Government Degree College (Autonomous), Baramulla

Semester: 4th **Course: Major /Minor**

Title: Real Analysis-I **Course Code: MATC1422M**

Credits: 6(4 Theory +2 Tutorials) **Contact Hours: 64th+ 32 Tu**

Course Objectives:

(i) ***To introduce real number system and properties of real numbers.***

(ii) ***To study sequence and series and their behaviour.***

(iii) ***To study Riemann Integral and integrability of functions.***

Course Outcomes:

After the completion of the paper:

(i) **The students can apply these concepts to understand higher and complex problems**

(ii) **The students shall be able to test the convergence of a sequence and series.**

(iii) **The students shall be able to check Riemann Integrability of various functions and will get prepared for advanced courses.**

Theory credits-4

UNIT-I

Real Numbers, Order Relation, Field and Order structure, Cardinality, Countable and Uncountable sets, Countability of rational numbers and uncountability of real numbers. Triangle Inequality,Bounded and unbounded sets of real numbers, supremum and infimum (lub and glb), Order completeness of R, Dedekind's property, R as ordered field Archimedean property, Incompleteness of the set of rational numbers.

UNIT-II

Sequences of real numbers, Bounds of a sequence, Convergence of sequences,Cauchy Sequences. Limit points of sequences, subsequences, Bolzano-Weirstrass theorem for sequences, limit inferior and limit superior, Theorems on limit and convergence of sequences, Bounded sequences,Bounded monotonic sequences, Cauchy's criterion for convergence of sequences, Nested Interval theorem.

UNIT-III

Infinite Series: Convergence and Divergence of a series, Necessary Condition for Convergence of a series, Cauchy's Criterion for Convergence of a series, Geometric Series, Series of positive terms, Test for convergence: Comparison test, Cauchy's root test,

D'Alembert's ratio test, Raabe's test, Logrithmic test and Integral test, Alternating series and Lebnitz test.

UNIT-IV

Partition of an interval, Lower and Upper Sums, Refinement of a Partition, Behaviour of Lower and Upper Sums under Refinement, Integral as a limit of sum, Definition of Riemann Integral, Necessary and Sufficient Condition for R-Integrability of a Bounded Function, R-Integrability of Sum, Difference, Product and Quotient of Two Functions, R-Integrabilty of Continuous and Monotonic functions, Riemann integral of Discontinuous Functions in an Interval, Mean Value Theorems for Integrals.

Tutorials Credits-2

UNIT-I

Problems related finding supremum and infimum of sets, Neighbourhood of a point, Limit point of a set and problems related to limit points of sets, Bolzano-Weirstrass theorem for sets, Some examples on convergent and non convergent sequences.

UNIT-II

Problems on convergent and non-convergent series, Convergence Tests, Partitioning of intervals, Problems for finding upper and lower integrals,Integrability of Greatest Integer Function, Absolute value Function and signum function.

TEXTBOOKS/ SUGGESTED READINGS:

1. S. C. Malik, Real Analysis, New Age International
2. T. M. Apostol, Mathematical Analysis, Narosa Publications.
3. S. C. Malik, Mathematical Analysis, New Age International.
4. R. Goldberg, Methods of Real Analysis, Oxford IBM Publication, 1970.
5. W. Rudin, Real and Complex Analysis, McGraw Hill.

Government Degree College (Autonomous), Baramulla

Semester: 4th **Course: Major**

Title: Geometry **Course Code: MATC2422M**

Credits: 6(4 Theory +2 Tutorials) **Contact Hours: 64th+ 32 Tu**

Course Objectives:

The aim of this course is:

(i) ***To elucidate the conic sections and its ramifications viz circle, ellipse, parabola and hyperbola.***

(ii) ***To study three dimensional structures viz cylinder,cone and sphere.***

Course Outcomes:

After the completion of this course,

(i) ***The students will fathom the utility of plane and solid geometrical objects and will get aquatinted with their properties.***

(ii) ***The students will also explore the conditions of tangency and normalcy of above mentioned geometrical structures.***

Theory Credits-4

Unit-I

Parabola, Latus Ractum, Focal Chord, Focal distance, length of the intercept, tangents and normals, pole and polar, condition of tangency ,pair of tangents from a point, normals to the parabola, equation of a chord of a parabola in terms of its middle point, parametric equations of a parabola.

Unit-II

Ellipse, tangents and normal, pole and polar, parametric equations of ellipse, Diameters, conjugate diameters and their properties, General second degree equation in x & y: conditions under which a general second degree equation represents a conic.

Unit-III

Hyperbola,Eccentricity,Foci,directrix,latusrectum, length of intercept, tangents and normal, equation of tangents and normal, equation of hyperbola referred to asymptotes as axes, rectangular and conjugate diameters and their properties.

Unit-IV

Cone, vertex, guiding curve, generator, equation of cone with vertex as origin or a given vertex and guiding curve, Condition that the general equation of the second degree should represent a cone, Necessary and sufficient conditions for a cone to have three mutually perpendicular generators.

Tutorials Credits-2

Unit-I

Plane: equation of plane in intercept form, normal form, reduction of general form to normal form, equation of plane through three points, angle between two planes, perpendicular distance of a point from a plane, plane through the intersection of two planes.

Unit-II

Sphere, Radical plane,coaxial system,simplified form of the equation of two spheres, Cylinder,Equation of the cylinder whose generators intersect a given conic and are parallel to given line, Enveloping cylinder of a sphere.

TEXTBOOKS/ SUGGESTED READINGS:

1. P. Balasubrahamanyam, K.G. Subramanian and G.R.Venkataraman, Coordinate Geometry of two and three Dimensions.
2. S.Pirzada and T.A.Chishti, Analytical Solid Geometry, Universities Press, Orient Blackswan, 2007.
3. Shanti Narayan, Analytical Solid Geometry.
4. M. R. Puri, Co-ordinate Geometry of the Conics, New Academic Publishers, Jammu.
5. R. J. T. Bell, A Text Book of Solid Geometry.

Government Degree College (Autonomous), Baramulla

Semester: 4th **Course: Major**

Title: Theory of Numbers **Course Code: MATC3422M**

Credits: 6(4 Theory +2 Tutorials) **Contact Hours: 64th+ 32 Tu**

Course Objectives:

The aim of this course is:

- **(i)** ***To build up the basic theory of the integers, prime numbers and their primitive roots, the theory of congruence, number theoretic functions, Fermat's last theorem,***
- **(ii)** ***To acquire knowledge in cryptography especially in RSA encryption and decryption.***
- **(iii)** ***To get expertise in solving cubic and biquadratic equations.***

Course Outcomes:

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

- ***(i)*** ***To know the basic definitions and theorems in number theory.***
- ***(ii)*** ***to solve congruences, linear diaphatine equations, primitive roots, Euler's criterion.***
- ***(iii)*** ***To understand modular arithmetic number-theoretic functions and apply them to cryptography.***

Theory credits-4

UNIT-I

Divisibility of integers, prime numbers, Fundamental theorem of arithmetic, Euclid's division algorithm, Euclid's first theorem, Linear Diophantine equations. Necessary and sufficient condition for solvability of linear Diophantine equations.

UNIT-II

Euclid's Second theorem,Fermat Numbers and their properties.Complete Residue System (*CRS*), Reduced Residue System (*RRS*) and their properties.Fermat and Euler's theorems, Number theoretic functions, Euler's ϕ-function, $\phi(m.\ n) = \phi(m)\ \phi(n)$ where $(m,\ n) = 1$, $\Sigma\ \phi(d) = n$, $\phi(m) = m\ \Pi\left(1 - \frac{1}{p}\right)$ for $m > 1$.

UNIT-III

Chinese Remainder theorem.Order of an integer modulo *n,* Primitive roots for primes, composite numbers having primitive roots, Euler's criterion, The Legendre symbol, law of reciprocity and its applications, Fermat's Last Theorem (statements only).

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UNIT-IV

Theory of polynomial equations, Remainder theorem and factor theorem,Solution of cubic and biquadratic polynomial equations, Problems on symmetric functions, Carden's method for solving cubic polynomials, and Descartes's rule of signs.

Tutorials Credits-2

Unit-I

Golbach Conjecture.GCD and LCM of integers and their properties.Linear congruence, solution and applications of linear congruences. Applications of Fermat's and Euler's theorems. Application of Chinese Remainder theorem.

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UNIT-II

Complex roots of a polynomial and their properties.Fundamental theorem of algebra (Statement only). Synthetic division, Relation between roots and coefficients, Examples on Cardan's Method and Descartes's rule of signs.

TEXTBOOKS/ SUGGESTED READINGS:

1. Aziz and Nisar, Theory of Equations, Kapoor and Son's, Srinagar.
2. W.J. Leveque, Topicsin Number Theory, Vol(I&II) Addition Wesley Publishing Company, INC.
3. Niven and H. S. Zuckerman,An Introduction of the Theory of Numbers.
4. Boevich and Shaferivich, Number Theory, I.R, Academic Press.

REFERENCE:

1. T. M. Apostal, Analytic Number Theory, Springer Verlag.
2. G.H Hardy and Wright, An Introduction to the theory of Numbers.
3. E. Landau, An Elementary Number Theory.
4. Thomas Koshy, Elementary Number Theory with Applications (2nd Edition), Academic Press, 2007.
5. Theory of Equations, C.C .Mac Duffee, John Wiley and Sons Inc., 1954.