

BHAVNAGAR UNIVERSITY

BHAVNAGAR

(NACC Accreditation Grade “B”)

CREDIT AND SEMESTER SYSTEM

SYLLABUS

MASTER OF SCIENCE (M.Sc.)

MATHEMATICS

(In Force From Academic Year: 2010-2011)

तमसो मा ज्योतिर्गमय

BHAVNAGAR UNIVERSITY
Master of Science in Mathematics

M.Sc. (Mathematics)

Credit and semester system syllabus in force from june 2010

Semester-I						
PAPER NO	NAME OF THE PAPER	TOTAL MARKS EXT + INT = TOTAL	PASSING STANDARD EXT + INT = TOTAL	TOTAL TEACHING HOURS	EXAM HOURS	CREDITS
1	Real Analysis	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05
2	Topology-I	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05
3	Differential Equations	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05
4	Number Theory	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05

<u>* INTERNAL</u>	<u>MARKS</u>
ASSIGNMENT	05
SEMINAR	05
TEST	20

Semester-II						
PAPER NO	NAME OF THE PAPER	TOTAL MARKS EXT + INT = TOTAL	PASSING STANDARD EXT + INT = TOTAL	TOTAL TEACHING HOURS	EXAM HOURS	CREDITS
5	Complex Analysis	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05
6	Topology-II	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05
7	Algebra-I	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05
8	Classical Mechanics	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05

<u>* INTERNAL</u>	<u>MARKS</u>
ASSIGNMENT	05
SEMINAR	05
TEST	20

BHAVNAGAR UNIVERSITY
Master of Science in Mathematics
M.Sc. (Mathematics)

Credit and semester system syllabus in force from june 2011

Semester-III						
PAPER NO	NAME OF THE PAPER	TOTAL MARKS EXT + INT = TOTAL	PASSING STANDARD EXT + INT = TOTAL	TOTAL TEACHING HOURS	EXAM HOURS	CREDITS
9	Functional Analysis-I	$70 + 30 = 100$	$28 + 12 = 40$	15 Weeks x 05 Hours = 75	3	05
10	Relativity-I	$70 + 30 = 100$	$28 + 12 = 40$	15 Weeks x 05 Hours = 75	3	05
11	Combinatorial Analysis-I	$70 + 30 = 100$	$28 + 12 = 40$	15 Weeks x 05 Hours = 75	3	05
12	Analytic Number Theory-I	$70 + 30 = 100$	$28 + 12 = 40$	15 Weeks x 05 Hours = 75	3	05

* <u>INTERNAL</u>	<u>MARKS</u>
ASSIGNMENT	05
SEMINAR	05
TEST	20

BHAVNAGAR UNIVERSITY
Master of Science in Mathematics

M.Sc. (Mathematics)

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Semester-IV (Group A) ⊗						
PAPER NO	NAME OF THE PAPER	TOTAL MARKS EXT + INT = TOTAL	PASSING STANDARD EXT + INT = TOTAL	TOTAL TEACHING HOURS	EXAM HOURS	CREDITS
13	Functional Analysis-II	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05
14	Algebra- II	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05
15	Combinatorial Analysis-II	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05
16	Analytic Number Theory-II	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05

Semester-IV (Group B) ⊗						
PAPER NO	NAME OF THE PAPER	TOTAL MARKS EXT + INT = TOTAL	PASSING STANDARD EXT + INT = TOTAL	TOTAL TEACHING HOURS	EXAM HOURS	CREDITS
13	Relativity-II	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05
14	Programming with C	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05
15	Computer Graphics and Multimedia	70 + 30 = 100	28 + 12 = 40	15 Weeks x 05 Hours = 75	3	05
16	Practical	100 + 00 = 100	40 + 00 = 40	15 Weeks x 05 Hours = 75	3	05

⊗ The student can select either any one Group from A & B Group papers.

<u>* INTERNAL</u>	<u>MARKS</u>
ASSIGNMENT	05
SEMINAR	05
TEST	20

BHAVNAGAR UNIVERSITY
Master of Science in Mathematics
M.Sc. (Mathematics)

M.Sc. (I.T.) Semester-I

Paper No.: 1

Title of the Paper: **Real Analysis**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Algebra of sets and σ -algebra of sets, Smallest algebra of sets and σ -algebra of sets generated by a given collection of subsets, Borel sets, Concept of measure, Outer measure, Outer measure of an interval and outer measure of a set, Measurable sets and Lebesgue measure, σ -algebra of measurable sets, Properties of outer measure and measure, Nonmeasurable sets.	15	14
Unit 2	Measurable functions, Sum, difference, product and limit of measurable functions, Characteristic functions and simple function, Borel measurable functions, Littlewood's three principles, Egoroff's theorem.	15	14
Unit 3	Integral of simple functions, Lebesgue integral of bounded function, Comparison of Riemann and Lebesgue integral of a bounded function, Properties of Lebesgue integral of bounded function, Bounded convergence Theorem.	15	14
Unit 4	Integral of nonnegative function, General Lebesgue integral and properties of integrable functions, Fatou's Lemma, Monotone convergence Theorem and Lebesgue convergence Theorem.	15	14
Unit 5	Differentiation of an increasing function, Functions of bounded variation, Differentiation of an integral, Absolutely continuous functions and indefinite integrals.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. Royden, H. L., Real Analysis, (Third Edition), Macmillan Publ. Co. 1988.
2. Rana, I. K., Introduction to measure and integration, Narosa Publ. House, New Delhi, 1997.
3. De Barra, G., Introduction to measure theory, Van Nostrand and Reinhold Co., 1974.

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Topological spaces. Neighborhoods. Topology generated by a collection of subsets. Base and subbase for a given topology. Conditions for a collection of subsets to form a basis for some topology. Subspaces. Finite products.	15	14
Unit 2	Continuous functions. Homeomorphisms. Continuity and limits of sequences. Closed sets, closure and limit points. T_1 and T_2 spaces. Interior and boundary of a set.	15	14
Unit 3	Quotient spaces. Continuity of functions on quotient spaces. Complete metric spaces — Cantor's intersection theorem, Banach's fixed point theorem and Baire's category theorem for metric spaces.	15	14
Unit 4	Connected spaces. Connected subsets of the real line. Continuous images of connected spaces. Product of finitely many connected spaces. Path connected spaces. Product of finitely many path connected spaces. Components. Path components. Local connectedness and local path connectedness. Finite products and quotients of locally connected spaces and locally path connected spaces.	15	14
Unit 5	Compactness. Continuous images of compact spaces. Product of two compact spaces. Compact subsets of Euclidean spaces. Totally bounded metric spaces and characterization of compact metric spaces. Lebesgue number of an open cover of a compact metric space. Uniform continuity of continuous function on compact metric spaces. Local compactness. One point compactification of a locally compact Hausdorff space.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. Munkres J. M. :Topology: A First Course, PHI (1978)
2. Kelley J.L.: General Topology, Van Nostrand Company, Inc. (1955)
3. Sims B. T.: Foundations of Topology, Collier MacMillan International Edition, (1976).
4. Gemignani M.C.: Elementary Topology, Addison-Wesley, (1967).
5. Joshi K. D.: Introduction to General Topology, Wiley Eastern Ltd. (1983).

Title of the Paper: **Differential Equations**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Existence and uniqueness of solutions to the first order equations, The method of successive approximations, The Lipschitz condition, Approximations and uniqueness of solutions.	15	14
Unit 2	Linear equations with variable coefficient, Homogeneous equations with analytic coefficient, The Legendre's equation, Legendre's polynomial and its properties, Bessel's equations, Bessel's functions and its properties.	15	14
Unit 3	Sturm Liouville's problem, Eigen functions of Sturm Liouville's problem, Orthogonality of eigen functions, Simultaneous differential equations of the first order and first degree method of solution of $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$. Method of solutions.	15	14
Unit 4	First order partial differential equations, Cauchy's problem, Linear partial differential equations with constant coefficients, Characteristic curves of second order, Reduction to canonical forms, Mongr's method for $Rr + Ss + Tt = V$.	15	14
Unit 5	Applications of differential equations, Method of separation of variables to solve the wave equations, Problems of Fourier series, Application to one dimensional wave equations.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. Coddington, E.A., An introduction to ordinary differential equations, Prentice Hall of India.
2. Sneddon, Ian N.: Elements of Partial Differential Equations, McGraw-Hill Book Company, 1988.
3. Simmons, G.F., Differential equations with Applications, Tata McGraw Hill.
4. Saxena, A and Iyengar N.Ch.S., Engineering Mathematics, Laxmi publications.

Title of the Paper: **Number Theory**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Divisibility, the g.c.d. of two integers, Euclid's algorithm for determination of g.c.d. of two integers, the property of g.c.d. and l.c.m., Diophantine equation $ax + by = c$.	15	14
Unit 2	Prime and composite numbers, the fundamental theorem of arithmetic, the infinitude of primes. Some special numbers: Fermat's numbers, Fibonacci numbers (These numbers may be introduced at any convenient stage and their elementary properties be discussed).	15	14
Unit 3	The definition of the congruence relation modulo n and its properties, Divisibility tests for 3, 9 and 11, CRS (mod m) and RRS (mod m), the linear congruence $ax \equiv b \pmod{m}$, the Chinese Remainder theorem, Fermat's little theorem and Wilson's theorem.	15	14
Unit 4	Number theoretic functions, the functions τ and σ , the multiplicative functions, Mobius inversion formula, the greatest integer function, Euler's totient function, Euler's generalization of Fermat's theorem.	15	14
Unit 5	Pythagorean triples, Pythagorean equation $x^2 + y^2 = z^2$, the Fermat's last theorem with $n = 4$. Certain identities involving Fibonacci numbers.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. D.M. Burton: Elementary Number Theory, 2nd Edition, Universal Book Stall, New Delhi (W.L.Brown Pub.) 1994.
2. Niven I. and H. Zuckerman: An Introduction to the Theory of Numbers, John Wiley and Sons, New York.
3. George E. Andrews, Number Theory, Hindustan Publishing Corp. New Delhi.
4. S.G. Telang: Number Theory, Tata McGraw-Hill Publishing Company Ltd., New Delhi.

M.Sc. (I.T.) Semester-II**Paper No.: 5**Title of the Paper: **Complex Analysis**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	A quick overview of complex number system, Polar representation and roots of complex numbers, The extended plane and its spherical representation, Metric spaces and the topology of C .	15	14
Unit 2	Power series-convergence, Absolute convergence and radius of convergence, Analytic functions- their examples and elementary properties, Cauchy-Riemann equations, Harmonic functions, Power series as an analytic function, Branch of logarithm-its analyticity, Analytic function as mapping, Mobius transformation.	15	14
Unit 3	Riemann-Stieljes integral, Line integral, Change of parameter, Fundamental theorem of calculus for the line integrals, Power series representation of analytic functions, Zeros of an analytic functions, The index of a closed curve, Cauchy's theorem and Cauchy integral formula, Cauchy inequality, Liouville's theorem, Fundamental theorem of algebra, Morera's theorem, The holomorphic version of Cauchy's theorem and simple connectivity, Counting zeros, The open mapping theorem, Goursat's theorem.	15	14
Unit 4	Classification of singularities, Laurent series, Residue, Integrals with the help of residue, The argument principle.	15	14
Unit 5	The maximal modulus principle, Schwarz's lemma, Convex functions and Hadamard's three circles theorem.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. Conway, J. B., Functions of One Complex Variable, (Second Edition), Narosa Publ. House, New Delhi, 1994.
2. Churchill, R. V., Brown, J. and Verle, R., Complex Variables and Applications, McGraw-Hill Publ. Co., 1974.
3. Ponnusamy, S., Foundations of Complex Analysis, Narosa Publ. House, New Delhi, 1995.

Title of the Paper: **Topology-II**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks
Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Vector Space, Definition and Examples, Vector Subspaces, Linear Dependence and Independence, Span of a Set, Basis and Dimension of a Vector Space, Line, Affine Spaces, Quotient Spaces.	15	14
Unit 2	Linear Transformation, Representation of Linear Transformation by a Matrix, Kernel and Image of a Linear Transformation, Linear Isomorphism.	15	14
Unit 3	Geometric Ideas and rank, Identity, Stretch along axes, Reflection with respect to axes, Rotation, Shear, Projection, Their Combinations.	15	14
Unit 4	Inner Product Spaces, The Euclidean plane and the dot product, General Inner Product Spaces, Orthogonality, Geometrical Application, Orthogonal Projection onto a Line.	15	14
Unit 5	Orthonormal Basis, Orthogonal Complements and Projections, Linear functionals and hyper-planes, Orthogonal Transformations, Associated Co-ordinates, Reflections, Orthogonal map of the plane.	15	14

Break up of Continuous internal Evaluation:

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|----|--------------|----------|
| 1) | ASSIGNMENT | 05 Marks |
| 2) | SEMINAR | 05 Marks |
| 3) | TEST | 20 Marks |
| | Total Marks: | 30 Marks |

REFERENCE BOOKS:

1. Munkres J. M. :Topology: A First Course, PHI (1978).
2. Kelley J.L.: General Topology, Van Nostrand Company, Inc. (1955).
3. Schurle A.W.: Topics in Topology, Elsevier North Holland Inc. (1979).
4. Gemignani M.C.: Elementary Topology, Addison-Wesley, (1967).
5. Willard S.: General Topology, Addison-Wesley, (1970).
6. Joshi K. D.: Introduction to General Topology, Wiley Eastern Ltd. (1983).

Paper No.: 7

Title of the Paper: **Algebra-I**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Principal ideal domains, Primes and irreducibles in an integral domains. Unique factorization domains, Euclidean domain. Gauss Lemma, Polynomial rings over UFD.	15	14
Unit 2	Definition and examples of modules, submodules. Homomorphisms and quotient modules. Isomorphism theorems for homomorphisms of modules. Isomorphism theorems for homomorphisms of modules. Direct products and direct sums of modules.	15	14
Unit 3	Definition and examples of free modules. Existence of a basis for vector spaces over a division ring. Simple modules. Modules of finite length. Dimension of a finitely generated vector space.	15	14
Unit 4	Noetherian modules. Artinian modules. Hilbert basis theorem.	15	14
Unit 5	Finite extensions of a field. Eisenstein criterion. Adjunction of roots and splitting fields. Algebraic extensions. Algebraically closed fields. Algebraic closure. Extension of field homomorphisms to algebraic extensions. Uniqueness of algebraic closure and splitting fields. Finite fields.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. T.W.Hungerford: Algebra, GTM, Springer (India) Private Limited.
2. I.N.Herstein: Topics in Algebra, Vikas Publishing House Pvt Ltd.
3. Bhattacharya, Jain and Nagpaul: Basic Abstract Algebra, Second Edition, Cambridge University Press.
4. Michael Artin: Algebra, Prentice-Hall of India Pvt. Ltd.
5. C.Musili: Rings and Modules, Narosa Publishing House.
6. S. Lang: Algebra, Addison-Wesley Publishing Company.

Title of the Paper: **Classical Mechanics**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Newton's law of motion, Mechanics of particles motion in a central force field, Equivalent one-body problem.	15	14
Unit 2	Motion in a central force field, General features of the motion, Equation of the orbits, Kepler's laws of planetary motion.	15	14
Unit 3	Lagrangian Formulation: Constraints, Generalized coordinates, D'alembert's principal, Lagranges equations, A general expression for kinetic energy, Symmetries and laws of conservation, Cyclic coordinates, Rayleigh's dissipation function.	15	14
Unit 4	Hamilton's Formulation: Configuration space, Hamilton's principle, Lagranges equations for non-holonomic systems and its applications, Hamilton's equations of motion and its application.	15	14
Unit 5	Canonical Transformation: Canonical transformation, Condition for a transformation to be canonical, Canonical equations in terms of poisson bracket notations, The Hamilton-Jacobi equations.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. H. Goldstein, Classical mechanics, Wesley.
2. Syngé and Griffith, Principle of Mechanics, Mcgraw-Hill,1980.
3. Gupta and Satya Prahash, Classical Mechanics, Kedarnath, Ramanath Meerut.
4. Gupta, Kumar and Sharma, Classical Mechanics, Pragati Prakashan.

M.Sc. (I.T.) Semester-III**Paper No.: 9**Title of the Paper: **Functional Analysis-I**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Normed spaces and its examples, Riesz Lemma, Linear maps between two normed spaces, continuous linear map, Spaces $BL(X, Y)$, $BL(X)$ and $BL(X, K)$.	15	14
Unit 2	Hahn-Banach extension Theorem, Banach spaces, Uniform boundedness principle, Open mapping Theorem and Closed graph Theorem, Bounded inverse Theorem, Two norm Theorem.	15	14
Unit 3	Inner product space and its examples, Hilbert space, orthogonal set, orthonormal set, Gram-Schmidt orthonormalization, Bessel's inequality, Projection theorem.	15	14
Unit 4	Continuous linear functional on an inner product space, Riesz representation Theorem.	15	14
Unit 5	Bounded operator on Hilbert space, Adjoint and its properties, Normal, Unitary and self-adjoint operators, compact self-adjoint operators.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. Limaye, B.V., Functional Analysis, New Age International Publ. Ltd., New Delhi, 1996.
2. Choudhary and Sudarsan Nanda: Functional Analysis, New Age International (P) Ltd. & Wiley Eastern Ltd., New Delhi, 1997.
3. P. K. Jain, O. P. Ahuja and Khajil Ahmed: Functional Analysis, New Age International (P) Ltd. & Wiley Eastern Ltd., New Delhi, 1997.
4. A. E. Taylor: Introduction to Functional Analysis, John Wiley and Sons, New York, 1958.

Paper No.: 10Title of the Paper: **Relativity-I**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Coloumb's law, Superposition Principle, Electrostatic potential, Gauss theorem for electroststic flux, Field lines and equipotential surfaces, The field of a line (infinitely long) charge, The field inside a charge of uniform charge density, Electric dipole, The electrostatic field of a system of point charges (up to quadrapole moment), The electrostatic energy of a system of charges.	15	14
Unit 2	Equations of mango-static and quasi-stationary fields, Magnetic potential vector, The magnetic field of steady current, Ampere's law, Biot-Sawart's law, Magnetic field of a quasi-stationary system of charges at a large distance from the system, The magnetic moment.	15	14
Unit 3	The equation of continuity, The electromagnetic field of a moving charge, Maxwell's equations, Electromegnatic field, Potentials, The action principle for the electromagnetic field, The energy of the field, Conservation of the totalenergy of the field and charges, The pointing vector, Electromagnetic waves, Lineard and Wichert Potentials.	15	14
Unit 4	Galilean principle of relativity, Galilean law of addition of velocities inelectrodynamics, Michelson-Moreley experiment, posulates of special theory of relativity, Lorentz transformations, Contraction of length and time dilation, Relativistic law of addition of velocities absolute (or proper) time, Four-dimentional formulation of the theory of relativity.	15	14
Unit 5	Four-velocity and four-acceleration, the equations of motion of a material particle, momentum, energy and mass in relativistic mechanics, the Lagrangian and Hamiltonian equations of a mass particle and system of particles, the theory of collisions between relativistic partcles. Charge conservation, The four dimensional current and equation of continuity, The relativistically invariant formulation of the equations of the electromagnetic field potentials, The field of a moving charge, The electromagnetic field tensor and Maxwell's equations in tensor form, The Lorentz force, The Lagrangian and Hamiltonian for a particle moving in an electromagnetic field, The radiation emitted by a moving charge.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. Levich, B. G., Theoretical Physical Vol. 1, North-Holland Pub. Co., Amsterdam (1970)
2. Goyal and Gupta, Theory of Relativity (Special and General), Krishna Prakashan Media (p) Ltd.
3. Landau, L. D. and Lifshitz, Classical Theory of Fields, Pergaman Press, 1971
4. Kompanyeests, A. S., Theoretical Physics, Foreign Laguages Pub. House, Moscow, 1961.

Title of the Paper: **Combinatorial Analysis-I**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks
 Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Sets and samples, Unordered selections, Binomial coefficients.	15	14
Unit 2	The Inclusion Exclusion principle with weights attached to the elements, The Sieve of Eratosthenes, The Euler's totient function $\phi(n)$, Permanents.	15	14
Unit 3	Menage numbers, Latin rectangles, Rook Polynomials.	15	14
Unit 4	Linear Homogeneous Recurrence Relations, General Linear Recurrence Relations, Applications, A system of Linear Recurrence Relations, The Method of Generating Functions.	15	14
Unit 5	The Ramsey's theorem and its applications.	15	14

Break up of Continuous internal Evaluation:

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|--------------|------------|----------|
| 1) | ASSIGNMENT | 05 Marks |
| 2) | SEMINAR | 05 Marks |
| 3) | TEST | 20 Marks |
| Total Marks: | | 30 Marks |

REFERENCE BOOKS:

1. H. J. Ryser: Combinatorial Mathematics, The Mathematical Association of America. (Carns Mathematical Monographs number(4), USA)
2. V. Krishnamurthy: Combinatorics, Theory and applications, Affiliated East -West press Ltd., 1985, New Delhi, Madras.
5. Ian Anderson, A First Course in Combinatorial Mathematics, Clarendon Press. (Oxford Applied Mathematics and Computing Science Series)
6. Chen Chuan-Chong, Koh Khee-Meng, Principles and Techniques in Combinatorics, World Scientific Publishing Co. Pte. Ltd.
7. J. E. Graver, M. E. Watkins: Combinatorics with emphasis on Theory of graphs, Graduate texts in Mathematics no. 54, Springer Verlag, 1977.

Title of the Paper: **Analytic Number Theory-I**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	The Dirchlet product of two arithmetical function (a.f.) and the group structure w.r.t. this product, Multiplicative a.f. and subgroup of multiplicative a.f., The inverse of a completely multiplicative a.f..	15	14
Unit 2	Generalized convolutions, The Bell series of a.f. , The selberg's identity $\Lambda(n) \log n + \sum_{d n} \Lambda(d) \Lambda\left(\frac{n}{d}\right) = \sum_{d n} \mu(d) \log^2 \frac{n}{d}.$	15	14
Unit 3	The notations O, Euler's summation formula, The average order of the functions $d(n)$, $\sigma_2(n)$, $\varphi(n)$, $\mu(n)$, $\Lambda(n)$, Lattice points visible from the origin.	15	14
Unit 4	Chebyshev's functions $\psi(x)$ and $\theta(x)$, Abel's identity, Relations between $\pi(x)$, $\theta(x)$ and $\psi(x)$, Equivalent forms of the prime Number Theorem (PNT), Lower and Upper bounds for $\pi(x)$ and P_n .	15	14
Unit 5	Shapiro's Tauberian Theorem, Asymptotic behaviour with a suitable error term of sum-functions of certain a.f. including the following: $\sum_{n \leq x} \Lambda(n) \left[\frac{x}{n} \right], \sum_{p \leq x} \frac{\log p}{p}, \sum_{p \leq x} \frac{1}{p}$, Selberg's asymptotic formula, A brief introduction (without proof) of the PNT and the results needed in the proof of PNT and the result related to PNT.	15	14

Break up of Continuous internal Evaluation:

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|----|--------------|----------|
| 1) | ASSIGNMENT | 05 Marks |
| 2) | SEMINAR | 05 Marks |
| 3) | TEST | 20 Marks |
| | Total Marks: | 30 Marks |

REFERENCE BOOKS:

1. T. M. Apostol: Introduction to Analytic Number Theory, Narosa Pub. House, New Delhi, 1980.
2. McCarthy P. J., Introduction to Arithmetical Functions, Springer Verlag, New York 1986.
3. K. Chandrashekharan: Introduction to Analytic Number Theory, Springer Verlag, Berlin Heidelberg, New York, 1968.
4. Hua L. K.: Introduction to Number Theory, Springer Verlag, Berlin Heidelberg, New York, 1982.

M.Sc. (I.T.) Semester-IV**Group A****Paper No.: 13**Title of the Paper: **Functional Analysis-II**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Dual of a normed space, Dual basis; Transpose of a bounded linear map, Duals of K^n , l^∞ (i.e., m), l^p , c and c_0 , Weak and Weak* convergence, Reflexivity.	15	14
Unit 2	Weierstrass Approximation Theorem, Stone-Weierstrass Theorem for a compact Hausdorff space, Spectral Theorem (finite dimensional).	15	14
Unit 3	Algebra, Normed Algebra, Banach Algebra, The Banach algebras $C(X)$, $A(D)$, $C^1[0,1]$, $AC[0,1]$, Regular and Singular elements in a Banach Algebra, Topological Divisor of Zero in a Banach Algebra, Spectrum, Spectral Radius Formula, The Radical and Semi-simplicity of a Banach Algebra.	15	14
Unit 4	The Gel'fand mapping, Applications of the spectral radius formula, Involution in Banach algebras, Ideals in $C(X)$ and the Banach-Stone theorem.	15	14
Unit 5	Commutative C^* -algebras, Stone-Weierstrass theorem, Gel'fand-Neumark theorem for commutative C^* -algebras.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. B. V. Limaye, Functional Analysis, New Age International (P) Ltd., 2001
2. G. F. Simmons, Introduction to Modern Analysis, McGraw-Hill Book Company, Inc. 1963.
3. R. Larsen, Banach Algebras, Marcell-Dekker, 1973.

GroupA**Paper No.: 14**Title of the Paper: **Algebra-II**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Rank of a finitely generated free module over a commutative ring. Submodules of free modules over a PID. Structure of finitely generated modules over a PID. Application to finitely generated abelian groups.	15	14
Unit 2	Direct Product of groups. Conjugacy relation and normalizer. Class equation for a group. Cauchy's theorem. Sylow's theorems. Groups of order p^2 , pq .	15	14
Unit 3	Solvable groups, Nilpotent groups and their properties, solvability of Nilpotent groups, Insolvability of S_n for $n > 4$.	15	14
Unit 4	Index of a finite extension. Normal extensions, separable extensions and the fundamental theorem of Galois theory.	15	14
Unit 5	Radical extensions. Geometrical constructions. Insolvability of quintic equations.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. T.W.Hungerford: Algebra, GTM, Springer(India) Private Limited.
2. I.N.Herstein: Topics in Algebra, Vikas Publishing House Pvt Ltd.
3. Bhattacharya, Jain and Nagpaul: Basic Abstract Algebra, Second Edition, Cambridge University Press.
4. Michael Artin: Algebra, Prentice-Hall of India Pvt. Ltd.
5. C.Musili: Rings and Modules, Narosa Publishing House.
6. S. Lang: Algebra, Addison-Wesley Publishing Company.

GroupA**Paper No.: 15**Title of the Paper: **Combinatorial Analysis-II**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	System of distinct representatives with suitable lower bounds, System of common representatives, A lower bound to the Latin squares of order n .	15	14
Unit 2	The theory of (0,1)-matrices, Term-rank of a (0,1)-matrix, Permutation matrices, The representation of matrices of nonnegative real numbers as a linear combination of permutation matrices.	15	14
Unit 3	The class $U(R,S)$, The completion of a Latin rectangle, Interchanges, The invariant 1's of a normalized class of (0,1)-matrices, Maximal term-rank.	15	14
Unit 4	Orthogonal Latin squares, Complete set of orthogonal Latin squares, Finite Projective planes and their relations with complete sets of orthogonal Latin squares.	15	14
Unit 5	Perfect difference sets. The quadratic residues of a prime $p \equiv 3 \pmod{4}$ and perfect difference sets mod p , multiples of a perfect difference set and their group structure, The multiplier theorem.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. H. J. Ryser: Combinatorial Mathematics, The Mathematical Association of America (Carns Mathematical Monographs number(4), USA.).
2. Chen Chuan-Chong, Koh Khee-Meng, Principles and Techniques in Combinatorics, World Scientific Publishing Co. Pte. Ltd.
3. V. Krishnamurthy: Combinatorics, Theory and applications, Affiliated East-West press Ltd., 1985, New Delhi, Madras.
4. J. E. Graver, M. E. Watkins: Combinatorics with emphasis on Theory of graphs, Graduate texts in Mathematics no. 54, Springer Verlag, 1977.

GroupA**Paper No.: 16**Title of the Paper: **Analytic Number Theory-II**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	The characters of finite abelian group and their properties including orthogonality relations, The Dirchlet characters.	15	14
Unit 2	The estimation of the sums $\sum_{n \leq x} \frac{\chi(n)}{n}$, $\sum_{n \leq x} \frac{\chi(n) \log n}{n}$, $\sum_{n \leq x} \frac{\chi(n)}{\sqrt{n}}$, The non-vanishing of $L(1, \chi)$ real non-principal character χ .	15	14
Unit 3	The Dirchlet's Theorem (for primes in a.p.).	15	14
Unit 4	Functions periodic modulo k , Existence of Finite Fourier series for periodic arithmetical functions, Ramanujan's sum and generalizations, Multiplicative properties of the sums $s_k(n)$.	15	14
Unit 5	Gauss sums associated with Dirichlet characters, Dirichlet characters with nonvanishing Gauss sums, Induced moduli and primitive characters, Properties of induced moduli, The conductor of a character, Primitive characters and separable Gauss sums, The finite Fourier series of the Dirichlet characters, Polya's inequality for the partial sums of primitive characters.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. T. M. Apostol: Introduction to Analytic Number Theory, Narosa Pub. House, New Delhi, 1980.
2. McCarthy P. J., Introduction to Arithmetical Functions, Springer Verlag, New York 1986.
3. K. Chandrashekharan: Introduction to Analytic Number Theory, Springer Verlag, Berlin Heidelberg, New York, 1968.
4. Hua L. K.: Introduction to Number Theory, Springer Verlag, Berlin Heidelberg, New York, 1982.

M.Sc. (I.T.) Semester-IV
Group B

Paper No.: 13

Title of the Paper: **Relativity-II**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Inertial frames, The principles of equivalence and transition from Minkowskian to curved geometry, Riemannian manifolds and metric tensor, Christoffel symbols, Covariant differentiation, Parallel transport, Geodesics, Riemann curvature tensor, geodesic deviation, Ricci and Einstein tensors, General and contracted Binachi identities.	15	14
Unit 2	Einstein's field equations for empty space-time, Slow motion, Weak gravitational fields and Newtonian approximation, Gravitational waves in the weak field approximation, Plane (polarized and unpolarized) gravitational waves, their generation, detection and energy loss.	15	14
Unit 3	Schwarzschild exterior solution, trajectories of test particles and light rays in Schwarzschild exterior space-time. Shift in the perihelion of Mercury, Pericenter shift of binary pulsars, Bending of light rays. Gravitational red-shift, Pathology of the Schwarzschild surface $r=2M$, Synge-Kruskal-Szekeres coordinates, Schwarzschild black-hole and its thermodynamics.	15	14
Unit 4	Einstein's field equations for non-empty space-times, Energy-momentum tensor for perfect fluids, Conservation laws, Interior structure of spherical stars filled with perfect fluids, Schwarzschild interior solution, Remarks on contraction of spherical stars and the Chandrasekhar limit.	15	14
Unit 5	Cosmological principle, Weyl's postulate, Friedmann Robertson-Walker models, Matter and radiation dominated models, Red-shift of galaxies and Hubble's law, Deceleration parameter, Microwave back-ground radiation, Steady state cosmological model and comparison with observations.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. Schutz, B. F., A first course in general relativity, Cambridge University Press (1988)
2. Pirani, F.A.E., Lectures on general relativity (Eds. S. Deser and K.W. Ford), Prentice-Hall (1965)
3. Adler R., Bazin M., Schiffer M., Introduction to general relativity, McGraw-Hill (1965)
4. Anderson, J. L., Principles of relativity Physics, Academic Press, (1960)

Group B**Paper No.: 14**Title of the Paper: **Programming with C**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Overview of Computer and Languages. Abstract view of computer, stored program concept, execution of instructions at processor-memory level, memory hierarchy - Cache memory, main memory, secondary memory. Types of Programming Languages, High & Low level language, Compiler, Translator, Machine Language.	15	14
Unit 2	Logic Development. Problem Analysis, Flow charts, algorithms, Variables, Expression & its manipulation, Data types in High level language, internal representation of integer and floating point numbers, I/O statements, Assignment statement. Arithmetic operators, logical operators and bitwise operators, understanding of all the operators at binary level.	15	14
Unit 3	Structured Programming & functions. Control strategies, Condition & Loop Statements. Method of Structured Programming, library functions, Detailed look into math.h and graphics.h functions. User-defined functions – declaration, definition and reference.	15	14
Unit 4	Complex Data Types. Arrays & pointers, Structure & Union, Arrays of structure, Passing pointers, arrays, structures and unions to function.	15	14
Unit 5	Programming. Implementation of Vector operations using one dimensional arrays, Implementation of matrix operations using two dimensional arrays, Solving system of linear equations in n variables: Gauss elimination method, Gauss Jordan method, Matrix inversion method.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. E. Balagurusamy : Programming in ANSI C, Tata McGraw-Hill Publishing Co. Ltd.
2. Cooper H. & Mullish H. : The Sprit of C, Jaico Publication House, New Delhi.
3. Kernighan B. W. & Ritchie D. M : The C Programming Language, Prentice Hall, India.
4. Gottfried : Programming with C, Tata McGraw-Hill Publishing Co. Ltd.

Group B**Paper No.: 15**Title of the Paper: **Computer Graphics & Multimedia**

Credits: 5

Marks: 100

Marks: Semester End Examination: 70 Marks

Continuous Internal Evaluation: 30 Marks

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Overview of Graphics Hardware. Video display devices - CRT, Raster-scan displays, Random-scan displays, Color CRT Monitor, DVST, Flat panels. Input devices - Keyboard, Mouse, Trackball, Space-ball, Joysticks, Image scanners, Touch panel.	15	14
Unit 2	Basic of Graphics Programming in C Language. Initialization of graphics – initgraph(), graphics drivers & modes, Writing programs for static drawing using various graphics functions like line(), circle(), arc(), etc.	15	14
Unit 3	Two Dimensional Transformation. Basic Transformation - Translation, Rotation, Scaling. Composite transformations - Translations, Rotations, Scaling. Other transformation - Reflection, Shear.	15	14
Unit 4	Three dimensional Concepts Three dimensional display methods. Projection: Parallel projection and perspective projection. Three dimensional and Stereoscopic views.	15	14
Unit 5	Three-dimensional geometric transformations. Translation, Rotation, Scaling, Reflection & Shear	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	05 Marks
2)	SEMINAR	05 Marks
3)	TEST	20 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. Donald Hearn & M. Pauline Baker : Computer Graphics, PHI.
2. F. S. Hill, J. R. : Computer Graphics, MacMillan Publishing Company.
3. Newman W., Sproul R. F. : Principles of Interactive Computer Graphics, McGraw-Hill.
4. Foley J. D., Van Dam A.: Fundamentals of Interactive Computer Graphics, Addison-Wesley.

Group B**Paper No.: 16**Title of the Paper: **Practical**

Credits: 05

Marks: 100

Practical Based On

Unit	Detailed Syllabus	Teaching Hour	Marks/Weight
Unit 1	Paper 14: Programming with C	37.5	50
Unit 2	Paper 15: Computer Graphics & Multimedia	37.5	50

**LIST OF COURSES PROPOSED TO BE OFFERED AS CHOICE BASED INTER DISCIPLINARY COURSES TO THE REGULAR STUDENTS REGISTERED IN OTHER PG DEPARTMENTS
(w.e.f. Academic Year commencing from June 2010)**

Faculty: Science
Subject: Mathematics
PG Department: Department of Mathematics

Sr. No.	Semester	Course Title	Eligibility	Remarks
1	1ST	M.Sc.(Mathematics)Paper 2: Topology-I	Graduate in any discipline with atleast 45 %	
2	1ST	M.Sc.(Mathematics)Paper 4: Number Theory	Graduate in any discipline with atleast 45 %	
3	2ND	M.Sc.(Mathematics)Paper 6: Topology-II	If having Credit of M.Sc.(Mathematics) Paper 2 Topology-I	
4	3RD	M.Sc.(Mathematics)Paper 11: Combinatorial Analysis-I	Graduate in any discipline with atleast 45 %	
5	4TH	M.Sc.(Mathematics)Paper 15: Combinatorial Analysis-II	If having Credit of M.Sc.(Mathematics) Paper 11 Combinatorial Analysis-I	

* 15 Seats offered for any paper/s based on eligibility Merit