Scheme of examination for B.A. (Hons.)/B.Sc. (Hons.) – I, II & III (i.e. from Semester – I to VI)

Annexure-I

w.e.f 2011-12

B.A. (Hons.)/B.Sc.(Hons.) - I year (Semester – I) **Time : 3 Hours**

Compulsory

Paper No.	Paper Name	B.Sc./Hons. B.A/Hons. Theory	B.Sc./Hons. Sessional	B.A/Hons. Theory	B.A/Hons. Sessional
BM – 111	Algebra	40 Marks	10 Marks	27 Marks	6 Marks
BM – 112	Calculus	40 Marks	10 Marks	26 Marks	7 Marks
BM – 113	Solid Geometry	40 Marks	10 Marks	27 Marks	7 Marks

B.A. (Hons.)/B.Sc.(Hons.) - I year (Semester – II)

Compulsory

Paper No.	Paper Name	B.Sc./Hons. B.A/Hons. Theory	B.Sc./Hons. Sessional	B.A/Hons. Theory	B.A/Hons. Sessional
BM – 121	Number Theory And Trignometry	40 Marks	10 Marks	27 Marks	6 Marks
BM – 122	Ordinary Differential Equations	40 Marks	10 Marks	26 Marks	7 Marks
BM – 123	Vector Calculus	40 Marks	10 Marks	27 Marks	7 Marks

B.A. (Hons.)/B.Sc.(Hons.) - II year (Semester – III)

Compulsory

		B.Sc./Hons. B.A/Hons.	B.Sc./Hons.	B.A/Hons.

Paper No.	Paper Name	Theory	Sessional	Theory Sessional	
BM – 231 Marks	Advanced Calculus	40 Marks	10 Marks	27 Marks	6
BM – 232 Marks	Partial Differential Equations	40 Marks	10 Marks	26 Marks	7
BM – 233 Marks	Statics	40 Marks	10 Marks	27 Marks	7

B.A. (Hons.)/B.Sc.(Hons.) - II year (Semester – IV)
Compulsory

Paper No.	Paper Name	B.Sc./Hons. B.A/Hons. Theory	B.Sc./Hons. Sessional	B.A/Hons. Theory	Sessional
BM – 241	Sequences and Series	40 Marks	10 Marks	27 Marks	6 Marks
BM – 242	Special Functions And Integral Transforms	40 Marks	10 Marks	26 Marks	7 Marks
BM – 243	Programming in C & Numerical Methods	Theory 30 Marks + Practical 20 Marks, no Sessional (B.Sc. Hons.) Th.-3 hrs. & P-2 hrs. Theory 20 Marks + Practical 14 Marks, no Sessional (B.A. Hons.)			

B.A./B.Sc.(Hons.) – III year (Semester –V)
Compulsory

Paper No.	Paper Name	B.Sc./Hons. B.A/Hons. Theory	B.Sc./Hons. Sessional	B.A/Hons. Theory	Sessional
BM – 351	Real Analysis	40 Marks	10 Marks	27 Marks	6 Marks
BM – 352	Groups and Rings	40 Marks	10 Marks	26 Marks	7 Marks
BM – 353	Numerical Analysis	Theory 30 Marks + Practical 20 Marks, No Sessional (B.Sc. Hons.) Th.- 3 hrs. & P-2 hrs. Theory 20 Marks + Practical 14 Marks, No Sessional (B.A. Hons.)			

Optional Papers :

Note : A student will opt one paper out of 354-(I), 354-(II), 354-(III). Likewise, second and third optional papers can be selected amongst 355-(I), 355-(II), 355-(III) and 356(i), 356(ii), 356(iii) respectively.

BM-354 (I) Differential Geometry	BM-354 (II) Mathematical Modeling – I	BM-354 (III) Applications of

B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10 B.A. (Hons.) Theory-27 B.A. (Hons.) Sessional-6	B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10 B.A. (Hons.) Theory-27 B.A. (Hons.) Sessional-6	Mathematics in Finance B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10 B.A. (Hons.) Theory-27 B.A. (Hons.) Sessional-6
BM-355 (I) Probability Theory B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10 B.A. (Hons.) Theory-26 B.A. (Hons.) Sessional-7	BM-355 (II) Number Theory B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10 B.A. (Hons.) Theory-26 B.A. (Hons.) Sessional-7	BM-355 (III) Discrete Mathematics-I B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10 B.A. (Hons.) Theory-26 B.A. (Hons.) Sessional-7
BM-356 (I) Mechanics B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10 B.A. (Hons.) Theory-27 B.A. (Hons.) Sessional-7	BM-356 (II) Principles of Computer Science-I B.Sc. (Hons.)Theory – 30 B.Sc. (Hons.)Practical-20 B.A. (Hons.) Theory-20 B.A. (Hons.) Practical-14	BM-356 (III) Computational Mathematics Laboratory-I B.Sc. (Hons.)Theory – 30 B.Sc. (Hons.)Practical-20 B.A. (Hons.) Theory-20 B.A. (Hons.) Practical-14

B.A. (Hons.)/B.Sc.(Hons.) – III year (Semester –VI)
Compulsory

Paper No.	Paper Name	B.Sc./Hons. B.A/Hons. Theory	B.Sc./Hons. Sessional	B.A/Hons. Theory	
BM – 361	Real & Complex Analysis	40 Marks	10 Marks	27 Marks	6 Marks
BM – 362	Linear Algebra	40 Marks	10 Marks	26 Marks	7 Marks
BM – 363	Dynamics	40 Marks	10 Marks	27 Marks	7 Marks

Optional Papers :

Note : A student will opt one paper out of 364-(I), 364-(II), 364-(III). Likewise, second and third optional papers can be selected amongst 365-(I), 365-(II), 365-(III) and 366-(I), 366-(II), 366-(III) respectively.

BM-364 (I) Optimization B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10	BM-364 (II) Riemannian Geometry B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10	BM-364 (III) Discrete Mathematics-II B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10

B.A. (Hons.) Theory-27 B.A. (Hons.) Sessional-6	B.A. (Hons.) Theory-27 B.A. (Hons.) Sessional-6	B.A. (Hons.) Theory-27 B.A. (Hons.) Sessional-6
BM-365 (I) Hydrostatic B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10 B.A. (Hons.) Theory-26 B.A. (Hons.) Sessional-7	BM-365 (II) Mathematical Modeling-II B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10 B.A. (Hons.) Theory-26 B.A. (Hons.) Sessional-7	BM-365 (III) Combinatorial Number Theory B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10 B.A. (Hons.) Theory-26 B.A. (Hons.) Sessional-7
BM-366 (I) Application of Mathematics in Insurance B.Sc. (Hons.)Theory – 40 B.Sc. (Hons.)Sessional-10 B.A. (Hons.) Theory-27 B.A. (Hons.) Sessional-7	BM-366 (II) Principles of Computer Science-II (Theory and Practical) B.Sc. (Hons.)Theory – 30 B.Sc. (Hons.)Practical-20 B.A. (Hons.) Theory-20 B.A. (Hons.) Practical-14	BM-366 (III) Computational Mathematics Laboratory-II B.Sc. (Hons.)Theory – 30 B.Sc. (Hons.)Sessional-20 B.A. (Hons.) Theory-20 B.A. (Hons.)Practical-14

B.A/B.Sc. (Hons.) in Mathematics

1. The qualification for admission to B.A/B.Sc. Hons. will be the same as for the admission to B.A/B.Sc. (General) with Mathematics as one of the main subjects in the qualifying examination.
2. Scheme of Examination (Annexure – I)
3. Apart from the existing B.A/B.Sc. (General) course papers, they will have to qualify six additional papers, three each in Semester V & VI.
4. Teaching hours for each theory paper will be minimum six periods per week.
5. Minimum two hours per week per group will be devoted for practical. Practical group will be formed as per university norms for science subjects.
6. Duration of the examination for each paper will be three hours.
7. Pass percentage : 35% (aggregate in all the three papers of a semsester)

B.A. (Hons.)/B.Sc.(Hons.) – Ist Year (Semester – I)
Compulsory
BM – 111 : Algebra

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 27
Sessional : 10	Sessional : 6

Note: The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I

Symmetric, Skew symmetric, Hermitian and skew Hermitian matrices. Elementary Operations on matrices. Rank of a matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Row rank and column rank of a matrix. Eigenvalues, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix.

Section – II

Applications of matrices to a system of linear (both homogeneous and non–homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices, Bilinear and Quadratic forms.

Section – III

Relations between the roots and coefficients of general polynomial equation in one variable. Solutions of polynomial equations having conditions on roots. Common roots and multiple roots. Transformation of equations.

Section – IV :

Nature of the roots of an equation Descarte's rule of signs. Solutions of cubic equations (Cardon's method). Biquadratic equations and their solutions.

Books Recommended :

1. H.S. Hall and S.R. Knight : Higher Algebra, H.M. Publications 1994.
2. Shanti Narayan : A Text Books of Matrices.
3. Chandrika Prasad : Text Book on Algebra and Theory of Equations.
   Pothishala Private Ltd., Allahabad.

B.A. (Hons.)/B.Sc. (Hons.) – Ist Year (Semester – I)
Compulsory
BM – 112 : Calculus

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 26
Sessional : 10	Sessional : 7

Note: The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I

× ▤ ☙ definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.

Section – II

Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes in polar coordinates. Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Newton's method. Radius of curvature for pedal curves. Tangential polar equations. Centre of curvature. Circle of curvature. Chord of curvature, evolutes. Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points. Type of cusps.

Section – III :

Tracing of curves in Cartesian, parametric and polar co-ordinates. Reduction formulae. Rectification, intrinsic equations of curve.

Section – IV :

Quardrature (area)Sectorial area. Area bounded by closed curves. Volumes and surfaces of solids of revolution. Theorems of Pappu's and Guilden.

Books Recommended :

1. Differential and Integral Calculus : Shanti Narayan.
2. Murray R. Spiegel : Theory and Problems of Advanced Calculus. Schaun's Outline series. Schaum Publishing Co., New York.
3. N. Piskunov : Differential and integral Calculus. Peace Publishers, Moscow.
4. Gorakh Prasad : Differential Calculus. Pothishasla Pvt. Ltd., Allahabad.
5. Gorakh Prasad : Integral Calculus. Pothishala Pvt. Ltd., Allahabad.

B.A. (Hons.)/B.Sc.(Hons.) – Ist Year (Semester – I)
Compulsory
BM – 113 : Solid Geometry

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 27
Sessional : 10	Sessional : 7

Note: The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I

General equation of second degree. Tracing of conics. Tangent at any point to the conic, chord of contact, pole of line to the conic, director circle of conic. System of conics. Confocal conics. Polar equation of a conic, tangent and normal to the conic.

Section – II

Sphere: Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, radical plane of two spheres. Co-oxal system of spheres

Cones. Right circular cone, enveloping cone and reciprocal cone.

Cylinder: Right circular cylinder and enveloping cylinder.

Section – III

Central Conicoids: Equation of tangent plane. Director sphere. Normal to the conicoids. Polar plane of a point. Enveloping cone of a coincoid. Enveloping cylinder of a coincoid.

Section – IV

Paraboloids: Circular section, Plane sections of conicoids.

Generating lines. Confocal conicoid. Reduction of second degree equations.

B.A. (Hons.)/B.Sc.(Hons.) – Ist Year (Semester – II)
Compulsory
BM – 121 : Number Theory And Trigonometry

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 27
Sessional : 10	Sessional : 6

Note: The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five part distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I :

Divisibility, G.C.D.(greatest common divisors), L.C.M.(least common multiple) Primes, Fundamental Theorem of Arithemetic. Linear Congruences, Fermat's theorem. Wilson's theorem and its converse. Linear Diophanatine equations in two variables

Section – II :

Complete residue system and reduced residue system modulo m. Euler ϕ function Euler's generalization of Fermat's theorem. Chinese Remainder Theorem. Quadratic residues. Legendre symbols. Lemma of Gauss; Gauss reciprocity law. Greatest integer function [x]. The number of divisors and the sum of divisors of a natural number n (The functions d(n) and $\sigma(n)$). Moebius function and Moebius inversion formula.

Section - III :

De Moivre's Theorem and its Applications. Expansion of trigonometrical functions. Direct circular and hyperbolic functions and their properties.

Section – IV :

Inverse circular and hyperbolic functions and their properties. Logarithm of a complex quantity. Gregory's series. Summation of Trigonometry series

Books Recommended :

1. S.L. Loney : Plane Trigonometry Part – II, Macmillan and Company, London.
2. R.S. Verma and K.S. Sukla : Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahabad.
3. Ivan Ninen and H.S. Zuckerman. An Introduction to the Theory of Numbers.

B.A. (Hons.)/B.Sc.(Hons.) – Ist Year (Semester – II)
Compulsory
BM – 122 : Ordinary Differential Equations

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 26
Sessional : 10	Sessional : 7

Note: The examiner is requested to set nine questions in all, selecting two question from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I

Geometrical meaning of a differential equation. Exact differential equations, integrating factors. First order higher degree equations solvable for x,y,p Lagrange's equations, Clairaut's equations. Equation reducible to Clairaut's form. Singular solutions.

Section – II

Orthogonal trajectories: in Cartesian coordinates and polar coordinates. Self orthogonal family of curves.. Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Equations reducible to homogeneous

Section – III

Linear differential equations of second order: Reduction to normal form. Transformation of the equation by changing the dependent variable/ the independent variable. Solution by operators of non-homogeneous linear differential equations. Reduction of order of a differential equation. Method of variations of parameters. Method of undetermined coefficients.

Section – IV

Ordinary simultaneous differential equations. Solution of simultaneous differential equations involving operators x (d/dx) or t (d/dt) etc. Simultaneous equation of the form $dx/P = dy/Q = dz/R$. Total differential equations. Condition for $Pdx + Qdy + Rdz = 0$ to be exact. General method of solving $Pdx + Qdy + Rdz = 0$ by taking one variable constant. Method of auxiliary equations.

Books Recommended :

1. D.A. Murray : Introductory Course in Differential Equations. Orient Longaman (India) . 1967
2. A.R.Forsyth : A Treatise on Differential Equations, Machmillan and Co. Ltd. London
3. E.A. Codington : Introduction to Differential Equations.
4. S.L.Ross: Differential Equations, John Wiley & Sons
5. B.Rai & D.P. Chaudhary : Ordinary Differential Equations; Narosa, Publishing House Pvt. Ltd.

B.A. (Hons.)/B.Sc.(Hons.) – Ist Year (Semester – II)
Compulsory
BM – 123 : Vector Calculus

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 27
Sessional : 10	Sessional : 7

Note: The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I

Scalar and vector product of three vectors, product of four vectors. Reciprocal vectors. Vector differentiation Scalar Valued point functions, vector valued point functions, derivative along a curve, directional derivatives

Section – II

Gradient of a scalar point function, geometrical interpretation of grad Φ , character of gradient as a point function. Divergence and curl of vector point function, characters of Div $\vec{f}$ and Curl $\vec{f}$ as point function, examples. Gradient, divergence and curl of sums and product and their related vector identities. Laplacian operator.

Section – III

Orthogonal curvilinear coordinates Conditions for orthogonality fundamental triad of mutually orthogonal unit vectors. Gradient, Divergence, Curl and Laplacian operators in terms of orthogonal curvilinear coordinates, Cylindrical co-ordinates and Spherical co-ordinates.

Section – IV

Vector integration; Line integral, Surface integral, Volume integral
Theorems of Gauss, Green & Stokes and problems based on these theorms.

Books Recommended:

1. Murrary R. Spiegal : Theory and Problems of Advanced Calculus, Schaum Publishing Company, New York.
2. Murrary R. Spiegal : Vector Analysis, Schaum Publisghing Company, New York.
3. N. Saran and S.N. NIgam. Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahabad.
4. Shanti Narayna : A Text Book of Vector Calculus. S. Chand & Co., New Delhi.

B.A. (Hons.)/B.Sc.(Hons.) - IInd Year (Semester-III)
Compulsory
BM -231 : Advanced Calculus

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40 Sessional : 10	Theory : 27 Sessional : 6

Note: The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five or six parts distributed over all the four sections. Candidates are required to attempt five questions in all, selecting at least one question form each section and the compulsory question.

SECTION-I

Continuity, Sequential Continuity, properties of continuous functions, Uniform continuity, chain rule of differentiability. Mean value theorems; Rolle's Theorem and Lagrange's mean value theorem and their geometrical interpretations. Taylor's Theorem with various forms of remainders, Darboux intermediate value theorem for derivatives, Indeterminate forms.

SECTION-II

Limit and continuity of real valued functions of two variables. Partial differentiation. Total Differentials; Composite functions & implicit functions. Change of variables. Homogenous functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables.

SECTION-III

Differentiability of real valued functions of two variables. Schwarz and Young's theorem. Implicit function theorem. Maxima, Minima and saddle points of two variables. Lagrange's method of multipliers.

SECTION-IV

Curves: Tangents, Principal normals, Binormals, Serret-Frenet formulae. Locus of the centre of curvature, Spherical curvature, Locus of centre of Spherical curvature, Involutes, evolutes, Bertrand Curves. Surfaces: Tangent planes, one parameter family of surfaces, Envelopes.

Books Recommended:

1. C.E. Weatherburn : Differential Geometry of three dimensions, Radhe Publishing House, Calcutta
2. Gabriel Klaumber : Mathematical analysis, Mrcel Dekkar, Inc., New York, 1975
3. R.R. Goldberg : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
4. Gorakh Prasad : Differential Calculus, Pothishala Pvt. Ltd., Allahabad
5. S.C. Malik : Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
6. Shanti Narayan : A Course in Mathemtical Analysis, S.Chand and company, New Delhi
7. Murray, R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing co., New York

B.A. (Hons.)/B.Sc.(Hons.) - IInd Year (Semester-III)
Compulsory
BM -232 :Partial Differential Equations

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 26
Sessional : 10	Sessional : 7

Note: The examiner is requested to set **nine questions** in all, selecting two questions from each section and **one compulsory question** consisting of five or six parts distributed over all the four sections. Candidates are required to attempt **five questions** in all, selecting **at least one question** form each section and the compulsory question.

SECTION-I

Partial differential equations: Formation, order and degree, Linear and Non-Linear Partial differential equations of the first order: Complete solution, singular solution, General solution, Solution of Lagrange's linear equations, Charpit's general method of solution. Compatible systems of first order equations, Jacobi's method.

SECTION-II

Linear partial differential equations of second and higher orders, Linear and non-linear homogenious and non-homogenious equations with constant co-efficients, Partial differential eqution with variable co-efficients reducible to equations with constant coefficients, their complimentary functions and particular Integrals, Equations reducible to linear equations with constant co-efficients.

SECTION-III

Classification of linear partial differential equations of second order, Hyperbolic, parabolic and elliptic types, Reduction of second order linear partial differential equations to Canonical (Normal) forms and their solutions, Solution of linear hyperbolic equations, Monge's method for partial differential equations of second order.

SECTION-IV

Cauchy's problem for second order partial differential equations, Characteristic equations and characteristic curves of second order partial differential equation, Method of separation of variables: Solution of Laplace's equation, Wave equation (one and two dimensions), Diffusion (Heat) equation (one and two dimension) in Cartesian Co-ordinate system.

Books Recommended:

1. D.A.Murray: Introductory Course on Differential Equations, Orient Longman, (India), 1967

2. Erwin Kreyszing : Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999

3. A.R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd.

4. Ian N.Sneddon : Elements of Partial Differential Equations, McGraw Hill Book Company, 1988

5. Frank Ayres : Theory and Problems of Differential Equations, McGraw Hill Book Company, 1972

6. J.N. Sharma & Kehar Singh : Partial Differential Equations

B.A. (Hons.)/B.Sc.(Hons.) - IInd Year (Semester-III)
Compulsory

BM -233 : Statics

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 27
Sessional : 10	Sessional : 7

Note: The examiner is requested to set **nine questions** in all, selecting two questions from each section and **one compulsory question** consisting of five or six parts distributed over all the four sections. Candidates are required to attempt **five questions in all**, selecting **at least one question** form each section and the compulsory question.

SECTION-I

Composition and resolution of forces. Parallel forces. Moments and Couples.

SECTION-II

Analytical conditions of equilibrium of coplanar forces. Friction. Centre of Gravity.

SECTION-III

Virtual work. Forces in three dimensions. Poinsots central axis.

SECTION-IV

Wrenches. Null lines and planes. Stable and unstable equilibrium.

Books Recommended:

1. S.L. Loney : Statics, Macmillan Company, London
2. R.S. Verma : A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad

B.A. (Hons.)/B.Sc.(Hons.) - IInd Year (Semester – IV)
Compulsory

BM -241 : SEQUENCES AND SERIES

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40 Sessional : 10	Theory : 27 Sessional : 6

Note: The examiner is requested to set **nine questions** in all, selecting two questions from each section and **one compulsory question** consisting of five or six parts distributed over all the four sections. Candidates are required to attempt **five questions in all**, selecting **at least one question** form each section and the compulsory question.

SECTION-I

Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighborhoods, interior points, isolated points, limit points, open sets, closed set, interior of a set, closure of a set in real numbers and their properties. Bolzano-Weiestrass theorem, Open covers, Compact sets and Heine-Borel Theorem.

SECTION-II

Sequence: Real Sequences and their convergence, Theorem on limits of sequence, Bounded and monotonic sequences, Cauchy's sequence, Cauchy general principle of convergence, Subsequences, Subsequential limits.

Infinite series: Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, Cauchy's general principle of Convergence of series, Convergence and divergence of geometric series, Hyper Harmonic series or p-series.

SECTION-III

Infinite series: D-Alembert's ratio test, Raabe's test, Logarithmic test, de Morgan and Bertrand's test, Cauchy's Nth root test, Gauss Test, Cauchy's integral test, Cauchy's condensation test.

SECTION-IV

Alternating series, Leibnitz's test, absolute and conditional convergence, Arbitrary series: abel's lemma, Abel's test, Dirichlet's test, Insertion and removal of parenthesis, re-arrangement of terms in a series, Dirichlet's theorem, Riemann's Re-arrangement theorem, Pringsheim's theorem (statement only), Multiplication of series, Cauchy product of series, (definitions and examples only) Convergence and absolute convergence of infinite products.

Books Recommended:

1. R.R. Goldberg : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970

2. S.C. Malik : Mathematical Analysis, Wiley Eastern Ltd., Allahabad.

3. Shanti Narayan : A Course in Mathematical Analysis, S.Chand and company, New Delhi

4. Murray, R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing co., New York

5. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985

6. Earl D. Rainville, Infinite Series, The Macmillan Co., New York

B.A. (Hons.)/B.Sc.(Hons.) - IInd Year (Semester – IV)
Compulsory

BM -242 : Special Functions And Integral Transforms

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40 Sessional : 10	Theory : 26 Sessional : 7

Note: The examiner is requested to set **nine questions** in all, selecting two questions from each section and **one compulsory question** consisting of five or six parts distributed over all the four sections. Candidates are required to attempt **five questions in all**, selecting **at least one question** form each section and the compulsory question.

SECTION-I

Series solution of differential equations – Power series method, Definitions of Beta and Gamma functions. Bessel equation and its solution: Bessel functions and their properties-Convergence, recurrence, Relations and generating functions, Orthogonality of Bessel functions.

SECTION-II

Legendre and Hermite differentials equations and their solutions: Legendre and Hermite functions and their properties-Recurrence Relations and generating functions. Orhogonality of Legendre and Hermite polynomials. Rodrigues' Formula for Legendre & Hermite Polynomials, Laplace Integral Representation of Legendre polynomial.

SECTION-III

Laplace Transforms – Existence theorem for Laplace transforms, Linearity of the Laplace transforms, Shifting theorems, Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives and integrals, solution of ordinary differential equations using Laplace transform.

SECTION-IV

Fourier transforms: Linearity property, Shifting, Modulation, Convolution Theorem, Fourier Transform of Derivatives, Relations between Fourier transform and Laplace transform, Parseval's identity for Fourier transforms, solution of differential Equations using Fourier Transforms.

Books Recommended:

1. Erwin Kreyszing : Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999
2. A.R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd.
3. I.N. Sneddon : Special Functions on mathematics, Physics & Chemistry.
4. W.W. Bell : Special Functions for Scientists & Engineers.
5. I.N. Sneddon: the use of integral transform, McGraw Hill, 1972
6. Murray R. Spiegel: Laplace transform, Schaum's Series

B.A. (Hons.)/B.Sc.(Hons.) - IInd Year (Semester – IV)
Compulsory
BM -243 : PROGRAMMING IN C & NUMERICAL METHODS

Time : 3 Hours (Theory)
Time : 2 Hours (Practical)

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 30	Theory : 20
Practical : 20	Practical : 14
No sessional	No sessional

Part-A (Theory)

Note: The examiner is requested to set **nine questions** in all, selecting two questions from each section and **one compulsory question** consisting of five or six parts distributed over all the four sections. Candidates are required to attempt **five questions in all**, selecting **at least one question** form each section and the compulsory question.

SECTION-I

Programmer's model of a computer, Algorithms, Flow charts, Data types, Operators and expressions, Input / outputs functions.

SECTION-II

Decisions control structure: Decision statements, Logical and conditional statements, Implementation of Loops, Switch Statement & Case control structures. Functions, Preprocessors and Arrays.

SECTION-III

Strings: Character Data Type, Standard String handling Functions, Arithmetic Operations on Characters. Structures: Definition, using Structures, use of Structures in Arrays and Arrays in Structures. Pointers: Pointers Data type, Pointers and Arrays, Pointers and Functions.

Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson's method. Newton's iterative method for finding pth root of a number, Order of convergence of above methods.

SECTION-IV

Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Crout's method, Cholesky Decomposition method. Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method.

Part-B (Practical)

-Simple programs in C and the implementation of Numerical Methods, studied in the theory paper, in 'C' programming Language.

Books Recommended:

1. B.W. Kernighan and D.M. Ritchie : The C Programming Language, 2nd Edition
2. V. Rajaraman : Programming in C, Prentice Hall of India, 1994
3. Byron S. Gottfried : Theory and Problems of Programming with C, Tata McGraw-Hill Publishing Co. Ltd., 1998
4. M.K. Jain, S.R.K.Lyengar, R.K. Jain : Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
5. M.K. Jain, S.R.K. Lyengar, R.K. Jain : Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999
6. Computer Oriented Numerical Methods, Prentice Hall of India Pvt. Ltd.
7. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill Publishing Co. Ltd.

B.A. (Hons.)/B.Sc.(Hons.) - IIIrd Year (Semester-V)
Compulsory

BM -351 : REAL ANALYSIS

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40 Sessional : 10	Theory : 27 Sessional : 6

Note: The examiner is requested to set **nine questions** in all, selecting two questions from each section and **one compulsory question** consisting of five or six parts distributed over all the four sections. Candidates are required to attempt **five questions in all**, selecting **at least one question** form each section and the compulsory question.

SECTION-I

Riemann integral, Integrabililty of continuous and monotonic functions, The Fundamental theorem of integral calculus. Mean value theorems of integral calculus.

SECTION-II

Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests, Frullani's integral, Integral as a function of a parameter. Continuity, Differentiability and integrability of an integral of a function of a parameter.

SECTION-III

Definition and examples of metric spaces, neighborhoods, limit points, interior points, open and closed sets, closure and interior, boundary points, subspace of a metric space, equivalent metrics, Cauchy sequences, completeness, Cantor's intersection theorem, Baire's category theorem, contraction Principle

SECTION-IV

Continuous functions, uniform continuity, compactness for metric spaces, sequential compactness, Bolzano-Weierstrass property, total boundedness, finite intersection property, continuity in relation with compactness, connectedness , components, continuity in relation with connectedness.

Book s Recommended:

1. P.K. Jain and Khalil Ahmad: Metric Spaces, 2nd Ed., Narosa, 2004
2. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
3. R.R. Goldberg : Real analysis, Oxford & IBH publishing Co., New Delhi, 1970
4. D. Somasundaram and B. Choudhary : A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997
5. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi
6. E.T. Copson, Metric Spaces, Cambridge University Press, 1968.
7. G.F. Simmons : Introduction to Topology and Modern Analysis, McGraw Hill, 1963.

B.A. (Hons.)/B.Sc.(Hons.) - IIIrd Year (Semester-V)
Compulsory

BM -352 : Groups and Rings

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 26
Sessional : 10	Sessional : 7

Note: The examiner is requested to set **nine questions** in all, selecting two questions from each section and **one compulsory question** consisting of five or six parts distributed over all the four sections. Candidates are required to attempt **five questions in all**, selecting **at least one question** form each section and the compulsory question.

SECTION-I

Definition of a group with example and simple properties of groups, Subgroups and Subgroup criteria, Generation of groups, cyclic groups, Cosets, Left and right cosets, Index of a sub-group Coset decomposition, Largrage's theorem and its consequences, Normal subgroups, Quotient groups,

SECTION-II

Homoomorphisms, isomophisms, automorphisms and inner automorphisms of a group. Automorphisms of cyclic groups, Permutations groups. Even and odd permutations. Alternating groups, Cayley's theorem, Center of a group and derived group of a group.

SECTION-III

Introduction to rings, subrings, integral domains and fields, Characteristics of a ring. Ring homomorphisms, ideals (principle, prime and Maximal) and Quotient rings, Field of quotients of an integral domain.

SECTION-IV

Euclidean rings, Polynomial rings, Polynomials over the rational field, The Eisenstein's criterion, Polynomial rings over commutative rings, Unique factorization domain, R unique factorization domain implies so is R[X1 , X2……Xn]

Books Recommended:

1. I.N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975

2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal : Basic Abstract Algebra (2^{nd} edition).
3. Vivek Sahai and Vikas Bist : Algebra, NKarosa Publishing House.
4. I.S. Luther and I.B.S. Passi : Algebra, Vol.-II, Norsa Publishing House.

B.A. (Hons.)/B.Sc.(Hons.) - IIIrd Year (Semester-V)

Compulsory

BM -353 : NUMERICAL ANALYSIS

Time : 3 Hours (Theory)
Time : 2 Hours (Practical)

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 30	Theory : 20
Practical : 20	Practical : 14
No sessional	No sessional

Part-A (Theory)

Note: The examiner is requested to set **nine questions** in all, selecting two questions from each section and **one compulsory question** consisting of five or six parts distributed over all the four sections. Candidates are required to attempt **five questions in all**, selecting **at least one question** form each section and the compulsory question.

SECTION-I

Finite Differences operators and their relations. Finding the missing terms and effect of error in a difference tabular values, Interpolation with equal intervals: Newton's forward and Newton's backward interpolation formulae. Interpolation with unequal intervals: Newton's divided difference, Lagrange's Interpolation formulae, Hermite Formula.

SECTION-II

Central Differences: Gauss forward and Gauss's backward interpolation formulae, Sterling, Bessel Formula.

Probability distribution of random variables, Binomial distribution, Poisson's distribution, Normal distribution: Mean, Variance and Fitting.

SECTION-III

Numerical Differentiation: Derivative of a function using interpolation formulae as studied in Sections –I & II.

Eigen Value Problems: Power method, Jacobi's method, Given's method, House-Holder's method, QR method, Lanczos method.

SECTION-IV

Numerical Integration: Newton-Cote's Quadrature formula, Trapezoidal rule, Simpson's one- third and three-eighth rule, Chebychev formula, Gauss Quadrature formula.

Numerical solution of ordinary differential equations: Single step methods-Picard's method. Taylor's series method, Euler's method, Runge-Kutta Methods. Multiple step methods; Predictor-corrector method, Modified Euler's method, Milne-Simpson's method.

Part-B (Practical)

Implementation of numerical methods, studied in the theory paper, in 'C' Programming Language.

Books Recommended:

1. M.K. Jain, S.R.K.Lyengar, R.K. Jain : Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
2. M.K. Jain, S.R.K. Lyengar, R.K. Jain : Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999
3. C.E. Froberg : Introduction to Numerical Analysis (2nd Edition).
4. Melvin J. Maaron : Numerical Analysis-A Practical Approach, Macmillan Publishing Co., Inc., New York
5. R.Y. Rubnistein : Simulation and the Monte Carlo Methods, John Wiley, 1981
6. Computer Oriented Numerical Methods, Practice Hall of India Pvt. Ltd.

Semester – V

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 27
Sessional : 10	Sessional : 6

BM-354 opt. (i) Differential Geometry

Note: - The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I

Local theory of curves: Tangent, Principal normal, curvature, Binormal, Torsion, Serret-Frenet for mulae. Centre of curvature, spherical curvature, Helices, spherical indicative of tangent.

Section – II

Involutes and evolutes of curves, Bertrand curves, surface, Tangent and normal envelopes, characteristics, edge of regression and Developable surfaces.

Section – III

First fundamental form, Direction on a surface, second order magnitude, curvature of normal section, Meunier's theorem.

Section – IV

Principal direction and curvatures, First and second curvature, Gacessian curvature, Euler's theorem, Gauss formula, Gacess-Bonnet formula, equation of Geodesic, Torsion of Geodesic.

Books Recommended:

Scope as in relevant portion of chapters I-VI of Book, C.E. Weather burn, Differential Geometry on three dimensions. The English language Book society – Cambridge University Press – 1971.

REFERENCES:

1. J.A. Thorpe, Introduction to Differential Geometry, springer-verlag.
2. B.O' Neill. Elementary Differential Geometry, Academic Press, 1966. S.St.

Semester – V

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40 Sessional : 10	Theory : 27 Sessional : 6

BM-354 opt. (ii) Mathematical Modeling – I

Note: -The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I

The process of Applied Mathematics: Mathematical modeling, need techniques classification and illustrative.

Section – II

Mathematical modeling through ordinary differential equation of first order. Mathematical modeling in population dynamics, mathematical modeling of epidemic and compartment models through system of ordinary differential equations.

Section – III

Mathematical modeling in economics, in medicine, Arms race, Battle, international trade and dynamics through ordinary differential equations. Mathematical modeling through ordinary differential equation of record order.

Section – IV

Mathematical modeling through difference equations: need Basic theory, Economics and finance, population dynamics and Genetics, probability theory and examples.

Books Recommended:

J.N. Kapur: Mathematical modeling Wiley Eastern limited, 1990
Relevant position of Scope arvid chapter I & V

Semester - V

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 27
Sessional : 10	Sessional : 6

BM-354 Opt.(iii) Applications of Mathematics in Finance

Note: - The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

SECTION-I

Financial Management-A Overview. Nature and Scope of Financial Management. Goals of Financial Management and Main Decisions of Financial Management.

SECTION-II

Difference between Risk, Speculation and Gambling. Time value of Money-Interest Rate and Discount Rate.
Present Value and Future Value-Discrete case as well as Continuous Compounding Case. Annuities and its kinds.

SECTION-III

Meaning of return. Return as Internal Rate of return (IRR). Numerical Methods like Newton Raphson Method to calculate IRR. Measurement of Returns under uncertaining situations. Meaning of risk. Difference between risk and uncertainty.

SECTION-IV

Types of risks. Measurement of risk. Calculation of security and Port-folio Risk and Return – Markowitz Model. Sharpe's Single Index Model-Systematic Risk and Unsystematic Risk. Taylor Series and Bond Valuation. Calculation of Duration and Convexity of bonds. Financial Derivatives- Futures. Forward. Swaps and Options. Call and Put Options.

REFERENCES:

1. Aswath Damodaran, Corporate Finance-Theory and Practice, John Waley and Sons, Inc.
2. John C. Hull, Options, Futures and Other Derivatives, Prentice Hall of India Pvt. Ltd.
3. Sheldon M. Ross, An Introduction to Mathematicsal Finance, Cambridge University Press.

Semester - V
Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40 Sessional : 10	Theory : 26 Sessional : 7

BM-355 opt (i) Probability Theory

Note: - The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

SECTION-1

Notion of Probability: Random Experiment, sample space, axiom of probability, elementary properties, equally likely outcome problems.

SECTION-II

Random Variable: concept, cumulative distribution function, discrete and continuous random variable, expectations, mean variance, moment generating function.

SECTION-III

Discrete distributions: Bernoulli, binomial, geometric and poisson. Continuous distributions: uniform, exponential, gamma and normal. Conditional probability and conditional expectations, Bayes theorem independence.

SECTION-IV

Computing expectation by conditioning; some applications – a list model, a random graph, 37laya's urn model. Bivariate random variables : joint distribution, joint and conditional distributions, the correlation, coefficient.

REFERENCES:

1. S.M. Ross, Introduction to Probability Models (Sixth Edition) Academic Press. 1997.
2. I.Blake, An Introduction to Applied Probability, John Wiley and sons, 1979.
3. J.Pitman, Probability, Narosa, 1993.

Semester – V

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40 Sessional : 10	Theory : 26 Sessional : 7

BM-355 opt. (ii) Number Theory:

Note: - The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I

Diophantine equations, Equation ax+by = c, simultaneous linear equations, Pythagorean triangles, Assorted examples.

Section – II

Farey sequences, Rational approximations, Irrational numbers.

Section – III

Simple continued fractions, Euclidean algorithm, uniqueness, infinite continued fractions, irrational numbers, approximations to irrational numbers.

Section – IV

Best possible approximations, periodic continued fractions. Pell's equation, Numerical computation.

Recommended Text :

1. I. Niven, S.H. Zuckerman, and L.H. Montgomery, An Introduction to the theory of Numbers, John Wiley, 1991.

REFERENCES :

1. David m. Burton, Elementary Number Theory, Wm. C. Brown Publishers, Dubuque, Lowa, 1989.
2. K. Ireland and M. Rosen, A Classical Introduction to Modern Number Theory. GTM Vol. 84, Springer – Verlag, 1972.

Semester - V

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 26
Sessional : 10	Sessional : 7

BM-355 opt (iii) Discrete Mathematics - I

Note: - The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I

Sets, proposections, Basic logical operations. Logical equivalence involving tautologies and contradictions, condition proposections, rules of inference.
Relation and functions. Banary relation equivalence relations and partions. Partially ordered sets. Chains and Antichains. Principle of inclusion and exclusion. Pigeon hole principle and its applications. Principle of mathematical induction.

Section – II

Numeric functions and asymptotic behaviour of numeric functions. Generating functions. Recurrence relations. Linear recurrence relations with constant coefficients. Homogeneous solutions, particular solutions and total solutions, solution by the method of generating functions. Sorting algoreithms.

Section – III

Lattices, sublattices. Principle of duality, Lattice as an algebraic system. Complete and incomplete lattices. Homomorphism and isomorphism of lattices. Order preserving and order reversing maps of lattices. Distributive lattices. Modular lattices. Sublattices of the form I[a,b], a>b. The theorem I[av,b,b]~ I[a,a^b]. The direct product of lattices.

Section – IV

Complemented lattices. Boolean algebras, Boolean algebra as Boolean ring and conversely a Boolean ring as a Boolean algebra. Finite Boolean algebras. Fundamental theorem of Boolean algebra. Boolean functions and Boolean expressions. (Polynomials). Application of Boolean algebra to switching circuits.

Semester – V

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 27
Sessional : 10	Sessional : 7

BM-356 opt. (i) Mechanics

Note: - The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I

Moments and products of inertia. The Momental ellipsoid Equimomental systems. Principal axes.

Section – II

'D' Alembert's principle. The general equations of motion of a rigid body. Independence of the motions of translation & Rotation. Motion about a fixed axis. The compound pendulum.

Section – III

Motion in two dimension, finite forces, kinetic energy in two dimensions. Moment of momentum in two dimension, motion in two dimension, impulsive forces.

Section – IV

Conservation of linear and angular momentum, conservation of energy, language's equations in generalized coordinates, initial motion.

REFERENCES :

1. S.L. Loney, An elementary Treatise on the Dynamics of a Particle and of rigid bodies, Cambridge University Press, 1956.
2. A.S. Ramsey, Dynamics, Part I, Cambridge University Press, 1973.

Semester – V

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 30 Practical : 20	Theory : 20 Practical :14

BM-356 opt. (ii) Principles of Computer Science-I

Note: - The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

SECTION-I

Data Storage-Storage of Bits. Main Memory. Mass Storage. Coding Information of Storage. The Binary System. Storing Integers, Storing Fraction, Communication errors.

SECTION-II

Data Manipulation- The Central processing Unit. The Stored-Programme Concept. Programme Execution. Other Architectures. Arithmetic/Logic Instructions. Computer-Peripheral Communication.

SECTION-III

Operating System and Networks- The Evolution of Operating System. Operating System Architecture. Co-ordinating the machine's activities.
Handling competition among process. Networks. Networks protocol.

SECTION-IV

Algorithms- The Concept of an Algorithm. Algorithm Representation.
Algorithm Discovery. Iterative Structures. Recursive Structures. Efficiency and Correctness. (Algorithms to be implemented in C^{++}).

REFERENCES:

1. J.Glen Brookshear, Computer Science: An Overview, Addition Wesley.
2. Stanely B.Lippman, Josee Lojoie, C^{++} Primer (3^{rd} Edition), Addison-Wesley.

Semester - V

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 30	Theory : 20
Practical : 20	Practical : 14

BM-356 opt. (iii) Computational Mathematics Laboratory-I

Note: - The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

The student is expected to familiarize himself/herself with popular softwares for numerical computation and optimization. Real life problems requiring knowledge of numerical algorithms for linear and non-linear algebraic equations, Eigen value problems, Finite Difference Methods, Inter-polation, Differentiation, Integration Ordinary differential equations etc. should be attempted. Capabilities to deal with linear, integer and non-linear optimization problems need to be developed. The objective of such a laboratory is to equip students to model and stimulate large-scale systems using optimization modeling languages (the concerned teacher is expected to provide the necessary theoretical background before the student does the corresponding practical). To this end softwares like MATLAB and LINDO.

SECTION-I

Plotting of Functions.

SECTION-II

Matrix operations, vector and matrix manipulations, matrix function. Sparse matrices-Iterative method for sparse linear-equations, Eigen values of sparse matrices, Game of life.

SECTION-III

Data analysis and curve fitting. Use of FFT algorithm.

SECTION-IV

Numerical integration, Roots finding, Simultaneous linear equation.

REFERENCES :

1. MATLAB- High performance numeric computation and visualization software: User's guide.
2. MATHEMATICA-Stephen Wolfram, Cambridge.
3. Introduction to operations research, F.S. Hiller and G.J. Liberman.
4. Optimization modeling with LINDO: Linus Scharge.

B.A. (Hons.)/B.Sc.(Hons.) - IIIrd Year (Semester – VI)
Compulsory
BM -361 : REAL &COMPLEX ANALYSIS

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40 Sessional : 10	Theory : 27 Sessional : 6

Note: The examiner is requested to set **nine questions** in all, selecting two questions from each section and **one compulsory question** consisting of five or six parts distributed over all the four sections. Candidates are required to attempt **five questions in all**, selecting **at least one question** form each section and the compulsory question.

SECTION-I

Jacobians, Beta and Gama functions, Double and Triple integrals, Dirichlets integrals, change of order of integration in double integrals.

SECTION-II

Fourier's series: Fourier expansion of piecewise monotonic functions, Properties of Fourier Co-efficients, Dirichlet's conditions, Parseval's identity for Fourier series, Fourier series for even and odd functions, Half range series, Change of Intervals.

SECTION-III

Extended Complex Plane, Stereographic projection of complex numbers, continuity and differentiability of complex functions, Analytic functions, Cauchy-Riemann equations. Harmonic functions.

SECTION-IV

Mappings by elementary functions: Translation, rotation, Magnification and Inversion. Conformal Mappings, Mobius transformations. Fixed pints, Cross ratio, Inverse Points and critical mappings.

Books Recommended:

1. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985

2. R.R. Goldberg : Real analysis, Oxford & IBH publishing Co., New Delhi, 1970

3. D. Somasundaram and B. Choudhary : A First Course in Mathematical, Analysis, Narosa Publishing House, New Delhi, 1997

4. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi

5. R.V. Churchill & J.W. Brown: Complex Variables and Applications, 5th Edition, McGraw-Hill, New York, 1990

6. Shanti Narayan : Theory of Functions of a Complex Variable, S. Chand & Co., New Delhi.

B.A./B.Sc.(Hons.) - IIIrd Year (Semester-VI)
Compulsory
BM -362 : LINEAR ALGEBRA

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40 Sessional : 10	Theory : 26 Sessional : 7

Note: The examiner is requested to set **nine questions** in all, selecting two questions from each section and **one compulsory question** consisting of five or six parts distributed over all the four sections. Candidates are required to attempt **five questions in all**, selecting **at least one question** form each section and the compulsory question.

SECTION-I

Vector spaces, subspaces, Sum and Direct sum of subspaces, Linear span, Linearly Independent and dependent subsets of a vector space. Finitely generated vector space, Existence theorem for basis of a finitely generated vactor space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension.

SECTION-II

Homomorphism and isomorphism of vector spaces, Linear transformations and linear forms on vactor spaces, Vactor space of all the linear transformations Dual Spaces, Bidual spaces, annihilator of subspaces of finite dimentional vactor spaces, Null Space, Range space of a linear transformation, Rank and Nullity Theorem,

SECTION-III

Algebra of Liner Transformation, Minimal Polynomial of a linear transformation, Singular and non-singular linear transformations, Matrix of a linear Transformation, Change of basis, Eigen values and Eigen vectors of linear transformations.

SECTION-IV

Inner product spaces, Cauchy-Schwarz inequality, Orthogonal vectors, Orthogonal complements, Orthogonal sets and Basis, Bessel's inequality for finite dimensional vector spaces, Gram-Schmidt, Orthogonalization process, Adjoint of a linear transformation and its properties, Unitary linear transformations.

Books Recommended:

1. I.N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal : Basic Abstract Algebra (2^{nd} edition).
3. Vivek Sahai and Vikas Bist : Algebra, NKarosa Publishing House.
4. I.S. Luther and I.B.S. Passi : Algebra, Vol.-II, Norsa Publishing House.

B.A. (Hons.)/B.Sc. (Hons.) - IIIrd Year (Semester-VI)
Compulsory

BM -363 : Dynamics

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 27
Sessional : 10	Sessional : 7

Note: The examiner is requested to set **nine questions** in all, selecting two questions from each section and **one compulsory question** consisting of five or six parts distributed over all the four sections. Candidates are required to attempt **five questions in all**, selecting **at least one question** form each section and the compulsory question.

SECTION-I

Velocity and acceleration along radial, transverse, tangential and normal directions. Relative velocity and acceleration. Simple harmonic motion. Elastic strings.

SECTION-II

Mass, Momentum and Force. Newton's laws of motion. Work, Power and Energy. Definitions of Conservative forces and Impulsive forces.

SECTION-III

Motion on smooth and rough plane curves. Projectile motion of a particle in a plane. Vector angular velocity.

SECTION-IV

General motion of a rigid body. Central Orbits, Kepler laws of motion. Motion of a particle in three dimensions. Acceleration in terms of different co-ordinate systems.

Books Recommended:

1. S.L.Loney : An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press, 1956
2. F. Chorlton : Dynamics, CBS Publishers, New Delhi
3. A.S. Ramsey:

Semester – VI

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 27
Sessional : 10	Sessional : 6

BM-364 Opt (i) Optimization

Note: - The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

SECTION-I

Functions of random variables: sum of random variables, the law of large numbers and central limit theorem, the approximation of distributions. Uncertainly, information and entropy, conditional entropy, solution of certain logical problems by calculating information.

SECTION-II

The linear programming problem. Problem formulation. Linear programming in matrix notation. Graphical solution of linear programming problems.

SECTION-III

Some basic properties of convex sets, convex functions and concave functions. Theory and application of the simplex method of solution of a linear programming problem.

SECTION-IV

Charne's M-technique. The two phase method. Principle of duality in linear programming problem. Fundamental duality theorem. Simple problems. The transportation and Assignment problems.

REFERENCES:

1. A.M. Yagolam and I.M.Yagolam, Probability and Information, Hindustan Publishing Corporation, Delhi, 1983.
2. Mokhtar S.Bazaraa, John J. Jarvis and Hanif D. Shirali, Linear Programming and Network flows, John Wiley & Sons, 1990.
3. G. Hadley, Linear Proramming, Narosa Publishing House, 1995.
4. S.I. Gass, Linear Programming: Methods and Applications (4th Edition) Mc Graw-Hill, New York, 1975. Kanti Swaroop, P.K. Gupta and Manmohan, Operations Research, Sultan Chand and sons, New Delhi, 1998.

Semester - VI
Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 27
Sessional : 10	Sessional : 6

BM- 364 opt. (ii) Riemannian Geometry

Note: -The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I

Summalian convention, Riemannia metric; Fundamental Tensor, Associate covariant and contravariant vectors, Principal directions for a symmetric covariant tensor of the record order.

Section – II

The clrisstoffe symbols, covariant derivation of a covariant vector and contravariant vector, covariant derivative of a Tensors, covariant differentiation of sums and products.

Section – III

Curvature of a curve, Geodesics, Differential equation of geodesics, geodesics coordinate, geodesics form of the linear element, geodesics in Euclideon space. Substance of a Riemannian manifold.

Section – IV

Rice, co-efficient of rotation, Geodesic congruences, curvature Tensor, identity of Bianchi.

RECOMMENDED BOOKS :

Relevant portion of chapter I-VI of Book : C.E. Weatherburn and the Tensor Calculus, Radha Publication Hosue, Calcutta.

REFERENCES :

J.A. Thorpe, Introduction to Differential Geometry, springer-verlag.
B.O' Neill. Elementary Differential Geometry, Academic Press, 1966. S.St.

Semester – VI

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 27
Sessional : 10	Sessional : 6

BM-364 opt. (iii) Discrete Mathematics - II

Section – I

Graphs, Finite, Infinite and simple graphs. Incident vertices and edges. Degree of a vertex. Isolated and pendent vertices. Isomorphism of graphs. Subgraphs, walks, paths and circuits in graphs connected and disconnected graphs. Components of a disconnected graph. Euler and Hamiltonkan circuits and graphs. Konisberg senan bridges problem. Travelling salesman problem. Trees Pendent vertices in a tree, Roited and binary tree. Spanning trees Rank and of a graph. Fundamental circuits.

Section – II

Cut sets. Fundamental cut sets. Fundamental circuits and cut sets. Connectivity Planar graphs. Kurtowski first and second graph. Euler formula on planar graphs Adjacency matrix of a graph and its properties.

Section – III

Computability and formal languages. Russell paradox and none computability. Ordered sets languages. Phrase structure grammars, type of Grammers and languages. Finite state machines. Infinite and output strings. Equivalence of finite state machines. Type – 1, Type – 2, Type – 3 grammar

Section – IV

Finite state, automata finite state, acceptor and their construction under a given condition. Non-deterministic finite state automation. The equivalence of DFSA and NDFSA. Moore machine and mealy machines and their equivalence, Turing machine. Regular grammar andfinite state automation.

Semester – VI

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 26
Sessional : 10	Sessional : 7

BM- 365 opt. (i) Hydrostatic

Note: -The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I

Pressure equation. Condition of equilibrium. Lines of force. Homogeneous and Heterogeneous fluids. Elastic fluids. Surface of equal pressure.

Section – II

Fluid at rest under action of gravity. Rotating fluids. Fluid pressure on plane surfaces. Centre of pressure. Resultant pressure on curved surfaces.

Section – III

Equilibrium of floating bodies. Curves of buoyancy. Surface of buoyancy. Stability of equilibrium of floating bodies. Meta center.

Section – IV

Work done in producing a displacement. Vessel containing liquid. Gas Laws. Mixture of gases. Internal energy. Adiabatic expansion. Work done in compressing a gas. Isothermal atmosphere. Connective Equilibrium.

REFERENCES :

1. W.H. Besant and A.S. Ramsey, A Treatise on Hydromechanics, ELBS and G.Bell and Sons Ltd., London.

Semester – VI

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 26
Sessional : 10	Sessional : 7

BM- 365 opt. (ii) Mathematical Modeling – II

Note: -The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

Section – I

Mathematical modeling, through partial differential equation: PDE models, Mass-Balance equation, variational/principles, Probability generating function, model for traffic flow, nature & Boundary conditions.

Section – II

Mathematical modeling through graphs : Modeling through graphs, Mathematical models in terms of Directed graphs, signed graphs, weighted Digraph and un-oriented graphs.

Section – III

Mathematical modeling through functional, integral equations, calculus of variations and dynamic programming (Optimization principles and Techniques).

Section – IV

Mathematical modeling through mathematical programming (linear and non-linear), maximum principle and maximum entropy principle.

Books Recommended:

Relevant book of the chapter (6)-(10) of Book J.N. Kapur, Mathematical Modelling, Wiley Eastern Ltd., 1990

Semester – VI

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40	Theory : 26
Sessional : 10	Sessional : 7

BM-365 opt. (iii) Combinatorial Number Theory

Note :- The examiner is requested to set ten questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

SECTION – I

Functions of random variables: sum of random variables, the law of large numbers and central limit theorem, the approximation of distributions. Uncertainly, information and entropy, conditional entropy, solution of certain logical problems by calculating information.

SECTION – II

The linear programming problem. Problem formulation. Linear programming in matrix notation. Graphical solution of linear programming problems.

SECTION – III

Some basic properties of convex sets, convex functions and concave functions. Theory and application of the simplex method of solution of a linear programming problem.

SECTION – IV

Charne's M-technique. The two phase method. Principle of duality in linear programming problem. Fundamental duality theorem. Simple problems. The transportation and Assignment problems.

REFERENCES :

1. A.M. Yagolam and I.M. Yagolam, Probability and Information, Hindustan Publishing Corporation, Delhi, 1983.
2. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Shirali, Linear Programming and Network flows, John Wiley & Sons, 1990.
3. G.Hadley, Linear Programming, Narosa Publishing House, 1995.

4. S.I. Gass, Linear Programming: Methods and Applications (4th Edition) Mc Graw-Hill, New York, 1975. Kanti Swaroop, P.K. Gupta and Manmohan, Operations Research, Sultan Chand and sons, New Delhi, 1998.

Semester -VI

Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 40 Sessional : 10	Theory : 27 Sessional : 7

BM-366 opt. (i) Application of Mathematics in Insurance

Note: - The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

SECTION-I

Insurance Fundamentals-Insurance defined. Meaning of Loss. Chances of Loss, peril, hazard and proximate cause in insurance. Costs and benefits of insurance to the society and branches of insurance-life insurance and various types of general insurance. Insurable loss exposures feature of a loss i.e. ideal for insurance.

SECTION-II

Life Insurance Mathematics-Construction of Mortality Tables. Computation of premium of Life Insurance for a fixed duration and for the whole life.

SECTION-III

Determination of claims for General Insurance-Using Poisson Distibution and Negative Binomial Distribution-the Polya Case.

SECTION-IV

Determination of the amount of Claims in General Insurance-Compound Aggregate claim model and its properties and claims of re-insurance. Calculation of a compound density function. F-Recursive and approximate formulae for F.

REFERENCES:

1. Mark S. Dorman, Introduction to Risk Management and Insurance, Prentice Hall, Englwood Cliffs, New Jersey.

2. C.D. Daykin, T.Pentikainen and M.Pesonam, Practical Risk Theory for Actuaries, Chapman and Hall.

Semester – VI
Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 30 Practical : 20	Theory : 20 Practical : 14

BM-366 opt. (ii) Principles of Computer Science-II

Note: -The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

SECTION-I

Programming languages-Historical Perspective. Traditional Programming Concepts, Program Units. Language Implementation. Parallel Computing. Declarative Computing. Software Engineering- The Software Engineering Discipline. The Software Life Cycle. Modularity.

SECTION-II

Development Tools and Techniques. Documentation. Software Ownership and Liability. Data Structures-Array. Lists. Stacks. Queues. Trees. Customised Data Types. Object Oriented Programming. File Structure-Sequential Files, Text Files.

SECTION-III

Data Base Structure- General issues. The Layered Approach to Data Base Implementation. The Relational Model. Object-Oriented Data Base. Maintaining Data base Integrity. E-R Models.

SECTION-IV

Artificial Intelligence-Some Philosophical Issues. Image Analysis. Reasoning. Control System Activities. Using Heuristics. Artificial Neural Networks. Applications of Artificial Intelligence. Theory of Computation-Turing machines.

REFERENCES:

1. J.Glen Brookshear, Computer Science: An Overview, Addition Wesley.
2. Stanely B.Lippman, Josee Lojoie, C^{++} Primer (3^{rd} Edition), Addison-Wesley.

Semester - VI
Optional Papers

Time : 3 Hours

B.Sc. (Hons.)	B.A. (Hons.)
Theory : 30 Practical : 20	Theory : 20 Practical : 14

BM-366 opt. (iii) Computational Mathematics Laboratory-II

Note: - The examiner is requested to set nine questions in all, selecting two questions from each section and one compulsory question consisting of five parts distributed over all the four sections. Candidates are required to attempt five questions, selecting at least one question from each section and the compulsory question.

The student is expected to familiarize himself/herself with popular softwares for numerical computation and optimization. Real life problems requiring knowledge of numerical algorithms for linear and non-linear algebraic equations, Eigen value problems, Finite Difference Methods, Inter-polation, Differentiation, Integration Ordinary differential equations etc. should be attempted. Capabilities to deal with linear, integer and non-linear optimization problems need to be developed. The objective of such a laboratory is to equip students to model and stimulate large-scale systems using optimization modeling languages (the concerned teacher is expected to provide the necessary theoretical background before the student does the corresponding practical). To this end softwares like MATLAB and LINDO.

SECTION-I

Non-linear equations and optimization functions. Differential equations.

SECTION-II

2-D Graphics and 3-D Graphics-general purpose graphics functions, color maps and color controls.

SECTION-III

Examples: Number theory, Picture of an FFT, Function of a Complex variable, Chaotic Motion in 3-D.

SECTION-IV

Linear Programming, Integer Programming and Quadratic Programming-Modeling and simulation techniques.

REFERENCES :

1. MATLAB- High performance numeric computation and visualization software: User's guide.
2. MATHEMATICA-Stephen Wolfram, Cambridge.
3. Introduction to operations research, F.S. Hiller and G.J. Liberman.
4. Optimization modeling with LINDO: Linus Scharge.