GONDWANA UNIVERSITY
GADCHIROLI

Proposed Syllabus For

M.Sc. Mathematics

Semester-I and Semester-II

Under Choice Based Credit System

(C.B.C.S.)

With effect from

Academic Year: 2016-17

(Considered and approved in B.O.S.)

M.Sc. Mathematics

Semester wise Syllabus

M.Sc. Semester- I

PSCMTHT01 : Algebra-I
PSCMTHT02 : Real Analysis-I
PSCMTHT03 : Topology-I
PSCMTHT04 : Linear Algebra and Differential Equations
PSCMTHT05 : Numerical Analysis

M.Sc. Semester- II

PSCMTHT06 : Algebra-II
PSCMTHT07 : Real Analysis-II
PSCMTHT08 : Topology-II
PSCMTHT09 : Classical Mechanics
PSCMTHT10 : Differential Geometry

Semester I for M.Sc. Program in Mathematics												
Core	Theory / Practical	Teaching scheme (Hours/ Week)		Credits			Examination Scheme					
							Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Total	Theory	Seminar	Total		External Marks	Internal Asst.		Th. External	Internal Ass.
PSCMTHT01	Paper 1	5	5	4	1	5	3	100	25	125	50	
PSCMTHT02	Paper 2	5	5	4	1	5	3	100	25	125	50	
PSCMTHT03	Paper 3	5	5	4	1	5	3	100	25	125	50	
PSCMTHT04	Paper 4	5	5	4	1	5	3	100	25	125	50	
PSCMTHT05	Paper 5	5	5	4	1	5	3	100	25	125	50	
	TOTAL	25	25	20	5	25		500	125	625	250	

Semester II for M.Sc. Program in Mathematics												
Core	Theory / Practical	Teaching scheme (Hours/ Week)		Credits			Examination Scheme					
							Duration in hrs.	Max. Marks		Total Marks	Minimum Passing Marks	
		Th	Total	Theory	Seminar	Total		External Marks	Internal Asst.		Th. External	Internal Ass.
PSCMTHT06	Paper 6	5	5	4	1	5	3	100	25	125	50	
PSCMTHT07	Paper 7	5	5	4	1	5	3	100	25	125	50	
PSCMTHT08	Paper 8	5	5	4	1	5	3	100	25	125	50	
PSCMTHT09	Paper 9	5	5	4	1	5	3	100	25	125	50	
PSCMTHT10	Paper 10	5	5	4	1	5	3	100	25	125	50	
	TOTAL	25	25	20	5	25		500	125	625	250	

DISTRIBUTION OF MARKS FOR INTERNAL ASSESSMENT

Sr. No.	Activities	Max. Marks
1	**Attendance**	**05(Compulsory)**
	Any Two of the Following Activities	
1	**Seminar**	**10**
2	**Unit Tests**	**10**
3	**Home Assignments**	**10**

Total Marks -25
Minimum Passing Marks -07

University Question Paper Patteren

A student of M. Sc. Sem I and Sem II in Mathematics has to attempt all five questions in each paper.
Q1 to Q4 are long answer questions with internal choice within unit whereas Q5 is compulsory question of short answers on all four units.
Setting of the question paper as under.

Total Marks: 100 **Time 3 hours**

Q1 (A) Unit I (10 marks)
(B) Unit I (10marks)
OR
Q1 (C) Unit I (10 marks)
(D) Unit I (10marks)
Q2 (A) Unit II (10marks)
(B) Unit II (10 marks)
OR
Q2 (C) Unit II (10marks)
(D) Unit II (10marks)
Q3 (A) Unit III (10marks)
(B) Unit III (10marks)
OR
Q3 (C) Unit III (10 marks)
(D) Unit III (10 marks)

Q4 (A) Unit IV (10 marks)
(B) Unit IV (10 marks)
OR
Q4 (C) Unit IV (10 marks)
(D) Unit IV (10 marks)

Q5 Attempt All. **(20 marks)**

(a) Unit I

(b) Unit II

(c) Unit III

(d) Unit IV

SEMESTER-I

Core Code :- PSCMTHT01 Credit - 05

Algebra-I

UNIT-I

Permutation Group. Group of Symmetry. Dihedral group. Commutator group. Isomorphism Theorems. Automorphisms. Characteristic subgroup. Conjugacy and G- Sets.

UNIT-II

Normal Series. Solvable groups. Nilpotent groups. Cyclic decomposition of permutation group. Alternating groups. Simplicity of An.

UNIT-III

Direct product, semi-direct product of groups. Sylows theorems. Groups of order 2 p and pq.

UNIT-IV

Ideals and Homomorphisms. Sum and direct sum of ideals. Maximal and prime ideals. Nilpotent and Nil ideals. Modules. Submodules. Direct sums. R-homomorphisms and quotient modules. Completely reducible modules. Free modules.

Text Book:

Basic Abstract Algebra :Bhattacharya, Jain, and Nagpal ,Second Edition, Cambridge University Press.

Reference Books :

1. Topics in Algebra, I. N. Herstein, Second Edition, John Wiley.
2. Abstract Algebra: David S.Dummit and Richard M. Foote, John Wiley**.**

Core Code :- PSCMTHT02 Credit - 05

Real Analysis-I

UNIT-I

Uniform convergence. Uniform convergence and continuity. Uniform convergence and integration. Uniform convergence and differentiation. Equicontinuous families of functions. TheStone- Weierstrass theorem.

UNIT-II

Differentiation. The Contraction Principle. The Inverse Function Theorem. The Implicit Function Theorem. The Rank Theorem. Partitions of unity.

UNIT-III

The space of tangent vectors at a point of Rn. Another definition of Ta(Rn). Vector fields on open subsets of Rn.Topological manifolds. Differentiable manifolds. Real Projective space. Grassman manifolds. Differentiable functions and mappings

UNIT-IV

Rank of a mapping. Immersion. Sub manifolds. Lie groups. Examples of Lie groups.

Text Books :

1.Principles of Mathematical Analysis (Third Edition) : Walter Rudin
Mc GRAW – HILL Book Company.
2.An Introduction to Differentiable Manifolds and Riemannian Geometry : W. Boothby, Academic Press,1975.

Reference Books :

1.Methods of Real Analysis: R.R. Goldberg , John Wiley..
2.Calculus of Several Variables: C Goffman , Harper and Row.

Core Code - PSCMTHT03 **Credit- 05**

Topology-I

UNIT-I

Countable and Uncountable sets. Examples and related Theorems. Cardinal Numbers and related Theorems. Topological Spaces and Examples.

UNIT-II

Open sets and limit points. Derived Sets. Closed sets and closure operators. Interior, Exterior and boundary operators. Neighbourhoods, bases and relative topologies.

UNIT-III

Connected sets and components. Compact and countably compact spaces. Continuous functions, and homeomorphisms.

UNIT-IV

To- and T_1- spaces, T_2- spaces and sequences. Axioms of countability. Separability. Regular and normal spaces.

Text Book:

Foundations of General Topology: W.J. Pervin, Academic press, 1964.

Reference Books:

1.Topology: J.R. Munkres, (second edition), Prentice Hall of India, 2002.
2. Introduction to Topology and Modern Analysis: G.F. Simmons, Mc Graw Hill 1963.
3. General Topology: J.L. Kelley, Van Nostrand, 1995.
4. Introduction to general Topology: K.D.Joshi, Wiley Eastern Ltd.1983.

Core Code - PSCMTHT04 Credit - 05

Linear Algebra and Differential Equations

UNIT-I

Matrices and operators, Subspaces, Bases and Dimension. Determinants, trace, and Rank. Direct sum decomposition. Real Eigen Values. Differential equations with Real Distinct Eigen values. Complex Eigen values.

UNIT-II

Complex vector spaces. Real operators with Complex Eigen values. Application of complex linear algebra to differential equations. Review of topology in Rn. New norms for old, Exponential of operators.

UNIT-III

Homogeneous linear systems. A non-homogeneous equation. Higher order systems. The primary decomposition. The S+N decomposition. Nilpotent canonical forms.

UNIT-IV

Jordan and real canonical forms. Canonical forms and differential equations. Higher order linear equations on function spaces. Sinks and sources. Hyperbolic flows. Generic properties of operators. Significance of genericity.

Text Book :

Differential equations, dynamical systems and linear algebra: M.W. Hirsch and S. Smale, Academic press 1975

Reference Book :

Dynamical systems: V.I. Arnold, Springer Verlag, 1992.

Core Code -PSCMTHT05 **Credit - 05**

Numerical Analysis

UNIT-I

Simple enclosure methods, Secant method, Newton's method, general theory for one point iteration methods. Aitken extrapolation for linearly convergent sequences, Error tests, Numerical evaluation of multiple roots, roots of polynomials, Mullers method, Non-linear systems of equations, Newton's method for non- linear systems.

UNIT-II

Polynomial interpolation theory, Newton's divided differences, finite difference and table oriented interpolation formulas. Forward-differences. Hermite interpolation.

UNIT-III

The Weierstrass theorem and Taylor's theorem. The minimax approximation problem, the least square approximation problem, orthogonal polynomial, economisation of Taylor series, minimax approximation.

UNIT-IV

The trapezoidal rule and Simpson's rule, Newton- Cotes integration formulas.

Text book:

An Introduction to Numerical Analysis : Kendal E. Atkinson, Johan Wiley and sons, Inc.

Semester-II

Core Code - PSCMTHT06 **Credit - 05**

Algebra-II

UNIT-I

Unique factorization domains. Principal Ideal domains. Euclidean domains. Polynomial rings over unique factorization domains.

UNIT-II

Irreducible polynomials and Eisenstein criterion. Adjunction of roots. Algebraic extensions. Algebraically closed fields. Splitting fields. Normal extensions. Multiple roots.

UNIT-III

Finite fields. Separable extensions. Automorphism groups, and fixed fields. Fundamental theorem of Galois theory. Fundamental theorem of algebra.

UNIT-IV

Roots of unity and Cyclotomic polynomials. Cyclic extensions. Polynomials solvable by radicals. Ruler and compass constructions.

Text Book :

Basic Abstract Algebra: Bhattacharya, Jain, Nagpaul; Second Edition, Cambridge University Press.

Reference Books :

1. Topics in Algebra, I. N. Herstein, Second Edition, John Wiley.
2. Abstract Algebra, David S.Dummit and Richard M.Foote, John Wiley.

Core Code - PSCMTHT07 **Credit - 05**

Real Analysis-II

UNIT-I

Outer measure.Measurable sets and Lebesgue measure. Anon-measurable set, Measurable functions, Littlewood's three principles.

UNIT-II

The Riemann integral. Lebesgue integral of a bounded function over a set of finite measure. Integral of a non-negative function.General Lebesgue integral.Convergence in measure. Differentiation of monotone functions. Functions of bounded variation. Differentiation of an integral.

UNIT-III

Absolute continuity.Convex functions. Lp-spaces. Holder and Minkowski inequality. Riesz-Fischer theorem. Approximation in Lp. Bounded linear functionals on Lp-spaces.

UNIT-IV

Compact metric spaces. Baire category theorem. Arzela Ascoli theorem. Locally compact spaces. Sigma compact spaces.

Text Book :

Real Analysis, H.L. Royden, Third edition, Prentice Hall, 1988.

Reference Books :

1. Measure theory and Integration, G. de Barra Wiley Eastern Limited, 1981.
2. An introduction to Measure & Integration, Inder K. Rana, Narosa Publishing House

Core Code -PSCMTHT08 **Credit- 05**

Topology-II

UNIT-I

Urysohn's lemma. Tietze extension theorem. Completely regular spaces.Completely normal spaces. Compactness for metric spaces. Properties of metric spaces.

UNIT-II

Quotient topology. Nets and filters.

UNIT-III

Product topology : Finite products, product invariant properties, metric products, Tichonov topology, Tichonov theorem.

UNIT-IV

Locally finite topological spaces. Paracompact spaces, Urysohn's metrization theorem.

Text books:

1. Foundations of General Topology: W.J. Pervin, Academic press, 1964.
2. Introduction to general Topology: K.D. Joshi, Wiley Eastern Ltd. 1983.

Reference books:

1. Topology: J.R.. Munkres, second edition, Prentice Hall of India, 2002.
2. Introductio n to topology and modern analysis :G.F. Simmons, Mc Graw Hill 1963.
3. General Topology: J.L. Kelley, Van Nostrand, 1995.

Core Code -PSCMTHT09 **Credit - 05**

Classical Mechanics

UNIT-I

Variational Principle and Lagrange's equations; Hamilton's Principle, some techniques of calculus of variations, Derivation of Lagrange equations from Hamilton's principle. Extension of principle to nonholonomic systems. Conservation theorems and symmetry properties.

UNIT-II

Legendre transformations and the Hamilton equations of motion. Cyclic coordinates and conservation theorems. Routh's procedure and oscillations about steady motion, The Hamiltonian formulation of relativistic mechanics, The Principle of least action.

UNIT-III

The equations of canonical transformation. Examples of canonical transformation. The symplectic approach to canonical transformations. Poisson brackets and other canonical invariants.

UNIT-IV

Equations of motion. Infinitesimal canonical transformations and conservation theorems in the Poisson bracket formulation, the angular momentum, Poisson bracket relations, symmetry groups of mechanical systems. Liouville's theorem.

Text Book :

Classical Mechanics: By H. Goldstein, Second Edition Narosa publishing house, New Delhi.

Reference Books:

1.Lectures in Analytic Mechanics: F. Gantmacher, MIR Publishers, Moscow, 1975.

2.Classical Mechanics: Narayan Chandra Rana and Pramod Sharad Chandra Jog, Tata Mc Graw Hill.

Core Code -PSCMTHT10 **Credit - 05**

Differential Geometry

UNIT-I

Definition of surface. Curves on a surface. Surfaces of revolution. Helicoids. Metric. Direction coefficients. Families of curves. Isometric correspondence. Intrinsic properties. Geodesics. Canonical geodesic equations.

UNIT-II

Normal property of geodesics. Existence theorems. Geodesic parallels.Geodesic curvature. Gauss Bonnet theorem. Gaussian curvature. Surfaces of constant curvature. Conformal mapping. Geodesic mapping.

UNIT-III

Second fundamental form. Principal curvatures. Lines of curvature. Developables. Developables associated with space curves. Developables associated with curves on surfaces. Minimal surfaces and ruled surfaces. Fundamental equations of Surface theory. Parallel surfaces.

UNIT-IV

Compact surfaces whose points are umbilics. Hilbert's lemma. Compact surfaces of constant
Gaussian or mean curvature. Complete surfaces. Characterisation of complete surfaces. Hilbert's theorem. Conjugate points on geodesics. Intrinsically defined surfaces. Triangulation. Two dimensional Riemannian manifolds. Problem of metrization. Problem of continuation.

Text Book:
An introduction to Differential Geometry: T.J. Wilmore; Oxford University Press

Reference Book:
Geometry of curves and surfaces: do Carmo, Academic Press.

Scheme of teaching and examination under semester patter Choice Based Credit System (CBCS) for M.Sc. Program in Mathematics.