C. U. SHAH UNIVERSITY

WADHWAN CITY

FACULTY OF SCIENCES

M.Sc.

MATHEMATICS

SEM - II

Syllabi (CBCS)

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES

DEPARTMENT OF MATHEMATICS

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Differential Geometry **SUBJECT CODE: 5SC02DIG1**

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			Total Marks
					Sessional Exam		University Exam		Internal		University	
Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	0	4	4	30	1.5	70	3	--	--	--	100

Objectives: - The main objective of the course is to the study of curves, surfaces and their higher dimensional analogues by means of the calculus.

Prerequisites:- Knowledge of Geometry, differentiation and its application up to graduate level.

Course outline:-

Sr. No.	Course Contents
1	Space curves, planar curves, parameterization, closed curve, simple closed curve, curvature, torsion, signed curvature, Frenet-Serret equations, fundamental theorem of curve theory, Isoperimetric Inequality, The Four Vertex Problem.
2	Surfaces: smooth surfaces, smooth maps, tangents, normals, first fundamental form, length of the curve on surfaces, isometries of surfaces, conformal mappings of surfaces, surface area.
3	Second fundamental form, normal and geodesic curvatures, principal curvature, Meunier's theorem, Euler's theorem, Gaussian and mean curvature, Gauss map.
4	Gauss equation, Christoffel symbols, Codazzi-Mainardi equations, Theorem Egregium, geodesics, local Gauss Bonnet theorem.

Learning Outcomes:-After this course the student is expected to:

- Appreciate how the calculus can make precise, intuitive ideas of curvature and twisting, and calculate the simplest invariants of curves and surfaces.
- Appreciate the use of linear algebra in a context where vector spaces without preferred bases arise naturally.
- Be able to quote the definitions and results relating to each part of the syllabus, and to reproduce the proofs of some key results.
- Understand the distinction between local and global properties in geometry.
- Understand the distinction between intrinsic and extrinsic properties of surfaces.

Books Recommended:-

1. 'Elementary Differential Geometry', **Pressly, A.**, *SUMSeries*.
2. 'Introduction to Differential Geometry', **Goetz, A.,** *Addison Wesley, Publ. Co.*
3. 'Differential Geometry in Three Dimensions', **Weatherburn, C. E.,** *Cambridge University Press*.

E-Resources:-

1. en.wikipedia.org/wiki/Differential_geometry
2. www.math.uga.edu/~shifrin/ShifrinDiffGeo.pdf
3. http://www.cs.elte.hu/geometry/csikos/dif/dif.html
4. http://ocw.mit.edu/courses/mathematics/18-950-differential-geometry-fall-2008/index.htm

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES

DEPARTMENT OF MATHEMATICS

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Partial Differential Equations **SUBJECT CODE: 5SC02PDE1**

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			
Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	Total Marks
					Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	0	4	4	30	1.5	70	3	--	--	--	100

Objectives:-The purpose of this course is to meet the following objectives:

- To give students an awareness of the range of engineering systems which are modelled using partial differential equations.
- To introduce students to use routinely, Fourier series methods for the representation of periodic functions
- To introduce students to use routinely, two widely applicable analytic techniques for the solution of partial differential equations, the D'Alembert method and the method of separation of variables.
- To enable students to recognise hyperbolic, parabolic and elliptic partial differential equations and know the principal differences to be expected in the properties of the solution of each type.
- To enable students to use Fourier series methods both in the solution of partial differential equations and in other wider contexts.

Prerequisites:-Multi-variable calculus, Ordinary differential equations, Linear Algebra.

Course outline:-

Sr. No.	Course Contents
1	Genesis of second order partial differential equations, second order linear partial differential equations with constant coefficients, solutions when f(x, y) to be polynomial, exponential, sine and cosine functions, general method for homogeneous equations.
2	Classification of second ordered partial differential equations and canonical form. Nonlinear second order partial differential equations: solution by Monge's method, special case and general case.
3	Second order partial differential equations with variable coefficients, method of changing variables for special type of equations. Separation of variable Method: solution of Laplace, Wave and diffusion equations, Solution of these equations in different coordinate systems.
4	Boundary value problems: Dirichlet boundary value problems for the upper half plane and a circle, Neumann boundary value problems, Maximum and minimum principles, Harnack's theorem, equipotential surfaces.

Learning Outcomes:-

To analyse the most important partial differential equations encountered in applied mathematics and to describe and analyse numerical methods for these equations.

Books Recommended:-

1. 'Elementary Course in Partial Differential Equations', **Amarnath, T.,** *Narosa Publ. House, New Delhi*.
2. 'Elements of Partial Differential Equations', **Sneddon, I. N.,** *McGraw- Hill Publ. Co.*
3. 'Higher Engineering Mathematics', **Grewal, B. S. and Grewal, J. S.,** *Khanna Publ., New Delhi*.
4. 'Advanced Differential Equations', **Raisinghania, M. D.,** *S. Chand & Co.*
5. 'Partial Differential Equations', **Phoolan, P. and Ravindran, R.,** *Wiley Eastern.*

E-Resources:-

1. en.wikipedia.org/wiki/Partial_differential_equation
2. www.math.umn.edu/~olver/pdn.html
3. www.math.tifr.res.in/~publ/ln/tifr70.pdf
4. www.physics.miami.edu/~nearing/mathmethods/pde.pdf
5. tutorial.math.lamar.edu/Classes/DE/IntroPDE.aspx
6. http://mathworld.wolfram.com/PartialDifferentialEquation.html

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DEPARTMENT OF MATHEMATICS

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Real Analysis **SUBJECT CODE: 5SC02REA1**

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			
Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	Total Marks
					Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	0	4	4	30	1.5	70	3	--	--	--	100

Objectives:-

- To investigate the fundamental concepts of analysis for real functions of a single variable.

Prerequisites:-Knowledge of basic real analysis.

Course outline:-

Sr. No.	Course Contents
1	Algebra and σ-algebra of sets, Borel sets in $\mathbb{R}$, Lebesgue outer measure in $\mathbb{R}$, measurable sets and Lebesgue measure on $\mathbb{R}$, non-measurable set, measurable functions.
2	Littlewood's three principles, Egoroff's theorem, the Lebesgue integral of a bounded function over a set of finite measure, comparison of Riemann and Lebesgue integral, bounded convergence theorem, Lebesgue integral of a nonnegative measurable function.
3	Fatou's lemma, monotone convergence theorem, bounded convergence, Chebyshev's inequality, Beppo-Levis theorem, general Lebesgue integral, Lebesgue's dominated convergence theorem, Convergence in measure, relation with convergence a.e., generalization of Lebesgue's theorem.

4	Differentiation of monotone functions, functions of bounded variation, Jordan's Lemma, differentiation of an integral, continuity and bounded variation of indefinite integral, absolute continuity of indefinite integral, different forms of fundamental theorem of integral calculus, relation between indefinite integral and absolute continuity.

Learning Outcomes:-Students will be able to give rigorous proofs of many theorems of real analysis and they will be able to use these theorems to solve problems.

Books Recommended:-

1. 'Real Analysis', **Royden, H. L.,** *Mc. Millan.*
2. 'An introduction to measure and integration', **Rana, I. K.,** *Narosa Publ. House, New Delhi*.
3. 'Introduction to measure theory', **De Barra G.,** *Van Nostrand Reinhold Co.*

E-Resources:-

1. en.wikipedia.org/wiki/Real_analysis
2. en.wikipedia.org/wiki/List_of_real_analysis_topics
3. http://www.math.hmc.edu/~su/math131/
4. www.mathcs.org/analysis/reals/
5. ramanujan.math.trinity.edu/wtrench/.../TRENCH_REAL_ANALYSIS.PDF
6. http://en.wikibooks.org/wiki/Real_Analysis

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DEPARTMENT OF MATHEMATICS

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Group Theory **SUBJECT CODE: 5SC02GRT1**

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			Total Marks
					Sessional Exam		University Exam		Internal		University	
Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	0	4	4	30	1.5	70	3	--	--	--	100

Objectives:-This course aims to provide a knowledge of group theory and it's properties. Also it deals with class equation, finite group, automorphism, sylow's theorem, simple group and fundamental theorem of finite abelian group.

Prerequisites:-

Basic knowledge of set theory, binary operation etc.

Course outline:-

Sr. No.	Course Contents
1	Quick review of basic group theory, counting principle, permutation groups, Cayley's theorem.
2	Conjugate elements, class equation of finite groups, automorphisms, inner and outer automorphisms.
3	Simple groups, solvable groups, Sylow's theorem and applications.
4	Direct products. Fundamental theorem of finite abelian groups.

Learning Outcomes:-

After successful completion of this course, students will be able to

- Understand different types of group like, permutation groups Simple groups, solvable groups.
- Find application of Sylow's theorem.
- Explain fundamental theorem of finite abelian groups, direct product, conjugate elements, inner and outer automorphisms.

Books Recommended:-

1. 'Topics in Algebra', **Herstein, I.N.**, *John Wiley & Sons.*
2. 'A first course in abstract algebra', **Fraleigh, J.B.,** *Narosa Pub. House 1983.*

E-Resources:-

1. http://www.math.niu.edu/~rusin/known-math/index/20-XX.html
2. http://dogschool.tripod.com/groups.html
3. http://en.wikipedia.org/wiki/Group_(mathematics)
4. http://www.groups.dcs.stand.ac.uk/history/HistTopics/Development_group_theory.html
5. http://mathworld.wolfram.com/Group.html

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COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: C Programming and Mathematical Algorithms-II

SUBJECT CODE: 5SC02CPM1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			Total Marks
					Sessional Exam		University Exam		Internal		University	
Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr	TW		
2	0	4	6	4	15	1	35	1.5	10	10	30	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 Mathematical problem.

Prerequisites:-Basic knowledge about computer and mathematics.

Course outline:-

Sr. No.	Course Contents
1	Function definition, calling a function, automatic, static and external variables, recursive functions, function prototype – forward reference, pointers in functions, passing by values and passing by reference. File management : opening a file, closing a file, reading from a file,fscanf() and fprintf() functions writing to a file, standard streams in C, file name, binary files,fread() and fwrite() functions.
2	Structures & unions: declaration of structures, accessing structure members, structure initialization, nested structure, array of structures, structure assignment, structure as a function arguments, unions. typedef declaration. Graphics: setting the mode, setgraphmode, getmaxx, drawpoly, initgraph, getmaxy, putimage, putpixel, rectangle, setbkcolor, setcolor, setfillpattern, setfillstyle, setlinestyle, setpalette functions, line, circle, ellipse, arc, bar charts.

3	Pracical List: Operations on matrices (addition, scalar multiplication, multiplication), Gauss elimination method and its applications. Sequences– sorting, searching, merging.
4	Pracical List: Newton's form of polynomial, interpolation polynomial, divided difference table, numerical integration, numerical solutions of differential equations, elementary graphics.

Learning Outcomes:- After successful completion of this course students will be able to prepare programs in C language to solve problems Operations on matrices, Gauss elimination method and its applications. Sequences– sorting, searching, merging, numerical solutions of differential equations.

Books Recommended:-

1. 'Thinking in C Including object orientated programming with C++', **Mahapatra, P. B.,** *Wheeler Publishing, New Delhi.*
2. 'The C programming Language', **Kernighan, B. W. and Ritchie, D. M.,** *Prentice Hall of India Pvt. Ltd.*
3. 'Computer Programming in C', **Rajaraman, V.,** *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

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COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Problem Solving-I **SUBJECT CODE: 5SC02PRS1**

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			Total Marks
					Sessional Exam		University Exam		Internal		University	
Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	0	4	4	30	1.5	70	3	--	--	--	100

Objectives: -Objective of this course is to develop skills of example solving.

Prerequisites:-

Knowledge of particular topics up graduate or postgraduate level.

Course outline:-

Sr. No.	Course Contents
1	Complex Analysis: Only Problems based on the following topics, Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions, Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Taylor series, Laurent series, calculus of residues, Conformal mappings, Mobius transformations.

2	Linear Algebra: Only Problems based on the following topics, Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations, Algebra of matrices, rank and determinant of matrices, linear equations, Eigenvalues and eigenvectors, Cayley-Hamilton theorem, Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms, Inner product spaces, orthonormal basis. Quadratic forms, reduction and classification of quadratic forms.
3	Ordinary Differential equation: Only Problems based on the following topics, Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs. General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem.

Learning Outcomes:-After successful completion of this course students will be able to solve examples of respective topics. And hence it will be useful to them for NET/SET Examination.

Books Recommended:-

1. 'UGC CSIR NET/SET (JRF & LS) Mathematical Sciences', **Sharma, P., Sharma N., Singh, S.,** *Arihant Publications (India) Limited.*
2. 'Topics in algebra', **Herstein, I. N.**, *Wiley Eastern Ltd., New Delhi*.
3. 'Linear Algebra: A Geometric Approach', **Kumaresan, S.**, *Prentice Hall of India*.
4. 'Advanced Differential Equations', **Raisinghania, M. D.**,*S. Chand & Co.*
5. 'Higher Engineering Mathematics', **Grewal, B.S. and Grewal, J.S.**, *Khanna Publ., New Delhi.*
6. 'Complex Variables and Applications', **Brown, J., Churchill, R.V.**, *McGraw-Hill Publ. Co.*

E-Resources:-

1. https://www.khanacademy.org/math/linear-algebra
2. http://www.wikihow.com/Solve-Differential-Equations
3. www.khanacademy.org/math/differential-equations
4. http://people.math.gatech.edu/~cain/winter99/complex.html