8,61,27 from the list. Display your list after each insertion and deletion.
5. Write a program to insert the elements {61,16,8,27} into linear queue and delete three elements from the list. Display your list after each insertion and deletion.
6. Write a program to insert the elements {61,16,8,27} into circular queue and delete 4 elements from the list. Display your list after each insertion and deletion.
7. Write a program to insert the elements {61,16,8,27} into ordered singly linked list and delete 8,61,27 from the list. Display your list after each insertion and deletion.
8. Write a program to add $6x^3+10x^2+0x+5$ and $4x^2+2x+1$ using linked list.
9. Write a program to push 5,9,34,17,32 into stack and pop 3 times from the stack, also display the popped numbers.
10. Write a recursive program to find GCD of 4,6,8.
11. Write a program to inert the elements {5,7,0,6,3,9} into circular queue and delete 6,9&5 from it(using linked list implementation)..
12. Write a program to convert an infix expression x^y/(5*z)+2 to its postfix expression
13. Write a program to evaluate a postfix expression 5 3+8 2 - *.
14. Write a program to create a binary tree with the elements {18,15,40,50,30,17,41} after creation insert 45 and 19 into tree and delete 15,17 and 41 from tree. Display the tree on each insertion and deletion operation

15. Write a program to create binary search tree with the elements {2,5,1,3,9,0,6} and perform inorder, preorder and post order traversal.
16. Write a program to Sort the following elements using heap sort {9.16,32,8,4,1,5,8,0}
17. Given S1={"Flowers"} ; S2={"are beautiful"} I. Find the length of S1 II. Concatenate S1 and S2 III. Extract the substring "low" from S1 IV. Find "are" in S2 and replace it with "is"