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

Credit and semester system syllabus in force from june 2010

Semester-II							
PAPER NO	NAME OF THE PAPER	PRACTICAL	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 × 5 HOURS=75	3	05
6	Linear Algebra		70+30=100	28+12=40	15 WEEKS × 5 HOURS=75	3	05
7	Algebra-I		70+30=100	28+12=40	15 WEEKS × 5 HOURS=75	3	05
8	Classical Mechanics		70+30=100	28+12=40	15 WEEKS × 5 HOURS=75	3	05

* INTERNAL	MARKS
ASSIGNMENT	10
SEMINAR	10
TEST	10

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Semester-IV (Group A) ⊗							
PAPER NO	NAME OF THE PAPER	PRACTICAL	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 * 5 HOURS=75	3	05
14	Relativity-II		70+30=100	28+12=40	15 WEEKS * 5 HOURS=75	3	05
15	Combinatorial Analysis-II		70+30=100	28+12=40	15 WEEKS * 5 HOURS=75	3	05
16	Analytic Number Theory-II		70+30=100	28+12=40	15 WEEKS * 5 HOURS=75	3	05

Semester-IV (Group B) ⊗							
PAPER NO	NAME OF THE PAPER	PRACTICAL	TOTAL MARKS EXT+INT* =TOTAL	PASSING STANDARD EXT+INT= TOTAL	TOTAL TEACHING HOURS	EXAM HOURS	CREDITS
13	Algebra- II		70+30=100	28+12=40	15 WEEKS * 5 HOURS=75	3	05
14	Topology-II		70+30=100	28+12=40	15 WEEKS * 5 HOURS=75	3	05
15	Programming with C		70+30=100	28+12=40	15 WEEKS * 5 HOURS=75	3	05
16	Practical	100	100	40	15 WEEKS * 5 HOURS=75	3	05

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

* INTERNAL	MARKS
ASSIGNMENT	10
SEMINAR	10
TEST	10

BHAVNAGAR UNIVERSITY
Master of Science in Mathematics
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M.Sc. (MATHEMATICS) 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^*-*a*lgebras.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	10 Marks
2)	SEMINAR	10 Marks
3)	TEST	10 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.

Group A

Paper No.: 14

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 uppolarized) 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-Krushkal-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, Consevation 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 Hubbl'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 10 Marks
2) SEMINAR 10 Marks
3) TEST 10 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 A **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	10 Marks
2)	SEMINAR	10 Marks
3)	TEST	10 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, Affilicated 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.

Group A **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 $\sum_{n\le x}\frac{\chi(n)}{n}$, $\sum_{n\le x}\frac{\chi(n)\log n}{n}$, $\sum_{n\le x}\frac{\chi(n)}{\sqrt{n}}$, The non-vanishing of L(1, χ) 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 10 Marks
2) SEMINAR 10 Marks
3) TEST 10 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. (MATHEMATICS) Semester-IV

Group B **Paper No.: 13**

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 fnitely 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 10 Marks
2) SEMINAR 10 Marks
3) TEST 10 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.

Group B **Paper No.: 14**

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	Infinite products. Infinite products of T_1 spaces, T_2 spaces, connected spaces, path connected spaces, locally connected spaces and locally path connected spaces. Countable product of metric spaces. Filters. Filter base. Filter generated by a collection of subsets with finite intersection property. Ultrafilters. Convergence and cluster points of filters. Continuity and closure in terms of filters. Convergence of filters on product spaces.	15	14
Unit 2	Compactness in terms of filters and ultrafilters. Tychonoff Theorem. Local compactness of product spaces. Other types of compactness - Bolzano-Weierstrass property (limit point compactness), countable compactness, sequential compactness- and their equivalence with compactness in metric spaces.	15	14
Unit 3	Countability conditions - separability, second countability, Lindelofness - and interrelations among them. Equivalence of these conditions in metric spaces.	15	14
Unit 4	Regular and normal spaces. Subspaces and products of regular and normal spaces. Urysohn's lemma. Tietze's extension theorem.	15	14
Unit 5	Completely regular spaces and Tychonoff spaces. Continuous functions separating points from closed sets and imbedding theorem. Embedding of a Tychonoff space into a product of unit intervals. Stone-Cech compactification and its universal property. Urysohn's metrization Theorem.	15	14

Break up of Continuous internal Evaluation:

1)	ASSIGNMENT	10 Marks
2)	SEMINAR	10 Marks
3)	TEST	10 Marks
	Total Marks:	30 Marks

REFERENCE BOOKS:

1. Munkres J. M. :Topology: A First Course, PHI (1978).
2. Kelley J.L.: General Topology, Van Nostrrand 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).

Group B **Paper No.: 15**

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 10 Marks
2) SEMINAR 10 Marks
3) TEST 10 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.: 16**

Title of the Paper: **Practical**

Credits: 5 Marks: 100

Practical Based On

Unit	Detailed Syllabus	Teaching Hour	Marks/ Weight
Unit 1	**Paper 15: Programming with C**	45	60
Unit 2	**Numerical Methods:** Interpolation Interpolation with Equal Intervals - Forward, backward and central difference Tables, Gregory - Newton formula for forward & backward Interpolation, Gauss central difference formula, forward and backward, Interpolation for Unequal Intervals-Newton's general interpolation formula, Lagrange Interpolation. Numerical Integration & Differential Equations Numerical integration - Geometric meaning of integration, Trapezoidel rule, Simpsion - 1/3 & 3/8 rules, Numerical solution of differential equations. Euler's method, Eular's modified method, Runge-Kutta methods.	30	40

REFERENCE BOOKS:

1. Rajaraman V. : Computer Oriented Numerical Methods, Prentice Hall of India Pvt. Ltd., 1983.
2. C. K. Kumbharana and N. N. Jani, Computer Oriented Numerical Methods (CONM), Saurashtra University, Rajkot.
3. B. W. Kernighan and D. M. Ritchie, The C Programming Language, PHI.
4. R. Sethi, Programming Languages, Addison-Wesley, 1996.
5. D. Appleby and J. J. VandeKopple, Programming Languages, Tata McGraw-Hill, 1991.