SYLLABUS

FOR

SEMESTER - I

- Mathematical Analysis
- Algebra
- Ordinary Differential Equations
- Probability and Statistics
- 'C' Programming Lab

101- Mathematical Analysis

L: 4, P: 0, Credits: 4

Pre Requisites: Foundation Course.

Objectives:

- To train the students thoroughly in mathematical concepts of Basic analysis.
- To impart firm foundation in analysis which is useful in many other subjects of Mathematics

UNIT-I

Numerical Sequences: Convergent Sequence- Subsequences- Cauchy Sequences.

UNIT-II

Infinite Series: Series of Non-negative Terms- The Number *e*- The Root and Ratio Tests- Power Series- Summation by parts- Absolute Convergence- Addition and Multiplication of Series.

UNIT-III

Continuity: Limits of Functions- Continuous Functions- Continuity and Compactness- Continuity and Connectedness- Discontinuities- Monotone Functions.

UNIT-IV

Differentiation: The Derivative of a real function- Mean value theorems- The Continuity of Derivatives- L'Hosoital's Rule- Derivatives of Higher Order- Taylor's Theorem.

UNIT-V

The Riemann-Stieltjes Integral-Definition and Existence of the Integral- Properties of Integral- Integration and Differentiation

Text Book:

1. Principles of Mathematical Analysis- Walter Rudin, Third Edition, Mc Graw Hill.

References:

1. Mathematical Analysis- S C Malik and Savitha Aurora, Secend Edition, New Age International (P) Ltd.
2. Mathematical Analysis- Tom. M. Apostol, Second Edition, Narosa Publishing House.

Outcomes:

- The students become familiar with basic concepts of analysis.
- The students attain the ability to use this knowledge to understand and to solve many problems in other subjects like Differential Equations, Partial Differential equations etc.
- This is a foundation course and students can use this as a pre requisite for many other subjects in their upcoming semesters.

102- Algebra

L: 4, P:0, Credits: 4

Pre Requisites: Foundation Course.

Objectives:

- To train the students thoroughly in mathematical concepts of algebra.
- To impart firm foundation in algebra this is useful in many other subjects of Mathematics.

UNIT-I

Group Theory-I: Definition of a Group – Some examples of group – Some preliminary Lemmas – Subgroups – A counting principle – Normal subgroups and Quotient groups.

UNIT-II

Group Theory-II: Homomorphisms – Automorphisms – Cayley's Theorem – Permutation Group

UNIT-III

Another counting principle – Sylow's Theorem – Direct products – Finite abelian groups.

UNIT-IV

Ring Theory-I: Definition and examples of rings – Some special classes of rings – Homomorphisms

UNIT-V

Ring Theory-II: Ideals and quotient rings – More ideals and quotient rings – The field of quotients of an integral domain. Euclidean rings – A particular Euclidean ring

Text Book:

1. Topics in Algebra- I.N. Herestein – Second Edition - John Willey

References:

1. Basic Abstract Algebra- P.B. Bhattacharya, S.K. Jain, S.R. Nagpaul, Second Edition - Cambridge University Press.
2. Algebra- M.Artin, PHI.
3. Algebra Contemporary Abstract- Joseph A. Gallian, Narosa.
4. Abstract Algebra – David S. Dummit, Richard M. Foote – 3rd Edition – Wiley.
5. Basic Algebra- P.B. Cohn, Springer.

Outcomes:

- The students become familiar with basic concepts of algebra.
- The students attain the ability to use this knowledge to understand and to solve many problems on other subjects like galois theory.
- This is a foundation course and students can use this as a pre requisite for many other subjects in their upcoming semesters.

103- Ordinary Differential Equations

L: 4, P:0, Credits: 4

Pre Requisites: Foundation Course.

Objectives:

- To train the students thoroughly in mathematical concepts of Theory of Ordinary Differential Equations.
- To impart firm foundation in Theory of Ordinary Differential Equations which is useful in many other subjects of mathematics.
- To train the students to use this knowledge in mathematical modeling and some related research areas.

UNIT-I

Linear Equation with Variable Coefficients -I: Introduction- Initial Value Problem for the Homogeneous Equation- Solutions of the Homogeneous Equation- The Wronskian and linear independence.

UNIT-II

Linear Equation with Variable Coefficients -II: Reduction of the order of Homogeneous Equation- The non- homogeneous Equation- Homogeneous Equations with analytic Coefficients- The legendre Equation- Justification of the power series method.

UNIT-III

Linear Equations with Regular Singular points: Introduction- The Euler equation- Second order equations with Regular Singular points- the general case- A convergence proof- The exponential case- The Bessel Equation- Regular Singular points at infinity.

UNIT-IV

Existence and Uniqueness of Solutions: Introduction- Preliminaries- Successive Approximations- Picard's Theorem- Continuation and dependence on initial conditions- Existence of solutions in the large interval - Existence and uniqueness of solutions of systems- Fixed point method.

UNIT-V

Boundary Value Problems: Introduction- Sturm Liouville problem- Green's Function.

Text BooK:

1. An Introduction to Ordinary Differential Equations- Earl A. Coddington, PHI.
2. Text Book of Ordinary Differential Equations – V. Lakshmikantam, S G Deo and V Raghavendra, Second Edition, Tata-Mc Graw-Hill.

References:

1. Differential Equation with Applications and Historical notes. –G.F.Simmons- Tata MC.GrawHill.
2. Text Book of Ordinary Differential Equations- SG.Deo, V.Lakshmikanthan, V.Ragavendra, Tata Mc.GrawHill.
3. A First Course in Differential Equations With Modeling Applications- Dennis G.Zill, 8th Edition, Thomson Books/college.
4. Elementary Differential Equations & Boundary Value Problems- Boyce-Dprima, Seventh Edition, John Willey.

Outcome:

- The students now ready to take higher courses in Differential Equations and Dynamical Systems.

104-Probability and Statistics

L: 4, P:0, Credits: 4

Pre Requisites: Foundation Course.
Objectives: The student will be able to:

- Define experiment, outcome, event, probability and equally likely.
- Restate the formula for finding the probability of an event.
- Determine the outcomes and probabilities for experiments.
- Interact with die rolls and spinners to help predict the outcome of experiments.
- Distinguish between an event and an outcome for an experiment.
- Recognize the difference between outcomes that are equally likely and not equally likely to occur.

UNIT-I
Probability: Sample spaces and events - Basic set theory - Definitions of probability - Axioms of probability - Addition Theorem - Independent events-Conditional probability -Multiplicative Theorem - Total probability - Baye's Theorem.

Random Variables - Introduction - Types of Random variables – Discrete and Continuous Random variable. Probability and Distribution Functions - Properties of Distribution Function - Mathematical expectation – Variance.

UNIT-II
Probability Distributions: - Chebyshev's inequality Theorem - Binomial distribution - Poisson distribution - Uniform distribution - Normal distribution.

UNIT-III

Fundamental Sampling Distribution: Random sampling – Some important Statistics – Sampling Distributions – Sampling distribution of mean – Statistical Inference – Estimation – Single Sample : Estimating the mean and proportion - Standard error of a point estimate – Interval estimation – Two sample: Estimating the difference between two mean and two proportions – Ratio of two variances.

UNIT-IV
Tests of statistical hypothesis - Introduction - Statistical Hypothesis -test of a statistical hypothesis- Procedure for Testing of Hypothesis - Set up a Hypothesis - Set up a Suitable significance Level - Setting's test criterion - Doing computations - Making decisions - Type I and Type II errors - Two-tailed and one-tailed test of Hypothesis –
Large sample tests: Test of significance of single mean - Test of significance for difference of means - Test of Significance for single proportion - Test of significance for difference of proportions.

UNIT-V

Tests of statistical hypothesis small sample tests: Introduction - Student's t-distribution- Properties of t-distributing - test of significance of single mean - Test of significance for inference between two mean of independent sample – Test of significance for difference between Two Means (dependent samples)- F-test for equality of Population Variance - Chi-square distribution : Properties of chi-square distribution - Applications of Test of a statistical χ^2 distributions - Chi-

square test for goodness of fit - Conditions for-applying χ^2 test - degree of freedom -Chi-square test for independence of attributes.

Text Book:

1. Fundamentals of Mathematical Statistics- Gupta and Kapoor.
2. Probability & Statistics for Engineers & Scientists – Ronald E Walpole, Raymond H Meyers, Sharon L Myers Ye, 9th Ed, Pearson Publishers.

Reference:

1. Probability and Statistics for Engineers and Scientists- Miller& Freund.
2. Probability and Statistics- Anthony J Hayter.
3. Introduction to Probability chartes M.Grinstead- J. Laurie Snell.

Outcomes:

The student will be able to:

- Define certain event, impossible event.
- Describe and list the contents of a standard deck of 52 playing cards.
- Examine the probabilities of experiments with certain outcomes.
- Examine the probabilities of experiments with impossible outcomes
- Evaluate interactive die rolls and spinners in relation to certain and impossible events.
- Explain the difference between certain and impossible events.
- Compute the probability of a certain event.
- Compute the probability of an impossible event.

105- 'C' Programming Lab

L:1, P:4, Credits: 3

Pre Requisites: Foundation Course.

Objectives:

- To provide students with a comprehensive study of the C programming language. Classroom lectures stress the strengths of C, which provide programmers with the means of writing efficient, maintainable, and portable code. The lectures are supplemented with non-trivial lab exercises.

UNIT-I

Introduction to 'C': Introduction -Basic Structure of C programming- Keywords and Identifiers- constants- variables- data types- declaration of variables- assigning values to variables - Operators and expressions - Decision making and branching – Decision making and looping.

UNIT-II

Arrays: Introduction – One dimensional arrays – Declaration of one dimensional arrays - Initialization of one dimensional arrays – Two dimensional arrays – Initializing two dimensional arrays – Multi dimensional arrays.

Strings: Introduction – Declaring and initializing string variables –Reading strings from terminal – writing strings to screen – Arithmetic operations on characters – putting strings together – Comparison of two strings – String handling functions.

UNIT-III

Functions: Introduction – Need for User defined functions – A multi function program – Elements of user defined functions – Definition of functions – Return values and their types – Function calls – Function declaration – Category of functions – No arguments and no return values – Argument but no return values - Arguments with return values – No arguments but returns a value - Functions that return multiple values – Nesting of functions – Recursion – Passing arrays to functions – Passing string to functions – The scope, visibility and lifetime of variables.

Pointers: Introduction – Accessing the address of variables – Declaring pointer variable – Initialization of pointer variables – Accessing a variable through its pointer – Chain of pointers – Pointer expressions – Pointer increments and scale factors – Pointers and arrays – Pointers and characters strings – Array of pointers – Pointers as function arguments – Functions returning pointers – Pointers to functions – Pointers and structures.

UNIT- IV

Structures and Unions: Introduction – Defining a structure – Declaring structure variable – Accessing structure variables – Structure Initialization – Copying and comparing structure variables – Operations on Individual members – Arrays of structures – Arrays within structures – Structure within structure – Structures and functions – Unions – Size of structures – Bit Fields – Typedef – Enum.

UNIT-V

File management in C: Introduction – Types of files – Defining and opening a file – Closing a file – Input / output operations on files – Error handling during I/O operations – Random Access to files – Command line arguments – Application of command line arguments.

Scope as in:

1. Computer Programming and Data Structures, Third Edition - E. Balagurusamy – Tata McGraw Hill

References:

1. Let Us C-.C. Proramming–YashavantKanitkarSchaum– BPB Publishers

Outcome:

Upon completion of this course, students will be able to:

- Write C programs that are non-trivial.
- Use the variety of data types appropriate to specific programming problems.
- Utilize the modular features of the language.
- Demonstrate efficiency and readability.
- Demonstrate the use of the various control flow constructs.
- Use arrays as part of the software solution.
- Utilize pointers to efficiently solve problems.
- Include the structure data type as part of the solution.
- Create their own data types.
- Use functions from the portable C library.

Lab Practice:

1. Write a program for addition of two numbers.
2. Write a program for finding area and circumference of a circle.
3. Write a program for finding simple interest.
4. Write a program for finding area and perimeter of a rectangle.
5. Write a program to read 5 subject marks of a student and find average marks of that student.
6. Write a program to convert the given KMPH to Meter per second.
7. Write a program to convert the given number of days into months and days.
8. Write a program to check whether the given number is even or odd.
9. Write a program to check whether the given number is positive or negative.
10. Write a program to calculate the division obtained by a student.
11. Write a program to demonstrate the use of sizeof() operator
12. Write a program to swap two numbers using 3 variables and 2 variables.
13. Write a program to find the biggest of three numbers.
14. Write a program to check whether the given year is leap year or not.
15. Write a program to read a date from the key board, and check whether the given date is in correct format or not. (dd/ mm/ yyyy)
16. Write a program to convert the given temperature from Fahrenheit to centigrade.
17. Write a program to count number of hundred notes, fifty notes and ten notes for the given amount.
18. Write a program to read an integer and check whether the entered value is palindrome or not.
19. Write a program to read an integer value, and print that integer in reverse order
20. Write a program to read an integer and check whether the entered value is Armstrong or not.
21. Write a program to evaluate arithmetic operations using switch case.
22. Write a program to evaluate arithmetic operations on complex numbers using switch case.
23. Write a program to determine whether the given character is vowel or not using switch case.
24. Write a program to calculate sum of all the numbers between 1 and 50 excluding multiples of 3 and 5.
25. Write a program to calculate the sum of digits of an integer.
26. Write a program to check whether the given number is prime or not.
27. Write a program to solve the following series
28. Write a program to calculate the sum of N- Terms of the following series
29. Write a program to calculate the sum of N- Terms of the following series
30. Write a program to print Fibonacci series of N terms.
31. Write a program to calculate the sum of odd numbers between 1 and 50.
32. Write a program to read a character from the keyboard and tell the user whether the character is alphabet, digit or any other special character.(use character test functions)
33. Write a program to read a character from the key board and print that character in reverse case. (use character test functions)
34. Write a program to find a large number in a given array.
35. Write a program to find the average, min and max value for the given array of elements.
36. Write a program to find Fibonacci series using arrays.
37. Write a program to read Two M X N Matrix and perform Addition Operation.
38. Write a program to read Two M X N Matrix and perform Subtraction Operation
39. Write a program to read Two M X N Matrix and perform Multiplication Operation
40. Write a program to read a M X N Matrix and find the Transpose of that matrix.
41. Write a program to read M X N and find the trace of the Matrix.
42. Write a program to read a M X N Matrix and print the diagonal elements.
43. Write a program to read a string and find the number of vowels in the given string.
44. Write a program to read a string and check whether the given string is palindrome or not.
45. Write a program to find the length of the given string including and excluding spaces.
46. S1, S2, S3 are three string variables. Write a program to read two string constants into S1 and S2 and compare whether they are equal or not. If they are not equal join them together. Copy the contents of S1 into the variable S3. At last the program should print the contents of all the three variables and their lengths.

47. Write a program to print a Fibonacci series using functions.
48. Write a program to find the factorial of a given number using recursive function.
49. Write a program to obtain prime factors of given number using functions.
50. Write a program to calculate sum of digits of an integer with and without recursion.
51. Write a program to pass a user defined function as an argument to another function.
52. Write a program to print structure elements.
53. Write a program to display the difference between structure and union.
54. Write a program to use structure within union.
55. Write a program to pass a structure variable as an argument to a user defined function.
56. Write a program to read and display car details using nested structures.
57. Write a program to print the Pascal triangle
58. Write a program to print the Parallelogram.
59. Write a program to swap two numbers using pointers.
60. Write a program to print the values and addresses of variables and pointer variables .
61. Write a program to perform different arithmetic operations using pointers.
62. Write a program to declare void pointer, assign address of integer, float and character to the pointer variable using type casting, and display the contents of the various variables.
63. Writ e a program to declare a pointer variable to a structure and display the contents of the structure.
64. Write a program to show the effect of increment operator on pointer variable. Display the memory location of integer, character and float variables before and after increment operation on pointer variables.
65. Write an example program for call by value concept.
66. Write an example program for call by reference concept.

SYLLABUSFOR

SEMESTER-II

- Linear Algebra
- Complex Analysis
- Partial Differential Equations
- Numerical Analysis
- Data Structures Through ‘C’ Lab

201- Linear Algebra

L: 4, P:0, Credits: 4

Pre Requisites: Algebra

Objectives:

- To train the students thoroughly in mathematical concepts of Linear Algebra.
- To impart firm foundation in linear algebra which is useful in many other subjects of mathematics.

UNIT-I

General Vector spaces: Real vector spaces – Subspaces – Linear Independence – Basis and Dimension – Row space, Column Space and Null space – Rank and Nullity.

UNIT-II

Inner product spaces- Inner products – Angle and orthogonality in inner product spaces – Orthonormal bases: Gram-Schmidt process: Q R-Decomposition – Best Approximation: Least squares – Change of basis – Orthogonal matrices.

UNIT-III

Linear Transformations: General linear transformations – Kernel and Range – Inverse linear transformations – Matrices of general linear transformations – Similarity – Isomorphism.

UNIT-IV

Eigen values and Eigen vectors: Eigen values and Eigen vectors – Orthogonal matrices– Unitary matrices- Normal matrices and Hermitian matrices- similar matrices- Properties of Eigen values and Eigen vectors –

UNIT-V

Additional Topics: Diagonalization - Factorization. Quadratic forms – Application to conic sections and quadratic surfaces.

Text Book:

1. Elementary Linear Algebra– Howard Anton, 9th Edition, John Wiley and Sons.

Reference:

1. An introduction to Linear Algebra- V. Krishna Murthy, Affiliated East-West press.
2. Introduction to Matrix Analysis- Richard Bellimen, Tata Mc Graw- Hill.
3. Linear Algebra-An Inroductory Approach- William Curtis, 4th edition, springer.
4. Linear Algebra- Kenneth Hoffman and Ray Kunge, PHI.
5. Linear Algebra with Applications- OltoBretscher, Pearson Education.

Outcomes:

- The students become familiar with advanced concepts of algebra.
- The students attain the ability to use this knowledge to understand and to solve many problems on other subjects like Galois Theory.
- This is a foundation course and students can use this as a pre requisite for many other subjects in their upcoming semesters.

202 – Complex Analysis

L: 4, P:0, Credits: 4

Pre Requisites: Analysis- I

Objectives:

- To train the students thoroughly in mathematical concepts of complex analysis.
- To impart firm foundation in analysis which is useful in many other subjects of mathematics

UNIT-I

The complex Plane and Elementary Functions: Complex number- Polar representation- Limits - Continuity – Derivatives-Sufficient Conditions for Differentiability-The Square and Square Root Functions- The Exponential Function- the Logarithm Function- Power Functions - Trigonometric and Hyperbolic Functions.

UNIT-II

Analytic Functions and Line Integrals: - Analytic Functions-Properties of Analytic function-The Cauchy-Riemann Equations- Harmonic and Conjugate Harmonic Functions- Construction of Analytic Functions- Milne Thomson Method - Line Integrals

UNIT-III

Complex Integration and Power Series : Cauchy's Theorem- The Cauchy Integral Formula-Maximum Modulus Principle-Liouville's Theorem - Morera's Theorem- Gourasat's Theorem.

Power Series- Power Series Expansion of an analytic Function- Absolute and Uniform Convergence of Power Series-Radius of Convergence of Power Series- Taylor Series-Laurent Series

UNIT –IV

Singularities and Residues- Isolated and Non-Isolated Singularities-Removable Singularites-Essential Singularites-Poles-Further illustrations through Laurent's Series.

Residue-Evaluation of Residue by formula and By Laurent's Series-Cauchy's Residue Theorem - The Argument Principle- Rouche's Theorem- Fundamental thereom of Algebra

UNIT-V

Conformal Mapping-Tranformation by e^z, $\log z$, z^2, z^n (n positive integer), $\sin z, \cos z$, $(z+a)/z$, translation, rotation, inversion and bilinear transformation – fixed point – cross ratio – properties – invariance of circles and cross ratio – determination of bilinear transformation mapping three given points.

Scope as in:

1. Complex Variables and Applications- J.W .Brown andR.V. Churchill, 6th Edition, Mc Graw-Hill.

References:

1. Functions of a Complex Variables-JN Sharma, 1st Edition, Krishna Prakashan Media (P) Ltd.
2. Complex Analysis- Theodary W. Gamelin, Springer International Edition.
3. Functions of One Complex Variable– John B. Conway, Springer.
4. Complex Analysis- L. Ahlfors, McGraw-Hill.
5. Complex Analysis- Serge Lang, springer.

Outcomes:

- The students become familiar with concepts of complex analysis.
- The students attain the ability to use this knowledge to understand and to solve many problems on other subjects like Differential Equations, Partial Differential equations etc.

203- Partial Differential Equations

L: 4, P:0, Credits: 4

Pre Requisites: Ordinary differential equations and Linear Algebra

Objectives:

- Where and how PDEs arise in applications.
- Fundamental concepts of PDE theory.
- Analytical methods for solving PDEs

UNIT-I

Simultaneous Differential Equations: Simultaneous Differential equations of the first order and the first degree of the form dx/P = dy/Q = dz/R.

UNIT-II

Partial Differential Equations of the First Order: Origins of Partial Differential Equations – Linear Partial Differential Equations of the order one: Lagrange's Method – Nonlinear Partial Differential equations of the first order : Charpit's Method and its Standard forms.

UNIT-III

Homogenous Linear Partial Differential Equations with constant coefficients: Homogenous Linear Partial Differential Equations with constant coefficients and its general solution.

UNIT-IV

Non-Homogenous Linear Partial Differential Equations with constant coefficients: Non-Homogenous Linear Partial Differential Equations with constant coefficients and its general solution for both reducible and irreducible.

UNIT-V

Applications of Partial Differential Equations: Classification of Partial Differential Equation of second order – Method of separation of variables – Heat equation and Wave equation (One dimension) – Laplace equation.

Scope as in:

1. Ordinary and Partial Diffential Equations- M D Raisinghania, S Chand.
2. Higher Engineering Mathematics – B S Grewal, Khanna Publishers.

Reference:

1. Elements of Partial Differential Equations- I.N. Sneddon, McGraw-Hill.
2. Partial Differential Equations- L.G.Petrovski.
3. Partial Differential Equations An Introduction- Bernard Epstein, Tata Mc Graw -Hill.
4. Partial Differential Equations- Methods and Applications- Robert, C.Mc Owen, Second Edition, Pearson Education.

Outcome:

- Describe real-world systems using PDEs.
- Solve first order PDEs using the method of characteristics.
- Determine the existence, uniqueness, and well-posedness of solution of PDEs.
- Solve linear second order PDEs using canonical variables for initial-value problems, Separation of Variables and Fourier series for boundary value problems

204 - Numerical Analysis

L: 4, P:0, Credits: 4

Pre Requisites: Foundation Course.

Objectives:

- To provide a firm foundation on numerical techniques involved in the study of Higher Mathematics

UNIT-I

Algebraic and Transcendental Equations: Introduction – Bisection Method – Method of False Position – Iteration method – Newton-Raphson Method – Systems of Nonlinear Equations – Method of Iteration – Newton-Rapshon Method.

UNIT-II

Interpolation : Introduction – Errors in Polynomial Interpolation – Finite Differences – Newton's Formulae for Interpolation – Central Difference Interpolation Formulae : Gauss' Central Difference Formulae – Interpolation with Unevenly Spaced Points: Lagrange's and Hermite's – Spline Interpolation: Linear and Quadratic.

UNIT-III

Least Squares, Differentiation and Integration: Introduction- Least-squares Curve Fitting Procedures – Weighted Least Squares Approximation – Numerical Differentiation – Numerical Integration : Trapezoidal Rule; Simpson's 1/3-Rule; Simpson's 3/8-Rule; Romberg Integration.

UNIT-IV

Matrices and Linear Systems of Equations: Introduction – Basic Definitions – Solution of Linear Systems – Direct Methods: Gauss Elimination; Gauss-Jordan Method; Ill-conditioned Matrices; Method of Ill-conditioned Matrices – Eigenvalue Problem – Householder's Method – Singular Value Decomposition.

UNIT-III

Interpolation: Introduction-Lagrange and Newton Interpolations- Finite Difference Operators-Interpolating Polynomials using finite Differences – Hermit Interpolation – Piecewise and Spline Interpolation. Least Squares Approximation

UNIT-V

Ordinary Differential Equations: Introduction- Solution by Taylor's Series – Picard's Method of Successive Approximations – Euler's Method – Runge-Kutta Methods – Predictor-Corrector Methods

Text Book:

1. Introductory Methods of Numerical Analysis- S.S. Sastry, Fourth Edition - PHI.

References:

1. Numerical Methods for Scientific and Engineering Computation- M.K. Jain, S.R.K. Iyengar, R.K.Jain, New Age International.
2. Elementary Numerical Analysis-Atkinson and Hahn, John Willey.
3. An Introduction to Numerical Analysis-. Atkinson and Hahn, John Willey.

Outcome:

- The student is able to solve all kinds of equations including algebraic, ODE, Differentiate, and Integrate using numerical techniques.

205- Data Structures Through'C'

L: 1, P: 4, Credits: 3

Pre Requisites:No Pre Requisites. Foundation Course

Objectives:

- Assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- Choose the appropriate data structure and algorithm design method for a specified application.
- Solve problems using data structures such as linear lists, stacks, queues, , binary trees, binary search trees, and graphs and writing programs for these solutions.

UNIT-I

Array and Records - Storages structures for arrays strings- sting operations- sparse matrices representation records- Linear data structures- Linear lists- operations on linear lists sequential allocation and linked allocation linked lists- single linked lists- double linked lists- insertion and deletion operations- simple applications of linked lists- multiple linked structures- Circular Linked Lists.

UNIT-II

Stacks - Stack operations- array and pointer implementations of stacks- simple applications of stacks - infix to postfix expression conversions- postfix expression evaluation recursion.

UNIT- III

Queues - Queue operations- array and pointer implementation of queues- circular queues- insertion and deletion operations on circular queues- Simple applications of queues.

UNIT-IV

Non Linear Data Structures - Trees and Graphs - Tree terminology- Binary trees- representations of binary trees- recursive and non recursive traversals of binary trees- Graphs-
Terminology- representation of graphs- depth first and breadth first search of graph.

UNIT-V

Searching - Linear search- binary search-**sorting** - Bubble sort- selection sort- insertion sort- merge sort- Quick Sort- heap Sort. Time and Space complexity-definition- time complexity of simple algorithms (Elementary treatment only).

Scope as in:

1. An introduction to data structures with application M.C.M.-Trem Bay Ad Sorenson.

Reference:

1. DataStructure- Kochen
2. Data Structure- Behrouz.A.Forouzan- Richard F.Gilberg.
3. Programming in ANSI E. Balaguruswamy.

Outcome:

- To describe the usage of various data structures
- To explain the operations for maintaining common data structures
- To write programs using linked structures such as List, trees, and graphs
- To analyze algorithms and to determine algorithm correctness and time efficiency class
- To demonstrate various methods of organizing large amounts of data.
- To design and apply appropriate data structures for solving computing problems

Lab Practice:-

1. Implement the following data structures using Arrays.

    i) Stacks

    ii) Linear Queues

    iii) Circular Queues

    iv) Dequeue

2. Implement Polynomial addition and multiplication with linked list sparse matrix.

3. Implement binary search tree using linked list and perform the following operations.

    i) Insertion

    ii) Deletion

    iii) Inorder Traversal

    iv) Preorder Traversal

    v) Preorder Traversal

4. Singly Linked list and doubly lists.

    i) Insertion

    ii) Deletion

    iii) Lockup

5. i) Implement Stack using Linked list.

   ii) Implement Queue using Linked list.

6. Implement the following sorting Techniques.

    i) Bubble sort

    ii) Insertion sort

    iii) Quick sort

    iv) Heap sort

7. Implementation the following Searching method.

    i) Sequential Search

    ii) Binary Search

    iii) Fibonacci

8. i) Conversion of Infix expression to Postfix notation.

   ii) Simple expression evaluation that can handle +--- /and*

SYLLABUSFOR

SEMESTER-III

- Optimization Techniques
- Calculus of Variations
- Fluid Dynamics
- **Elective – I**
  (i) Numerical Methods for Partial Differential Equations
  (ii) Mathematical Methods
  (iii) Topology
- Python Programming Lab

301-Optimization Techniques

L: 4, P:0, Credits: 4

Pre Requisites: Linear Algebra

Objectives:

- To lay a strong foundation in various optimization techniques. So that the student can solve problems that arise in subjects like fluid dynamics.

UNIT-I

Linear Programming problem-I: Formulation of LP Problems -Graphical Solution of Two Variable Problems - General Formation of Linear Programming Problem - Slack and Surplus Variables - Standard Form of Linear Programming Problem - Matrix Form of LP Problem- Some Important Definitions - Convex Set - Extreme Points of a Convex Set - Computational Procedure of Simplex Method.

UNIT-II

Linear Programming problem-II: Artificial variables Techniques: Two Phase Method - Simple way for two-phase simplex method-Alternative Approach of Two-phase Simplex Method - Big-MMethod - Method to Resolve Degeneracy-Special Cases: Alternative solutions, Unbounded Solutions and Non-existing feasible solutions -Concept of Duality in Linear Programming - General Rules for Converting any Primal into its Dual- Comparison of solutions of the Dual and its primal.

UNIT-III

Transportations models: Introduction-Mathematical Formulation-Matrix form of Transportation Problem - Feasible Solution, Basic Feasible Solution, and Optimum Solution - Tabular Representation - Loops in Transportation Table -Methods for Initial Basic Feasible Solution - Moving Towards Optimality -To Examine the Initial Basic Feasible Solution for Non-Degeneracy - Determination of Net Evaluations - The Optimality test - Degeneracy in Transportation problem - Resolution of Degeneracy During the Initial Stage - Unbalanced Transportation Problem.

UNIT-IV

Assignment Problem: Introduction - Mathematical Formulation of Assignment Problem-Hungarian Method for Assignment Problem- Assignment Algorithm - A Rule to Draw Minimum Number of Lines-Unbalanced Assignment Problem- The Maximal Assignment Problem - Restrictions on Assignment-Sensitivity in Assignment Problems -The Travelling-Salesman(ROUTING) Problem.

UNIT-V

Job Sequencing: Introduction - Terminology and notations - Principal Assumptions - Solution of Sequencing Problem - Processing n Jobs Through Two, Three and m Machines -Processing Two Jobs Through M Machines (Graphical method).

Scope as in:

1. Operations Research by S.D.Sharma.

Reference:

1. Data Structures in Pascal- Horowitz And Sahni, Galgotia publications.
2. Linear programming by M.K.Venkata Raman.

Outcome:

- The student can apply optimization techniques to solve and understand problems in statistics, fluid dynamics etc.

302. Calculus of Variations

L: 4, P:0, Credits: 4

Pre Requisites: Knowledge of solving ODEs.

Objectives:

- To teach students variational techniques,

UNIT-I

The methods of variations in problems with Fixed Boundaries: Variation and its properties- Euler's equation- Functionals of the form $\int_{x_0}^{x_1} F(x, y_1, y_2, ...y_n, y_1', y_2', ...y_n')dx$ - Functionals dependent on Higher order derivatives.

UNIT-II

Functionals dependent on the functions of several independent variables- Variational problems in parametric form- Some applications.

UNIT-III

Variational problems with moving boundaries and certain other problems: An elementary problem with moving boundaries- The moving boundary problem for a functional of the form $\int_{x_0}^{x_1} F(x, y, z, y', z')dx$ - Extremals with corners- One sided variations.

UNIT-IV

Sufficient conditions for an Extremum: Field of extremals- The function $E(x, y, p, y')$ - Transforming the Euler equations to the canonical form.

UNIT-V

Variational problems involving a conditional extremum: Constraints of the form $\varphi(x, y_1, y_2, ..., y_n) = 0$ - Constraints of the form $\varphi(x, y_1, y_2, ..., y_n, y'_1, y'_{2,} ....., y_n) = 0$ - ISO perimetric problems.

Scope as in:

1. Differential equations and the calculus of variations- George Yankovsky- Mir Publishers.

References:

1. Methods of Applied Mathematics, 2nd Edition - Francis B. Hildebrand, PHI.
2. Calculus of variations- Gelfand, Prentice Hall, Inc.

Outcomes:

- The student can apply variational techniques to different problems in mathematics.

303 - Fluid Dynamics

L: 4, P:0, Credits: 4

Pre Requisites: Mechanics.

Objectives:

- Develop an understanding of fluid dynamics in aerospace engineering as well as a variety of other fields.
- Learn to use control volume analysis to develop basic equations and to solve problems.
- Understand and use differential equations to determine pressure and velocity variations in internal and external flows.

UNIT-I

General Orthogonal Curvilinear Coordinates: Arc length in Orthogonal coordinates – Gradient in orthogonal coordinates – Divergence in orthogonal coordinates – Laplacian in orthogonal coordinates – Curl of a vector function in orthogonal coordinates.

UNIT-II

Kinetics of fluids in motion: Real fluids and ideal fluids – Velocity of a fluid at a point – Streamlines and Pathlines: Steady and unsteady flows – The velocity potential – The vorticity vector – Local and particle rates of change – Conditions at a rigid boundary – General analysis of fluid motion.

UNIT-III

Equations of Motion of a Fluid: Pressure at a point in a fluid at rest- Pressure at a point in a moving fluid -Conditions at boundary of two inviscid immiscible fluids - Euler's equation of motion- Bernoulli's equation – Discussion of the case of steady motion under conservative body forces – Some potential theorems – Some flows involving axial symmetry – Some special two dimensional flows – Impulsive motion – Some further aspects of vortex motion.

UNIT-IV

Some Three Dimensional Flows: Sources, Sinks, Doublets - Images in a rigid infinite plane- Images in solid spheres - Axi-symmetric flows; Stoke's stream function – Some special forms of the stream function for Axi Symmetric irrotational motions.

UNIT-V

Some Two-Dimensional Flows: Meaning of two dimensional flows- Use of cylindrical polar coordinates –The stream function- The complex potential for two dimensional irrotational incompressible flow.

Scope as in:

1. Text book of Fluid Dynamics- F. Chorlton.

References:

1. Hydrodynamics- Milne Thomson.
2. Fluid Mechanics- Raisinghania, S. Chand.
3. An Introduction to Fluid Dynamics- G.K. Batchets, Cambridge University Press.
4. Elementary Fluid Dynamics- D.J. Acheson, Oxford University Press.
5. A First Course in Fluid Dynamics, Cambridge University press.

Elective - I

304(i)- Numerical Methods for Partial Differential Equations

L: 4, P: 0, Credits: 4

Pre Requisites: B. Sc Mathematics

Objectives:

- Gain a fundamental understanding of finite difference method for solving partial differential equation.
- To equip the students with the finite element analysis fundamentals.
- To train the students to use this knowledge in related research area.

UNIT-I

Introduction to finite difference formula – Parabolic equation – Explicit finite difference approximation to one dimensional equation Crank – Nicholson implicit method – Derivation boundary conditions.

UNIT-II

Alternate direction implicit (ADI) method finite difference in cylindrical and spherical polar co-ordinates.

Convergence Stability and consistency: Definitions of local truncation error and consistency convergence analysis – stability analysis by matrix method eigenvalue von Newmann stability methods, global rounding error – local truncation error – Iax's equation theorem.

UNIT-III

Hyperbolic Equations: Analytical solution of 1^{st} order quasi linear equation – Numerical Integration along a characteristic Iax wenderoff explicit method. CFL condition wenderoff implicit approximation – Propagation of discontinues – Numerical solution by the method of characteristics.

UNIT-IV

Elliptic Equations: Introduction – Finite differences in polar co-ordinates – formulas for derivative near a curved boundary analysis of the discretization error of the five point approximation to polman's equation over a rectangle.

UNIT-V

Finite Element Method: weighted residual method – variations methods – division of the region into elements linear element – Galerkin formulation.

Scope as in:

1. Numerical Solution of Partial Differential Equations, Finite Differences methods - G.D. Smith, Brunel University, Clarandon Press Oxford.
2. Numerical Solution of Differential Equations 2^{nd} Edition – M. K. Jain, Wiley Eastern Limited. (for V Unit).

References:

1. Numerical Solution of Differential Equations- M. K. Jain, New Age International Publisher.
2. The Finite Finite Differences Methods in Partial Differential Equations – A. R. Mitchel and D.F. Grnra, John Wiley.
3. Numerical Methods for Engineers and Scientists – Joe D.Hoffman, Mc Graw Hill.
4. Applied Finite Element Analysis – Larry J. Segerlind, John Wiley.

Outcome:

At the end of the course, the student will be able to

- Apply the FOM and FEM to partial differential equations.
- Solve the simple ID equations using different numerical techniques.

304 (ii) Mathematical methods

Pre Requisites: Basic Integration and Basics in Differential equations.

Objectives:

- A student is trained to learn to evaluate various improper integrals
- To train the student in order to learn series solutions to ODE.

UNIT-I

Beta and Gamma functions: Relation between them and their properties – evaluation of improper integrals using Gamma / Beta functions.

UNIT-II

Power Series solution of O.D.E. – Ordinary and Singular points- Series solution about an ordinary point -Series solution about Singular point-Frobenius Method.

UNIT-III

Lagendre Polynomials: Lengendre's equation and its solution- Lengendre Polynomial and its properties- Generating function-Orthogonal properties- Recurrance relations- Laplace's definite integrals for Pn (x)- Rodrigue's formula.

UNIT-IV

Bessels Functions: Bessel's equation and its solution- Bessel function of the first kind and its properties - Recurrence Relations- Generating function - Orthogonality properties.

UNIT-V

Hermite Polynomials: Hermite's equation and its solution- Hermite polynomial and its properties - Generating function- Alternative expressions (Rodrigue's formula) – Orthogonality properties - Recurrence Relations.

Scope as in:

1. Higher Engineering Mathematics - B.S. Grewal, Khanna Publishers, 36th Edition, 2010.
2. Ordinary and Partial Differential Equations - M.D. Raisingania, S. Chand Company Ltd., New Delhi.

References:

1. Text book of Ordinary Differential Equation - S.G.Deo, V. Lakshmi Kantham, V. Raghavendra, Tata Mc.Graw Hill Pub. Company Ltd.

Outcome:

At the end of the course, the student will be able to

- Use this knowledge to understand and to solve many problems in application of multiple integrals.
- Understand various special functions and their properties, recurrence relations.

304 (iii)- Topology

L: 4, P:0, Credits: 4

Pre Requisites: Analysis- I

Objectives:

- The object of Topology is to stress on the ideas of abstraction, aesthetics and the development of mathematical tools and the use of the language of mathematics.

UNIT-I

Basic Topology: Metric Spaces - Compact Sets- Perfect Sets- Connected Sets.

Topological Spaces: The definition and some examples – Elementary concepts – Open bases and open sub bases – Weak topologies.

UNIT-II

The function algebras $\mathcal{C}(X,\mathbb{R})$ and $\mathcal{C}(X,C)$.

Compactness: Compact spaces – Product of spaces – Tychonoff's theorem and locally compact spaces.

UNIT-III

Compactness for metric spaces – Ascoli's theorem.

Separation: T_1- spaces and Hausdorff spaces.

UNIT-IV

Completely regular spaces and normal spaces – Urysohn's lemma and the Tietze extension theorem – The Urysohn imbedding theorem- The Stone Cech compactification.

UNIT-V

Connectedness: Connected spaces – The components of a space – Totally disconnected spaces – Locally connected spaces.

Scope as in:

1. Introduction to Topology and Modern Analysis- G.F. Simmons, Tata Mc graw-Hill.

References:

1. Topology -James R. Munkers, PHI.
2. General Topology- Kelley, Springer.
3. Topology- Dugundji, Cambridge University Press.
4. Principles of Topology- Fred.H.Groom, Cengage Learning.

Outcome:

- Students should be familiar with basic concepts of topology.
- Student should gain mathematical maturity.
- Students should become competent in writing proofs.
- Apply special imagination to theory.

305. Python Programming Lab

L: 1, P:4, Credits: 3

Prerequisites: Students should install Python on Linux platform.

Course Objectives:

- To be able to introduce core programming basics and program design with functions using Python programming language.
- To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.
- To understand the high-performance programs designed to strengthen the practical expertise.

UNIT - I

Introduction to Python, Installing Python. How a Program Works, Using Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops. **Data types and Expressions:** Strings, Assignment and Comments, Numeric Data Types and Character Sets, Expressions, Functions and Modules.

UNIT - II

Control Statements: Definite Iteration, Formatting Text for Output, Selection, Conditional Iteration. File and Exceptions: Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions. Functions: Introduction, Defining and Calling a Void Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions-Generating Random Numbers, The math Module, Storing Functions in Modules.

UNIT - III

Strings and Text Files: Accessing Characters and Substrings in a String, Strings and Number System, String Methods, Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings. Text Files, Data Encryption, Lists, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples Sequences, Tuples. Dictionaries and Sets: Dictionaries, Sets, Serializing Objects. Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms.

UNIT - IV

Design with Classes: Classes and Objects, Classes and Functions, Classes and Methods, Working with Instances, Inheritance and Polymorphism. Object-Oriented Programming: Procedural and Object-Oriented Programming, Classes, techniques for Designing Classes.

UNIT - V

Graphical User Interfaces: Behavior of terminal based programs and GUI-based programs, Coding simple GUI-based programs, other useful GUI resources. GUI Programming: Graphical

User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons. **Simple Graphics and Image Processing**: Overview of Turtle Graphics, Two dimensional Shapes, Colors and RBG System, Image Processing.

Scope as in:

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning.
2. **Think Python First Edition**, by Allen B. Downey, Orielly publishing

References:

1. Introduction to Computation and Programming Using Python. John V. Guttag, The MIT Press.
2. James Payne, Beginning Python using Python 2.6 and Python 3, Wrox publishing.
3. Paul Gries, Practical Programming: An Introduction to Computer Science using Python 3,The Pragmatic Bookshelf, 2nd edition (4 Oct. 2013)
4. Charles Dierach, Introduction to Computer Science using Python

Course Outcomes:

- Student should be able to understand the basic concepts scripting and the contributions of scripting language
- Ability to explore python especially the object oriented concepts, and the built in objects of Python.
- Ability to create practical and contemporary applications such as TCP/IP network programming, Web applications, discrete event simulations

List of Programs:

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python.
3. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
4. Write a python script to print the current date in the following format "Sun May 2902:26:23 IST 2017"
5. Write a program to create, append, and remove lists in python.
6. Write a program to demonstrate working with tuples in python.
7. Write a program to demonstrate working with dictionaries in python.
8. Write a python program to find largest of three numbers.
9. Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [Formula : c/5 = f-32/9]
10. Write a Python program to construct the following pattern, using a nested for loop

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

11. Write a Python script that prints prime numbers less than 20.
12. Write a python program to find factorial of a number using Recursion.
13. Write a program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle (Recall from the Pythagorean Theorem that in a right triangle, the square of one side equals the sum of the squares of the other two sides).
14. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
15. Write a python program to define a module and import a specific function in that module to another program.

16. Write a script named **copyfile.py**. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.

17. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.

18. Write a Python class to convert an integer to a roman numeral.

19. Write a Python class to implement pow(x, n)

20. Write a Python class to reverse a string word by word.

SYLLABUSFOR

SEMESTER - IV

- **Elective – II**
  (i) Discrete Mathematics
  (ii) Functional Analysis
  (iii) Integral Transforms &Integral Equations

- **Open Elective**
  (i) Introduction to Machine Learning
  (ii) Operations Research
  (iii) Basics of Finance

- MATLAB

Elective – II

401(i).Discrete Mathematics

L: 4, P:0, Credits: 4

Pre Requisites: Algebra.

Objectives:

- To train the students thoroughly in mathematical concepts of discrete mathematics.
- To impart firm foundation in discrete mathematics which is useful in many other subjects of mathematics.
- The student is made to learn the logic and the applications into computer science.

UNIT-I

Recurrence Relations: Generating Functions-Coefficients of Generating Functions-Recurrence Relations-Inhomogeneous recurrence relations.

UNIT-II

Relations and Digraphs: Product Sets and Partitions- Relations and Digraphs- Paths in relation and Digraphs- Properties of Relations- Equivalence Relations -Data structures for Relations and Digraphs- Operations on Relations- Transitive Closure and Warshall's Algorithm- Adjacency Matrices.

UNIT-III

Functions: Functions- Functions for Computer Science- Growth of Functions- Permutation Functions.

UNIT-IV

Order Relations and Structure:-Partially Order Sets- External Elements of Partially Ordered Sets- Lattices- Finite Boolean Algebras- Functions on Boolean Algebras- Circuit Design.

UNIT-V

Graphs: Isomorphism-Trees Spanning Trees-Binary Trees-Planar Graphs-Euler Circuits-Hamiltonian Graphs-Chromatic Numbers.

Scope as in:

1. Discrete Mathematics for Computer Science- L. Mott, A. Kendal and T.P. Baker, 2nd Edition,

Kiston(I-IV UNIT) .

1. DiscreteMathematical Structure- Kolman-Busby-Ross, 5th Edition, Pearson Education

References:

1. Discrete Mathematics- Trembly Manohar
2. Discrete and Combinational Mathematics, Ralph. P.Grimaldi, Pearson Education India.
3. Discrete Mathematical Structure, G. Shanker Rao, NewAge International Pub.
4. Discrete Mathematics- Iyenger, Vikas Publications.
5. Discrete Mathematics with Applications, Thomous Koshy, Academic Press Print of Elsevier India.

Outcomes:

- The students become familiar with concepts of discrete mathematics.
- The students attain the ability to use this knowledge to understand and to solve many problems on other subjects like galois theory.

401(ii)- Functional Analysis

L: 4, P:0, Credits: 4

Pre Requisites: Analysis- I and Analysis- II.

Objectives:

- The objective of the module is to study linear mappings defined on Banach spaces and Hilbert spaces, especially linear functional and some sequence spaces. In particular, the four big theorems in functional analysis, namely, Hahn-Banach theorem, uniform boundedness theorem, open mapping theorem and Banach-Steinhaus theorem will be covered.

UNIT- I

Normed Spaces - Banach Spaces: Normed Space- Banach Space –Further Properties of Normed Spaces –Finite Dimensional Normed Spaces and Subspaces –Compactness and Finite Dimension.

UNIT-II

Linear Operators - Bounded and Continuous Linear Operators – Linear Functionals –Linear Operators and Functionals on Finite Dimensional Spaces –Normed Spaces of Operators- Dual Space.

UNIT-III

Inner Product Spaces.Hillbert Spaces: Inner Product Space. Hilbert Space - Further Properties of Inner Product Spaces –Orthogonal Complements and Direct Sums – Orthonormal Sets and Sequences –Series Related to Orthonormal Sequences and Sets –Total Orthonormal Sets and Sequences –Representation of Functionals on Hilbert Spaces.

UNIT-IV

Fundamental Theorems for Normed and Banach Spaces: Zorn's Lemma-Hahn-Banach Theorem-Hahn-Banach Theorem for Complex Vector Spaces and Normed Spaces-Application to Bounded Linear Functional on C[a,b] -Adjoint Operator-Reflexive Spaces-Category Theorem-Uniform Boundedness Theorem.

UNIT-V

Strong and Weak Convergence-Convergence of Sequences of operators and Functionals-Application to Summability of Sequences -Weak Convergence –Open Mapping Theorem –Closed Linear Operators- Closed Graph Theorem.

Scope as in:

1. Introductory Functional Analysis with Applications– Erwin Kreyszig, John Wiley.

References:

1. Introduction to topology and modern Analysis- G.F Simmons – Tata Mc Graw-Hill.
2. Functional Analysis- B.V. Limaye.
3. A First Course in Functional Analysis– Goffman and Pedrick.
4. Operator Theory– S.K. Berberian– Springer.
5. Functional Analysis-A problem oriented approach– V.K. Krishnan, PHI
6. Topics in Functional Analysis and Applications- S. Kesavan, John Wiley.

Outcome:

This is a basic Foundation course in functional analysis with which student gets a better understanding of advanced courses in ODE and PDE.

401(iii). Integral Transforms and Integral Equations

L: 4, P:0, Credits: 4

Pre Requisites: Analysis- I and TODE

Objectives:

- The student is trained to learn various techniques of transforms.
- To train the student in order to learn how to apply the techniques in applications.

UNIT-I

Laplace Transforms: Definition- The Inverse Laplace Transform- Discontinuous Functions, Heaviside's expansion formula- Operational Properties of Laplace Transforms, The convolution theorem- Delta Function, Application of Laplace Transforms.

UNIT-II

The Fourier Transforms: Fourier Integral representation forms, Fourier Transform- Inverse Fourier Transforms, Properties – Fourier sine and cosine Transforms –Convolution Theorem.

UNIT-III

Volterra Integral Equations: Introduction-Volterra integral equations-Relationship between IVP and Volterra integral equations- Method of iterative kernels- Method of polynomial kernel

UNIT-IV

Application of Laplace transform to Volterra Integral Equation- Integro Differential equations-Volterra integral equation of first kind- Euler's Integrals –Abel's problem-Abel's Integral Equation and generalizations- Volterra integral equation of convolution type.

UNIT-V

Fredholm Integral Equations- Fredholm Integral Equation of the second kind-fundamentals-The method of Fredholm determinants -Iterative kernels method – Integral equation with degenerate kernel- Characteristic members and Eigen functions- solution of homogeneous equations with degenerate kernel – Non-homogeneous Symmetric Equations. Fredholm Alternative.

Scope as in:

1. Advanced Engineering Mathematics - Alan Jeffrey – Elsevier.
2. Mathematical Methods -Srimantha Pal- OXFORD Publications
3. Problems and Exercises in Integral Equations- M. Kraslov, A.Kiselev, Mir Publishers

Reference:

1. Operational Mathematics- R.V.Churchil, McGraw-Hill.
2. Integral Transforms – Goyal & Guptha, Pragathi Prakashan Publishers.
3. Introduction to Integral equations with applications- Abdul J Jerri, Marcel, Dekker Inc
4. Methods of Applied Mathematics- Francis B.Hildebrand, Second Edition, PHI Ltd, New Delhi
5. Transforms-I. N Sneddon, McGraw-Hill.

Outcome:

The student is able to solve differential equations, boundary value problems and integral equations by using various transform techniques

Open Elective

402(i) Introduction to Machine Learning

L: 3, P:0, Credits: 3

Pre Requisites: Mathematics Knowledge.

Objectives:

- The purpose of this course is to introduce mathematical foundations of basic Machine Learning concepts among learners, on which Machine Learning systems are built.
- To train the student in order to learn how to apply Linear Algebra, Vector Calculus, Probability and Distributions problems in machine learning.
- Concepts in this course help the learners to understand the mathematical principles in Machine Learning and aid in the creation of new Machine Learning solutions.

UNIT-I

Linear Algebra: Systems of Linear Equations – Matrices – Solving System of Linear Equations – Vector Spaces - Linear Independence – Basis and Rank- Linear Mappings – Affine Spaces.

UNIT-II

Matrix Decompositions: Determinant and Trace **–** Eigenvalues and Eigenvectors – Cholesky Decomposition – Eigen decomposition and Diagonalization – Singular Value Decomposition – Matrix Approximation – Matrix Phylogeny.

UNIT-III

Vector Calculus: Differentiation of UnivariateFunctions – Partial Differentiation and Gradients – Gradients of Vector-ValuedFunctions – Gradients of Matrices – Useful Identities for Computing Gradients – Back propagation and Automatic Differentiation - Higher-Order Derivatives – Linearization and Multivariate Taylor Series

UNIT-IV

Probability and Distributions: Construction of a Probability Space – Discrete and Continuous Probabilities – Sum Rule, Product Rule, and Bayes' Theorem – Summary Statistics and Independence – Gaussian Distribution – Conjugacy and the Exponential Family – Change of Variables/ InverseTransform

UNIT-V

Linear Regression: Problem Formulation – Parameter Estimation – Bayesian Linear Regression – Maximum Likelihood as Orthogonal Projection.

Scope as in:

1. Mathematics for machine Learning – MarcDeisenroth, a. Aldo Faisal, Cheng Soon Ong, Cambridge University Press.

References:

1. Analysis for Applied Mathematics – ward Cheney, Springer.
2. Linear Algebra and Its Applications, 4th Edition by Gilbert Strang.
3. Introduction to Applied Linear Algebra by Stephen Boyd and LievenVandenberghe, 2018 published by Cambridge University Press

Outcome:

After the completion of the course the student will be able to

- Make use of the concepts, rules and results about linear equations, matrix algebra, vector spaces, eigenvalues & eigenvectors and orthogonality & diagonalization to solve computational problems.
- Perform calculus operations on functions of several variables and matrices, including partial derivatives and gradients
- Utilize the concepts, rules and results about probability, random variables, additive & multiplicative rules, conditional probability, probability distributions and Bayes' theorem to find solutions of computational problems
- Perform calculus operations on parametric estimation, Bayesian Linear Regression, Maximum Likelihood as Orthogonal Projection.

402(ii) - Operations Research

L: 3, P:0, Credits: 3

Pre Requisites: Optimization Techniques

Objectives:

- Model decision making problems using major modeling formalisms of artificial intelligence and operations research, including propositional logic, constraints, linear programs and Markov processes
- Evaluate the computational performance of search, satisfaction, optimization and learning algorithms.
- Apply search, satisfaction, optimization and learning algorithms to real world problems.

UNIT-I

Theory of Games: Introduction - Characteristics of Games Theory - Basic Definitions - Minimax (Maximin)Criterion and Optimal Strategy - Saddle Point, Optimal Strategies and Value of the Game - Solution of Games with Saddle Points - Rectangular Games Without Saddle Point - Minimax-Maximin Principlefor Mixed Strategy Games - Two-By-Two(2x2) Games Without Saddle Point- Arithmetic Method for (2X2) Games- Dominance method - Graphical Method for 2xn and mx2 Games.

UNIT-II:

Dynamic Programming: Introduction - Decision Tree and Bellman's Principles of Optimality - Solution of Problem with Finite Numberof Stages - Model 1: Minimum Path Problem - Model II Single Additive Constraint, Multiplicatively Separable Return - Model III. Single Additive Constraint, Additively Separable Return -Model IV: Single Multiplicative Constraint, Additively Separable Return.

UNIT-III

Inventory Production Management: Introduction –What is Inventory? - Types of Inventory Models - Inventory Decisions - How to Develop an Inventory Model? - Costs Involved in Inventory Problems -Why Inventory is Maintained?-Variables in Inventory Problem - Concept of Average Inventory- Concept of Economic Ordering Quantity(EOQ) - Determination of EOQ by Trial and Error Method- Graphical method - The EOQ model without shortage.

UNIT-IV:

Project scheduling by PERT - CPM: Introduction - Historical Development of CPM / PERT Techniques - Applications of PERT / CPM Techniques - Basic Steps in PERT / CPM Techniques - Network Diagram Representation - Rules for Drawing Network Diagram -Labelling: FULKERS'S 1-J Rule - Time Estimates and Critical Path in Network Analysis - Project Evaluation and Review Techniques (PERT).

UNIT-V

Replacement Models: Introduction: The Replacement Problem - Failure Mechanism of Items - Replacement Policy for Items Whose Maintenance Cost Increases with Time and Money Value is Constant

Scope as in:

1. Operations Research by S.D.Sharma.

References:

1. Operations Research by TahaHandi, Prentice –Hall.
2. Operations Research by Prem Kumar Gupta S.Chand.

Outcome:

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

- Describe at an initiative level the process of artificial intelligence and operations research: a real-time cycle of problem understanding, formulation, solution and implementation.
- Formulate simple reasoning, learning and optimization problems, in terms of the representations and methods presented.
- Manipulate the basic mathematical structures underlying these methods, such as system state, search trees, plan spaces, model theory, propositional logic, constraint systems, Markov decision processes, decision trees, linear programs and integer programs.
- Demonstrate the hand execution of basic reasoning and optimization algorithms on simple problems.
- Formulate more complex, but still relatively simple problems, and apply implementations of selected algorithms to solve these problem.
- Evaluate analytically the limitations of these algorithms, and assess tradeoffs between these algorithms.

402(iii) Principles of Management

L: 3, P:0, Credits: 3

Pre Requisite:. Foundation Course

Objectives:

- To enable the students to study the evolution of management.
- To study the functions and principles of management.
- To learn the application of the principles in an organization
- To study the system and process of effective controlling in the organization.

UNIT - I

Introduction to Management: Meaning, definition, concept, scope and principles of management; Evolution of management thought - Management theories- classical, behaviour, system, contingency and contemporary perspectives on management. Management art or science and management as profession.Process and levels of Management.Introduction to Functions (POSDCORB) of Management.

UNIT – II

Planning – Importance: Planning – Importance, objectives, process, policies and procedures, types of planning, Decision making - Process of decision making, Types of decision, Problems involved in decision making.

UNIT – III

Organizing: Meaning, importance, principles of organizing, span of management, Patterns of organization – formal and informal organizations, Common organizational structures; departmentalization, Authority- delegation, centralization and decentralization, Responsibility – line and staff relationship;

UNIT – IV

Staffing: Sources of recruitment, Selection process, Training, Directing, Controlling – Meaning and importance, Function, span of control, Process and types of Control, Motivation, Co-ordination – Need and types and techniques of co-ordination - Distinction between coordination and co-operation - Requisites for excellent co-ordination - Systems Approaches and co-ordination.

UNIT – V

Emerging Issues In Management: Total Quality management, Technology Management, Talent and Knowledge Management, Leadership, Organizational change and Development, Corporate Social responsibility.

Suggested Books

1. Robbins, S. P., &DeCenzo, A. D. Fundamentals of Management.New Delhi: Pearson Education.
2. Harold Koontz &HeinjWeihrich, Essentials of Management, Tata McGraw-Hill Education, New Delhi.

3. T.Ramasamy Principles of Management, Himalaya Publishing House, Mumbai.
4. L.M. Prasad, Principle and Practice of Management, Sultan Chand and Sons
5. Gupta, Sharma and Bhalla; Principles of Business Management; Kalyani Publications
6. P.C. Tripathi& P.N. Reddy Principles of Management, Tata McGraw-Hill Education, New Delhi.
7. Singh, "Principles and Practices of Management and Organizational Behaviour, Sage Publication.
8. Ganguly, Principlesof Management, Cengage Publications.

Course Outcomes:

- Students will be able to have clear understanding of managerial functions.
- Understand planning process in the organization
- Learn the principles of Organizing
- Understand the concept and process of Staffing
- Demonstrate the ability to directing, leadership and communicate effectively

403. MATLAB

L: 1, P: 4, Credits: 3

Pre Requisite:. Foundation Course

Objectives:

- The goal of this course is to introduce students to the fundamental concepts of Scientific Programming using MATLAB and we introduce the necessary mathematical concepts as we go.
- The course will cover the syntax and semantics of MATLAB including data types, control structures, comments, variables, functions, and other abstraction mechanisms.

UNIT-I

Introduction to MAT LAB: Starting and ending a MATLAB-MATLAB Environment- Help future- Types of Files- Platform- Search Path - Built-in Functions- Assignment Statement. **Vectors and Matrices:-**Scalars and Vectors- Entering Data in Matrices- Line Continuation- Matrix Subscripts/Indices- Multidimensional Matrices and Arrays- Matrix Multiplications.

UNIT-II

Polynomials:-Entering a polynomial- Polynomial Evolution- Roots of a Polynomial- Addition- Subtraction- Multiplication- Division- Polynomial Differentiation- Integration- Polynomial Curve fitting. **MATLAB Graphics:-**Two Dimensional Plots- Multiple Plots - Style Option -Sub plots- Specialized Two–Dimensional Plots- Three dimensional Plots.

UNIT-III

Loops: While loop-For loop- Break and Continue Statements- Nesting loops- Branches Control Structures. **Writing Programs and Functions:-** MATLAB Editor-MATLAB Programming- Function Subprograms- Types of Functions - Function handles- Errors and Warnings.

UNIT-IV

Solutions of Algebraic and Transcendental Equations Programs by Using MATLAB: Bisection Method-the Method of False Position Method- Iterative Method Newton –Raphson Method-**Solutions to System of Nonlinear Equations: -** Iterative method -Picards Method.

UNIT-V

Numerical Integration programs by Using MATLAB:-Trapezoidal Rule- Simpson's 1/3-rule- Simpson's 3/8-rule-**Interpolation:-**Newton's Forward and Backward Interpolation Formulas. **Ordinary Differential Equations and Symbolic Mathematics:** Ordinary Differential Equation solvers- Syntax of ODE solvers and steps to use ODE solvers.

Scope as in:

1. MATLAB and Its Application In Eginerring- RajkumarBanasal, Ashok Kumar

Geo, Manoj Kumar Sharma, Pearson Publications.

References: Numerical Methods using MATLAB- John H. Mathews, D.fink, PHI.

Outcome:

Students who successfully complete this course will:

- Become familiar with general concepts in computer science
- Gain an understanding of the general concepts of programming
- Obtain a solid foundation in the use of MATLAB.

Lab Practice:-

1. . Let a 4X3 Matrix A= $\begin{bmatrix} 2 & 3 & 4 \\ 3 & 4 & 5 \\ 4 & 5 & 6 \\ 5 & 6 & 7 \end{bmatrix}$, Using matlab Commands

   a) Delete a 1st row of A

   b) Delete the 1st&2nd columns of all rows of matrix.

   c) Replace the elements A(3,4), A(2,3) with 9 and 8.

2. Express the following sets of algebraic equation in the matrix form AY=B.

$$\begin{aligned} x_1 + x_2 - x_3 &= 2 \\ -x_1 + 3x_2 - x_3 &= 2 \\ 3x_1 - 5x_2 - 2x_3 &= 0 \end{aligned} \quad \& \quad \begin{aligned} x_1 + x_2 + x_3 &= 4 \\ -x_1 + 3x_2 - x_3 &= 4 \\ 4x_1 - 4x_2 &= 0 \end{aligned}$$

   a) Find the inverse of both matrices.

   b) Obtain the solution for the variables $x_1, x_2 \& x_3$.

   c) Find the eigen values and eigen vectors of both matrices.

   d) Find rank, trace and transpose of both matrices.

3. Draw multiple plots using hold command and also use legend command.
4. Draw the multiple plots of the following curves $y1 = \sqrt{x^2 + 1}$, $y2 = 5X + 20$, using Line command X varies from 0 to 100 and step size is 10.
5. Divide the figure window into 4 sub windows and plot the following functions

   i) Plot V v/s I , where V=4*I and I=1,2,3,4

   ii) Plot Y v/s X, where $Y=X^2$ and X=1,2,3,4

   iii) For t=0 : 2*pi in step t=pi/60, plot sin(t) v/s t.

   iv) For t=0 : pi/30 : 2*pi, plot cos(t) v/s t

6. Plot the graph for the equation $y=X^3+2X^2-5$, X varies from -10 to 10, use gtext command to write this equation on the curve plotted.

7. Write a program to plot the curve for equation $A=10e^{-0.2t}$ for t=0 to 50, show the grid lines on the graph.
8. Write a program for Bisection method.
9. Write a program for Newton Raphson method
10. Write a program for Regula Falsi method
11. Write a program for Rungekutta method.
12. Write a program for Simpson's 1/3 rule
13. Write a program for Simpson's 3/8 rule
14. Write a program for Trapezoidal Method.
15. Write a program for Legranges Interpolation.
16. Write a program for Newton forward Interpolation.
17. Write a program for Newton backward Interpolation.
18. Write a program to implement logic gates.
19. Write a program to solve explicit ODE.
20. Write a program to solve implicit ODE.
21. Write a program to solve Boundary Value Problem (BVP).

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