RANI DURGAVATI UNIVERSITY, JABALPUR

SYLLABUS OF M.A./M.Sc. MATHEMATICS SEMESTER SYSTEM
Semester-I (Session 2012-13 and onwards)
Syllabus opted by the board of studies in Mathematics, R. D. University
in the meeting held on 08-06-2012.

Session	Course	Title of papers	Max. Marks Theory/CCE	Mini. Passing Marks Theory/CCE	Total Marks
First	Paper-I	Advanced Abstract Algebra-I	35/15	12/05	300
	Paper-II	Complex Analysis-I	35/15	12/05	
	Paper-III	Functional Analysis	35/15	12/05	
	Paper-IV	Real Analysis	35/15	12/05	
	Paper-V	Topology	35/15	12/05	
		Two Seminars and Attendance	50 = 40+10		

Note:
- The Seminar is conducted by a board of at least two examiners. In two seminars 40 marks is allocated. Each seminar is of 20 marks.
- In attendance 10 marks is allocated as per ordinance No. 79 of R.D. University Jabalpur.
- The students, whose attendance is less as per ordinance No. 79 of R.D. University Jabalpur, will not allow to appear in the examination at the close of semester and he/she would be declared having failed in that semester.

Max. Marks: 35
Min. Pass. Marks: 12

Unit-I: Another Counting Principle, Conjugacy relation, Normalizer, Class Equation, Cauchy theorem, Sylow's theorems, Double coset, Second & Third part of Sylow's theorem, Application of Sylow's theorems in finite groups.

Unit-II: Series of Groups: Normal and Subnormal series, Composition series, Zassenhaus lemma, Schreir refinement theorem, Jordan Holder theorem.

Unit-III: Solvable Groups, Commutator subgroup and Nilpotent Groups.

Unit-IV: Fields: Extension field, Finite extension, Algebraic element, Algebraic and transcendental extension, Roots of polynomials, Splitting field.

Unit-V: More about roots: Derivative of a polynomial, Simple extension, Primitive element, Separable and inseparable extension, Perfect field, Finite field.

Text Books:

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975. (For Units I, III, IV, and V)
2. Vivek Sahai & Vikas Bist, Algebra, Narosa Publishing House, 1999 (For Unit-II).

Reference Books:

1. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra (2nd Ed.), Cambridge University Press, Indian Edition, 1997.
2. I.S. Luther and I.B.S. Passi, Algebra, Vol. I - Groups, Narosa Publishing House, 1996.
3. Surjeet Singh and Quazi Zameeruddin, Modern Algebra, Vikas Publishing House Pvt. Ltd., 1990.
4. N. Jacobson, Basic Algebra, Vols. I & II, Hindustan Publishing Company, 1980.
5. S. Lang, Algebra, 3rd Edition, Addison-Wesley, 1993.

Max. Marks: 35
Min. Pass. Marks: 12

Unit-I: Complex integration, Cauchy -Goursat theorem, Cauchy integral formula, Higher order derivatives.

Unit-II: Morera's theorem, Cauchy's inequality, Liouville's theorem, The fundamental theorem of algebra, Taylor's theorem.

Unit-III: The maximum modulus principle, Schwartz lemma, Laurent series, Isolated singularities, Meromorphic functions, The argument principle, Rouche's throrem. Inverse function theorem.

Unit-IV: Residues, Cauchy's residue theorem, Evaluation of integrals, Branches of many valued functions with special reference to argz, log z, z^a.

Unit-V: Bilinear transformations, their properties and classification, Defiinitions and examples of conformal mappings.

Text Book:

J.B. Convey, Functions of one complex variable, Springer- Verlag, 1980.

Reference Books:

1. S. Ponnuswamy, Foundations of complex analysis, Narosa Publishing House, 1997.
2. L.V. Ahlfors, Complex Analysis, McGraw Hill, 1979.

Max. Marks: 35
Min. Pass. Marks: 12

Unit-I: Convergence, Completeness and Baire's Theorem, Cantors intersection Theorem, Continuous mappings, Uniformly continuous mapping, Spaces of continuous functions.

Unit-II: Euclidean and Unitary spaces, Cauchy, Minkowski and Holders inequalities, Normed linear spaces, Examples and elementary properties, Equivalence of norms, Banach space and examples, Continuous linear transformations.

Unit-III: Functionals and their extensions, related Lemma, Hahn-Banach Theorem for normed linear spaces, Conjugates of normed linear spaces, The natural embedding of normed linear space in its second conjugate space, Reflexive Banach spaces, open mapping theorem, Closed graph theorem.

Unit-IV: Conjugate of an operator, Uniform boundedness principle and its applications, Inner product spaces and their elementary properties, Parallelogram law, Schwartz inequality and polarization identity, Hilbert Space and examples. **o**rthogonal complements in Hilbert spaces.

Unit-V: Orthonormal sets, Bessel's inequality, Gram Schmidt orthonormalization process, Conjugate Space of Hilbert Space, Riesz representation theorem. Adjoint of an operator, Properties.

Text Book:

G.F. Simmons,Topology and Modem Analysis, McGraw Hill International Edition, 1963.

Reference Books:

1. E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley & Sons, New York, 1978.

2. R.E. Edwards, Functional Analysis, Dover Publ., New York, 1995.P.K. Jain, O.P. Ahuja and Khalil Ahmed, Functional Analysis, New Age International (P) Ltd. Publ.

Max. Marks: 35
Min. Pass. Marks: 12

Unit-I: Definition and existence of Riemann-Stieltjes integral and its Properties, Integration and differentiation, The fundamental theorem of Calculus.

Unit-II: Integration of vector-valued functions, Rectifiable curves. Rearrangements of terms of a series. Riemann's theorem.

Unit-III: Sequences and series of functions, pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, Abel's and Dirichlet's tests for uniform convergence, uniform convergence and continuity, uniform convergence and Riemann-Stieltjes integration, uniform convergence and differentiation, Weierstrass approximation theorem, Power series, uniqueness theorem for power series, Abel's and Tauber's theorems.

Unit-IV: Functions of several variables, linear transformations, Derivatives in an open subset of R^n, Chain rule, Partial derivatives, interchange of the order of differentiation, Derivatives of higher orders, Taylor's theorem, Inverse function theorem.

Unit-V: Implicit function theorem, Jacobians, extremum problems with constraints, Lagrange's multiplier method, Differentiation of integrals, Partitions of unity, Differential forms, Stoke's theorem.

Text Book:

Water Rudin, Principles of Mathematical Analysis, McGraw Hill, 1978.

Reference Books:

1. T.M. Apostal, Mathematical Analysis, Narosa.

2. H.L. Royden, Real Analysis, Macmillan (Indian Edition).

M.A./M.Sc. (Mathematics) First Semester
Paper V: TOPOLOGY

Max. Marks: 35
Min. Pass. Marks: 12

Unit-I: Definition and examples of topological spaces, Basis for a topology, Standard topology, lower limit topology, The order topology, The product topology on $X \times Y$. Projections, The Subspace topology, Closed sets and limit points, Closure and interior of a set, Hausdorff spaces.

Unit-II: Continuous functions, Equivalence with ε-δ condition, Examples of continuous functions, the alternative conditions of Continuity, Homeomorphisms, topological property, topological Imbedding, Examples of Homeomorphisms, Rules for Constructing continuous functions, The Pasting lemma, Maps into products, The product topology, Box topology, Projection mapping, comparison of the product topology and the box topology.

Unit-III: The Metric topology, Metrizable space, Standard bounded metric, The spaces $\mathbf{R^n}$ **and** $\mathbf{R^w}$, Euclidean metric, square metric, Metrizability of $\mathbf{R^n}$ **and** $\mathbf{R^w}$, Uniform metric, The sequence lemma, Uniform limit theorem.

Unit-IV: Connected space, Separation, Definition and examples, Cartesian product of connected spaces, Connected sets in the real line, Linear continuum, Intermediate value theorem, Path connectedness, Definition and examples, Dictionary order topology on $I \times I$, Comb space and deleted comb space, Topologist's sine curve.

Unit-V: Compact spaces, Finite product of compact spaces, The Tube Lemma, Finite intersection condition, compact sets in the real line, Maximum and minimum value theorem, Limit point compactness, The Lebesgue number Lemma, Second countable and first countable spaces, Separation Axioms (T_1, T_2, T_3 spaces).

Text Book:
James R. Munkres, Topology: A First Course, Prentice Hall or India, 1988.

Reference Books:

1. G.F. Simmons, Topology and Modern Analysis, McGraw Hill International Edition, New York, 1963.

2. J. Dugundji, Topology, Prentice Hall of India, 1975.

3. K.D. Joshi, Introduction to General Topology, Wiley Eastern Ltd., 1983.