C. U. SHAH UNIVERSITY

WADHWAN CITY

FACULTY OF SCIENCE

M.Sc.

MATHEMATICS

SEM-I & II

Syllabi (CBCS) of Mathematics (Core)

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: M.Sc. **SEMESTER:I**

SUBJECT NAME:Linear Algebra **SUBJECT CODE: MSCMTC101**

Teaching & Evaluation Scheme:-

Teaching Scheme(hrs)				Evaluation Scheme								
				Theory					Practical (Marks)			
Th	Seminar	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
				Marks	Hrs	Marks	Hrs					
4	0	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-Topics include systems of linear equations and their solutions, matrices and matrix algebra, inverse matrices, determinants and permutations, real n-dimensional vector spaces, abstract vector spaces and their axioms, linear transformations, inner products (dot products), orthogonality, cross products, and their geometric applications, subspaces, linear independence, bases for vector spaces, dimension, matrix rank, eigenvectors, eigenvalues, matrix diagonalization. Some applications of linear algebra will be discussed.

Prerequisites:-Knowledge of Matrices, functions, vectors of Bachelor degree.

Course outline:-

Sr. No.	Course Contents
1	Quick review of vector spaces, Subspaces, linear independence and basis, coordinate vectors relative to basis, dual space, Gram Schmidt Process, minimal polynomial, Reisz-representaion theorem.
2	The algebra of linear transformations,homomorphism, Isomorphism, First isomorphism theorem, Characteristic roots, Matrices.
3	Canonical forms: triangular forms, Canonical forms of a Nilpotent linear transformation, Decomposition of a finite dimensional vector space: Jordan forms.
4	Trace and transpose, Determinants, Classification of quadrics.

Learning Outcomes:-After successful completion of this course, students will be able:

- To solve problems related to matrices and linear equation.
- To use the linear algebra in different branches.

Books Recommended:-

1. 'Topics in algebra', **Herstein, I. N.**, *Wiley Eastern Ltd., New Delhi*.
2. 'Linear Algebra: A Geometric Approach', **Kumaresan, S.**, *Prentice Hall of India*.
3. 'Introduction to Topology and Modern Analysis', **Simmons G. F.**, *McGraw-Hill Co., Tokyo*.
4. 'Linear Algebra',**Helson, H.**, *Hindustan Book Agency, TRIM-4.*
5. 'Linear Algebra',**Kwak J. H., Hong S.**, *Birkhauser*.

E-Resources:-

1. http://aleph0.clarku.edu/~djoyce/ma130/
2. en.wikipedia.org/wiki/Linear_algebra
3. http://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm
4. https://www.khanacademy.org/math/linear-algebra

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: M.Sc. **SEMESTER:I**

SUBJECT NAME:Differential Equations **SUBJECT CODE: MSCMTC102**

Teaching & Evaluation Scheme:-

Teaching Scheme(hrs)				Evaluation Scheme								
				Theory					Practical (Marks)			
Th	Seminar	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
				Marks	Hrs	Marks	Hrs					
4	0	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-The general purpose of this course is

- To expose the student to some of the more commonly used techniques for finding explicit solutions of ordinary differential equations.
- To introduce several numerical techniques for finding approximate solutions to ordinary differential equations and,
- To explore some of the applications of ordinary differential equations to the physical, behavioral and engineering sciences.

Prerequisites:-Knowledge of Calculus, Differential Equations and Algebra of bachelor degree.

Course outline:-

Sr. No.	Course Contents
1	Review of ODE of First order, Second order differential equations: the method of variation of parameters, Classification of singularities, series solution near an ordinary point, point at infinity , Frobenius method : series solution near regular singular point, point at infinity.
2	Legendre equation, Legendre polynomial and its properties,Rodrigue's formula, generating function for Legendrepolynomial, Recurrence relations for $P_n(x)$,Bessel's equation, Bessel's function of first and second kind and their properties, generating function for Bessel's function, Recurrence relations for $J_n(x)$.

3	Pfaffian differential equations, Lagrange Method, Partial differential equation of first order and compatible system of first order partial differential equations, Picard's method of successive approximations.
4	Gauss hypergeometric equation, Gauss hypergeometric function and its properties,Charpit's and Jacobi's method.

Learning Outcomes:-After successful completion of this course, students will be able to solve differential equations.

Books Recommended:-

1. 'Differential equations with applications and historical notes', **G. F. Simmons,***McGrawHill International Editions, second edition.*
2. 'Elementary Course in Partial Differential Equations',**Amarnath, T.**, *Narosa Publ. House, New Delhi.*
3. 'Elements of Partial Differential Equations', **Sneddon, I. N.**, *McGraw-Hill Publ. Co.*
4. 'Introduction to Ordinary Differential Equations',**Rabenstein, A. L.**, *Academic Press.*
5. 'Advanced Differential Equations',**Raisinghania, M. D.**,*S. Chand \& Co.*
6. 'Higher Engineering Mathematics', **Grewal, B.S. and Grewal, J.S.**, *Khanna Publ., New Delhi.*
7. 'Ordinary Differential Equations: A First Course',**Somasundaram, D.**, *Narosa Publ. House, New Delhi*.

E-Resources:-

1. http://www.bhcc.mass.edu/inside/981
2. http://en.wikipedia.org/wiki/Differential_equation
3. http://www.wikihow.com/Solve-Differential-Equations
4. www.khanacademy.org/math/differential-equations
5. http://www.sosmath.com/diffeq/diffeq.html
6. http://tutorial.math.lamar.edu/Classes/DE/DE.aspx
7. http://mathworld.wolfram.com/OrdinaryDifferentialEquation.html

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: M.Sc. **SEMESTER:I**

SUBJECT NAME:Complex Analysis-I **SUBJECT CODE: MSCMTC103**

Teaching & Evaluation Scheme:-

Teaching Scheme(hrs)				Evaluation Scheme								
				Theory					Practical (Marks)			
Th	Seminar	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
				Marks	Hrs	Marks	Hrs					
4	0	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-The main objective of Complex Analysis is to study the development of functions of one complex variable. Students will perform a thorough investigation of the major theorems of complex analysis – the Cauchy-Riemann Equations, Cauchy's Theorem, Cauchy's Integral Formula, the Maximum Modulus Principle, Liouville's Theorem, the Residue Theorem– including their proofs. They will also apply these ideas to a wide range of problems that include the evaluation of both complex line integrals and real integrals.

Prerequisites:-Basic knowledge of Complex numbers, functions and basic knowledge of series up to bachelor degree level.

Course outline:-

Sr. No.	Course Contents
1	A quick overview of complex number system, Complex plane, polar representation and powers and roots of complex numbers, elementary functionsand properties.
2	Limit, Continuity, derivatives, Cauchy-Riemann equations in polar coordinates and complex form, analytic functions, harmonic functions and harmonic conjugate,power series, power series as an analytic function, branch of logarithm - its analyticity, analytic functions as mappings.

3	Classification of Contours, line integral, contour integrals, anti-derivative, Zeros of an analytic function, Cauchy's theorem, simply and multiply connected domains and Cauchy's Integral Formula, Derivatives of an analytic function, Cauchy's inequality, Liouville's theorem, Fundamental theorem of Algebra, Morera's theorem, Cauchy's theorem and simple connectivity, Goursat's theorem, Gauss mean value theorem, Principle of deformation of paths, Maximum modulus principle.
4	Convergence Tests, absolute convergence of power series, radius of convergence, Taylor's theorem, uniform convergence of power series, Laurent series, classification of singularities, residues, residues theorem, residues at poles, evaluation of improper real integrals, definite integrals with sine and cosine function, Schwarz's reflection principle, Mobius transformation.

Learning Outcomes:-

Upon successful completion of the course, students should be able to

- Prove the above theorems
- Solve difficult problems using the above theorems
- Apply Cauchy's Integral Formula to evaluate complex line integrals
- Expand functions in Taylor and Laurent series
- Apply the Residue Theorem to evaluate real integrals
- Apply normal families arguments in proofs
- Apply the theorems in Engineering Mathematics

Books Recommended:-

1. 'Functions of One Complex Variable',**Conway, J.B.**, *Narosa Publ. House, New Delhi.*
2. 'Complex Variables and Applications',**James Brown, Ruel Churchill**, *McGraw-Hill Publ. Co.*
3. 'Foundations of Complex Analysis',**Ponnusamy, S.**, *Narosa Publ. House, New Delhi*.

E-Resources:-

1. http://en.wikipedia.org/wiki/Complex_analysis
2. http://people.math.gatech.edu/~cain/winter99/complex.html
3. http://people.math.gatech.edu/~cain/winter99/complex.html
4. http://mathworld.wolfram.com/ComplexAnalysis.html
5. http://mathworld.wolfram.com/ComplexDifferentiable.html

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: M.Sc. **SEMESTER:I**

SUBJECT NAME:Topology-I **SUBJECT CODE: MSCMTC104**

Teaching & Evaluation Scheme:-

Teaching Scheme(hrs)				Evaluation Scheme								
				Theory					Practical (Marks)			
Th	Seminar	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
				Marks	Hrs	Marks	Hrs					
4	0	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-Topology achieved the status of "Language of Mathematics" in early 50s and based on that the Analysis flourished. Later on every course on Analysis depends on the concepts developed in topology. Metric spaces form the backbone of the theory of topology. The use of metric starts from early introduction to Analysis to the higher level courses like Relativity in Physics. The aim of this course is to make the students comfortable with the language of mathematics.

The aim of Topology is to introduce the theory of metric spaces and topological spaces. Students are expected to learn how to write, in logical manner, proofs using important theorems and properties of metric spaces and topological spaces. Students learn to solve problems using the concepts of topology. They present their solutions as rigorous proofs written in correct mathematical English. Students will be able to devise, organize and present brief solutions based on definitions and theorems of topology. Students who successfully complete this course should be capable of understanding the concept of open and closed sets, the interior, closure and boundary of sets, connected sets, compact sets and continuous functions defined on topological spaces.

Prerequisites:-Knowledge of set theory.

Course outline:-

Sr. No.	Course Contents
1	Topological spaces, Bases, Subspace, Closed sets, Open sets, Interior, Exterior, Closure, Limit point, Boundary of a set,Neighborhoods, Relative topology, T_1, T_2-spaces, Continuous functions, Pasting Lemma, Product space, Projections, Weak topology, Product of T_1, T_2-spaces.
2	Metric topology, Basic concepts and sequences, Continuity and uniform continuity, Bounded subsets, Totally bounded subsets, Compact topological spaces, Locally Compact Spaces, Finite Intersection Property, Hausdorff and Compactness.
3	Compact metric spaces, Heine-Borel Theorem,Regular, Normal, Completely regular spaces, Urysohns Lemma, Compact Hausdorff spaces.
4	Second countable space, Separable space, Second countability and separability in metric spaces, Connected topological spaces.

Learning Outcomes:-The students who succeeded in this course,

- will be able to use axioms of set theory.
- will be able to define topology, and its construction.
- will be able to define the product topology, and the quotient topology.
- Will be able to use the concept in Analysis and Higher Level courses.

Books Recommended:-

1. 'Topology: A First Course', **Munkres, J.,***Prentice Hall of India Pvt. Ltd., New Delhi.*
2. 'Introduction to Topology and Modern Analysis',**Simmons G. F.**, *McGraw-Hill Co., Tokyo.*
3. 'General Topology',**Willards, S.**,*Addison-Wesley.*

E-Resources:-

1. http://en.wikipedia.org/wiki/Topology
2. http://mathworld.wolfram.com/Topology.html
3. www.journals.elsevier.com/topology/
4. http://mathworld.wolfram.com/Topology.html
5. http://at.yorku.ca/
6. http://mathworld.wolfram.com/classroom/classes/Topology.html

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: M.Sc. **SEMESTER:I**

SUBJECT NAME:C Programming and Mathematical algorithms-I

SUBJECT CODE: MSCMTC105

Teaching & Evaluation Scheme:-

Teaching Scheme(hrs)				Evaluation Scheme								
				Theory					Practical (Marks)			
Th	Seminar	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
				Marks	Hrs	Marks	Hrs					
2	0	4	6	15	1	35	2	50	30	20	50	100

Objectives:-Objective of this course is to get basic knowledge of C language and to know that how to use C language for solving Mathematics Problems.

Prerequisites:-Basic knowledge about computer and knowledge of Mathematics of bachelor degree.

Course outline:-

Sr. No.	Course Contents
1	Structure of a C program,the concept of function,preprocessors in C, include statement, function prototype error, comments in C, data types in C, integer family, float family, character family, type casting of variables, arithmetic and relational operators in C, input – output functions, I/O format string, precision of numbers, field width, assignment operators, Mathematical expressions, logical expressions, precedence and associativity of operators, standard library functions, define statement, common programming errors, Arrays in C.
2	Statements: if, if-else, else-if statements, goto statement, switch statement. Loops: while, do–while, for, break and continue statements, nesting of loops. Pointers: address of a variable, pointer variable, pointers and array, Functions: automatic, static and external variables.

3	(Practical List:) Elementary problems of number theory such as sum of digits of a number reverse order of digits of a number, primes, perfect, Fibonacci numbers, factorization of a number.
4	(Practical List:) Roots of quadratic equation, maximum/minimum and average of n– numbers, values of some number theoretic functions, values of sin(x), cos(x), e^x. Solution of f(x) = 0, by using numerical methods.

Learning Outcomes:-

After successful completion of this course students will be able to prepare programs in C language to solve elementary problems of number theory such as sum of digits of a number reverse order of digits of a number, primes, perfect, Fibonacci numbers, factorization of a number also they will be able to find roots of quadratic equation, maximum/minimum and average of n– numbers, values of some number theoretic functions.

Books Recommended:-

1. 'Thinking in C Including object orientated programming with C++', **P. B. Mahapatra**, *Wheeler Publishing, New Delhi.*
2. *'Theory and Problems of Programming with C++',* **John R. Hubbard,**Schaum's Outline Series, McGRAW Hill.
3. 'The C programming Language', **B. W. Kernighan and D. M. Ritchie**, *Prentice Hall of India Pvt. Ltd.*
4. 'Computer Programming in C', **V. Rajaraman**, *Prentice Hall of India Pvt. Ltd.*

E-Resources:-

1. www.math.utah.edu/~carlson/c/cbook.pdf
2. en.wikipedia.org/wiki/Algorithm
3. www.aimms.com/aimms/download/.../aimms3lr_advancedalgorithms.pdf
4. www.math.upenn.edu/~wilf/website/CombinatorialAlgorithms.pdf
5. homepages.ulb.ac.be/~bmaresc/A&P.1.pdf
6. en.wikipedia.org/wiki/Linear_programming

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: M.Sc. **SEMESTER: I**

SUBJECT NAME:Operations Research **SUBJECT CODE: MSCMTE101**

Teaching & Evaluation Scheme:-

Teaching Scheme(hrs)				Evaluation Scheme								
				Theory					Practical (Marks)			
Th	Seminar	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
				Marks	Hrs	Marks	Hrs					
4	0	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-This course is intended to provide students with a knowledge that can make them appreciate the use of various research operations tools in decision making in organizations.

Prerequisites:-Basic knowledge of Mathematics.

Course outline:-

Sr. No.	Course Contents
1	Introduction to Operations Research (OR), Introduction to linear programming, LP model, Property of LP Model, Graphical LP solution: Maximization and Minimization, sensitivity analysis, simplex method, basic solutions, artificial starting solution.
2	Degeneracy, alternative optima, duality, dual problem, prime dual relationship, economic interpretation.
3	Dual simplex method, definition of transportation models and assignment models and applications, Hungarian method.
4	Non-linear programming and applications.

Learning Outcomes:-

At the end of the Course participants are expected to demonstrate a working knowledge of the various OR /OM tools in making decisions as well as being able to formulate organizational problems into OR models for seeking optimal solutions.

Books Recommended:

1. 'Operations Research: An introduction',**Hamdy and Tahia**,*Prentice-Hall.*
2. 'Operations Research', **V.K.Kapoor,** *S. Chand and Sons, New Delhi.*
3. 'Operations Research: Applications and Algorithms', **Wayne L Winston,** *Indian University.*

E-Resources:

1. en.wikipedia.org/wiki/Operations_research
2. http://www.mit.edu/~orc/resources/orlinks.html
3. http://mat.gsia.cmu.edu/
4. www.me.utexas.edu/~jensen/ORMM/frontpage/intro.html
5. http://annaunivpgmaterials.blogspot.in/2010/11/e-books.html
6. http://mathworld.wolfram.com/OperationsResearch.html

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: M.Sc. **SEMESTER:I**

SUBJECT NAME:Number Theory **SUBJECT CODE: MSCMTE102**

Teaching & Evaluation Scheme:-

Teaching Scheme(hrs)				Evaluation Scheme								
				Theory					Practical (Marks)			
Th	Seminar	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
				Marks	Hrs	Marks	Hrs					
4	0	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-To learn divisibility, congruences, power residues, quadratic reciprocity, diophantine equations. Number theoretic functions, continued fractions and rational approximation, partitions.

Prerequisites:-Knowledge of Bachelor degree Mathematics.

Course outline:-

Sr. No.	Course Contents
1	Divisibility: foundations, division algorithm, greatest common divisor, Euclid's algorithm, Fundamental theorem, properties of primes, Arithmetical functions: the function [x], multiplicative functions, Euler's (totient) function $\varphi(n)$. The Mobius function $\mu(n)$, the functions $\tau(n)$, and $\sigma(n)$, brief introduction of convolution of arithmetical functions, perfect numbers.
2	Congruences: definitions, Chinese Remainder theorem, the theorem of Fermat and Euler, Wilson's theorem, Lagrange's theorem, primitive roots, indices.
3	Miscellaneous topics: finite, infinite continued fractions, linear Diophantine equations $x + by = c$, Pell's equations, Pythagorean triplets, brief introduction of Fermat's last theorem.
4	Quadratic Fields: algebraic number fields, the quadratic fields, units, primes and factorization, Euclidean fields, the Gaussian field, Gaussian primes.

Learning Outcomes:-

Students will be able for

- Finding the greatest common divisor and least common multiple of a pair of natural numbers, and finding the linear form of the greatest common divisor.
- Prime factorization.
- Solving linear congruences and systems of simultaneous linear congruence.
- The theorems of Fermat, Wilson, and Euler.
- Primitive roots modulo primes and prime powers.
- Determining whether a quadratic congruence has solutions, and if so, finding them.

Books Recommended:-

1. 'An introduction to the Theory of Numbers', **Ivan Nivan, H. S. Zuckermann, H. L. Montgomery**, *John Wiley & Sons Inc.*
2. 'Elementary number theory', **David M. Burton**, *Universal Book stall, New Delhi.*
3. 'A Concise introduction to the Theory of Numbers',**Alan Baker**, *Cambridge Uni. Press, Cambridge*.

E-Resources:-

1. en.wikipedia.org/wiki/Number_theory
2. www.numbertheory.org/
3. http://mathworld.wolfram.com/NumberTheory.html
4. archives.math.utk.edu/topics/numberTheory.html
5. http://www.worldscientific.com/worldscinet/ijnt