SCHEME OF INSTRUCTION AND SYLLABUS

B.Sc. (Hons.) Mathematics

3 Year (6 Semester) Programme

Academic Year - 2024-25

Faculty of Applied Sciences and Humanities

United University

Rawatpur-Jhalwa (Prayagraj)

Uttar Pradesh

University Vision

"To establish a value based Global University having dynamic learning environment encouraging creativity and innovation, research inspired experimental learning and focusing on topics that are pertinent to the development of the region, the Country and the World."

University Mission

To achieve the Vision, the Mission of the University is

- "To provide a dynamic, inspiring, and varied learning environment with global exposure.
- To position the institution as a premier hub for research and experiential learning.
- To develop into an adaptable university meeting the demands of society and business.
- To incorporate Value thinking, integrity, wisdom and passion in professional for their career and life"

Department Vision

" The Vision of the Faculty of Applied Sciences & Humanities is to foster an inclusive academic environment that promotes interdisciplinary learning, critical thinking, and innovative research. We strive to cultivate a community of scholars dedicated to addressing global challenges through science, technology and the humanities. By aligning with the University's commitment to excellence, we aim to empower students with the knowledge, skills and ethical values needed to contribute meaningfully to society and to lead in their chosen fields."

Department Mission

"To create a community of learners where we may contribute to their expertise and admire one another to create an enhanced society.

To provide learners with a solid foundation not only in the field of engineering by employing model tools and research facilities but also to teach them maths, the fundamental sciences, Environmental issues, and human values.

The Department is focused on a student-centred curriculum that emphasizes intellectual development, connecting with challenging coursework, and assignment-based learning.

The department is committed to encouraging an entrepreneurial, innovative mind-set in the students by exposing them to a plethora of events and activities on a global level too.

It promotes the overall development of a good citizen and an upright individual.

We look forward to helping them strengthen their inborn skills with the proper training in their field and offer an opportunity for expression to lead a bright career ahead."

Program Educational Objectives

(Undergraduate)

1. **PEOs-1:** Develop a strong foundation in mathematical theories and techniques, enabling the application of these concepts to solve complex real-world problems.
2. **PEOs-2:** Graduates will be prepared for pursuing higher studies in mathematics and related fields, contributing to academic research and interdisciplinary projects that demand a high level of mathematical expertise.
3. **PEOs-3:** Acquire skills necessary for careers in sectors requiring quantitative analysis, problem-solving, and logical reasoning, such as finance, technology, data science and operation research.
4. **PEOs-4:** Instill ethical values, social responsibility, and an understanding of the broader impact of mathematics on society and the global scientific community.
5. **PEOs-5:** Cultivate an attitude of lifelong learning, staying updated with technological advancements and new mathematical developments to enhance professional skills and adaptability.

B.SC. (HONS.) MATHEMATICS

Program Outcomes

On successful completion of the B.Sc. (Hons) in Mathematics the student will acquire:

PO.1 - *Disciplinary knowledge:* Capability of demonstrating comprehensive knowledge of basic concepts and ideas in mathematics, its subfields, and its applications to other disciplines.

PO.2 - *Critical thinking and analytical reasoning:* Ability to apply critical thinking in understanding the concepts in mathematics and allied areas, identify relevant assumptions, hypothesis, implications or conclusions; formulate mathematically correct arguments, ability to analyze and generalize specific arguments to get broader concepts.

PO.3 - *Problem specific analysis:* Ability to identify, formulate, review research literature, and analyze complex mathematical problems reaching substantiated conclusions using principles of mathematics.

PO.4 - *Problem solving skills:* Capacity to use the gained knowledge to solve different kinds of non-familiar problems and apply the learning to real world situations; Capability to solve problems in computer graphics using concepts of linear algebra; Capability to apply the knowledge gained in differential equations to solve specific problems or models in operations research, physics, chemistry, electronics, medicine, economics, finance etc.

PO.5 - *Research-related skills:* Capability to ask and inquire about relevant/appropriate questions, ability to define problems, formulate hypotheses, test hypotheses, formulate mathematical arguments and proofs, draw conclusions; ability to write clearly the results obtained.

PO.6 - *Modern tool usage:* Knowledge to select, and apply appropriate software, techniques, resources, and modern mathematical and IT tools including Python, LATEX, Mathematica, MATLAB, Maple, etc.

PO.7 - *Self-directed learning:* Ability to work independently, ability to search relevant resources and e-content for self-learning and enhancing knowledge in mathematics**.**

PO.8 - *Individual and team work:* Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO.9 - *Communications skills:* Ability to communicate various concepts of mathematics in effective and coherent manner both in writing and orally, ability to present the complex mathematical ideas in clear, precise and confident way, ability to explain the development and importance of mathematics and ability to express thoughts and views in mathematically or logically correct statements.

PO10 - *Life-long learning:* Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of scientific and technological change.

Program Specific Outcomes

PSO.1: Bachelor's Degree in Mathematics is the culmination of in-depth knowledge of many core branches of mathematics, viz. Algebra, Calculus, Geometry, Differential Equations, Mechanics, Real and Complex Analysis including some related areas like Computer Science and Statistics. Thus, this program helps students build a solid foundation for further higher studies and research in Mathematics.

PSO.2: Enable the students to think in a critical manner and familiarize them with suitable tools of mathematical analysis to handle issues and problems in mathematics and related sciences.

PSO.3: Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of mathematics.

PSO.4: Provide students sufficient knowledge and skills enabling them to undertake further studies in mathematics and its allied areas on multiple disciplines concerned with mathematics.

PSO.5: This program will help students enhance their employability for Government jobs, jobs in banking, insurance, and investment sectors, data analysis jobs, and jobs in various other public and private enterprises.

SCHEME OF INSTRUCTION

COURSE CATEGORY ABBREVIATIONS

1. Program Core - PC
2. Soft Skills-SS
3. Skill Enhancement Course-SEC
4. Compulsory Course-MC
5. Program Elective-PE
6. Open Elective-OE
7. Internship/Project

Semester I

				Contact Hours			***29***
S. No.	***Course Code***	***Course Category***	***Course Name***	***L***	***T***	***P***	***C***
1	SCUCMT111T	PC	Calculus-I	***4***	***1***	***0***	***4***
2	SCUCMT112T	PC	Algebra	***4***	***1***	***0***	***4***
3	SCUCMT113T	PC	Geometry	***4***	***1***	***0***	***4***
4	CASCPSC10T	SEC	Fundamentals of Computer and C-Programming	***4***	***0***	***0***	***4***
5	CASCPSC10P	SEC	C- Programming Lab	***0***	***0***	***4***	***2***
6	ARSPCSC10T	SS	Introduction to Professional Communication	***2***	***0***	***0***	***2***
7	PTSPPSC10T	SS	Professional Proficiency	***4***	***0***	***0***	***4***
				Total Credit			***24***
L – Lecture, T – Tutorial, P – Practical, C - Credit							

Semester II

				Contact Hours			***30***
S. No.	***Course Code***	***Course Category***	***Course Name***	***L***	***T***	***P***	***C***
1	SCUCMT211T	PC	Calculus-II	***4***	***1***	***0***	***4***
2	SCUCMT212T	PC	Real Analysis-I	***4***	***1***	***0***	***4***
3	SCUCMT213T	PC	Ordinary Differential Equations	***4***	***1***	***0***	***4***
4	CASCPSC20T	SEC	Fundamentals of Data Science	***3***	***0***	***0***	***2***
5	CASCPSC20P	SEC	Fundamentals of Data Science Lab	***0***	***0***	***4***	***2***
6	SCUCEV201T	SEC	Environmental Science	***4***	***0***	***0***	***4***
7	PTSPPSC20T	SS	PROFESSIONAL PROFICIENCY	***4***	***0***	***0***	***4***
				Total Credit			***24***
L – Lecture, T – Tutorial, P – Practical, C - Credit							

Semester III

				Contact Hours			***27***
S. No.	***Course Code***	***Course Category***	***Course Name***	***L***	***T***	***P***	***C***
1	SCUCMT301T	PC	Probability and Statistics	***4***	***1***	***0***	***4***
2	SCUCMT302T	PC	Group Theory	***4***	***1***	***0***	***4***
3	SCUCMT303T	PC	Mechanics	***4***	***1***	***0***	***4***
4	CASCPSC30T	SEC	Image processing using MATLAB	***4***	***0***	***0***	***4***
5	CASCPSC30P	SEC	Image processing using MATLAB Practicals	***0***	***0***	***4***	***2***
6	PTSPPSC30T	SS	Professional Proficiency	***4***	***0***	***0***	***4***
				Total Credit			***22***
L – Lecture, T – Tutorial, P – Practical, C - Credit							

Semester IV

				Contact Hours			***30***
S. No.	***Course Code***	***Course Category***	***Course Name***	***L***	***T***	***P***	***C***
1	SCUCMT401T	PC	Complex Analysis	***4***	***1***	***0***	***4***
2	SCUCMT402T	PC	Linear Algebra	***4***	***1***	***0***	***4***
3	SCUCMT403T	PC	Partial differential equations	***4***	***1***	***0***	***4***
4	SCUCMT404T	PC	Mathematical Methods	***4***	***1***	***0***	***4***
5	CASPYSC40T	SEC	PYTHON Programming	***4***	***0***	***0***	***4***
6	CASPYSC40P	SEC	PYTHON Programming Lab	***0***	***0***	***2***	***2***
7	PTSPPSC40T	SS	Professional Proficiency	***4***	***0***	***0***	***4***
				Total Credit			***26***
L – Lecture, T – Tutorial, P – Practical, C - Credit							

Semester V

				Contact Hours			***30***
S. No.	***Course Code***	***Course Category***	***Course Name***	***L***	***T***	***P***	***C***
1	SCUCMT501T	PC	NUMERICAL METHODS	***4***	***1***	***0***	***4***
2	SCUCMT501P	PC	NUMERICAL METHODS LAB	***0***	***0***	***4***	***2***
3	SCUCMT502T	PC	ADVANCED ALGEBRA	***4***	***1***	***0***	***4***
4	SCUCMT503T	PC	REAL ANALYSIS -II	***4***	***1***	***0***	***4***
5	SCUCMT504T	PC	NUMBER THEORY	***4***	***1***	***0***	***4***
6	CASCPSC50T	SEC	AI AND MACHINE LEARNING	***4***	***0***	***0***	***4***
7	CASCPSC50P	SEC	AI AND MACHINE LEARNING LAB	***0***	***0***	***2***	***2***
				Total Credit			***24***
L – Lecture, T – Tutorial, P – Practical, C - Credit							

Semester VI

				Contact Hours			***24***
S. No.	***Course Code***	***Course Category***	***Course Name***	***L***	***T***	***P***	***C***
1	SCUCMT601T	PC	DIFFERNCIAL GEOMETRY AND TENSOR ANALYSIS	***4***	***1***	***0***	***4***
2	SCUCMT602T	PC	LINEAR PROGRAMMING	***4***	***1***	***0***	***4***
3	SCUCMT6101T / SCUCMT6102T / SCUCMT6103T	OE	ADVANCED DIFFERENTIAL EQUATION / OPERATION RESEARCH / CRYPTOGRAPHY	***4***	***1***	***0***	***4***
4	SCUCMT6201T / SCUCMT6202T / SCUCMT6203T	OE	DISCRETE MATHEMATICS / MATHEMATICAL MODELLING AND BOOLEAN ALGEBRA / PRINCIPLES OF COMPUTER SCIENCE	***4***	***1***	***0***	***4***
5	SCUCMT601P		PROJECT	***0***	***0***	***4***	***8***
				Total Credit			***24***
L – Lecture, T – Tutorial, P – Practical, C - Credit							

COURSE DETAILS FOR SEMESTER I

COURSE CODE & NAME: SCUCMT111T / CALCULUS - I

COURSE OBJECTIVES:

To familiar students with fundamental concepts and function of graphical, numerical, analytical and relationship between the derivative.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Find limits of functions (graphically, numerically and algebraically)
2. Analyze and apply the notions of continuity and differentiability to algebraic and transcendental functions.
3. Determine derivatives by a variety of techniques including explicit differentiation, implicit differentiation, and logarithmic differentiation.
4. Use these derivatives to study the characteristics of curves. Determine derivatives using implicit differentiation and use to study characteristics of a curve.
5. Construct detailed graphs of nontrivial functions using derivatives and limits.

SYLLABUS:

UNIT I:

Real number system: Completeness axiom, density of rationals (irrationals) in reals, convergence of a sequence, Sandwich theorem, Monotone sequences, Cauchy Criterion, Subsequence, Bolzano-Weierstrass theorem.

UNIT II:

Limit and Continuity $\in$-δ definition of limit of a real valued function, Limit at infinity and infinite limits; Continuity of a real valued function, Properties of continuous functions, Intermediate value theorem, Geometrical interpretation of continuity, Types of discontinuity; Uniform continuity.

UNIT III:

Differentiability, Differentiability of a real valued function, Geometrical interpretation of differentiability, Relation between differentiability and continuity, Differentiability and monotonicity, Chain rule of differentiation; Successive differentiation, Leibnitz's theorem.

UNIT IV:

Expansions of Functions Maclaurin's and Taylor's theorems for expansion of a function in an infinite series, Taylor's theorem in finite form with Lagrange, Cauchy and RocheSchlomilch forms of remainder; Maxima and minima.

UNIT V:

Curvature, Asymptotes and Curve Tracing Curvature; Asymptotes of general algebraic curves, Parallel asymptotes, Asymptotes parallel to axes; Symmetry, Concavity and convexity, Points of inflection,

TEXTBOOKS

1. Gorakh Prasad (2016). Differential Calculus (19th edition). Pothishala Pvt. Ltd.
2. Shanti Narayan, Differential Calculus, S Chand Publication.

REFERENCE BOOKS

1. Howard Anton, I. Bivens & Stephan Davis (2016). Calculus (10th edition).
2. Gabriel Klambauer (1986). Aspects of Calculus. Springer-Verlag.
3. Wieslaw Krawcewicz & Bindhyachal Rai (2003). Calculus with Maple Labs Narosa.

COURSE CODE & NAME: SCUCMT112T / ALGEBRA

COURSE OBJECTIVES:

Students will be able to recognize that complex numbers are an extension of real numbers and understand that complex numbers, Method for solving advanced problems in matrices.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. To evaluate square roots of negative numbers,
2. Identify the real and imaginary parts of a complex number.
3. To Solve the matrix equation AX = B using row operations and matrix operations.
4. Understand the concept of square matrix, and of the inverse of an invertible matrix.

SYLLABUS:

UNIT I:

Theory of Equations and Complex Numbers, Elementary theorems on the roots of an equations including Cardan's method, The remainder and factor theorems, Synthetic division, Factored form of a polynomial, The Fundamental theorem of algebra

UNIT II:

Relations between the roots and the coefficients of polynomial equations, Imaginary roots, Integral and rational roots; Polar representation of complex numbers, The nth roots of unity, De Moivre's theorem for integer and rational indices and its applications.

UNIT III:

Relations and Basic Number Theory:- Relations, Equivalence relations, Equivalence classes; Functions, Composition of functions, Inverse of a function; Finite, countable and uncountable sets; The division algorithm, Divisibility and the Euclidean algorithm, The fundamental theorem of arithmetic, Modular arithmetic and basic properties of congruences; Principles of mathematical induction and well ordering.

UNIT IV:

Row Echelon Form of Matrices and Applications Systems of linear equations, Row reduction and echelon forms, Linear independence, The rank of a matrix and applications.

UNIT V:

Introduction to linear transformations, The matrix of a linear transformation, Matrix operations, Determinants, The inverse of a matrix, Characterizations of invertible matrices; Applications to Computer Graphics; Eigenvalues and eigenvectors, The characteristic equation and the Cayley–Hamilton theorem.

TEXTBOOKS

1. A.R. Vasishtha, Linear Algebra & Matrices text book for B.Sc., Krishna Prakashan, Eighteen Edition 2020.
2. Dr. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publication

REFERENCE BOOKS

1. Titu Andreescu, & Dorin Andrica (2014). Complex Numbers from A to...Z. (2nd edition). Birkhäuser.
2. David C. Lay, Linear Algebra and It's Application, 3rd Edition, Pearson Education Asia, Indian Reprint, 2007.

COURSE CODE & NAME: SCUCMT113T / GEOMETRY

COURSE OBJECTIVES:

The course aims to explore the knowledge of student on geometric ideas, theorems of Euclidean geometry with conceptual meaning of measurement.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Understand Polar equation of a conic
2. Understand lines & Plane in 3 dimensions.
3. Find equation in various form of line & plane circle,
4. Find equation in various form sphere, cones, cylinder etc.

SYLLABUS:

UNIT I:

Conics: Transformation of rectangular axes. General equation of second degree and its reduction to normal form. Classification of quadratic equation representing lines, parabola, ellipse and hyperbola, Systems of conies. Polar equation of a conics; Equation of chord, Equation of the tangent to a conic, Director circle, Normal equation (in polar form)

UNIT II:

Straight line and Plane in space (Using Vector Technique): Direction ratio & cosine, Projection of point on a line & segment of a line on another line, vector equation of line , Bisector of the angle between two straight lines, coplaner lines, Shortest distance between two lines, Normal form of plane equation, Intercept form of plane equation , General equation of a plane, plane passing through a line, angle between two planes, length of the perpendicular from a point to a plane, plane passing through the line of two plane.

UNIT III:

Sphere: Equation of a Sphere, Plane section of sphere, intersection of two spheres, spheres passing through a circle, Tangent plane, Plane of contact, Polar lines, Angle of intersection of two sphere, Power of point, Redical plane & line, Coaxial system of spheres.

UNIT IV:

Cone and Cylinder: Cones & Cylinder with given vertex and a given conic as base, Intersection of cone and a plane passing through the vertex of the cone, tangent lines and planes, Polar planes and polar lines, Reciprocal cones, Normal plane passing through a generator of the cone, Enveloping, Right circular cones and Cylinders

UNIT V:

Generating lines, Central conicoids & paraboloids: Ruled Surfeces, generating lines of a hyperboloid of one sheet and hyperbolic paraboloid and its properties. Standerd equation of central conicoids & paraboloids, plane sections of conicoids.

TEXTBOOKS

1. R. S. Gupta and R. D. Pathak: Conic Sections.
2. N. Saran and R. S. Gupta: Analytical Geometry of three dimensions.
3. Shanti Narayan, Analytical Geometry of three dimensions.

REFERENCE BOOKS

1. Bell, R. J. T., Elementary Treatise on Coordinate geometry.
2. Chaki, M. C., A Text book of Analytical Geometry, Calcutta Publishers.
3. P K Mittal, Mathematics for Degree Students B. Sc. 1St Yr ISBN: 9788121932400 S. Chand Publishing.

COURSE CODE & NAME: CASCPSC10T / Fundamentals of Computer and C-Programming

COURSE OBJECTIVES:

The course is designed to provide the foundation of logic development. This course will provide the base of further programming related courses. Students could develop their own logic and construct the programs & applications in C.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Develop efficient algorithms for solving a problem.
2. Use the various constructs of a programming language viz. conditional, iteration and recursion.
3. Implement the algorithms in "C" language.
4. Use simple data structures like arrays, stacks and linked list in solving problems.

SYLLABUS:

UNIT I:

Introduction to Programming: The Basic Model of Computation, Algorithms, Flow-charts, Programming Languages, Compilation, Linking and Loading, Testing and Debugging, Documentation Algorithms for Problem Solving: Exchanging values of two variables, summation of a set of numbers, Decimal Base to Binary Base conversion, Reversing digits of an integer, GCD (Greatest Common Division) of two numbers, Test whether a number is prime, Organize numbers in ascending order, Find square root of a number, factorial computation, Fibonacci sequence, Evaluate 'sin x' as sum of a series, Reverse order of elements of an array, Find largest number in an array, Print elements of upper triangular matrix, multiplication of two matrices, Evaluate a Polynomial

UNIT II:

Introduction to 'C' Language.: Character set, Variables and Identifiers, Built-in Data Types, Variable Definition, Arithmetic operators and Expressions, Constants and Literals, Simple assignment statement, Basic input/output statement, Simple 'C' programs. Conditional Statements and Loops: Decision making within a program, Conditions, Relational Operators,

Logical Connectives, if statement, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement, structured Programming. **Arrays:** One dimensional array: Array manipulation; Searching, Insertion, Deletion of an element from an array; Finding the largest/smallest element in an array; Two dimensional arrays, Addition/Multiplication of two matrices, Transpose of a square matrix; Null terminated strings as array of characters, Standard library string functions.

UNIT III:

Functions: Top-down approach of problem solving, Modular programming and functions, Standard Library of C functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, passing arguments to a Function: call by reference, call by value, Recursive Functions, arrays as function arguments.

Storage Classes: Scope and extent, Storage Classes in a single source file: auto, extern and static, register, Storage Classes in multiple source files: extern and static.

UNIT IV:

Structures and Unions: Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions. **Pointers:** Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays, pointers and structures, dynamic memory allocation.

UNIT V:

Self-Referential Structures and Linked Lists: Creation of a singly connected linked list, Traversing a linked list, Insertion into a linked list, Deletion from a linked list. **File Processing:** Concept of Files, File opening in various modes and closing of a file, Reading from a file, Writing

TEXTBOOKS

1. Byron S Gottfried “Programming with C” Second edition, Tata Mc Grawhill, 2007 (Paperback)
2. R.G. Dromey, “How to solve it by Computer”, Pearson Education, 2008.
3. Kanetkar Y, “Let us C”, BPB Publications, 2007.
4. Hanly J R & Koffman E.B, “Problem Solving and Program design in C”, Pearson Education, 2009.

REFERENCE BOOKS

1. E. Balagurusamy, “Programming with ANSI-C”, Fourth Edition, 2008, Tata Mc GrawHill.
2. Venugopal K. R and Prasad S. R, “Mastering ‘C’”, Third Edition, 2008, Tata McGraw Hill.
3. B.W. Kernighan & D.M. Ritchie,“The C Programming Language”, Second Edition, 2001, Pearson Education.
4. ISRD Group, “Programming and Problem-Solving Using C”, Tata Mc GrawHill, 2008.

COURSE CODE & NAME: CASCPSC10P / C- Programming Lab

COURSE OBJECTIVES:

The course aims to acquire logical thinking, Implement the algorithms, Identify the correct and efficient ways of solving problems.

COURSE OUTCOMES:

After Completing of this lab course, students are able to:

1. Understand the logic for a given problem.
2. Write the algorithm of a given problem.

Note: A minimum of ten experiments from the following should be performed.

- Write a program to find sum of all prime numbers between 100 and 500.
- Write a program to obtain sum of the first 10 terms of the following series for any positive integer value of X: $X + X^3/3! + X^5/5! + X^7/7! + \ldots$
- Write a program to reverse the digits of a given number. For example, the number 9876 should be returned as 6789.
- Write a program to compute the wages of a daily laborer as per the following rules:- Hours Worked Rate Applicable Upto first 8 hrs Rs 50/- . For next 4hrs Rs 10/- per hr extra For next 4hrsRs 20/- per hr extra, For next 4hrs Rs 25/- per hr extra For rest Rs 40/- per hr extra.

  Accept the name of the laborer and no. of hours worked. Calculate and display the wages. The program should run for N number of laborers as specified by the user.

- Write a program to input 20 arbitrary numbers in one-dimensional array. Calculate Frequency of each number. Print the number and its frequency in a tabular form.
- Define 2dimensional array a (3,3), b (3,3), sum (3,3), diff (3,3), mult (3,3). Store 9 arbitrary numbers in a (3,3) and 9 arbitrary numbers in b (3,3). Do the following:

  a. Calculate sum of a (3,3) and b (3,3) and store in sum (3,3) where sum (i,j)=a (i,j)+b (i,j)
  b. Calculate difference of a (3,3) and b (3,3) and store in diff (3,3) where diff (i,j)=a (i,j)- b(i,j)
  c. Calculate product of two arrays a (3,3) and b (3,3) and store in mult (3,3) where mult (i,j)= summation of a (i,k)*b (k,j) over k where k=1 to 3.

  Print the result in a tabular form

- Write a function, str_ search (char* s1, char* s2, int n), that takes two strings and an integer, as arguments and returns a pointer to the nth occurrence of 1st string s1 in 2nd string s2, or NULL if it is not present.
- Write a C function to remove duplicates from an ordered array. For example, if input array contains 10,10,10,30,40,40,50,80,80,100 then output should be 10,30,40,50,80,100
- Apply recursive call to do the following:

  i. Input 'n'(1-200). Calculate sum of 'n' numbers.
  ii. Input 'n'(1-20). Calculate product of 'n'numbers.
  iii. Input 'n'(2-20). Print 'n' number of Fibonacci numbers. In Fibonacci sequence the sum of two successive terms gives the third term. The following are few terms of Fibonacci sequence: - 1 1 2 3 5 8 13 ……

- Write a program which will arrange the positive and negative numbers in a one-dimensional array in such a way that all positive numbers should come first and then all the negative numbers will come without changing original sequence of the numbers.

  Example:

  Original array contains: 10, -15, 1, 3, -2, 0, -2, -3, 2, -9
  Modified array :10, 1, 3, 0, 2, -15, -2, -2, -3, -9

- Write a menu driven program to maintain a Telephone Directory having following file structure:
  1. Name: Character type: Length =20 characters.
  2. Address Character type: Length =40 characters.
  3. Phone: Character type: Length =12 characters.

  Menu

  1. Add record(s)
  2. Display record(s)
  3. Search record(s)
  4. Modify record(s)
  5. Delete record(s)
  6. Backup copy of File
  7. Exit

  Type your choice= 1,2,3,4,5,6,7---->

COURSE CODE & NAME: ARSPCSC10T / Introduction to Professional Communication

COURSE OBJECTIVES:

To put in use the basic mechanics of Grammar. To provide an outline to effective Organizational Communication. Understand the role of communication in personal & professional success. Prepare and present messages with a specific intent.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. create substantial base by the formation of strong professional vocabulary for its application at different platforms and through numerous modes as Comprehension, reading, writing and speaking etc.
2. understand the basic objective of the course by being acquainted with specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.
3. cultivate relevant technical style of communication & presentation at their work place & also for academic uses.
4. apply it at their work place for writing purposes such as Presentation/official drafting/administrative communication and use it for document/project/report/research paper writing.
5. apply it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics. They will apply techniques for developing interpersonal communication skills and positive attitude leading to their professional competence.

SYLLABUS:

UNIT I:

Components of Technical Writing and Functional Grammar: Words and Phrases: Word formation; Root words from foreign languages & their use in English; Prefixes & Suffixes: Derivatives; Modals; Infinitives; vocabulary development: technical vocabulary, vocabulary used in formal letters/emails and reports.

UNIT II:

Fundamentals of Technical Communication: Introduction to Communication; Process of Communication; Technical Communication: features: Distinction between General and

Technical Communication; The flow of communication: Downward, Upward, Lateral/Horizontal (Peer group); Barriers to Communication; Dimensions of Communication: Reading, Listening & Comprehension: skills, types & methods.

UNIT III:

Technical Style & Written Communication: Technical Style: Features; types; Requisites of Sentence Construction; Types of Sentences; Paragraph Development: Techniques and Methods: Inductive, Deductive, Spatial, Linear, Chronological etc. Devices;

UNIT IV:

Written Business Communication: Letter writing: Principles, Type: Sales; Credit letters; Claim; Adjustment Letters; Job Application & official letter; Reports: Types; Significance; Structure, & drafting of Reports. Technical Proposal; Types; Writing of Proposal; Significance; Seminar & Conference paper writing; Expert Technical Lecture: Theme clarity; Analysis & Finding; Notices; Agenda; Minutes of Meeting.

UNIT V:

Presentation Strategies & Oral Communication: Analysis of Audience and Locale; Nuances and Modes of Delivery; Kinesics; Proxemics; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections; Flow in Speaking; Public Speaking: method; Techniques: Clarity of substance; emotion; Humour.

TEXTBOOKS

1. Improve your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
2. Technical Communication- Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.
3. Functional skills in Language and Literature, by R.P. Singh, Oxford Univ. Press, 2005, New Delhi.
4. Ashraf Rizvi, "Effective Technical Communication", 2nd Edition, McGraw Hill Education, 2017.

REFERENCE BOOKS

1. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.

2. Business Correspondence and Report Writing by Prof. R.C., Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd. 2001, New Delhi.
3. Word Power Made Easy by Norman Lewis, W.R. Goyal Pub. & Distributors, 2009, Delhi.
4. Developing Communication Skills by Krishna Mohan, Mecra Bannerji- Macmillan India Ltd. 1990, Delhi

COURSE CODE & NAME: PTSPPSC10T / Professional Proficiency

COURSE OBJECTIVES:

Students should be able to read and write correct English, attain reasonable fluency in the Language and should also be exposed to introductory lessons of Aptitude Building.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Better representation of himself/herself in terms of communication skills, overall personality development and aptitude building required for jobs.
2. This program will help students employable and ready for Industries /corporate and other Public and Private Sector jobs.

SYLLABUS:

UNIT I:

Hard Skills: Revision: (1) Grammar (Basics) (2) Preposition (3) Tense (4) Subject-Verb Agreement (5) Synonyms & Antonyms

The goal is to teach Grammar implicitly through reading comprehensions. A short story/paragraph should be given for the students to identify the parts of speech and the other topics mentioned above. The classes should be learner centric and the students should be able to apply the lessons learnt in their daily conversations.

UNIT II:

Soft Skills: Speaking: Etiquettes (not theoretical/written but practical) of Listening, Speaking, Writing, Speech Delivery.

The aim should be to attempt to make the students the centre of the learning process and break the ice with speaking the language. They should develop the confidence to speak and think in the language for further professional exposure. They should be engaging in intelligent conversation with the instructor and expressing themselves in English.

UNIT III:

Practice Sheet: Questions (Subjective and Objective) based on the instruction given every week.

The aim should be to bring the instruction given in practice by making them write, speak and think along the lines of the instruction given. The practice sheet should be evaluated and

necessary feedback must be given. Some exercise on compositional skills must be given so they develop a sense of writing and expressing themselves through the written word.

UNIT IV:

Quantitative Aptitude & Logical Reasoning:

- Simplification & Approximation
- Alpha-Numeric Series & Miscellaneous
- Coding-Decoding

COURSE DETAILS FOR SEMESTER II

COURSE CODE & NAME: SCUCMT211T / Calculus-II

COURSE OBJECTIVES:

The course is designed to provide the study of function of several variables & vector calculus.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. understand partial differentiation for several variables
2. understand expansion of functions for several variables
3. understand vector differentiation & integration.

SYLLABUS:

UNIT I:

Partial Differentiation Functions of several variables, Level curves and surfaces, Limits and continuity, Partial differentiation, Tangent planes, Chain rule, Directional derivatives, The gradient, Maximal and normal properties of the gradient, Tangent planes and normal lines.

UNIT II:

Differentiation Higher order partial derivatives, Total differential and differentiability, Jacobians, Change of variables, Euler's theorem for homogeneous functions, Taylor's theorem for functions of two variables and more variables, Envelopes and evolutes.

UNIT III:

Extrema of Functions and Vector Field Extrema of functions of two and more variables, Method of Lagrange multipliers, Constrained optimization problems, Definition of vector field, Divergence, curl, gradient and vector identities.

UNIT IV:

Double and Triple Integrals Double integration over rectangular and nonrectangular regions, Double integrals in polar coordinates, Triple integral over a parallelepiped and solid regions, Volume by triple integrals, Triple integration in cylindrical and spherical coordinates, Change of variables in double and triple integrals, Dirichlet integral.

UNIT V:

Green's, Stokes' and Gauss Divergence Theorem Line integrals, Applications of line integrals: Mass and Work, Fundamental theorem for line integrals, Conservative vector fields, Green's theorem, Area as a line integral, Surface integrals, Stokes' theorem, The Gauss divergence theorem.

TEXTBOOKS

1. G. B. Thomas and R. L. Finney, *Calculus*, (9^{th} Edition), Pearson Education, Delhi, 2005.
2. M. J. Strauss, G. L. Bradley and K. J. Smith, *Calculus*, (3th Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
3. Shanti Narayan, Integral Calculus, S. Chand Publication.
4. Shanti Narayan, Vector Calculus, S. Chand Publication.

REFERENCE BOOKS

1. E. Marsden, A. J. Tromba and A. Weinstein, Basic multivariable Calculus, Springer (SIE), Indian reprint, 2005.
2. James Stewart, Multivariable Calculus, Concepts and Contexts, (2nd Ed.), Brooks/Cole, Thomson Learning, USA, 2001.
3. P K Mittal, Mathematics for Degree Students B. Sc. 1St Yr ISBN: 9788121932400 S. Chand Publishing

COURSE CODE & NAME: SCUCMT212T/ Real Analysis-I

COURSE OBJECTIVES:

To expose the students to the basics of real analysis. More precisely, learn about Riemann integrals, sequences and series of functions.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. understand the basics of Real analysis
2. get clear idea about the real numbers and real-valued
3. obtain the skills of analyzing the concepts and applying appropriate methods for testing the convergence of a sequence
4. understand Riemann integration of functions
5. know the geometrical interpretation of mean value

SYLLABUS:

UNIT I:

Real Number System Algebraic and order properties of $\mathbb{R}$, Absolute value of a real number; Bounded above and bounded below sets, Supremum and infimum of a nonempty subset of $\mathbb{R}$, the completeness property of $\mathbb{R}$, Archimedean property, Density of rational numbers in $\mathbb{R}$, Definition and types of intervals, Nested intervals property; Neighbourhood of a point in $\mathbb{R}$, Open, closed and perfect sets in $\mathbb{R}$, connected subsets of $\mathbb{R}$, Cantor set and Cantor function.

UNIT II:

Sequences of Real Numbers Convergent sequence, Limit of a sequence, Bounded sequence, Limit theorems, Monotone sequences, Monotone convergence theorem,

UNIT III:

Subsequence, Bolzano–Weierstrass theorem for sequences, Limit superior and limit inferior of a sequence of real numbers, Cauchy sequence, Cauchy's convergence criterion.

UNIT IV:

Infinite Series Convergence and divergence of infinite series of positive real numbers, Necessary condition for convergence, Cauchy criterion for convergence; Tests for convergence of positive

term series; Basic comparison test, Limit comparison test, D'Alembert's ratio test, Cauchy's nth root test, Integral test; Alternating series, Leibniz test, Absolute and conditional convergence, Rearrangement of series and Riemann's theorem.

UNIT V:

Riemann Integration Riemann integral, Integrability of continuous and monotonic functions, Fundamental theorem of integral calculus, first mean value theorem, Bonnet and Weierstrass forms of second mean value theorems.

TEXTBOOKS

1. N. N. Bhattacharya: Elementary Analysis.
2. S. C. Malik: *Mathematical Analysis.*
3. Elements of Real Analysis as per UGC Syllabus by Shanti Narayan and Dr. M.D. Raisinghaniya, published by S. Chand & Company Pvt. Ltd. New Delhi.

REFERENCE BOOKS

1. Books Re R. G. Bartle and D. R. Sherbert, *Introduction to Real Analysis*, John Wiley.
2. T.M. Apostol, *Calculus* Vol. 1
3. W. Rudin, Principles of Mathematical Analysis McGraw-Hill Education

COURSE CODE & NAME: SCUCMT213T / Ordinary differential equations

COURSE OBJECTIVES:

The major aim of the course is to explore the knowledge on differential equation and select and apply the appropriate analytical technique for finding the solution of first order and selected higher order ordinary differential equations.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Solve first order differential equations utilizing the standard techniques for separable, exact, linear, homogeneous cases.
2. Solve higher order linear differential equations using reduction of order, undetermined coefficients, or variation of parameters.
3. Understand the condition for existence and uniqueness of solutions of ODE, solve second order ODE using different methods.
4. Solve ODE in series.

SYLLABUS:

UNIT I:

First Order Differential Equations Basic concepts and genesis of ordinary differential equations, Order and degree of a differential equation, Differential equations of first order and first degree, Equations in which variables are separable, Homogeneous equations, Linear differential equations and equations reducible to linear form, Exact differential equations, Integrating factor

UNIT II:

First order higher degree equations solvable for x, y and p. Clairaut's form and singular solutions. Picard's method of successive approximations and the statement of Picard's theorem for the existence and uniqueness of the solutions of the first order differential equations**.**

UNIT III:

Second Order Linear Differential Equations Statement of existence and uniqueness theorem for linear differential equations, General theory of linear differential equations of second order with variable coefficients, Solutions of homogeneous linear ordinary differential equations of second order with constant coefficients, Transformations of the equation by changing the

dependent/independent variable, Method of variation of parameters and method of undetermined coefficients, Reduction of order, Coupled linear differential equations with constant coefficients.

UNIT IV:

Higher Order Linear Differential Equations Principle of superposition for a homogeneous linear differential equation, linearly dependent and linearly independent solutions on an interval, Wronskian and its properties, Concept of a general solution of a linear differential equation, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler-Cauchy equation, Method of variation of parameters and method of undetermined coefficients, Inverse operator method.

UNIT V:

Series Solutions of Differential Equations Power series method, Legendre's equation, Legendre polynomials, Rodrigue's formula, Orthogonality of Legendre polynomials, Frobenius method, Bessel's equation, Bessel functions and their properties, Recurrence relations**.**

TEXTBOOKS

1. S. L. Ross, *Differential Equations*, (3 rd Edition) John Wiley and sons, India, 2004.
2. M. D. Raisinghania, *Ordinary and Partial Differential Equations*, S, Chand and Co. Ltd, 2013.
3. E. Kreyszig, *Advanced Engg. Mathematics.*

REFERENCE BOOKS

1. Belinda Barnes and Clenn R. Fulford, *Mathematical Modeling with Case Studies, A Differential equation Approach using Maple and Matlab*, 2nd Ed., Taylor and Francis group, Londan and New York, 2009.
2. C. H. Edwards and D. E. Penny, *Differential Equations and Boundary Value problems Computing and Modeling*, Pearson Education India, 2005.
3. G. F. Simmons, *Differential Equations*

COURSE CODE & NAME: CASCPSC20T / Fundamentals of Data Science

COURSE OBJECTIVES:

To create awareness towards various environmental issues like global warming, urbanization, pollutions, ozone layer depletion etc; their causes and remedial steps for protecting impacted society.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Apply principles of Data Science to the analysis of business problems.
2. Use data mining software to solve real-world problems.
3. Employ cutting edge tools and technologies to analyze Big Data.
4. Apply algorithms to build machine intelligence.
5. Demonstrate use of team work, leadership skills, decision making and organization theory.

SYLLABUS:

UNIT I:

Introduction: What is Data Science? Data Science process; Matrices-Matrices to represent relations between data, and necessary linear algebraic operations on matrices-Approximately representing matrices by decompositions (SVD and PCA); Statistics: Descriptive Statistics: distributions and probability - Statistical Inference: Populations and samples - Statistical modelling - probability distributions - fitting a model - Hypothesis Testing, Intro to Python.

UNIT II:

Data preprocessing: Data cleaning - data integration - Data Reduction, Data Transformation and Data Discretization. Evaluation methods: Confusion matrix, Students T-tests and ROC curves-Exploratory Data Analysis (EDA): Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, Feature Generation and Feature Selection - Feature Selection algorithms - Filters; Wrappers.

UNIT III:

Basic Machine Learning Algorithms: Association Rule mining- Linear Regression- Logistic Regression - Classifiers - k-Nearest Neighbours (k-NN), k-means- Decision tree- Naive Bayes-Ensemble Methods- Random Forest. Decision Trees and Random Forests.

UNIT IV:

Clustering: Choosing distance metrics- Different clustering approaches-hierarchical agglomerative clustering, k-means (Lloyd's algorithm), - DBSCAN- Relative merits of each method- clustering tendency and quality.

UNIT V:

Regression and ANOVA: Regression: Linear and Logistic regression, ANOVA, R-square, Correlation and causation. Data Visualization: Basic principles, ideas and tools for data visualization

TEXTBOOKS

1. Cathy O'Neil and Rachel Schutt, “Doing Data Science, Straight Talk from The Frontline”, O'Reilly, 2014.
2. Jiawei Han, Micheline Kamber and Jian Pei, “Data Mining: Concepts and Techniques”, Third Edition. ISBN 0123814790, 2011.

REFERENCE BOOKS

1. Mohammed J. Zaki and Wagner Miera Jr, “Data Mining and Analysis: Fundamental Concepts and Algorithms”, Cambridge University Press, 2014.
2. Matt Harrison, “Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, O'Reilly, 2016.
3. Joel Grus, “Data Science from Scratch: First Principles with Python”, O’Reilly Media, 2015.
4. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”, O'Reilly Media, 2012.

COURSE CODE & NAME: CASPYSC20T / Fundamentals of Data Science Lab

COURSE OBJECTIVES:

The course should enable the students to Understand the basics of Python Programming Language. Exposure on solving of data science problems. Understand the visualization effect.

LAB OUTCOMES:

Upon completion of the course, students will be able to

1. Analyze and interpret results from descriptive and predictive data analysis.
2. Apply their knowledge to a given problem domain and articulate potential data analysis problems.
3. Identify potential pitfalls, and social and ethical implications of data science.
4. Write, test, and debug simple Python programs.
5. Implement Python programs with conditionals and loops.
6. Develop Python programs step-wise by defining functions and calling them.

LIST OF EXPERIMENTS:

INTRODUCTION TO PYTHON-

1. A program to compute distance between two points taking input from the user Write a program add.py that takes 2 numbers as command line arguments and prints its sum.
2. Write a Program for checking whether the given number is an even number or not.
3. Write a Program to demonstrate list and tuple in python. Write a program using a for loop that loops over a sequence. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.
4. Write a program to count the numbers of characters in the string and store them in a dictionary data structure Write a program to use split and join methods in the string and trace a birthday of a person with a dictionary data structure.
5. Write function to compute gcd, lcm of two numbers.

READING AND WRITING DIFFERENT TYPES OF DATASETS-

a. Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk Location.
b. Reading Excel data sheet.

c. Reading XML dataset.

VISUALIZATIONS-

a. Find the data distributions using box and scatter plot.
b. Find the outliers using plot.
c. Plot the histogram, bar chart and pie chart etc. on sample data.

COURSE CODE & NAME: SCUCEV201T / Environmental

COURSE OBJECTIVES:

To create awareness towards various environmental issues like global warming, urbanization, pollutions, ozone layer depletion etc; their causes and remedial steps for protecting impacted society.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Understand the environmental issues pertaining to day-to-day living; gain awareness for the need of environmental education vis-à-vis education for sustainable development.
2. Acquire knowledge in ecological perspective and value of environment, biotic components, ecosystem process: energy, food chain, water cycle etc.
3. Understand water quality standards and parameters, assessment of water quality, air pollution, pollutants, acid rain, global climate change and greenhouse gases.
4. Understand variety of social issues associated with environmental deterioration involving human components such as population, ethics and urban settlements.

SYLLABUS:

UNIT I:

Introduction to Environmental Studies: Multidisciplinary nature of environmental studies; Scope and importance; Environmental education; Concept of sustainability and sustainable development. Ecosystems: Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological pyramids. Nutrient cycle (carbon cycle, nitrogen cycle, Sulphur cycle, water cycle, oxygen cycle).

UNIT II:

Natural Resources: Renewable and non-renewable Resources, Land resources and land use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impact due to mining dam building on environment. Water: use and over exploitation of surface and ground water, floods, droughts. Water borne and water induced diseases.

UNIT III:

Environmental Pollution: air pollution, water pollution, thermal pollution, noise pollution, soil pollution; Solid Waste Management; Environmental Impact Assessment.

UNIT IV:

Biodiversity and Conservation: Levels of biological diversity: genetic, species and ecosystem diversity; hot spots; threats to biodiversity; Conservation of biodiversity: in-situ and ex -situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and informational value.

UNIT V:

Impact of energy usage on environment: Global warming, Climate change, Depletion of ozone layer, Acid rain. Environmental ethics, Role of NGOs, Environmental Laws: Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection. Act. Forest Conservation Act.

TEXTBOOKS

1. Deswal & Deswal, "Environment and Ecology" Dhanpat Rai & Co.
2. Smriti Srivastava,"Environment and Ecology"KATSON"

REFERENCE BOOKS

1. Environmental studies - R, Rajgopalan -Oxford Publication.
2. Benny Joseph, "Environmental Studies" Tata McGraw-Hill Education.
3. AK De "Environmental Studies" New Age International Publisher, New Delhi.
4. Shashi K Singh and Anisha Singh, "Environmental Science & Ecology" A.B. Publication.

COURSE CODE & NAME: PTSPPSC20T / PROFESSIONAL PROFICIENCY

COURSE OBJECTIVES:

Listening, Speaking, Reading, and Writing skills to be developed to enable the students to read and write correct English, attain reasonable fluency in the Language and should also be exposed to introductory lessons of Aptitude Building.

COURSE OUTCOMES:

1. Better representation of himself/herself in terms of communication skills, overall personality development and aptitude building required for jobs.
2. This program will help students employable and ready for Industries /corporate and other Public and Private Sector jobs.

SYLLABUS:

UNIT I: Hard Skills

Transformation of Sentences (Simple, Complex, Compound), Direct-Indirect Speech, Active Passive Voice. Reading Comprehension.

The goal is to teach Grammar implicitly through reading comprehensions. A short story/paragraph should be given for the students to identify the parts of speech and the other topics mentioned above. The classes should be learner centric and the students should be able to apply the lessons learnt in their daily conversations.

UNIT II: Soft Skills

Speaking: Group Discussion, Role Play, Skit, Interviews.

The aim should be to develop the students' interpersonal skills though the activities and they should be in a position to better engage with their peers and also develop language speaking skills according to the situation that they are in. They should be comfortable in the use of the language by now and therefore should be in a better position to engage with their peers in the language.

UNIT III: Practice Sheet

Questions (Subjective and Objective) based on the instruction given for hard skills to be distributed every week.

The aim should be to bring the instruction given in practice by making them write, speak and think along the lines of the instruction given. The practice sheet should be evaluated and necessary feedback must be given. Some exercise on compositional skills must be given so that they develop a sense of writing and expressing themselves through the written word.

UNIT IV:

Quantitative Aptitude & Logical Reasoning

- Clock
- Average
- Calendar

COURSE DETAILS FOR SEMESTER III

COURSE CODE & NAME: SCUCMT301T / Probability and Statistics

COURSE OBJECTIVES:

Students will use appropriate statistical terms to describe data. Identify the types of data (qualitative, quantitative, discrete, and continuous). Identify the types of sampling (random, stratified, systematic, cluster). Identify the misuses of statistics

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. define the principal concepts about probability.
2. express the concept of probability and its features
3. explain the concept of a random variable and the probability distributions
4. explain major distributions of random variables.

SYLLABUS:

UNIT I:

Probability Functions and Moment Generating Function Basic notions of probability, Conditional probability and independence, Baye's theorem.

UNIT II:

Random variables - Discrete and continuous, Cumulative distribution function, Probability mass/density functions; Transformations, Mathematical expectation, Moments, Moment generating function, Characteristic function.

UNIT III:

Univariate Discrete and Continuous Distributions Discrete distributions: Uniform, Bernoulli, Binomial, Negative binomial, Geometric and Poisson; Continuous distributions: Uniform, Gamma, Exponential, Chi-square, Beta and normal; Normal approximation to the binomial distribution.

UNIT IV:

Correlation, Regression and Central Limit Theorem, the Correlation coefficient, Covariance, Calculation of covariance from joint moment generating function, Independent random variables, Linear regression for two variables.

UNIT V:

The method of least squares, Bivariate normal distribution, Chebyshev's theorem, Strong law of large numbers, Central limit theorem and weak law of large numbers.

TEXTBOOKS

1. S.M. Ross, Introduction to probability models (Six Edition) Academic Press, 1997.
2. A.M. Yagolam and I.M. Yagolam, Probability and Information, Hindustan Publishing Corporation, Delhi, 1983.

REFERENCE BOOKS

1. Robert V. Hogg, Joseph W. McKean & Allen T. Craig (2013). Introduction to Mathematical Statistics (7th edition), Pearson Education
2. Sheldon M. Ross (2014). Introduction to Probability Models (11th edition). Elsevier.
3. A.M. Yagolam and I.M. Yagolam, Probability and Information, Hindustan Publishing Corporation, Delhi, 1983.

COURSE CODE & NAME: SCUCMT302T / Group Theory

COURSE OBJECTIVES:

This course aims to provide an initial approach to the subject of Algebra, which is one of the basic foundations of modern mathematics. The focus of the course is to study certain algebraic structures like Groups & their properties.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Acquire the basic knowledge and structure of groups, subgroups and cyclic
2. recognize the mathematical objects called groups;
3. link the fundamental concepts of groups and symmetries of geometrical objects;
4. explain the significance of the notions of cosets, normal subgroups, and factor groups;
5. analyze consequences of Lagrange's theorem;
6. describe about structure preserving maps between groups and their consequences.

SYLLABUS:

UNIT I:

Groups and its Elementary Properties: Symmetries of a square, Definition , Elementary properties and examples of groups including dihedral, permutation and quaternion groups, Klien's four group,

UNIT II:

Subgroups and Cyclic Groups Subgroups and examples of subgroups, Cyclic groups, Properties of cyclic groups, Lagrange's theorem, Euler phi function, Euler's theorem, Fermat's little theorem.

UNIT III:

Normal Subgroups Properties of cosets, Normal subgroups, Simple groups, Factor groups, Cauchy's theorem for finite abelian groups; Centralizer, Normalizer, Center of a group, Product of two subgroups; Classification of subgroups of cyclic groups.

UNIT IV:

Permutation Groups Cycle notation for permutations, Properties of permutations, Even and odd permutations, alternating groups, Cayley's theorem and its applications.

UNIT V:

Homomorphism and Isomorphism of groups, Fundamental theorem of homomorphism, Group Automorphism, Inner Automorphism.

TEXTBOOKS

1. M. Artin, Abstract Algebra, 2nd Ed., Pearson,2011
2. Joseph A. Gallian (2017). Contemporary Abstract Algebra (9th edition).
3. Ramji Lal (2017). Algebra 1: Groups, Rings, Fields and Arithmetic. Springer.

REFERENCE BOOKS

1. J. J. Rotman, An Introduction to the Theory of Groups, 4th Ed., Springer Verlag, 1995.
2. I.N. Herstein, Topics in Algebra, Wiley Eastern Limited, India,1975
3. John B. Fraleigh (2007). A First Course in Abstract Algebra (7th edition). Pearson.

COURSE CODE & NAME: SCUCMT303T / Mechanics

COURSE OBJECTIVES:

To develop problem solving skills in mechanics through the application of concepts in statics and dynamics to complex problems.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Identify the mechanics theory of equilibrium for mechanical systems.
2. Identify the concepts of kinematics of particles and rigid bodies.
3. Describe the motion for particles and associate its related equations.
4. Evaluate kinetics of particles using both free body and kinetics diagrams.

SYLLABUS:

UNIT I:

Statics Equilibrium of a particle, Equilibrium of a system of particles, Necessary conditions of equilibrium, Moment of a force about a point, Moment of a force about a line, Couples, Moment of a couple, Equipollent system of forces, Work and potential energy, Principle of virtual work for a system of coplanar forces acting on a particle or at different points of a rigid body, Forces which can be omitted in forming the equations of virtual work.

UNIT II:

Centres of gravity of plane area including a uniform thin straight rod, triangle, circular arc, semicircular area and quadrant of a circle, Centre of gravity of a plane area bounded by a curve, Centre of gravity of a volume of revolution

UNIT III:

Flexible strings, Common catenary, Intrinsic and Cartesian equations of the common catenary, Approximations of the catenary.

UNIT IV:

Rectilinear Motion Simple harmonic motion (SHM) and its geometrical representation, SHM under elastic forces, Motion under inverse square law, Motion in resisting media, Concept of terminal velocity, Motion of varying mass.

UNIT V:

Motion in a Plane Kinematics and kinetics of the motion, Expressions for velocity and acceleration in Cartesian, polar and intrinsic coordinates; Motion in a vertical circle, projectiles in a vertical plane and cycloidal motion.

TEXTBOOKS

1. S L Loney, The Elements of Statics and Dynamics Part-I (Statics), New Age International (P) Ltd
2. S L Loney, The Elements of Statics and Dynamics Part-II (Dynamics), New Age International (P) Ltd
3. R. S. Varma (1962). A Text Book of Statics. Pothishala Pvt. Ltd.

REFERENCE BOOKS

1. S. Narayanan, R. Hanumantha Rao, K. Sitaraman, P. Kandaswamy, Statics, S. Chand and Company Ltd, New Delhi.
2. S. L. Loney (2006). An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies. Read Books.
3. P. L. Srivatava (1964). Elementary Dynamics. Ram Narin Lal, Beni Prasad Publishers Allahabad.

COURSE CODE & NAME: CASCPSC30T / Image processing using MatLab

COURSE OBJECTIVES:

Image processing becomes a very important aspect in various industries ranging from process industry to medical field. This course will help to understand, analyze a wide range of problems and provide solutions related to the design of image processing systems through suitable algorithms, structures, diagrams, and other appropriate methods.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Aware of Image Processing techniques.
2. Design, analyze and realize various algorithms for image processing case studies.
3. Select the appropriate hardware and software tools for image analysis.
4. Develop diagnostic tools for medical applications.

SYLLABUS:

UNIT I:

Introduction and Digital Image Fundamentals: The origins of Digital Image Processing Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image as a 2D data, Image representation – Gray scale and Color images.

UNIT II:

Digital image Representation: Reading, Displaying, Writing Images using MATLAB, Data Classes, Image Types using MATLAB, Converting Between data classes and Image Types, Introduction to Matlab Function used in MATLAB Programming.

UNIT III:

Image enhancement in Spatial domain: Basic gray level Transformations, Histogram Processing Techniques, Enhancement Using Arithmetic and Logic operations, Combining Spatial Enhancement Methods. Basics of Spatial Filters.

UNIT IV:

Image Enhancement in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain, Computing and Visualizing the 2D DFT (MATLAB), Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering.

Image Restoration and Reconstruction: Noise Models, Noise Reduction, MMSE (Wiener) Filtering.

UNIT V:

Object Recognition and Case studies: Object Recognition- Pattern Recognition and pattern classes, case studies – image analysis, Face Detection and Recognition, Application of Image processing in industries.

TEXTBOOKS

1. Gonzalez & Woods, ―Digital Image Processing, 3rd ed., Pearson education, 2008
2. Jain Anil K., ―Fundamentals Digital Image Processing, Prentice Hall India, 2010

REFERENCE BOOKS

1. Milan Sonka, Vaclav Hlavav, Roger Boyle, ―Image Processing, Analysis and Machine Vision, 2nd ed., Thomson Learning, 2001
2. Rangaraj M. Rangayyan, ―Biomedical Image Analysis, CRC Press, 2005
3. Pratt W.K, ―Digital Image Processing, 3rd ed., John Wiley & Sons, 2007
4. Digital Image Processing, 3rd Edition, by Rafael C Gonzalez and Richard E Woods. Publisher:Pearson Education

COURSE CODE & NAME: CASCPSC30P / Image processing using MatLab Practical

COURSE OBJECTIVES:

To apply various techniques and algorithms to manipulate digital images to achieve desired results.

LAB OUTCOMES:

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

1. Understand and comprehend the basics of Matlab.
2. Demonstrate the principles of structured programming and be able to describe, design, implement, and test structured programs using currently accepted methodology.
3. Explain the use of the built-in data structures list, sets, tuples and dictionary.
4. Make use of functions and its applications.

List of Experiments:

1. Simulation and Display of an Image, Negative of an Image (Binary & Gray Scale)
2. Implementation of Relationships between Pixels.
3. Intensity transformation of images.
4. Implementation of Transformations of an Image.
5. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization.
6. Display of bit planes of an Image.
7. Display of FFT (1-D & 2-D) an analysis of an image.
8. Computation of Mean, Standard Deviation, Correlation coefficient of the given image.
9. Implementation of Image Smoothening Filters (Mean and Median filtering of an Image).
10. Implementation of image sharpening filters and Edge Detection using Gradient Filters.

COURSE CODE & NAME: PTSPPSC30T / Professional Proficiency

COURSE OBJECTIVES:

Listening, Speaking, Reading, and Writing skills to be developed to enable the students to read and write correct English, attain reasonable fluency in the Language and should also be exposed to introductory lessons of Aptitude Building

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Better representation of himself/herself in terms of communication skills, overall personality development and aptitude building required for jobs.
2. This program will help students employable and ready for Industries /corporate and other Public and Private Sector jobs.

SYLLABUS:

UNIT I:

Hard Skills: Phrasal Verbs, Idioms and Phrases, Interchange of Sentences (Affirmative to Negative), Composition (Expressing opinions and critical thoughts on current issues), Comprehension (Advanced Level), Cloze Test.

The goal is to teach Grammar implicitly through reading comprehensions. A short story/paragraph should be given for the students to identify the parts of speech and the other topics mentioned above. The classes should be learner centric and the students should be able to apply the lessons learnt in their daily conversations.

UNIT II:

Soft Skills: Speaking activities, describe a Picture: Tell a story around an idiom you have studied, Finish the sentence, Would you Rather and Why? Talk about an activity you enjoy doing, Give directions, Timed discussion.

The aim should be to attempt to immerse the students in the language so that they develop exposure to it and develop confidence for further professional exposure.

UNIT III:

Questions (Subjective and Objective) based on the instruction given for hard skills to be distributed every week.

The aim should be to bring the instruction given in practice by making them write, speak and think along the lines of the instruction given. The practice sheet should be evaluated and necessary feedback must be given. Some exercise on compositional skills must be given so that they develop a sense of writing and expressing themselves through the written word.

UNIT IV: Quantitative Aptitude & Logical Reasoning

- Blood Relation
- Direction and Distance
- Percentage

TEXTBOOKS

1. Gonzalez & Woods, ―Digital Image Processing, 3rd ed., Pearson education, 2008
2. Jain Anil K., ―Fundamentals Digital Image Processing, Prentice Hall India, 2010

COURSE DETAILS FOR SEMESTER IV

COURSE CODE & NAME: SCUCMT401T / Complex Analysis

COURSE OBJECTIVES:

The objective of the course is aimed to provide an introduction to the theories for functions of a complex variable. The concepts of analyticity and complex integration are presented. Cauchy's theorem and its applications, the calculus of residues, and its applications are discussed in detail.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. understand the function of complex variables, and their analysis
2. under the concept of linear and bilinear transformations,
3. learn the concept of integrations of functions of complex variables along curves and domains
4. handle certain integrals not evaluated earlier and will know a technique for counting the zeros of polynomials.
5. this course is a prerequisite to many other advanced analysis courses

SYLLABUS:

UNIT I:

Functions of a complex variable, Concepts of limit, continuity and differentiability of complex functions, Analytic functions, Cauchy-Riemann equations (Cartesian and polar form), Harmonic functions, Orthogonal system, Power series as an analytic function.

UNIT II:

Elementary functions, Mapping by elementary functions, Linear and bilinear transformations, fixed points, Cross ratio, Inverse points and critical points, Conformal transformations

UNIT III:

Complex Integration, Line integral, Cauchy's fundamental theorem, Cauchy's integral formula, Morera's theorem, Liouville theorem, Maximum Modulus theorem, Taylor and Laurent series.

UNIT IV:

Singularities and zeros of an analytic function, Rouche's theorem, Fundamental theorem of algebra, Analytic continuation.

UNIT V:

Residue theorem and its applications to the evaluation of definite integrals, Argument principle.

TEXTBOOKS

1. R.V.Churchill and J.W.Brown, (1984) Complex Variables and Applications. McGraw Hill International Book Co., Singapore. (Third Edition)
2. S. Ponnusamy. (2000) Foundations of Complex Analysis, Narosa Publishing House, New Delhi

REFERENCE BOOKS

1. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications (Eighth Edition), McGraw - Hill International Edition, 2009.
2. Joseph Bak and Donald 1. Newman, Complex analysis (2ndEdition), Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.

COURSE CODE & NAME: SCUCMT402T / Linear Algebra

COURSE OBJECTIVES:

This course to learn, how Linear Algebra is ubiquitous in Mathematics and therefore a strong foundation has to be laid in studying the abstract algebraic concepts intertwining geometric ideas. The fundamental notions of vector spaces viz linear dependence, basis and dimension and linear transformations on these spaces have to be studied thoroughly.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Provide an axiomatic description of an abstract vector space
2. Given a linear transformation and bases, find a matrix representation for the linear transformation
3. Find the eigenvalues and eigenvectors of a matrix,
4. Understand how to determine the angle between vectors and the orthogonality of vectors.

SYLLABUS:

UNIT I:

Vector Spaces Definition and examples, Subspace, Linear span, Quotient space and direct sum of subspaces, linearly independent and dependent sets, Bases and dimension.

UNIT II:

Linear Transformations Definition and examples, Algebra of linear transformations, Matrix of a linear transformation, Change of coordinates, Rank and nullity of a linear transformation and rank-nullity theorem.

UNIT III:

Further Properties of Linear Transformations Isomorphism of vector spaces, Isomorphism theorems, Dual and second dual of a vector space, Transpose of a linear transformation

UNIT IV:

Eigen vectors and eigen values of a linear transformation, Characteristic polynomial and Cayley–Hamilton theorem, Minimal polynomial.

UNIT V:

Inner Product, orthogonality, Cauchy–Schwarz inequality, Gram–Schmidt orthogonalization, Diagonalization of symmetric matrices.

TEXT BOOKS

1. Vivek Sahai & Vikas Bist (2013). Linear Algebra (2nd Edition). Narosa Publishing House
2. Kenneth Hoffman & Ray Kunze (2015). Linear Algebra (2nd edition). Prentice-Hall.

REFERENCE BOOKS

1. Stephen H. Friedberg, Arnold J. Insel & Lawrence E. Spence (2003). Linear Algebra (4thedition). Prentice-Hall of India Pvt. Ltd.
2. Gilbert Strang (2014). Linear Algebra and its Applications (2nd edition). Elsevier.
3. Serge Lang (2005). Introduction to Linear Algebra (2nd edition). Springer India.

COURSE CODE & NAME: SCUCMT403T / Partial differential equations

COURSE OBJECTIVES:

Understand the application of Partial Differential Equations, learn to solve fundamental solution of Laplace equation.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Solve Partial Differential Equation of Second Order.
2. Understand the application of Partial Differential Equations
3. Find the solutions of Laplace equation and Poisson's equation

SYLLABUS:

UNIT I:

First Order Partial Differential Equations Order and degree of Partial differential equations (PDE), Concept of linear and non-linear partial differential equations, Partial differential equations of the first order, Lagrange's method, some special type of equation which can be solved easily by methods other than the general method, Charpit's general method.

UNIT II:

Second Order Partial Differential Equations with Constant Coefficients Classification of linear partial differential equations of second order, Homogeneous and nonhomogeneous equations with constant coefficients.

UNIT III:

Partial differential equations reducible to equations with constant coefficient, Second order PDE with variable coefficients,

UNIT IV:

Classification of second order PDE, Reduction to canonical or normal form; Monge's method

UNIT V:

Solution of heat and wave equations in one and two dimensions by method of separation of variables.

TEXTBOOKS

1. Ian N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company, 1988
2. J.N. Sharma & Kehar Singh: Partial Differential Equations
3. A. S. Gupta (2004). Calculus of Variations with Applications. PHI Learning.

REFERENCE BOOKS

1. M.D. Raisinghania, [2001] Ordinary and Partial Differential Equations, S.Chand and Co.,New Delhi.
2. Erwin Kreyszig (2011). Advanced Engineering Mathematics (10th edition). Wiley.
3. TynMyint-U & Lokenath Debnath (2013). Linear Partial Differential Equation for Scientists and Engineers (4th edition). Springer India.

COURSE CODE & NAME: SCUCMT404T / Mathematical Methods

COURSE OBJECTIVES:

Course intends to deliver the concept of Laplace transforms, Fourier series and apply it to various levels.

COURSE OUTCOMES:

1. After successful completion of the course, the students will be able to:
2. Apply the Laplace Transform and its properties to evaluate the Integrals.
3. Apply Laplace & Inverse Laplace Transform to find the solution of differential equations
4. Interpret the concept of Fourier Transform and Inverse Fourier Transform.

SYLLABUS:

UNIT I:

Laplace Transforms Laplace transform, Linearity, Existence theorem, Laplace transforms of derivatives and integrals, shifting theorems, change of scale property, Laplace transforms of periodic functions, Dirac's delta function.

UNIT II:

Further Properties of Laplace Transforms and Applications Differentiation and integration of transforms, Convolution theorem, Integral equations, Inverse Laplace transform, Lerch's theorem, Linearity property of inverse Laplace transform, Translations theorems of inverse Laplace transform, Inverse transform of derivatives, Applications of Laplace transform in obtaining solutions of ordinary differential equations and integral equations.

UNIT III:

Fourier Transforms Fourier and inverse Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier sine and cosine transforms, Linearity property, change of scale property, Shifting property, Modulation theorem, Relation between Fourier and Laplace transforms.

UNIT IV:

Solution of Equations by Fourier Transforms Solution of integral equation by Fourier sine and cosine transforms, Convolution theorem for Fourier transform, Parseval's identity for Fourier transform, Plancherel's theorem, Fourier transform of derivatives, Applications of infinite

Fourier transforms to boundary value problems, Finite Fourier transform, Inversion formula for finite Fourier transforms.

UNIT V:

Fourier series Fourier cosine and sine series, Fourier series, Differentiation and integration of Fourier series, Absolute and uniform convergence of Fourier series, Bessel's inequality, The complex form of Fourier series.

TEXT BOOKS

1. Walter Rudin (2017). Fourier Analysis on Groups. Dover Publications.
2. M R Spigel, Theory and Problems of Laplace Transform, Schaum Outline Series. 2018.

REFERENCE BOOKS

1. James Ward Brown & Ruel V. Churchill (2011). Fourier series and Boundary Value Problems.McGraw-Hill Education.
2. R.R.Goldberg, Fourier Transform, Cambridge Univ. Press,2009
3. Advanced Engineering Mathematics Kreyszig E. 9th Ed (Wiley, 2006)

COURSE CODE & NAME: CASPYSC40T / PYTHON Programming

COURSE OBJECTIVES:

Master the fundamentals of writing Python programs. Learn core Python scripting elements such as variables and flow control structures. Discover how to work with lists and sequence data. Write Python functions to facilitate code reuse. Use Python to read and write files. Work with the Python standard library and modules.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Understanding basic programming skills using Python programming language.
2. Understanding the notion of data types and complex data types such as lists, tuples etc.
3. Understanding the concept of decision making and iterative control structure in python.
4. Understanding the concepts of functions and file handling in Python.

SYLLABUS:

UNIT I:

Introduction to Python Language: Introduction to Python: Python variables, Python basic Operators, Understanding python blocks. Python Data Types, Declaring and using Numeric data types: int, float etc.

UNIT II:

Control Structures: Python Program Flow Control Conditional blocks: if, else and else if, Simple for loops in python, For loop using ranges, string, list and dictionaries. Use of while loops in python, Loop manipulation using pass, continue, break and else. Programming using Python conditional and loop blocks.

UNIT III:

Strings, Lists, Tuples and Dictionaries: Python Complex data types: Using string data type and string operations, Defining list and list slicing, Use of Tuple data type. String, List and Dictionary, Manipulations Building blocks of python programs, string manipulation methods, List manipulation. Dictionary manipulation, Programming using string, list and dictionary in-built functions. Python Functions, organizing python codes using functions.

UNIT IV:

Functions & Modules: Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables. Importing module, Math module, Packages and their composition

UNIT V:

File Handling: Python File Operations: Reading files, Writing files in python, Understanding read functions, read(), readline(), readlines(). Understanding write functions, write() and writelines() Manipulating file pointer using seek Programming, using file operations.

TEXT BOOKS

1. R Nageswar Rao, *Core Python Programming*, 2018.
2. Eric Mathews, Python Crash Course, 2019.

REFERENCE BOOKS

1. Dr. Krishna Kumar Mohbey, Dr. Brijesh Bakariya, An Introduction to Python Programming: A Practical Approach, BPB Publication.

COURSE CODE & NAME: CASPYSC40T / PYTHON Programming Lab

COURSE OBJECTIVES:

1. To acquire programming skills in core Python.
2. To acquire Object Oriented Skills in Python.
3. To develop the skill of designing Graphical user Interfaces in Python.
4. To develop the ability to write database applications in Python.

LAB OUTCOMES:

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

1. Understand and comprehend the basics of python programming.
2. Demonstrate the principles of structured programming and be able to describe, design, implement, and test structured programs using currently accepted methodology.
3. Explain the use of the built-in data structures list, sets, tuples and dictionary.
4. Make use of functions and its applications.

List of Experiments:

Implement all the concepts taught in the Python Programming classes. Some experiments are:

1. Write a program to demonstrate different number data types in Python
2. Write a program to compute distance between two points taking input from the user using Pythagorean Theorem.
3. Write a Program for checking whether the given number is a even number or not.
4. Write a Python script that prints prime numbers less than 20.
5. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
6. Write a program to create, append, and remove lists in python.
7. Write a program to demonstrate working with tuples in python.
8. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
9. Write a python program to define a module and import a specific function in that module to another program.

10. 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.
11. Write a Python class to implement pow(x, n) and other user defined functions.

COURSE CODE & NAME: PTSPPSC40T / Professional Proficiency

COURSE OBJECTIVES:

Listening, Speaking, Reading, and Writing skills to be developed to enable the students to read and write correct English, attain reasonable fluency in the Language and should also be exposed to introductory lessons of Aptitude Building

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Better representation of himself/herself in terms of communication skills, overall personality development and aptitude building required for jobs.
2. This program will help students employable and ready for Industries /corporate and other Public and Private Sector jobs.

SYLLABUS:

UNIT I: Hard Skills:

Idioms and Phrases, Clause, (context building), Critical Analysis on News Articles/Current Affairs, Correction of Sentences, Reproduction of story/poem (Creative abilities)

The goal is to teach Grammar implicitly through reading comprehensions. A short story/paragraph should be given for the students to identify the parts of speech and the other topics mentioned above. The classes should be learner centric and the students should be able to apply the lessons learnt in their daily conversations.

UNIT II: Soft Skills:

Debate, Speech developing activities: The world in twenty years, Guess the word, Time Trials, describing a game, brainstorming an idea, listening and repeating.

The aim should be to enable the students to express themselves in the language and gain proficiency and confidence in speaking the language. They should develop skills to be able to better present their ideas and openly express their thoughts and opinions. They should develop independent and critical thinking.

UNIT III:

Questions (Subjective and Objective) based on the instruction given for hard skills to be distributed every week.

The aim should be to bring the instruction given in practice by making them write, speak and think along the lines of the instruction given. The practice sheet should be evaluated and necessary feedback must be given. Some exercise on compositional skills must be given so that they develop a sense of writing and expressing themselves through the written word.

UNIT IV: Quantitative Aptitude & Logical Reasoning

- Order and Ranking
- Ratio and Proportion
- Time and Work

TEXT BOOKS

1. Gonzalez & Woods, ―Digital Image Processing, 3rd ed., Pearson education, 2008
2. Jain Anil K., ―Fundamentals Digital Image Processing, Prentice Hall India, 2010

COURSE DETAILS FOR SEMESTER V

COURSE CODE & NAME: SCUCMT501T / NUMERICAL METHOD

COURSE OBJECTIVES:

To develop and analyze Numerical Methods & algorithms to solve Mathematical Problems.

COURSE OUTCOMES:

Upon successful completion, a student will be able to:

1. Derive numerical methods for approximating the solution of problems of continuous mathematics,
2. Analyze the error incumbent in any such numerical approximation,
3. Implement a variety of numerical algorithms using appropriate technology, and
4. Compare the viability of different approaches to the numerical solution of problems arising in roots of solution of non-linear equations, interpolation and approximation, numerical differentiation and integration, solution of linear systems.

SYLLABUS:

UNIT I:

Numerical Methods for Solving Algebraic and Transcendental Equations Round-off error and computer arithmetic, Local and global truncation errors, Algorithms and convergence; Bisection method, False position method, Fixed point iteration method, Newton's method and secant method for solving equations.

UNIT II:

Numerical Methods for Solving Linear Systems Partial and scaled partial pivoting, Lower and upper triangular (LU) decomposition of a matrix and its applications, Thomas method for tri-diagonal systems; Gauss–Jacobi, Gauss–Seidel and successive over-relaxation (SOR) methods.

UNIT III:

Interpolation Lagrange and Newton interpolations, Piecewise linear interpolation, Cubic spline interpolation, Finite difference operators, Gregory–Newton forward and backward difference interpolations.

UNIT IV:

Numerical Differentiation and Integration First order and higher order approximation for first derivative, Approximation for second derivative; Numerical integration: Trapezoidal rule, Simpson's rules and error analysis, Richardson extrapolation.

UNIT V:

Solution of ordinary differential equation, Euler's and modified Euler's method, Picard's method, Runge's Kutta method, Milne's predictor-corrector method, Adam bash forth predictor-corrector method, second order differential equations, boundary value problem, Simultaneous first order differential equation.

TEXT BOOKS

1. M. K. Jain, S. R. K. Iyengar & R. K. Jain (2012). Numerical Methods for Scientific and Engineering Computation (6th edition). New Age International Publishers.
2. F. B. Hildebrand (2013). Introduction to Numerical Analysis: (2nd edition). Dover Publications.

REFERENCE BOOKS

1. Brian Bradie (2006), A Friendly Introduction to Numerical Analysis. Pearson.
2. C. F. Gerald & P. O. Wheatley (2008). Applied Numerical Analysis (7th edition), Pearson Education, India
3. Robert J. Schilling & Sandra L. Harris (1999). Applied Numerical Methods for Engineers Using MATLAB and C. Thomson-Brooks/Cole.

COURSE CODE & NAME: SCUCMT501P / NUMERICAL METHODS LAB

COURSE OBJECTIVES:

To Provide to hands on experience and practical implementation of various numerical algorithms and methods to solve to mathematical problems.

COURSE OUTCOMES:

Upon successful completion, a student will be able to:

1. write the computer program for the methods studied in theory classes.
2. correlate the theory and practical of various numerical methods.

LIST OF EXPERIMENTS

1. TO FIND THE ROOTS OF NON-LINEAR EQUATION USING BISECTION METHOD.
2. TO FIND THE ROOTS OF NON-LINEAR EQUATION USING NEWTON'S RAPHSON METHOD.
3. TO FIND THE ROOTS OF NON-LINEAR EQUATION USING REGLA FALSI METHOD.
4. CURVE FITTING BY LEAST – SQUARE APPROXIMATIONS.
5. TO SOLVE THE SYSTEM OF LINEAR EQUATIONS USING GAUSS – ELIMINATION METHOD.
6. TO SOLVE THE SYSTEM OF LINEAR EQUATIONS USING GAUSS - SEIDAL ITERATION METHOD.
7. TO SOLVE THE SYSTEM OF LINEAR EQUATIONS USING GAUSS - JORDEN METHOD.
8. TO INTEGRATE NUMERICALLY USING TRAPEZOIDAL RULE.

9. TO INTEGRATE NUMERICALLY USING SIMPSON'S RULES.
10. TO FIND THE LARGEST EIGEN VALUE OF A MATRIX BY POWER - METHOD.
11. TO FIND NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS BY EULER'S METHOD.
12. TO FIND NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS BY RUNGE- KUTTA METHOD.
13. TO FIND NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS BY MILNE'S METHOD.
14. TO FIND NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS BY PICARD'S METHOD.

TEXTBOOKS

1. M. K. Jain, S. R. K. Iyengar & R. K. Jain (2012). Numerical Methods for Scientific and Engineering Computation (6th edition). New Age International Publishers.
2. F. B. Hildebrand (2013). Introduction to Numerical Analysis: (2nd edition). Dover Publications.

REFERENCE BOOKS

1. Brian Bradie (2006), A Friendly Introduction to Numerical Analysis. Pearson.
2. C. F. Gerald & P. O. Wheatley (2008). Applied Numerical Analysis (7th edition), Pearson Education, India
3. Robert J. Schilling & Sandra L. Harris (1999). Applied Numerical Methods for Engineers Using MATLAB and C. Thomson-Brooks/Cole.

COURSE CODE & NAME: SCUCMT502T / ADVANCED ALGEBRA

COURSE OBJECTIVES:

To deepen and extend the understanding of algebraic structure and their properties.

COURSE OUTCOMES:

Upon successful completion, students will be able to:

1. Assess properties implied by the definitions of groups and rings,
2. Use various canonical types of groups (including cyclic groups and groups of permutations) and canonical types of rings (including polynomial rings and modular rings),
3. Analyze and demonstrate examples of subgroups, normal subgroups and quotient groups,
4. Analyze and demonstrate examples of ideals and quotient rings,
5. Use the concepts of isomorphism and homomorphism for groups and rings, and produce rigorous proofs of propositions arising in the context of abstract algebra.

SYLLABUS:

UNIT I:

Group Actions: Group actions, Orbits and stabilizers, Conjugacy classes, Orbit-stabilizer theorem, Normalizer of an element of a group, Centralizer of an element of a group, Center of a group, Class equation of a group, Inner and outer automorphisms of a group.

UNIT II:

Sylow Theorems: Cauchy's theorem for finite abelian groups, Finite simple groups, Sylow theorems and applications including non-simplicity tests.

UNIT III:

Rings and Fields: Definition, examples and elementary properties of rings, Commutative rings, Integral domain, Division rings and fields, Characteristic of a ring, Ring homomorphism and isomorphism, Ideals and quotient rings. Prime, principal and maximal ideals, Relation between integral domain and field, Euclidean rings and their properties, Wilson and Fermat's theorems.

UNIT IV:

Polynomial Rings: Polynomial rings over commutative ring and their basic properties, The division algorithm; Polynomial rings over rational field, Gauss lemma and Eisenstein's criterion, Euclidean domain, principal ideal domain, and unique factorization domain**.**

UNIT V:

Field Extensions: Field Extensions and Finite Fields Extension of a field, Algebraic element of a field, Algebraic and transcendental numbers, Perfect field, Classification of finite fields.

TEXTBOOKS

1. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011
2. Joseph A. Gallian (2017). Contemporary Abstract Algebra (9th edition).
3. Ramji Lal (2017). Algebra 1: Groups, Rings, Fields and Arithmetic. Springer.

REFERENCE BOOKS

1. J. J. Rotman, An Introduction to the Theory of Groups, 4th Ed., Springer Verlag, 1995.
2. I.N. Herstein, Topics in Algebra, Wiley Eastern Limited, India,1975
3. John B. Fraleigh (2007). A First Course in Abstract Algebra (7th edition). Pearson.

COURSE CODE & NAME: SCUCMT503T / REAL ANALYSIS -II

COURSE OBJECTIVES:

To study the properties, structures and behaviors of Real-Valued Functions.

COURSE OUTCOMES:

Upon successful completion, a student will be able to:

1. Understand a strong foundation in functional analysis,
2. focusing on spaces Metric Spaces Operators, Fundamental Theorems and Applications.
3. To strengthen students understanding of this theory through applications of functional analysis.
4. To develop student's skills and confidence in mathematical analysis and proof techniques.
5. To build an understanding of mathematical analysis through the use of mathematical proof.

SYLLABUS:

UNIT I:

Theory of Sets Finite and infinite sets, Countable and uncountable sets, Cardinality of sets, Schröder–Bernstein theorem, Cantor's theorem, Order relation in cardinal numbers, Arithmetic of cardinal numbers, partially ordered set.

UNIT II:

Concepts in Metric Spaces Definition and examples of metric spaces, Open spheres and closed spheres, Neighborhoods, Open sets, Interior, exterior and boundary points, Closed sets, Limit points and isolated points, Interior and closure of a set, Boundary of a set, Bounded sets

UNIT III:

Distance between two sets, Diameter of a set, Subspace of a metric space. Complete Metric Spaces and Continuous Functions Cauchy and Convergent sequences, Completeness of metric spaces

UNIT IV:

Cantor's intersection theorem, Dense sets and separable spaces, nowhere dense sets and Baire's category theorem, Continuous and uniformly continuous functions, Homeomorphism, Banach contraction principle.

UNIT V:

Compactness Compact spaces, Sequential compactness, Bolzano–Weierstrass property Compactness and intersection property, Heine–Borel theorem, totally bounded sets, Equivalence of compactness a sequential compactness, Continuous functions on compact space

TEXTBOOKS

1. N. N. Bhattacharya: Elementary Analysis.
2. S. C. Malik: *Mathematical Analysis.*
3. Elements of Real Analysis as per UGC Syllabus by Shanti Narayan and Dr. M.D. Raisinghania, published by S. Chand & Company Pvt. Ltd. New Delhi

REFERENCE BOOKS

1. N.L Carothers, Real Analysis, McGraw Hill, NY
2. G. F. Simmons (2004). Introduction to Topology and Modern Analysis. McGraw-Hill
3. E. T. Copson (1988). Metric Spaces. Cambridge University Press.
4. P. K. Jain & Khalil Ahmad (2019). Metric Spaces. Narosa.

COURSE CODE & NAME: SCUCMT504T / NUMBER THEORY

COURSE OBJECTIVES:

To study the properties relationships and patterns of integers and their various mathematical structures.

COURSE OUTCOMES:

Upon successful completion, a student will be able to:

1. Define and interpret the concepts of divisibility, congruence, greatest common divisor, prime, and prime-factorization,
2. Apply the Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues,
3. Formulate and prove conjectures about numeric patterns, and
4. Produce rigorous arguments (proofs) centered on the material of number theory, most notably in the use of Mathematical Induction and/or the Well Ordering Principal in the proof of theorems.

SYLLABUS:

UNIT I:

Division Algorithm, Euclidean algorithm, Distribution of Primes and Linear Diophantine equation, Prime counting function, Prime number theorem, Goldbach conjecture, Twin-prime conjecture, Odd perfect numbers conjecture, Fermat and Mersenne primes,

UNIT II:

Congruence relation and its properties, Theory of Congruencies, Linear congruence and Chinese remainder theorem, Fermat's little theorem, Wilson's theorem.

UNIT III:

Number Theoretic Functions Number theoretic functions for sum and number of divisors, Multiplicative function, The Möbius inversion formula, Greatest integer function, Euler’s phi-function and properties, Euler’s theorem.

UNIT IV:

Primitive Roots Order of an integer modulo n, Primitive roots for primes, Composite numbers having primitive roots; Definition of quadratic residue of an odd prime, Euler’s criterion.

UNIT V:

Quadratic Reciprocity Law the Legendre symbol and its properties, Quadratic reciprocity, Quadratic congruencies with composite moduli.

TEXTBOOKS

1. David M. Burton (2007). Elementary Number Theory (7th edition). McGraw-Hill
2. Gareth A. Jones & J. Mary Jones (2005). Elementary Number Theory. Springer.

REFERENCE BOOKS

1. Neville Robbins (2007). Beginning Number Theory (2nd edition). Narosa.
2. I.Niven (2012). An Introduction to the Theory of Numbers (5th edition). John Wiley & Sons.
3. Neal Koblitz (1994). A Course in Number Theory and Cryptography (2nd edition). Springer Verlag.

COURSE CODE & NAME: CASCPSC50T / AI AND MACHINE LEARNING

COURSE OBJECTIVES:

To understand the basics of the theory and practice of Artificial Intelligence as a discipline and machine learning algorithms along with their strengths and weaknesses.

COURSE OUTCOMES:

Upon successful completion, a student will be able to:

1. Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents.
2. The student will learn to apply knowledge representation techniques and problem solving strategies to common AI applications.
3. Student should be aware of techniques used for classification and clustering.
4. To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

SYLLABUS:

UNIT I:

Introduction to Artificial Intelligence: Definition, Future of Artificial Intelligence, Characteristics of Intelligent Agents, Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II:

Introduction to the basic concepts of Probability: Conditional Probability, Bayes theorem and naive bayes, Random Vectors, Expectation, Correlation, Covariance.

UNIT III:

Knowledge Representation: First Order Predicate Logic, Prolog Programming, Unification: Forward Chaining-Backward, Chaining, Resolution, Knowledge Representation, Ontological Engineering-Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.

UNIT IV:

Introduction to Machine Learning: Fundamentals of ML, supervised, unsupervised, reinforcement learning;

Supervised Learning:
Classification: kNN, Centroid Method, Perceptron, Support Vector Machines, Multi-level Perceptron, Decision tree
Regression: Linear Regression

UNIT V:

Neural Network: Introduction to neural networks, Fundamental concepts- neuron models and basic learning rules; Single layer neural Networks, input layer, output layer, hidden layers, Multilayer Neural Networks, Backpropagation.

TEXTBOOKS

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.
2. I. Bratko, ―Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCE BOOKS

1. Biostatistics -A Foundation for Analysis in the Health Sciences' by Wayne E. Daniel and Chad L. Gross.
2. Fundamental of Biostatistics, by Bernard Rosner.
3. Kevin Murphy , Machine Learning: a Probabilistic Perspective, 2012.

COURSE CODE & NAME: CASCPSC50T / AI AND MACHINE LEARNING LAB

COURSE OBJECTIVES:

To familiarize students with machine learning algorithms to solve problems of moderate complexity.

COURSE OUTCOMES:

Upon successful completion, a student will be able to:

5. Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents.
6. The student will learn to apply knowledge representation techniques and problem solving strategies to common AI applications.
7. Student should be aware of techniques used for classification and clustering.
8. To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

List of Experiments:

At least 06 experiments from following:

1. Write a python program to remove punctuations from the given string.
2. Write a program to implement Tic-Tac-Toe game using python.
3. Implement the rule base classifier.
4. Implement the Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
5. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set.
6. Implement the Decision Tree Representation for Appropriate Problems.
7. Write a program to demonstrate the working of the decision tree for a given data set.
8. Handling Training Examples with missing values.
9. Implement to Cluster the data using K-Means algorithm
10. To develop ANN classification model.

TEXTBOOKS

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.
2. I. Bratko, ―Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCE BOOKS

1. Biostatistics -A Foundation for Analysis in the Health Sciences' by Wayne E. Daniel and Chad L. Gross.
2. Fundamental of Biostatistics, by Bernard Rosner.
3. Kevin Murphy , Machine Learning: a Probabilistic Perspective, 2012.

COURSE DETAILS FOR SEMESTER VI

COURSE CODE & NAME: SCUCMT601T / DIFFERNCIAL GEOMETRY AND TENSOR ANALYSIS

COURSE OBJECTIVES:

To provide deeper understanding of the geometry of curved spaces and the mathematical tools to describe analyze physical phenomena in curved and higher-dimensional spaces.

COURSE OUTCOMES:

Upon successful completion, a student will be able to:

1. Define the equivalence of two curves.
2. Analyze the equivalence of two curves by applying some theorems.
3. Defines surfaces and their properties
4. express definition and parametrization of surfaces.
5. express tangent spaces of surfaces.

SYLLABUS:

UNIT I:

Local theory of curves-Space curves, Examples, Plane curves, tangent and normal and binormal, Osculating plane, normal plane and rectifying plane. Helices, Serret-Frenet apparatus, contact between curve and surfaces, tangent surfaces, involutes and evolutes of curves, Intrinsic equations, fundamental existence theorem for space curves, Local theory of surfaces- Parametric patches on surface curve of a surface, surfaces of revolutions, Helicoids, metric-first fundamental form and arc length.

UNIT II:

Local theory of surfaces (Contd.), Direction coefficients, families of curves, intrinsic properties, geodesics, canonical geodesic equations, normal properties of geodesics, geodesics curvature, geodesics polars, Gauss-Bonnet theorem, Gaussian curvature, normal curvature, Meusneir's theorem, mean curvature, Gaussian curvature, umbilic points, lines of curvature, Rodrigue's formula, Euler's theorem.

UNIT III:

The fundamental equation of surface theory- The equation of Gauss, the equation of Weingarten, the Mainardi-Codazzi equation, Tensor algebra: Vector spaces, the dual spaces, tensor product of vector spaces, transformation formulae, contraction, special tensor, inner product, associated tensor.

UNIT IV:

Differential Maniforl-examples, tangent vectors, connexions, covariant differentiation. Elements of general Riemannian geometry-Riemannian metric, the fundamental theorem of local Riemannian Geometry, Differential parameters, curvature tensor, Geodesics, geodesic curvature, geometrical interpretation of the curvature tensor and special Riemannian spaces.

UNIT V:

Contravariant and covariant vectors and tensors, Mixed tensors, Symmetric and skew-symmetric tensors, Algebra of tensors, Contraction and inner product, Quotient theorem, Reciprocal tensors, Christoffel's symbols, Covariant differentiation, Gradient, divergence and curl in tensor notation.

TEXTBOOKS

1. R.S. Millman and G.D. Parkar, Elements of Differential Geometry, Prentice Hall 1977.
2. R.S. Mishra, A Course in Tensors with Applications to Riemannian Geometry, Pothishala Pvt. Ltd, Allahabad.

REFERENCE BOOKS

1. M.P. do Carmo, Differential Geometry of Curves and Surfaces, CRC Press, 1998.
2. John Opera, Differential Geometry and its applications, Prentice Hall 1997.
3. David C. Kay, Tensor Analysis, Schaum’s Outline Series, McGraw Hill 1988.

COURSE CODE & NAME: SCUCMT602T / LINEAR PROGRAMMING

COURSE OBJECTIVES:

To maximize or minimize a linear objective function subject to a set of linear constraints and to find the best possible for real world problems.

COURSE OUTCOMES:

Upon successful completion, a student will be able to:

1. Formulate and model a linear programming problem from a word problem and solve them graphically in 2 and 3 dimensions, while employing some convex analysis,
2. Place a Primal linear programming problem into standard form and use the Simplex Method or Revised Simplex Method to solve it,
3. Find the dual, and identify and interpret the solution of the Dual Problem from the final tableau of the Primal problem,
4. Be able to modify a Primal Problem, and use the Fundamental Insight of Linear Programming to identify the new solution, or use the Dual Simplex Method to restore feasibility,
5. Interpret the dual variables and perform sensitivity analysis in the context of economics problems as shadow prices, imputed values, marginal values, or replacement values,

SYLLABUS:

UNIT I:

Linear Programming Problem, Convexity and Basic Feasible Solutions Formulation, Canonical and standard forms, Graphical method; Convex and polyhedral sets, Hyperplanes, Extreme points; Basic solutions, Basic Feasible Solutions, Reduction of feasible solution to basic feasible solution, Correspondence between basic feasible solutions and extreme points.

UNIT II:

Simplex Method Optimality criterion, Improving a basic feasible solution, Unboundedness, Unique and alternate optimal solutions; Simplex algorithm and its tableau format; Artificial variables, Two-phase method, Big-M method.

UNIT III:

Duality Formulation of the dual problem, Duality theorems, Complimentary slackness theorem, Economic interpretation of the dual, Dual-simplex method.

UNIT IV:

Sensitivity Analysis Changes in the cost vector, right-hand side vector and the constraint matrix of the linear programming problem.

UNIT V:

Applications Transportation Problem: Definition and formulation, Methods of finding initial basic feasible solutions: Northwest-corner rule, Least- cost method, Vogel approximation method; Algorithm for obtaining optimal solution. Assignment Problem: Mathematical formulation and Hungarian method.

TEXTBOOKS

1. G. Hadley (2002). Linear Programming. Narosa Publishing House.
2. Paul R. Thie & Gerard E. Keough (2014). An Introduction to Linear Programming and Game Theory (3rd edition). Wiley India Pvt. Ltd

REFERENCE BOOKS

1. Mokhtar S. Bazaraa, John J. Jarvis & Hanif D. Sherali (2010). Linear Programming and Network Flows (4th edition). John Wiley & Sons.
2. Frederick S. Hillier & Gerald J. Lieberman (2015). Introduction to Operations Research (10th edition). McGraw-Hill Education.
3. Hamdy A. Taha (2017). Operations Research: An Introduction (10th edition). Pearson.

COURSE CODE & NAME: SCUCMT6101T/ ADVANCED DIFFERENTIAL EQUATION

COURSE OBJECTIVES:

The main objectives of this course are to introduce the students to the exciting world of Advanced Differential Equations and their applications.

COURSE OUTCOMES:

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

1. understand that physical systems can be described by differential equations
2. understand the differences between initial value and boundary value problems (IVPs and BVPs)
3. appreciate the importance of establishing the existence and uniqueness of solutions
4. analytically solve a wide range of ordinary differential equations (ODEs)
5. obtain approximate solutions of ODEs using graphical and numerical techniques
6. use Fourier analysis in differential equation solution methods
7. solve differential equations using computer software

SYLLABUS:

UNIT I:

Linear System- Introduction, properties of linear homogeneous systems, AbelLiouville formula, Periodic linear System, Floquet's theorem, Solution of nth order linear homogeneous equation with variable coefficients.

UNIT II:

Inhomogeneous linear system, nth order linear non-homogeneous equation with variable coefficients, Hurwitz's theorem, Non-linear system, Volterra's prey & predator equation, Non-linear equations: Autonomous system.

UNIT III:

The phase plane & its phenomena, types of critical points & Stability, Critical points & stability for linear system, stability by Liapunov's direct method.

UNIT IV:

Green function, Construction of Green functions, Green function of homogeneous and non-homogeneous end conditions, Strum Liouville systems.

UNIT V:

Second order differential equation: Introduction, Preliminary results, Boundedness of solutions, Oscillatory equation, number of zeroes, Pruffer's transformation, Strum theorem, Strum's comparison theorem.

TEXTBOOKS

1. G. F. Simmons: Differential Equation, Tata McGraw-Hill
2. B. Rai, D. P. Chaudhary, H.I. Freedman: A course in Ordinary Differential Equations, Narosa Publishing House.

REFERENCE BOOKS

1. B. Rai, D. P. Chaudhary, H.I. Freedman: A course in Ordinary Differential Equations, Narosa Publishing House.
2. S. L. Ross: Differential Equations, Wiley Indian, 2004
3. E. A. Coddington: An Introduction to Ordinary Differential Equations.

COURSE CODE & NAME: SCUCMT6102T / OPERATION RESEARCH

COURSE OBJECTIVES:

The objective of this course is to enable the student to understand and analyze managerial and engineering problems to equip him to use the resources such as capitals, materials, productions, controlling, directing, staffing, and machines more effectively.

COURSE OUTCOMES:

1. Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained.
2. Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods, Finding initial basic feasible and optimal solution of the Transportation problems
3. Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons.
4. Model competitive real-world phenomena using concepts from game theory. Analyze pure and mixed strategy games
5. Formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems

SYLLABUS:

UNIT I:

Definition and scope of operations research (OR), OR model, solving the OR model, art of modeling, phases of OR study. Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis.

UNIT II:

Types of transportation problems, mathematical models, transportation algorithms, Assignment: Allocation and assignment problems and models, processing of job through machines.

UNIT III:

Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem. Project Management: Phases of project management, guidelines for network construction, CPM and PERT.

UNIT IV:

Rectangular games, Minima theorem, graphical solution of 2 x n or m x 2 games, game with mixed strategies, reduction to linear programming model. Quality Systems: Elements of Queuing model, generalized poisson queuing model, single server models

UNIT V:

Inventory Control Models of inventory, operation of inventory system, quantity discount., Replacement, Replacement models: Equipments that deteriorate with time, equipments that fail with time.

TEXTBOOKS

1. G. Hadley (2002). Linear Programming. Narosa Publishing House.
2. Paul R. Thie & Gerard E. Keough (2014). An Introduction to Linear Programming and Game Theory (3rd edition). Wiley India Pvt. Ltd
3. Operations Research, Kanti Swarup, P. K. Gupta, Man Mohan, Sultan Chand & Sons.

REFERENCE BOOKS

1. Mokhtar S. Bazaraa, John J. Jarvis & Hanif D. Sherali (2010). Linear Programming and Network Flows (4th edition). John Wiley & Sons.
2. Frederick S. Hillier & Gerald J. Lieberman (2015). Introduction to Operations Research (10th edition). McGraw-Hill Education.
3. Hamdy A. Taha (2017). Operations Research: An Introduction (10th edition). Pearson.

COURSE CODE & NAME: SCUCMT6103T / CRYPTOGRAPHY

COURSE OBJECTIVES:

To understand basics of Cryptography and Network Security. To be able to secure a message over insecure channel by various means. To learn about how to maintain the Confidentiality, Integrity and Availability of a data. To understand various protocols for network security to protect against the threats in the networks.

COURSE OUTCOMES:

After successful completion of the course, the students would be able to :

1. Provide security of the data over the network.
2. Do research in the emerging areas of cryptography and network security.
3. Implement various networking protocols.
4. Protect any network from the threats in the world.

SYLLABUS:

UNIT I:

Introduction to Cryptography and Classical Cryptography Cryptosystems and basic cryptographic tools: Secret-key cryptosystems, Public-key cryptosystems, Block and stream ciphers, Hybrid cryptography, Message integrity: Message authentication codes, Signature schemes, Nonrepudiation, Certificates, Hash functions, Cryptographic protocols, Security; Hybrid cryptography: Message integrity, Cryptographic protocols, Security, Some simple cryptosystems, Shift cipher, Substitution cipher, Affine cipher, Vigenère cipher, Hill cipher, Permutation cipher, Stream ciphers, Cryptanalysis of affine, substitution, Vigenère, Hill and LFSR stream ciphers.

UNIT II:

Cryptographic Security, Pseudo Randomness and Symmetric Key Ciphers Shannon's theory, Perfect secrecy, Entropy, Spurious keys and unicity distance; Bit generators, Security of pseudorandom bit generators. Substitution-permutation networks, Data encryption standard (DES), Description and analysis of DES; Advanced encryption standard (AES), Description and analysis of AES; Stream ciphers, Trivium.

UNIT III:

Basics of Number Theory and Public-Key Cryptography Basics of number theory; Introduction to public-key cryptography, RSA cryptosystem, Implementing RSA; Primality testing, Legendre and Jacobi symbols, Solovay–Strassen algorithm, Miller–Rabin algorithm; Square roots modulo n, Factoring algorithms, Pollard p – 1 algorithm, Pollard rho algorithm, Dixon's random squares algorithm, Factoring algorithms in practice; Rabin cryptosystem and its security.

UNIT IV:

More on Public-Key Cryptography Basics of finite fields; ElGamal cryptosystem, Algorithms for the discrete logarithm problem, Shanks' algorithm, Pollard rho discrete logarithm algorithm, Pohlig-Hellman UGC DOCUMENT ON LOCF MATHEMATICS 64 algorithms; Discrete logarithm algorithms in practice, Security of ElGamal systems, Bit security of discrete logarithms.

UNIT V:

Hash Functions and Signature Schemes Hash functions and data integrity, SHA-3; RSA signature scheme, Security requirements for signature schemes, Signatures and Hash functions, ElGamal signature scheme, Security of ElGamal signature scheme, Certificates.

TEXTBOOKS

1. Jeffrey Hoffstein, Jill Pipher & Joseph H. Silverman (2014). An Introduction to Mathematical Cryptography (2nd edition). Springer.
2. Christof Paar & Jan Pelzl (2014). Understanding Cryptography. Springer

REFERENCE BOOKS

1. Neal Koblitz (1994). A Course in Number Theory and Cryptography (2nd edition). Springer-Verlag.
2. W. Stallings, Cryptography and Network Security, Principles and Practice, Pearson Education, 2000.

COURSE CODE & NAME: SCUCMT6201T / DISCRETE MATHEMATICS

COURSE OBJECTIVES:

The main objectives of the course are to Introduce concepts of mathematical logic for analyzing propositions and proving theorems. Use sets for solving applied problems, and use the properties of set operations algebraically. Work with relations and investigate their properties. Investigate functions as relations and their properties. Introduce basic concepts of graphs, digraphs and trees.

COURSE OUTCOMES:

After completion of the course students are expected to be able to:

1. Analyze logical propositions via truth tables.
2. Prove mathematical theorems using mathematical induction.
3. Understand sets and perform operations and algebra on sets.
4. Identify functions and determine their properties.
5. Define graphs, digraphs and trees, and identify their main properties.
6. Evaluate combinations and permutations on sets.

SYLLABUS:

UNIT I:

Partially Ordered Sets Definitions, examples and basic properties of partially ordered sets (poset), Order isomorphism, Hasse diagrams, Dual of a poset, Duality principle, Maximal and minimal elements, Least upper bound and greatest upper bound, Building new poset, Maps between posets.

UNIT II:

Boolean Algebras and Switching Circuits Boolean algebras, De Morgan's laws, Boolean homomorphism, Representation theorem; Boolean polynomials, Boolean polynomial functions, Disjunctive and conjunctive normal forms, Minimal forms of Boolean polynomials, Karnaugh diagrams, Switching circuits and applications.

UNIT III:

Finite-State and Turing Machines Finite-state machines with outputs, and with no output; Deterministic and nondeterministic finite-state automaton; Turing machines: Definition, examples, and computations.

UNIT IV:

Graphs Definition, examples and basic properties of graphs, Königsberg bridge problem; Subgraphs, Pseudographs, Complete graphs, Bipartite graphs, Isomorphism of graphs

UNIT V:

Paths and circuits, Eulerian circuits, Hamiltonian cycles, Adjacency matrix, Weighted graph, Travelling salesman problem, shortest path and Dijkstra's algorithm.

TEXTBOOKS

1. A Textbook of Discrete Mathematics, Swapan Kumar Sarkar, S. Chand Publication.
2. C. L. Liu (1985). Elements of Discrete Mathematics (2nd edition). McGraw-Hill.

REFERENCE BOOKS

1. B. A. Davey & H. A. Priestley (2002). Introduction to Lattices and Order (2nd edition). Cambridge University Press.
2. Edgar G. Goodaire & Michael M. Parmenter (2018). Discrete Mathematics with Graph Theory (3rd edition). Pearson Education.
3. Kenneth H. Rosen (2012). Discrete Mathematics and its Applications: With Combinatorics and Graph Theory (7th edition). McGraw-Hill.

COURSE CODE & NAME:SCUCMT6203T/ PRINCIPLES OF COMPUTER SCIENCE

COURSE OBJECTIVES:

Our main objectives for students will be able to draw upon foundational knowledge, learn, adapt and successfully bring to bear analytical and computational approaches on changing societal and technological challenges.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Understand different methods of organizing large amount of data using data structure.
2. Able to choose appropriate data structure as applied to specified problem definition.
3. Understand various techniques for representation of the data in the real world.
4. Able to compute the complexity of various algorithms.

SYLLABUS:

UNIT I:

Data Storage - Storage of bits, main memory, mass storage, Information of storage, the binary system, Storing integers, storing fractions, communication errors. Data Manipulations - The central processing unit, The stored program concept, Programme execution, Other Architectures, arithmetic/logic instructions, Computer – peripheral communication.

UNIT II:

Operating System and Network – The evolution of operating system, Operating system architecture, Coordinating the machines activates, Handling competition among process, networks, network protocol.

UNIT III:

Algorithms - The concept of an algorithm, Algorithm representation, Algorithm, Discovery, Iterative structure, Recursive structures, Efficiency and correctness, (algorithm to be implemented in C++).

UNIT IV:

Programming Languages - Historical perspective, Traditional programming Concepts, Program units, Languages implementation, Parallel computing, Declarative computing.

UNIT V:

Software Engineering - The software engineering discipline, The software life cycle, Modularity, Development, Tools and techniques, Documentation, Software ownership and liability. Data Structures - Array, Lists, Stack, Queues, Trees, Customized data types, Object-oriented.

TEXTBOOKS

1. David G. Luenberger (2013). Investment Science (2nd edition). Oxford University Press.

REFERENCE BOOKS

1. John C. Hull & Sankarshan Basu (2018). Options, Futures and Other Derivatives (10th edition). Pearson Education.
2. Sheldon M. Ross (2011). An Elementary Introduction to Mathematical Finance (3rd edition). Cambridge University Press.