C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: VI**

SUBJECT NAME:Real Analysis **SUBJECT CODE: 4SC06RAC1**

Teaching & Evaluation Scheme:-

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

Objectives:-The objectives of this course are to study Sequence, Bolzano-Weierstrass theorem, Infinite seriesCauchy' general principle of convergence, Geometric series, Riemann integrals, Darboux's theorem,fundamental theorem of integral calculusand to study theorems related to them.

Prerequisites:-Knowledge of Calculus.

Course outline:-

Sr. No.	Course Contents
1	Review of Sequence: Sequences, bounds of a sequence, convergence of sequences, Limit point of a sequence, Bolzano-Weierstrass theorem, Convergent and divergent sequences. Infinite series: Definition, A necessary condition for convergence, Cauchy' general principle of convergence, some preliminary theorems, Geometric series and its convergence.
2	Infinite series: Positive term series, Integral test, p – test, Comparison tests, Cauchy' root test, D'Alembert test, Leibnitz test for alternating series, Rearrangement of series, Absolute convergence, Conditional convergence, Power series, Radius of convergence, Cauchy product of two series, Merten's theorem.

3	Riemann integrals definitions and existence, inequalities for integrals, Refinement of partitions, Darboux's theorem for integrals, conditions of Integrability, integrability of the sum, difference, product, quotient and modulus of functions.
4	Integral as the limit of sums (Riemann sums), Some integrable Functions, Integration and differentiation (the primitive), the fundamental theorem of integral calculus, mean value theorems of integral, second mean value theorem.

Learning Outcomes:-

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

- To use the definitions of convergence as they apply to sequences, series, and functions.
- To determine whether or not real series are convergent by comparison with standard series or using the Ratio Test.
- To apply the Mean Value Theorem and the Fundamental Theorem of Calculus to problems in the context of real analysis.
- To explain the Bolzano-Weierstrass Theorem.
- To express a definite integral as limit of Riemann sum.
- To express a limit of a Riemann sum as definite integral.

Books Recommended:-

1. 'Mathematical analysis', **S.C. Malik and Savita Arora**, *New Age International (p) limited publishers.*
2. 'Fundamentals of Mathematical Analysis*',* **G.Das,S.Pattanayak,** *Tata Mc GrawHil, 10th Edition*
3. 'An Introduction to Analysis', **Gerald G. Bilodean**,*Jones and Barlett, 2nd Edition.*
4. 'Principles of Real Analysis', **S.C.Malik**, *Revised Edition, New Age International, New Delhi, 2000.*
5. 'Principles of Mathematical analysis', **R.R.Goldberg**,*oxford and IBH (India).*
6. 'Introduction to Real Analysis',**Robert G. Bartle and Donald R. Sherbert**, *Wiley Student Edition, 2010.*

E-Resources:-

1. http://en.wikipedia.org/wiki/Real_analysis
2. http://en.wikipedia.org/wiki/List_of_real_analysis_topics
3. http://ramanujan.math.trinity.edu/wtrench/texts/TRENCH_REAL_ANALYSIS.PDF
4. http://nptel.ac.in/courses/111106053/
5. http://math.louisville.edu/~lee/ira/
6. http://en.wikibooks.org/wiki/Real_Analysis
7. http://ocw.mit.edu/courses/mathematics/18-100c-real-analysis-fall-2012/

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: VI**

SUBJECT NAME: Ring Theory **SUBJECT CODE:4SC06RTC1**

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 objectives of this course are to study Ring, Integral Domain, Ideal,Field, Homomorphism of ring, Ring of Polynomials and to study theorems related to them.

Prerequisites:-Students must be familiar with the concept of set theory, group theory, the division algorithm, Euclidean algorithm, and unique factorization theorem for integers, functions and mathematical induction.

Course outline:-

Sr. No.	Course Contents
1	Rings: Definition and Examples, Properties of ring, examples.
2	Integral Domain: Zero – Divisor and definition, Characteristic of Ring, Solution of Equation $ax = b$ in ring R, Examples. Ideal: Sub rings, Ideal, Quotient ring and examples.
3	Field: Definition, properties and examples. Homomorphism of ring: Definition, examples, Characteristic.
4	Ring of Polynomials: Introduction, Integral domain $D[x]$, Familiar form of Integral domain $D[x]$, Unique factorization of polynomials.

Learning Outcomes:-

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

- To understand the properties of Ring.
- To give examples of Rings.
- To distinguish integral domain, principal ideal domain, unique factorisation domain and Euclidean ring.
- To appreciate the role of polynomial rings in constructing finite fields.
- To have a good understanding of homomorphisms of rings.
- To demonstrate knowledge of the structures of Rings and to apply the knowledge in solving problems in different areas in Algebra.

Books Recommended:-

1. 'Abstract Algebra', **I. H. Sheth**, *Prentice-Hall of India Private Limited*.
2. 'Topic in Algebra', **I. N. Herstein,***Willey Eastern Ltd. New Delhi*.
3. 'University Algebra', M. S. Gopalakrishna, willey easterm Ltd.
4. 'Text book of morden abstract algebra', Shantinarayan, S chand and co. New Delhi.
5. 'A first course in abstract – algebra', John B. Fraleigh, Addison – Wesley publishing company.

E-Resources:-

1. http://en.wikipedia.org/wiki/Ring_theory
2. http://www.math.iitb.ac.in/atm/atmt1/jkv.pdf
3. http://mathworld.wolfram.com/Ring.html
4. https://www.youtube.com/watch?v=-ljA4ZsX5Es
5. http://wwwf.imperial.ac.uk/~anskor/notesM2P4.pdf
6. http://www.saylor.org/site/wp-content/uploads/2011/04/Ring-mathematics.pdf

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FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: VI**

SUBJECT NAME: Topology **SUBJECT CODE:4SC06TOC1**

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 objectives of this course are to study definition and examples of Topological spaces, Continuity in a topological space, homeomorphism, Connectedness, Compact space,Hausdorff property of a metric space and to study theorems related to them.

Prerequisites:-Knowledge of set theory, Metric space.

Course outline:-

Sr. No.	Course Contents
1	Topological spaces: Definition and examples, Open and close sets in topological spaces, Usual topology and S - topology on R, Comparison of topologies, Neighborhood.
2	Cluster points, Closure and interior points of a set, Definition and examples of a door space and dense set, Continuity in a topological space and homeomorphism.
3	Definition and examples of connected and disconnected spaces, Connectedness in R, Relative topology, Connected subspaces, Open cover, Compact space.
4	Compactness in R_1; $R_2$and metric space, Properties of compact spaces, Definition and examples of T_0; T_1; T_2 - space, Hausdorff property of a metric space.

Learning Outcomes:-

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

- To explain elementary theorems involving sets and functions.
- To identify various topological properties of topological space.

- To define topology, and its construction.
- To prove elementary theorems involving the concepts of topological space, continuous function, compactness, and connectedness.

Books Recommended:-

1. 'Introduction to Topology', **M. J. Mansfield,***CBS Publishers & Distributors, Delhi.*
2. 'Topology', **J. N. Sharma**,*Krishna Prakashan.*
3. 'Introduction to Topology and Modern Analysis', **G . F . Simmons**, *McGraw Hill Education (India) Private Limited.*
4. 'Methods of Real Analysis', **R . R . Goldberg,** *Wiley and Son Publishers*.

E-Resources:-

1. http://en.wikipedia.org/wiki/Topology
2. http://mathworld.wolfram.com/Topology.html
3. http://en.wikibooks.org/wiki/Topology
4. https://www.youtube.com/watch?v=zsN_guq__Ac
5. https://www.youtube.com/watch?v=4MWLTV11zeU
6. http://ocw.mit.edu/courses/mathematics/18-901-introduction-to-topology-fall-2004/

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DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: VI**

SUBJECT NAME: Graph Theory **SUBJECT CODE:4SC06GTC1**

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 objectives of this course are to study Graph, Sub graph, Connected and Disconnected Graphs,Euler Graph, Trees, Spanning trees, Cut sets,matrices of the graphs and to study theorems related to them.

Prerequisites:-Basic concept ofsets, Relations, Functions, Matrix, Mathematical induction.

Course outline:-

Sr. No.	Course Contents
1	Graph: Introduction, Application of Graph, Finite and Infinite Graphs, Incidence and Degree, Isolated Vertex, Pendant Vertex, Null Graph, Isomorphism, Sub graph, Spanning sub graphs.
2	Walk, Path, Circuits, Connected and Disconnected Graphs, Euler Graph, Operations on graph, More on Euler graphs, Hamiltonian Paths and Circuits.
3	Trees, Some properties of Trees, Pendant Vertices in a tree, Distance and Centers, Rooted and Binary tree, Spanning trees.
4	Cut sets and its properties, Fundamental Circuits and cut sets, Incidence Matrix, Sub matrices of $A(G)$, Circuit matrix, Cut-set matrix, Path matrix, Adjacency Matrix.

Learning Outcomes:-

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

- To define a mathematical graph, identifying edges and vertices.
- To represent real-life situations with mathematical graphs.
- To recognize patterns that arise in various graph problems.
- To explain the relation of tree with connected graph.
- To apply the concepts of graph theory in real world situation.
- To express in to single algebraic expression by use of tee.

Books Recommended:-

1. 'Graph Theory with applications to Engineering and Computer Science', **Narsingh Deo**, *Prentice Hall of India Pvt. Ltd.*
2. 'Introduction to graph theory',**Robin J. Wilson**,*Rongrman addition Wesley longman Limited, 4th edition.*
3. 'A First Look at Graph Theory',**John Clerk**,*World Scientific Publishing company.*
4. 'Introduction to graph theory', **Douglas B. west,***prentice Hall of India Pvt. Ltd.*
5. 'A First Course in Graph Theory', **S. A. Choudum**, *Macmillan India Limited.*
6. 'Graph Theory', **G. Suresh Singh**, *Prentice Hall of India.*

E-Resources:-

1. http://en.wikipedia.org/wiki/Graph_theory
2. http://math.tut.fi/~ruohonen/GT_English.pdf
3. http://primes.utm.edu/graph/
4. http://cs.bme.hu/fcs/graphtheory.pdf
5. http://www.nptel.ac.in/downloads/106108054/
6. http://www.personal.psu.edu/cxg286/Math485.pdf

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DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: VI**

SUBJECT NAME:Operations Research **SUBJECT CODE: 4SC06ORE1**

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 objectives of this course are tostudyOperations Research, Linear Programming Problem, Simplex Method,Transportation Problem, Theory of Games, PERT and CPM and to study theorems related to them.

Prerequisites:-Basic knowledge of Matrix Theory, Graphs.

Course outline:-

Sr. No.	Course Contents
1	Operations Research: Quantitative Approach to Decision Making, History, Nature and Significance, Features, Definitions. Linear Programming Problem: Introduction, Structure, Assumptions, Advantages, Limitations, General Mathematical Model, Examples.
2	Graphical Method: Introduction, Definitions, Graphical Solution Method of LPP: Examples on Maximization, Minimization, Mixed Constraints, Special Cases in Linear Programming: Alternative Optimal Solutions, Unbounded Solution, Infeasible Solution. Simplex Method: Introduction, Standard form of an LPP, Simplex Algorithm: Maximization, Minimization, Big M Method.
3	Transportation Problem: Introduction, Mathematical Model of Transportation Problem, The Transportation method, Finding initial solution by NWCM, LCM, VAM, Modi Method and its Solution. Variations in TP: Unbalanced Supply and Demand, Degeneracy and Its Resolution, Alternative Optimal Solution, Maximization Transportation Problem.

4	Theory of Games:Introduction, Two-Person Zero- Sum Games, Pure Strategies: Games with saddle point, Rule to determine saddle point. PERT and CPM: Introduction, Basic Differences between PERT and CPM, Significance of using PERT/CPM, Phases of Project Management: Project Planning Phase, Scheduling Phase, Project Control Phase, PERT/CPM Network Components and Precedence Relationships: Rule of AOA Network Construction, Errors and Dummies in Network.

Learning Outcomes:-

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

- To explain the fundamental concept and approach of linear programming.
- To solve these LP problems graphically and using the Simplex Method and translate the solution into courses of action for the user.
- To recognize the importance and value of Operations Research and mathematical modeling in solving practical problems in industry.
- To formulate a managerial decision problem into a mathematical model.
- To understand Operations Research models and apply them to real-life problems.
- To formulate the transportation problem and apply Transportation Simplex to find its optimal solution.

Books Recommended:-

1. 'Operation Research: Theory and Application', **J. K. Sharma**, *Macmillan India Ltd.*
2. 'Operations Research', **V.K.Kapoor**, *S. Chand and Sons, New Delhi*.
3. 'Operations Research', **Nita H. Shah, Ravi M. Gor and Hardik Soni**, *PHI learning*.
4. 'Operation Research', **S. D. Sharma**, *Kedarnath Ramnath & Co.*
5. 'Operation Research', **Kanti Swaroop & Man Mohan**, *Sultan Chand & Co.*
6. 'Operation Research', **A. M. Natarajan, P. Balasubramani, A. Tamilarasi**, *Pearson Education.*

E-Resources:-

1. http://en.wikipedia.org/wiki/Operations_research
2. http://en.wikibooks.org/wiki/Operations_Research
3. http://nptel.ac.in/courses/112106134/
4. http://www.cs.toronto.edu/~stacho/public/IEOR4004-notes1.pdf
5. http://textofvideo.nptel.iitm.ac.in/112106134/lec1.pdf
6. http://www.learnerstv.com/Free-Management-Video-lectures-ltv218-Page1.htm
7. http://nptel.ac.in/courses/110106059/

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FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: VI**

SUBJECT NAME:Mechanics **SUBJECT CODE:4SC06MEE1**

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 objectives of this course are tostudyIngredients of mechanics, Fundamental laws of Newtonian mechanics, equilibrium of systems,principle of virtual work, principle of virtual work, kinematics of a particleand to study theorems related to them.

Prerequisites:-Basic knowledge of Physics and Calculus.

Course outline:-

Sr. No.	Course Contents
1	Ingredients of mechanics, position vector, velocity vector, acceleration vector, gradient vector, Fundamental laws of Newtonian mechanics, the theory of dimensions.
2	Plane statics, equilibrium of a particle, equilibrium of systems of particles, moment of force about a line, necessary and sufficient condition for equilibrium.
3	Couples, work and potential energy, principle of virtual work, application in plane statics, center of mass and center of gravity, gravitational potential.
4	Flexible cables, cable in contact with smooth and rough curve plane Kinematics, kinematics of a particle, motion of a rigid body parallel to a plane.

Learning Outcomes:-

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

- To identify different vectors in Mechanics.
- To explain equilibrium system of particle.
- To apply work, potential energy, principal of virtual work in plane static.
- To explain motion of rigid body.

Books Recommended:-

1. 'Principles of Mechanics', **J.L.Synge and B.A.Griffith**, *McGraw-Hill Book Company.*
2. 'Statics and Dynamics', **P.N.Chaterjee**, *Krishna Publication*.
3. 'A Text Book on Mechanics', **P. N. Sinhal & S. Sareen**, *Anmol Publications Pvt. Ltd., New Delhi.*
4. 'Mechanics', **S. L. Kalani, C. Hemrajani, Shubhara Kalani**, *Viva Books Pvt. Ltd., New Delhi.*

E-Resources:-

1. http://en.wikipedia.org/wiki/Mechanics
2. https://www.coursera.org/course/particles2planets
3. http://www.physics.uoguelph.ca/poisson/research/mech.pdf
4. http://civile.utcb.ro/cmsdc/mechanics.pdf
5. http://www.cmi.ac.in/~souvik/books/mech/Goldstein.pdf

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FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: VI**

SUBJECT NAME: Mathematics Practical-VI **SUBJECT CODE: 4SC06MTP1**

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		
0	0	4	4	2	--	--	--	--	10	10	30	50

Objectives:-To enhance problem solving skill in the courses Real analysis, Ring theory, Topology, Graph theory.

Prerequisites:-Basic Knowledgeof Set theory, Group theory,Metric Space, functions, Calculus.

Course outline:-

Sr. No.	Course Contents
1	Problems based on Sequence, Integral test, P-test, Comparison test, Root test.
2	Problems based on Ratio test, Leibnitz test, Radius of convergence, Absolute convergence.
3	Problems based on Riemann integral.
4	Problems based on Rings, integral domain, Ideals.
5	Problems based on Field, Ring of polynomials.
6	Problems based on Topology.
7	Problems based on Isomorphic Graph, Walk, Path, Circuit, Euler Graph, Hamiltonian graph.
8	Problems based on Trees, Binary trees, Spanning trees, Distance and center, Cut-set.
09	Incidence Matrix, Sub matrices of $A(G)$, Circuit matrix, Cut-set matrix, Path matrix, Adjacency Matrix.
10	Problems based on construction of LPP, Graphical method.
11	Problems based on Simplex method, Transportation problems.