CURRICULUM AND SYLLABUS

B.Sc. (Honours) Mathematics

Academic Year: 2025 - 26

Department of Mathematics

United University

Rawatpur - Jhalwa (Prayagraj)

Uttar Pradesh

University Vision

"Toestablish avalue 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 Department of Applied Science & Humanities is to foster the knowledge of basic sciences, mathematics, Physics, and professional ethics along with inculcating a humanistic approach in students. The Department will become a model of excellence in multidisciplinary branches of science and the humanities. This will enable the graduates to flourish and contribute to a constantly changing, globally competent society."

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."

B.SC. (HONS.) MATHEMATICS

"Without mathematics, there's nothing you can do. Everything around you is mathematics".

— Shakuntala Devi, (Famous Writer and Thinker)

Mathematics has very broad scope in science, engineering, economics and social sciences. The key areas of study in mathematics are Calculus, Algebra, Geometry, Analysis, Differential Equations, Mechanics etc.The B.Sc. (Hons.) Mathematics program covers the full range of mathematics, from classical Calculus to modern Artificial Intelligence and Machine Learning (AIML). The course lays a structured foundation of Calculus, Real & Complex analysis, Abstract Algebra, Differential Equations (including Mathematical Modelling), Number Theory, Graph Theory, and C++ Programming exclusively for Mathematics. An exceptionally broad range of topics covering Pure & Applied Mathematics: Linear Algebra, metric Spaces, Statistics, Linear Programming, Numerical Analysis, and Mechanics, the program aims at developing the ability to think critically, logically, and analytically and hence use mathematical reasoning in everyday life. Following are the Outcomes of the Program:

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 nonfamiliar 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 econtent 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.

Curriculum and Syllabus: First Year

BSc. (Honours) Mathematics

2025-2026 Session

Courses outline (Semester wise)

Semester I

					Contact Hours = 30
S. No.	**Course Code**	**Course Name**	**Course Category**	**Credits**	**L/T/P**
1	SCUCMT111T	Calculus-I	**PC**	**4**	**4 /1 /0**
2	SCUCMT122T	Algebra	**PC**	**4**	**4 /1 /0**
3	SCUCMT113T	Geometry	**PC**	**4**	**4 /1 /0**
4	CASCPSC10T	Fundamentals of Computer and C-Programming	**MC**	**4**	**4 /1 /0**
5	CASCPSC10P	C- Programming Lab	**MC**	**2**	**2 /0 /0**
6	ARSPCSC10T	Introduction to Professional Communication	**SEC**	**2**	**2 /0 /0**
7	PTSPPSC10T	Professional Proficiency	**SS**	**4**	**4 /0 /0**
8	UUSCVA001P	NSS/NCC/YOGA/MUSIC/SPORTS	**VAD**	**0**	**0 /0 /2**
					Total Credits = 24

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. Value Audit Course-VAD
8. Internship/Project
9. Discipline Specific Elective – DSE
10. General Elective – GE
11. Ability Enhancement Course – AEC

Semester II

					Contact Hours = 28
S. No.	**Course Code**	**Course Name**	**Course Category**	**Credits**	**L/T/P**
1	SCUCMT211T	Calculus-II	**PC**	**4**	**4 /1 /0**
2	SCUCMT212T	Real Analysis-I	**PC**	**4**	**4 /1 /0**
3	SCUCMT213T	Ordinary Differential Equations	**PC**	**4**	**4 /1 /0**
4	CASCPSC20T	Fundamentals of Data Science	**MC**	**4**	**4 /1 /0**
5	CASCPSC20P	Fundamentals of Data Science Lab	**MC**	**2**	**2 /0 /0**
6	SCUCEV201T	Environmental Science	**MC**	**2**	**2 /0 /0**
7	PTSPPSC20T	Professional Proficiency	**SS**	**4**	**4 /0 /0**
					Total Credits = 24

COURSE DETAILS FOR SEMESTER I

COURSE CODE & NAME: SCUCMT111T / CALCULUS-I

COURSE OBJECTIVES:
To provide a basic understanding of the limit, continuity and differentiability of function of one real variable and their applications.
COURSE OUTCOMES:
Upon successful completion, a student will be able to:
1. Learn the basics of real numbers its properties and functions of a real variable.
2. understand the concept of limit and continuity of the function of one real variable,
3. learn the concept of differentiability and basic theorems on it
4. apply the above concepts in various physical problems
5. Learn to trace the curves represented by function of real variables and analyse it.

SYLLABUS:
UNIT I:
Real number system: Properties of real numbers, Absolute value and its properties, Intervals, Archimedean principle (without proof) , Rational density theorem (without proof), open and closed sets, limit point of a set, functions of real variables, introduction to sequences and series of real numbers and their convergence.
UNIT II:
Limit and Continuity:$\in$-δ definition of limit of a real valued function, One sided limits, Algebra of limits, 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. The sequential approach to limits and continuity.
UNIT III:
Differentiability: Differentiability of a real valued function, Geometrical interpretation of derivative of a function, Relation between differentiability and continuity, Roll's theorem. Mean value theorems, 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 Roche-Schlomilch forms of remainder; Maxima and minima, Indeterminate forms, L'Hospital rule.
UNIT V:
Curvature, Asymptotes and Curve Tracing; Tangents and normal, 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). Wiley India.
2. Gabriel Klambauer (1986). Aspects of Calculus. Springer-Verlag.
3. Wieslaw Krawcewicz & Bindhyachal Rai (2003). Calculus with Maple Labs. Narosa.
4. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018)Thomas' Calculus (14th edition). Pearson Education.

COURSE CODE & NAME: SCUCMT122T / ALGEBRA

COURSE OBJECTIVES:

To provide a basic understanding of the language of mathematics, the basics of set theory, relations on sets and functions.

COURSE OUTCOMES:

Upon successful completion, a student will be able to:

6. Develop the ability to think critically, logically and analytically and hence use mathematical reasoning in everyday life.
7. Understand the basic concept of sets, set algebra, relations on sets, and the concept of ordering in a set.
8. Analyze number-theoreticand algebraic structures.
9. Find roots of polynomials and relations between roots and applications
10. Understand the algebra and properties ofmatrices.

SYLLABUS:

UNIT I:

Mathematical Logic : Propositions, Compound proposition, Propositions and truth tables, Logical Equivalence, Algebra of propositions, Conditional proposition, Converse, Contra positive and inverse, Biconditional statement, Negation of compound statement, Tautologies and contradictions, Logic in proof, Methods of proof, Principles of mathematical induction.

UNIT II:

Basic concepts on sets, Operation on sets, Algebra of sets, Venn diagram, Cardinality of sets, Countable and uncountable sets, inclusion-exclusion principle, pigeon-hole principle, Ordered pair, Cartesian product, Relations on sets, Inverse and composition of relations, Types of relations in a set, Equivalence relations, equivalence classes and partition.

UNIT III:

Order relation, Partial and total order, Infimum and supremum, Well ordering principle (without proof).

Function, types of functions, Inverse image and inverse function, composition of functions. Quotient map, Equivalence relation induced by a map, Binary operations.

UNIT IV:

Elementary theorems on the roots of an equation, Polynomials, The remainder and factor theorem, Synthetic division, Factored form of a polynomial, The Fundamental theorem of algebra, Relations between the roots and the coefficients of polynomial equations, Integral, rational and imaginary roots,

Integers, Divisibility in Z, the division algorithm, the Euclidean algorithm, Thefundamental theorem of arithmetic, Euler's Ø- function, primitive roots.

UNIT V:

Elementary operations on matrices, Echelon and normal form of a matrix, Inverse of a matrix by elementary operations, Rank of a matrix, System of linear homogeneous and non-homogeneous equations, Theorems on consistency of a system of linear equations, Characteristic equation of a matrix, Eigen values, Eigen vectors and Cayley-Hamilton theorem and its use in finding inverse of a matrix.

TEXTBOOKS

1. R.S. Mishra, N.N. Bhattacharya, Fundamental Structures in Modern Algebra, PothiShala Pub.
2. Ramji Lal, Algebra (Volume-I), Shail Publication.
3. S.C.Malik, S. Arora, Mathematical Analysis, New Age International Publishers.

REFERENCE BOOKS

1. P.B. Bhattacharya, S.K. Jain, S.R. Nagpaul, First Course in Linear Algebra, New Age International Pub.
2. A.R. Vasishtha, Linear Algebra and Matrices text book for B.Sc., Krishna Prakashan, Eighteen Edition 2020.
3. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publication.

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. 3. P K Mittal, Mathematics for Degree Students B. Sc. 1St Yr ISBN: 9788121932400 S. Chand Publishing

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

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, DocumentationAlgorithms 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.

SUBJECT CODE & NAME: CASCPSC10P / C-Programming Lab

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 onedimensional 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---->

SUBJECT CODE & NAME: ARSPCSC10T/ Introduction to Professional Communication

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

E-Resources and Other Digital Materials:

SUBJECT CODE & NAME: PTSPPSC10T/Professional Proficiency

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

TEXTBOOKS

REFERENCE BOOKS

E-Resources and Other Digital Materials:

COURSE DETAILS FOR SEMESTER II

COURSE CODE & NAME: SCUCMT211T / CALCULUS-II

COURSE OBJECTIVES: To provide a basic understanding of the multivariable calculus and vector calculus

COURSE OUTCOMES:

Upon successful completion, a student will be able to:

1. Extend the concept of derivatives to functions of several variables.
2. use partial derivatives in various physical problems
3. evaluate and use multiple integrals various physical problems
4. learn differentiation of vector valued function, divergence and curl
5. Learn integration of vector valued function, line, surface and volume integral and theorems relating them.

SYLLABUS:

UNIT I:

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

UNIT II:

Higher order partial derivatives: Total differential and differentiability, Jacobians, Change of variables, Euler's theorem for homogeneous functions, Taylor's theorem for functions of several variables, Error approximation, Extrema of functions of several variables,

UNIT III:

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. Calculation of mass, centre of gravity and moment of inertia of a solid,

UNIT IV:

Vector Differentiation: Vector function of a scalar variable, Formulae of differentiation, Scalar and vector point functions, Gradient of a scalar point function, Divergence and curl of a vector function, Physical interpretation of gradient, divergence and curl, solenoidal and irrotational vectors, vector identities

UNIT V:

Vector Integration: Line, Surface and Volume integrals, Applications of line integrals: Mass and Work, Fundamental theorem for line integrals, Conservative vector fields, Area as a line integral, Surface and Volume integrals, Green's theorem, Stokes' theorem, Gauss divergence theorem, Curvilinear coordinates.

TEXTBOOKS

1. G. B. Thomas and R. L. Finney, *Calculus*, (9th 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 develop a rigorous understanding of the foundational concepts of real numbers, sequences, series, uniform convergence and improper integral.

COURSE OUTCOMES:

Upon successful completion, a student will be able to:

1. Understand the basics of Real analysis.
2. Understand and analyze sequences of real numbers.
3. Understand and apply the concepts of convergence and divergence of infinite series of positive real numbers.
4. Understand and analyze the convergence of improper integrals over infinite intervals and Riemann integrals.

SYLLABUS:

UNIT I: Real Numbers: Algebraic, Order completeness property , Archimedean property of R, density property of R. Absolute value of a real number, Triangle inequality,Intervals in R, sets in R, Nested interval property , Neighborhood of a point in R, Connected subset of R,Cantor set, Real Functions, cantor Functions, Limit point , isolated point, Bolzano-Weierstrass theorem for limit. Derived set

UNIT II: Sequences: Sequences of real numbers, Bounded Sequence, Limit of a sequence , limit point of sequence Convergent sequence, Limit theorem , monotone sequence, monotone convergence theorem Subsequences, Sub sequential limit, Limit superior and limit inferior of a sequence of a real number, Bolzano-Weierstrass theorem for sequence, sandwich theorem, Cauchy sequence , Cauchy's convergence criterion , Cauchy's theorem on limits

UNIT III: Infinite series: Convergence and divergence of infinite series of positive real numbers, Necessary condition for convergence, Cauchy criterion for convergence; Test for convergence of positive term series, Basic comparison test,Limit comparison test, D'Alembert's ratio test, Cauchy's nth root test, integral test; Raabe's test, Logarithmic test, Gauss's test, Alternating series , Leibnitz test, absolute and conditional convergence, Abel's test and Dirichlet's test . Rearrangement of series, Dirichlet's and Riemann's theorem on rearrangement of absolutely and conditionally convergent series.

UNIT IV: Uniform Convergence:Pointwise convergence, uniform convergence on an interval, Tests for uniform convergence, Properties of uniformly Convergent Sequences and Series. The Weierstrass Approximation Theorem.

UNIT V: Riemann Integral,Partition, Riemann integrability, Properties of Riemann intrgrable functions, Fundamental theorem, Improper Integral, Integral over infinite interval with bounded integrand , Improper integral and their convergence, comparison test, μ-test , Abel's test , Dirichlet's test, convergence of integral of product of two function , Convergence of integral with unbounded integrands

TEXTBOOKS:

1. Mathematical Analysis" Fifth Edition by S.C. Malik and Savita Arora.
2. A first course in Real Analysis"(2nd Edition) by N. N Bhattacharya.
3. Real Analysis by J.N Sharma, A.R. Vasishtha, Krishna Publication.

REFERENCE BOOKS:

1. Introduction to Real Analysis" Revised 6th Edition by S.K. Mapa.
2. Elements of Real Analysis (Revised Edition) by Shanti Narayan,Dr. M.D. Raisinghania

COURSE CODE & NAME: SCUCMT213T /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 sries.

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*

E-Resources and Other Digital Materials:

COURSE CODE & NAME: CASCPSC20T/Fundamentals of Data Science

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 curvesExploratory 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.

E-Resources and Other Digital Materials:

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

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.

SUBJECT CODE & NAME: SCUCEV201T / Environmental Science

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, and 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. 3