C. U. SHAH UNIVERSITY

C. U. SHAH UNIVERSITY

WADHWAN CITY

FACULTY OF SCIENCES

B.Sc.

SEM - V

Syllabi (CBCS) of Mathematics

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc.   **SEMESTER: V**
SUBJECT NAME: Complex Analysis   **SUBJECT CODE: 4SC05COA1**
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 main 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:-

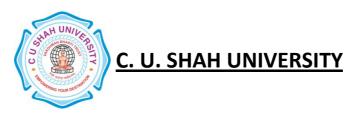| Sr. No.	Course Contents
1	Analytic function: Functions of a complex variable, Theorems on Limit, continuity and derivatives. Cauchy – Riemann Equations, Sufficient conditions, Harmonic Function, Applications of Harmonic Function. Polar form of C-R equation, derivative formula, Analytic function.
2	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

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FACULTY OF SCIENCES

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc. **SEMESTER: V**
SUBJECT NAME: Group Theory **SUBJECT CODE: 4SC05GRT1**
Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							Total Marks
					Theory				Practical			
					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 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:-

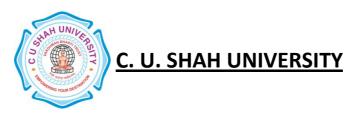| Sr. No.	Course Contents
1	Groups: Introduction, Definitions and Examples, Elementary properties of a Group, Equivalent definitions of a group, Generalized form of Associative law.
2	Subgroups: Definitions and Examples, Lagrange's theorem.Normal Subgroup: Definitions and Examples, Quotient Group
3	Permutations: 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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DEPARTMENT OF MATHEMATICS

COURSE: B.Sc.   **SEMESTER: V**
SUBJECT NAME: Metric Space   **SUBJECT CODE: 4SC05MES1**

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 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', **R.R. Goldberg,** *Oxford and IBH.*
4. 'A first course in mathematical Analysis', **D. Somasundraram and 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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DEPARTMENT OF MATHEMATICS

COURSE: B.Sc.   **SEMESTER: V**
SUBJECT NAME:Real Analysis - ISUBJECT CODE: 4SC05REA1
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 completeness and order completeness in R, , axioms of a complete ordered field absolute values, sequence, Subsequences, Bolzano-Weierstrass theorem, Cauchy's general principle of convergence, Infinite series, Merten's theorem, uniform continuity.

Prerequisites:-Knowledge of calculus.

Course outline:-

Sr. No.	Course Contents
1	Finite and Infinite Sets, Algebraic properties of R, Absolute Value and Real Line, Field structure , order structure, bounded and unbounded sets , Supremum andinfimum, completeness and order completeness in R, Archimedean property of real numbers, axioms of a complete ordered field absolute values, exponential functions , logarithmic functions , generalized power functions.
2	Sequences, bounds of a sequence, convergence of sequences, Limit point of a sequence, Bolzano-Weierstrass theorem, Limit superior and Limit inferior of a sequence, Convergent and divergent sequences, Cauchy's general principle of convergence, Cauchy sequences, Algebra of sequences,Monotonic sequences

3	Infinite series, Definition, A necessary condition for convergence, Cauchy general principle of convergence, some preliminary theorems, Positive term, Subsequences, (includes lim sup and lim inf) Infinite limits, Comparison tests for positive term series, Condensation Test, Pringsheim's Test, Cauchy' root and ratio test, D'Alembert test, Absolute convergence (includes alternating series), ratio and root tests with lim sup and lim inf. Rearrangement of series, Cauchy Product of Series, Merten's theorem, Power Series.
4	Limits, definition and examples, theorems on limits, continuous function: definition and examples, functions continuous on Closed and bounded intervals, Intermediate values, extreme values Uniform continuity, Monotone and Inverse functions.

Learning Outcomes:-

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

- Define supremum and infimum.
- Determine whether or not real series are convergent by comparison with standard series or using the Ratio Test.
- Define Cauchy sequence and prove that specific sequences are Cauchy
- Explain the Bolzano-Weierstrass Theorem.
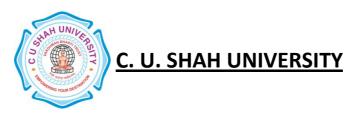- Convergence and divergence of sequences, infinite series.

Books Recommended:-

1. 'Principles of Real Analysis', **S.C.Malik,** *New Age International, New Delhi, 2000.*
2. 'Mathematical analysis', **S.C. Malik and Savita Arora**, *New Age International (p) limited publishers.*
3. 'Fundamentals of Mathematical Analysis', **G.Das,S.Pattanayak,** *Tata Mc GrawHil, 10th Edition*
4. 'An Introduction to Analysis', **Gerald G. Bilodean**, *Jones and Barlett, 2nd Edition.*
5. 'Principles of Real Analysis', **S.C.Malik**, *Revised Edition, New Age International, New Delhi, 2000.*
6. 'Principles of Mathematical analysis', **R.R.Goldberg**,*oxford and IBH (India).*
7. '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. nptel.ac.in/courses/111106053/
3. https://www.khanacademy.org/math/integral-calculus/sequences-series-approx-calc
4. http://math.stackexchange.com/questions/653100/difference-between-continuity-and-uniform-continuity

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DEPARTMENT OF MATHEMATICS

COURSE: B.Sc.   **SEMESTER: V**
SUBJECT NAME:Transform Methods   **SUBJECT CODE: 4SC05TRM1**
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 main objective of this course are to study Fourier series, Fourier Transform, Laplace Transform, Z-Transform 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 transform and inverse transform, 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 transform.

Books Recommended:-

1. 'Higher Engineering Mathematics', **B. S. Grewal**, *Khanna Publishers.*
2. 'A Textbook of Engineering Mathematics', **N. P. Bali and Manish Goyal**, *Laxmi Publications (P) Ltd.*
3. '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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DEPARTMENT OF MATHEMATICS

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

SUBJECT NAME: Number Theory **SUBJECT CODE: 4SC05NUT1**

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.

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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/

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FACULTY OF SCIENCES

DEPARTMENT OF MATHEMATICS

COURSE: B.Sc.   **SEMESTER: V**
SUBJECT NAME: Mathematics Practical-V   **SUBJECT CODE:4SC05MAP1**

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		
0	0	6	6	3	--	--	--	--	20	10	70	100

Objectives:-To learn mathematical software and mathematical documentation.

Prerequisites:-Basic knowledge of computer.

Course outline:-

Sr. No.	Course Contents
1	SCILAB: Introduction, commands, Practical based on operations on Matrices, Gauss Jorden method, Eigen value and Eigen Vectors, Gauss Elimination method, Graph of Circle, Parabola, Ellipse, Hyperbola, Trigonometric Functions, Inverse Trigonometric Functions, Exponential Functions, Logarithmic function.
2	LATEX:Introduction, commands, Drafting a letter, Resume, Mathematics Assignment.

Learning Outcome:-

After successful completion of this course, the student will be able to know how to solve mathematical problem using SCILAB and they able to make document using Latex.

Books Recommended:-

1. 'The Textbook, VolumeA of computers and typesetting', **Donald E. Knuth**, *Addison-Wesley, Reading, Massachusetts, second edition, 1984.*

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2. 'Latex: A document preparation system', **Leslie Lamport,** *Addison-Wesley, Reading, Massachusetts, second edition,1994.*
3. 'Scilab',**H.Ramchandran ,A.S.Nair**, *S.Chand limited*

E-Resources:-

1. http://cm.bell-labs.com/who/hobby/
2. http://www.ursoswald.ch
3. CTAN://info/lshort/german
4. CTAN://help/catalogue.html