C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: V**

SUBJECT NAME: Complex Analysis **SUBJECT CODE: 4SC05CAC1**

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 objective of this course are to study Analytic function,Cauchy – Riemann Equations, Line Integral, Cauchy's Integral Formula, Conformal Mappingand to study theorems related to them.

Prerequisites:-Basic knowledge of Complex numbers, functions.

Course outline:-

Sr. No.	Course Contents
1	Analytic function: Functions of a complex variable, Theorems on Limit, continuity and derivatives. Cauchy – Riemann Equations, Sufficient conditions, Harmonic Function, Applications of Harmonic Function. Polar form of C-R equation, derivative formula, Analytic function.
2	Definite Integrals, contours, Line Integral, Examples, Cauchy–Goursat theorem, Examples.
3	Cauchy integral formula, Examples, Derivatives of Analytic functions, Examples.
4	Some Important Conformal Mappings:$1) w = z + c, 2)\ w = Bz, 3) w = Bz + C,$ $4) w = \frac{1}{z}$, 5)Mobius Transformation (Bilinear Transformation), $w = e^z, w = \sin z.$

Learning Outcomes:-

After successful completion of this course, the student will be able:

- To define a function of complex variable and carry out basic mathematical operations with complex numbers.
- To understand the condition(s) for a complex variable function to be analytic and/or harmonic.
- To identify the Cauchy Riemann Equation.
- To apply Cauchy Riemann equation to identify analyticity of function.
- To use Cauchy's Integral Formula for evaluation of complex line integrals.
- To explain the concept of transformation in a complex space andsketch associated diagrams.

Books Recommended:-

1. 'Complex Variables and applications'**,R.V. Churchill and J.W. Brown,** *McGraw – Hill Book Company 10th Edition.*
2. 'Functions of one complex variables'**,J.B.Conway**, *Narosa publ. House, New Delhi, 1973.*
3. 'Theory of functions of a Complex variables', **Shantinarayan**, *Chand & Co.*
4. 'Complex variables introduction and application'**,Mark Ablowitz and A.S.Fokas**, *Cambridge University press.*

E-Resources:-

1. http://nptel.ac.in/syllabus/111103070/
2. http://mathworld.wolfram.com/ContourIntegration.html
3. http://mathworld.wolfram.com/ComplexAnalysis.html
4. http://en.wikipedia.org/wiki/Complex_analysis/Holomorphic_functions
5. https://rutherglen.science.mq.edu.au/wchen/lnicafolder/ica10.pdf

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: V**

SUBJECT NAME: Group Theory **SUBJECT CODE: 4SC05GTC1**

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 Groups, Subgroup, Normal Subgroup,Permutations, Cyclic Group, Isomorphism, Homomorphismand to study theorems related to them.

Prerequisites:-Students must be familiar withthe concept of sets, functions, and binaryoperations. Reasonable comfort with the use of symbols to denote sets, elements and operations. An ability to manipulate algebraic expressions based on fixed rules.

Course outline:-

Sr. No.	Course Contents
1	Groups: Introduction, Definitions and Examples, Elementary properties of a Group, Equivalent definitions of a group, Generalized form of Associative law.
2	Subgroups: Definitions and Examples, Lagrange's theorem.Normal Subgroup: Definitions and Examples, Quotient Group
3	Permutations: Definitions and Examples, Transpositions and Cycle.Isomorphism of Groups: Definitions and Examples
4	Cyclic Group: Properties, Isomorphism, Subgroups, Generators.Homomorphism: Definitions and Examples, Kernel, Cayley's Theorem.

Learning Outcomes:-

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

- To understand the axioms for a group.
- To recognize examples of groups.
- To know the definitions of basic terms.
- To familiar with symmetric groups, cyclic groups and dihedral groups.
- To explain the proof, statement and simple uses of Lagrange's Theorem.

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/Group_theory
2. http://dogschool.tripod.com/
3. http://mathworld.wolfram.com/Group.html
4. https://www.youtube.com/watch?v=XTHcTT8YFiw
5. http://people.brandeis.edu/~igusa/Math47aF08/M47F08Note09aa.pdf
6. http://math.kennesaw.edu/~plaval/math4361/permutations

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FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: V**

SUBJECT NAME: Matric Space **SUBJECT CODE: 4SC05MSC1**

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 objective of this course are to study Metric spaces,continuous functions on a Metric space, connected sets, complete metric spaces, Compact metric spaces, uniform continuity and to study theorems related to them.

Prerequisites:-Familiarity with algebraic manipulation of equalities and inequalities, the notation of set theory, proof techniques including induction and contradiction.

Course outline:-

Sr. No.	Course Contents
1	Metric spaces, Limit in metric spaces, continuous functions on a Metric space.
2	Open and closed sets, More about open sets, connected sets.
3	Bounded and totally bounded Sets, complete metric spaces, Compact metric spaces.
4	Continuous functions on compact metric Spaces, continuity of the inverse function, uniform continuity.

Learning Outcomes:-

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

- To identify metric spaces, and know the definitions and important properties of metric spaces.
- To use metric space properties to obtain a variety of results.
- To have some familiarity with continuous functions.

- To use the ideas of metric spaces to other areas of mathematics.

Books Recommended:-

1. 'Mathematical Analysis (second Edition)', **S.C.Malik and Savita Arora**, *New Age International Pvt. Ltd., New Delhi 2000.*
2. 'Introduction to Topology and Modern Analysis', **G . F . Simmons**, *McGraw Hill Education (India) Private Limited.*
3. 'Methods of Real Analysis',**Goldberg, R.R.**, *Oxford and IBH.*
4. 'A first course in mathematical Analysis', **D. Somasundraram B. Chaudhary**, *Narosa publishing house*.
5. 'Mathematical Analysis', **T. M. Apostol**,*Pearson Publisher.*
6. 'A course of Mathematical Analysis', **Shantinarayan**, *S. Chand & Sons.*
7. 'Metric space', **E. T. Capson**,*Cambridge University Press.*
8. 'Metric space', **P. K. Jain & Ahmad**,*Narosa Publishing House.*

E-Resources:-

1. http://en.wikipedia.org/wiki/Metric_space
2. http://www-history.mcs.st-and.ac.uk/~john/MT4522/Lectures/L5.html
3. http://www.math.uiuc.edu/~mjunge/metricmas.pdf
4. https://www.dpmms.cam.ac.uk/~twk/Top.pdf
5. http://en.wikibooks.org/wiki/Topology/Metric_Spaces
6. http://en.wikibooks.org/wiki/Real_Analysis/Metric_Spaces

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FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: V**

SUBJECT NAME:Discrete Mathematics **SUBJECT CODE: 4SC05DMC1**

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 objective of this course are to study Fuzzy Sets,Relations, Lattice, Boolean algebraand to study theorems related to them.

Prerequisites:-Knowledge of basic concepts on Sets, different operations on sets, binary operations, functions.

Course outline:-

Sr. No.	Course Contents
1	Fuzzy Sets:Introduction, Concept of membership, Operations on Fuzzy sets, Properties of Fuzzy subsets, Algebraic product and Algebraic sum of two fuzzy subsets.
2	Relations, Equivalence relations, Equivalence class and Partitions. Partial order relations Partial Order sets (Posets), Hasse diagram. Lattice as posets, properties of lattices.Lattice as algebraic systems. Sub lattice Direct product of two lattices, complete lattice, Distributive lattice.
3	Boolean Algebra: Definition and example of Boolean algebra, Boolean algebra of circuit and switches, Direct product of two Boolean algebra. Homomorphism Atoms of Boolean algebra. Stone's representation theorem.

4	The set A(x) of all the atoms of Boolean algebra, and its properties. Isomorphism of finite Boolean algebra. Boolean functions, Expressions, Min terms, Max terms A expression as sum of product/ product of sum canonical form expression by cube array method.

Learning Outcomes:-

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

- To demonstrate a working knowledge of set notation and elementary set theory.
- To recognize the connection between set operations and logic.
- To determine whether a relation is reflexive, symmetric, or transitive.
- To define a lattice and identify lattices among posets.
- To recognize isomorphic lattices and Boolean algebra.
- To solve problem using the algebraic properties of the elements of a Boolean algebra.

Books Recommended:-

1. 'Discrete mathematical structures with applications to computer science',**Trembley I.P. and Manohar R.**,*McGraw-Hill interamericana.*
2. 'Discrete mathematics',**J.K. Sharma**,*Macmillan Publishers india Limited.*
3. 'Discrete mathematics',**Rosen**,*McGraw Hill Education.*
4. 'HigherEngineering Mathematics-Vol. 1', **K. R. Kachot**, *Mahajan Publication House.*
5. 'Elements of Discrete Mathematics (2nd edition)', **L. Liu**, *Me.GrawHill, International edition.*
6. 'Discrete Mathematics', **Vatsa**, *Vikas Publications.*
7. 'Discrete Mathematics Structure', **Dugragi**, *Narora Pubication.*
8. 'Foundation of Discrete Mathematics', **K. D. Joshi**, *New Age International Ltd. Publishers.*

E-Resources:-

1. http://en.wikipedia.org/wiki/Discrete_mathematics
2. http://mathworld.wolfram.com/DiscreteMathematics.html
3. http://en.wikibooks.org/wiki/Discrete_Mathematics
4. http://www.electronics-tutorials.ws/boolean/bool_7.html
5. http://www.doc.ic.ac.uk/~dfg/hardware/HardwareLecture01.pdf
6. http://www.ee.surrey.ac.uk/Projects/Labview/boolalgebra/

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DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: V**

SUBJECT NAME:Transform Theory **SUBJECT CODE: 4SC05TTE1**

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		
3	0	0	3	3	30	1.5	70	3	--	--	--	100

Objectives:-The objective of this course are to study Fourier series, Fourier Transforms, Laplace Transforms, Z-Transforms and to study theorems related to them.

Prerequisites:-Calculus, Series and Differential equation.

Course outline:-

Sr. No.	Course Contents
1	Fourier Series: Periodic Function, Introduction, Dirichlet's condition, Euler's Formulae, Condition for a Fourier expansion, Functions having points of discontinuity, Change of interval, Odd and even function, Expansions of odd and even periodic functions, Half-Range series.
2	Fourier Transforms: Introduction, Definition, Fourier integrals, Fourier sine and cosine integral, Fourier Transform, Fourier sine and cosine transform, Finite Fourier sine and cosine transform, Properties of Fourier transforms.
3	Laplace Transforms: Introduction, Definition, Condition for existence, Transforms of elementary function, Properties of Laplace transforms, Transforms of periodic functions, Transforms of derivatives, Transform of integrals, Multiplicative by t^n, Division by t, Evaluation of integrals by Laplace transforms, Inverse transforms, Other methods of finding inverse transforms, Application to differential equations.
4	Z-Transforms: Introduction, Definition, Some standard Z-transforms, Linearity property, Damping rule, Some standard results, Shifting u_n to the right and to the left, Multiplication by n, Two basic theorems, Some useful Z-transforms.

Learning Outcomes:-

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

- To find the Fourier series of a function.
- To find Laplace transforms and inverse transforms, and apply these to solve differential equations.
- To calculate the Fourier transform of elementary functions.
- To recognize even and odd functions and use the resulting simplifications for Fourier series and transforms.
- To compute the Z transform of elementary sequences both from the definition and by using tables and use the appropriate theorems to calculate Z transforms.

Books Recommended:-

1. 'Higher Engineering Mathematics', **B. S. Grewal**, *Khanna Publishers.*
2. 'Advanced Engineering Mathematics', **K. R. Kachot**, *Mahajan Publication House.*
3. 'A Textbook of Engineering Mathematics', **N. P. Bali and Manish Goyal**, *Laxmi Publications (P) Ltd.*
4. 'Advanced Engineering Mathematics', **Kreyszig E.**, *New Age International Publishing Co.*

E-Resources:-

1. http://en.wikipedia.org/wiki/Laplace_transform
2. http://mathworld.wolfram.com/LaplaceTransform.html
3. https://www.khanacademy.org/math/differential-equations/laplace-transform
4. http://en.wikipedia.org/wiki/Z-transform
5. http://dea.brunel.ac.uk/cmsp/Home_Saeed_Vaseghi/Chapter04-Z-Transform.pdf
6. http://nptel.ac.in/courses/106106097/pdf/Lecture10_ZTransForm.pd
7. http://mathworld.wolfram.com/FourierSeries.html
8. http://www.sosmath.com/fourier/fourier1/fourier1.html
9. http://tutorial.math.lamar.edu/Classes/DE/FourierSeries.aspx

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FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: V**

SUBJECT NAME: Number TheorySUBJECT CODE: 4SC05NTE1

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 objective of this course are to study Divisibility, Greatest common divisor, Least common multiple, Congruences,Linear indeterminate equations,Number theoretic functions and to study theorems related to them.

Prerequisites:-Classification of numbers, divisibility rules, Greatest common divisor, Least common multiple.

Course outline:-

Sr. No.	Course Contents
1	Divisibility , Fundamental theorem of divisibility, Greatest common divisor, the Euclidean algorithm, Least common multiple, Prime Numbers, Euclid lemma, Factorization in prime numbers, Unique factorization theorem.
2	Perfect numbers, Mersenne numbers, Fermat numbers, multiplicative function, the function$T(a)$, the function $S(a)$, the function$P(a)$, Gauss function $[x]$, Mobius function$\mu(a)$.
3	Congruences, Properties of congruences, Complete residue system(mod m) , Reduced residue system(mod m), Euler's function, Euler's theorem, Fermat's Theorem Congruence in one unknown , Solution of Linear congruence in one unknown and two unknown.
4	Chinese Remainder Theorem, Lagrange theorem, Wilson's theorem, Linear indeterminate equations $ax + by = c$ and its solution, Shang-gao indeterminate equation and its solution, Fibonacci numbers.

Learning Outcomes:-

After successful completion of this course, the student will be able:

- To find the greatest common divisor and least common multiple of a pair of natural numbers, and finding the linear form of the greatest common divisor.
- To stateunique factorization theorem.
- To solve linear Diophantine equations and congruence of various types, and find the use theory of congruence.
- To explain properties of multiplicative functions such as the Euler phi-function.

Books Recommended:-

1. 'Elementary Theory of Numbers', **C. Y. Hsiung**, *Allied Publishers Ltd.-India.*
2. 'Elementary Number Theory', **David M. Burton**, *Universal Book stall, New Delhi.*
3. 'Number Theory', **S. G. Telang**, *Tata Mc Graw-Hill Publishing Company Limited, New Delhi.*
4. 'Beginning Number Theory', **Neville Robbins**, *Narosa Pub. House -New Delhi.*
5. 'A first course in Theory of Numbers', **K. C. Chowdhary**, *Asian Books Pvt Ltd New Delhi.*
6. 'Elementary Number Theory', **Gareth A. Jones & J. Mary Jones**, *Springer Verlag*.

E-Resources:-

1. http://en.wikipedia.org/wiki/Number_theory
2. http://www.math.brown.edu/~jhs/frintch1ch6.pdf
3. http://mathworld.wolfram.com/NumberTheory.html
4. http://www.britannica.com/EBchecked/topic/422325/number-theory
5. http://nrich.maths.org/4352
6. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-fall-2010/video-lectures/lecture-4-number-theory-i/

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: V**

SUBJECT NAME: Mathematics Practical-VSUBJECT CODE: 4SC05MTP1

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 complex analysis, Group theory, Matric Space, Discrete mathematics.

Prerequisites:-Basic Knowledgeof complex number, Set theory,functions, Calculus.

Course outline:-

Sr. No.	Course Contents
1	Problems based on analytic function.
2	Problems based on integral, line integral, Cauchy integral formula.
3	Problems based on Mappings.
4	Problems based on Group, normal group, Lagrange's theorem, Quotient group.
5	Problems based on permutation group, cyclic group, Isomorphism.
6	Problems based on Metric spaces, continuous functions, open closed sets, connected sets.
7	Problems based on fuzzy sets, Relation, Partially order sets, Hasse Diagram.
8	Problems based on Lattice, Direct product of two lattice, complete lattice, distributive lattice.
9	Problems based on Boolean algebra of circuit and switches, atoms, Boolean functions, min terms, max terms.
10	Problems based on Fourier series.
11	Problems based on Laplace transform.