FOR QUALITY & EXCELLENCE
IN HIGHER EDUCATION
A GRADE (3.12)
ACCREDITED BY NAAC

BANGALORE UNIVERSITY

REGULATIONS, SCHEME AND SYLLABUS

(Approved in the BOS meeting held on 10.10.2009)

for the BACHELOR OF SCIENCE(B.Sc.)course

Mathematics Papers of I to VI Semesters

(Semester System - Y2K10 scheme)

Revised w. e. f.
Academic Year 2010 – 2011

DEPARTMENT OF MATHEMATICS
Central College Campus, Bangalore-560 001

BANGALORE UNIVERSITY
BANGALORE

DEPARTMENT OF MATHEMATICS

Proceedings of the adjourned meeting of BOS (UG) held on 10-10-2009 at 4.30 pm in the chambers of the Chairman, Department of Mathematics, Bangalore University, Central College, Bangalore – 1

Members

1. **Dr. Y. B. Maralabhavi** — Chairman
   Bangalore University, Bangalore-1
2. **Smt. Chayadevi R** — Member
   Maharani Lakshmi Ammanni College, Bangalore-12
3. **Mr. Narayana Nambiyar** — "
   Government Science College, Bangalore - 1.
4. **Sri. Gopalappa A.** — "
   V.V. PuramCollege of Science, K. R. Road, Bangalore-4
5. **Sri. Ravi Kumar S.** — "
   Rural College, Kanakapura - 562117
6. **Sri. Venkataramana Reddy N.** — "
   KGF First Grade College, Oorgaum-563 120
7. **Sri. Rajareddy K.** — "
   Govt. First Grade College for Women, Chintamani - 563125
8. **Smt. Vatsala R.** — "
   National College, Basavanagudi, Bangalore -4
9. **Dr. B. R. Nagaraj** — "
   TIFR Center for Applicable Mathematics, YNT, Bangalore-64
10. **Dr. R. Rangarajan** — "
    DOS in Mathematics, Univ. of Mysore, Mysore-6

The Chairman welcomed the members. The members discussed about the Revision of Syllabus of B.Sc degree Mathematics in detail and approved the contents. Since the topics like Mathematical Modeling and Topology were included in V and VI semesters which require more time for teaching, the members have raised the work load for each paper in V and VI semester from 4 hours per week to 5 hours per week.

Finally, the chairman thanked the members and the members reciprocated the same to the chairman.

Y.B. MARALABHAVI
Chairmana
BOS in Mathematics
Bangalore University, Bangalore

Title of Papers and Scheme of Study & Examination

for

B.Sc. (Bachelor of Science) Revised w.e.f. 2010– 2011

Sem.	Paper	Title of the paper	Lec. Hrs/Wk	Problem working hrs/week	Theory Max. Marks	CE	Total Marks
I	Math1	Mathematics I	5	2	90	10	100
II	Math2	Mathematics II	5	2	90	10	100
III	Math3	Mathematics III	5	2	90	10	100
IV	Math4	Mathematics IV	5	2	90	10	100
V	Math5	Mathematics V	5	2	90	10	100
V	Math6	Mathematics VI	5	2	90	10	100
VI	Math7	Mathematics VII	5	2	90	10	100
VI	Math8	Mathematics VIII	5	2	90	10	100

Note : In each semester two hours of problem working classes are to be conducted in batches of not more than 15 students in each batch. This should be outside the lecture hours. The work load must be taken in full for the teacher who is handling the problem working classes.

Regulations, Scheme of Study and Examamination for B.Sc. degree course under Semester System

(Revised w.e.f. 2010– 2011)

R 1. a) **Title of the course: Bachelor of Science**

b) Scheme of study:

i) There shall be one theory paper in Mathematics from first semester to fourth semester. There shall be two theory papers each during fifth and sixth semesters.

ii) Medium of Instruction: The medium of instruction shall be English.

c) Scheme of Examination:

i) At the end of each semester there shall be University examination of three hours duration in each of the theory papers.

ii) Continuous Evaluation (CE) carrying 10 marks in each of theory papers shall be based on the performance of the students in two written tests of one hour duration. No Minimum marks for passing is required in CE.

R 2. Attendance: Attendance requirement will be dealt with as per University rule from time to time.

R 3. Eligibility for admission:

a) Any student who has passed PUC – II with Mathematics and scoring a minimum of 35% of marks.

R 4. Results:

Results of candidate shall be declared and the classes awarded as per the procedure followed by the University for B.Sc. courses.

R 5. POWER TO REMOVE DIFFICULTIES

1) If any difficulty arises in giving effect to the provisions of these regulations, the Vice-Chancellor may by order make such provisions not inconsistent with the Act, Statutes, Ordinances or other Regulations, as appears to be necessary or expedient to remove the difficulty.

2) Every order made under this rule shall be subject to ratification by the appropriate University Authorities.

SYLLABUS

FIRST SEMESTER

MATHEMATICS – I

75 HOURS

(5 lecture hours per week + 2 hours of problem working classes) *

1. MATRICES

Elementary row and column transformations (operations) equivalent matrices, Theorem on it. Row- reduced echelon form, Normal form of a matrix, Rank of a matrix, Problems.

Homogeneous and Non – Homogeneous systems of m linear equations in n unknowns consistency criterion – criterion for uniqueness of solutions. Solution of the same by elimination method.

Eigen values and Eigen vectors of a square matrix of order 2 and 3, standard properties. Cayley-Hamilton theorem (with proof). Finding A^{-1}, A^{-2} and A^2, A^3, A^4.

(15 lecture hours)

2. DIFFERENTIAL CALCULUS

Successive Differentiation - n^{th} derivatives of the functions: e^{ax}, $(ax + b)^n$, $\log(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $e^{ax}\ sin\ (bx + c)$, $e^{ax}\ \cos(bx + c)$ – Problems

Leibnitz theorem (with proof) and its applications.

Partial differentiation ¬Function of two and three variables - First and higher derivatives - Homogeneous functions – derivatives- Euler's theorem and its extension (with proof) - Total derivative and differential - Differentiation of implicit functions and composite functions – Problems

Jacobians – Properties of Jacobians Problems. (20 lecture hours)

3. INTEGRAL CALCULUS

Reduction formulae for $\int \sin^n x\, dx$, $\int \cos^n x\, dx$, $\int \tan^n x\, dx$, $\int \cot^n x\, dx$, $\int \sec^n x\, dx$, $\int \operatorname{cosec}^n x\, dx$, $\int \sin^m x \cos^n x\, dx$, with definite limit, Differentiation under the integral sign by Leibnitz rule. (10 lecture hours)

4. ANALYTICAL GEOMETRY OF THREE DIMENSIONS

a) Direction cosines of a line (as components of unit vector) -Direction ratios- Angle between two lines, volume of a tetrahedron with given vertices.

Equation of a line in different forms : one point form, Two points form, Parallel and perpendicular conditions, Intersection of two lines, perpendicular from a point onto a line, Reflection of a point.

Equation of a plane in different forms - Perpendicular from a point on to a line.

Equation of a plane in different forms - Perpendicular from a point onto a plane.

Reflection of a point in a plane.

b) Angle between two planes - Line of intersection of two planes - Plane coaxal with given planes - Planes bisecting the angle between two planes - Angle between a line and a plane - Coplanarity of two lines - Shortest distance between two lines. Equation of the sphere in general and standard forms - equation of a sphere with given ends of a diameter. Tangent plane to a sphere, orthogonallity of spheres Standard equations of right circular cone & right circular cylinder. (30 lecture hrs)

Note: All the derivations (book works) must be through vector methods with reduction to corresponding Cartesian equivalents.

Suggested distribution of lecture hours.

1. Matrices: 1 hour *I* week
2. Differential calculus and Integral Calculus: 2 hours *I* week
3. Analytic Geometry of three dimensions: 2 hours *I* week.

* Two hours of problem working classes are to be conducted in batches of not more than 15 students per teacher, in each batch.

Format of Question Paper: Semester 1

Q. No.	Topic and No. of subdivisions to be set in the topic		No. of subdivisions to be answered	Marks for each subdivision	Maximum Marks for the question
I	Matrices	3			
	Diff. Calculus	6			
	Integral Calculus	2	15	2	30
	Ana Geo(a)5 and(b)4	9			
	Total	20			
II	Matrices	4	2	5	10
III	Diff. Calculus	5	3	5	15
IV	Integral Calculus	3	2	5	10
V	Analytical Geometry Upto plane (a)	5	3	5	15
VI	Analytical Geometry Remaining (b)	3	2	5	10

Note: All questions are to be answered

Maximum Marks for the paper	
Examination Marks:	90
Internal Assessment Marks:	10
Total Marks:	**100**

Books for Reference.

1. A R Vashista — Matrices, Krishna Prakashana Mandir
2. S Shanthinarayana — Differential Calculus ,S Chand
3. S Shanthinarayana — Integral Calculus,S Chand
4. S Shanthinarayana — Elements of Analytical Geometry,S Chand

SECOND SEMESTER

MATHEMATICS – II

(5 lecture hours per week + 2 hours of problem working classes) **75 hours**

1. GROUP THEORY

Recapitulation of the definition and standard properties of groups and subgroups.

Order of an element of a group – properties related to order of an element – subgroup generated by an element of a group – coset decomposition of a group, Cyclic groups - properties - modulo relation – index of a group – Lagrange's theorem – consequences. (20 lecture hours)

2. DIFFERENTIAL CALCULUS

Polar coordinates - Angle between the radius vector and the tangent - Angle of intersection of curves (polar form) polar sub-tangent and polar subnormal- perpendicular from pole on the tangent - Pedal equations. Derivative of an arc in Cartesian, parametric and polar forms.

Curvature of plane curves - formula for radius of curvature in Cartesian, parametric, polar and pedal forms - centre of curvature - evolutes. Singular points – Asymptotes – Envelopes.

Tracing of standard Cartesian, parametric and polar curves (Cissoid, Strophic, Astroid, Folium of descartes, Catenary, Cycloid, Cardiod, Lemniscate, Equiangular Spiral, Three leaved rose and four leaved rose). (30 lecture hours)

3. INTEGRAL CALCULUS

Applications of Integral Calculus: computation of length of arc, plane area and surface area and volume of solids of revolutions for standard curves in Cartesian and Polar forms. (10 lecture hours)

4. DIFFERENTIAL EQUATIONS

Solutions of ordinary differential equations of first order and first degree:

(i) Homogenous and reducible to homogenous
(ii) Linear equations, Bernoulli equation and those reducible to these.
(iii) Exact equations, equations reducible to exact form with grouping and standard integrating factors.

Equations of first order and higher degree – non linear first order, higher degree - (Mention) solvable for p - solvable for y - solvable for x - Clairaut's equation - singular solution - Geometric meaning. Orthogonal trajectories in Cartesian and polar forms. (15 lecture hours)

Suggested distribution of lecture hours.

1. Group theory : 1 hour / week
2. Differential calculus: 2 hours / week.
3. Integral Calculus: 1 hour / week.
4. Differential Equations: 1 hour / week.

- Two hours of problem working classes are to be conducted in batches of not more than 15 students per teacher, in each batch.

Format of Question Paper: Semester 2

Q. No.	Topic and No. of subdivisions to be set in the topic		No. of subdivisions to be answered	Marks for each subdivision	Maximum Marks for the question
I	Group Theory	5			
	Diff. Calculus-Evolute	5			
	Rest	3			
	Integral Calculus	3	15	2	30
	Diff. Equations	4			
	Total	20			
II	Groups	5	3	5	15
III	Diff. Calculus (upto evolutes)	4	2	5	10
IV	Diff. Calculus (remaining)	3	2	5	10
V	Integral Calculus	3	2	5	10
VI	Diff. Equations	5	3	5	15

Note: All questions are to be answered

Maximum Marks for the paper

Examination Marks: 90

Internal Assessment Marks: 10

Total Marks: 100

Books for Reference.

1. Baumslag & Chandler Group Theory, Schaum Series
2. S Shanthinarayana Differential Calculus, S Chand
3. S Shanthinarayana Integral Calculus, S Chand
4. J B Fraleigh First course in Abstract Algebra, A Wesley
5. M D Raisinghania Advanced Differential Calculus, S Chand
6. I N Herstein Topics in Algebra, Vikas

THIRD SEMESTER

MATHEMATICS - III

(5 Lecture hours per week + 2 hours of problem working classes) **75 hours**

1. GROUP THEORY

Normal subgroups-examples and problems-Quotient group-Homomorphism and Isomorphism of groups-Kernel and image of a homomorphism-Normality of the kernel- Fundamental theorem of homomorphism-properties related to isomorphism-Permutation group-Cay ley's theorem. (15 lecture hours)

2. LINEAR PROGRAMMING

Linear inequalities and their graphs. Statement of the linear programming problem in standard form-classification of solutions-solution of linear programming problems by graphical method.

Illustrative examples on the solution of linear programming problems in two and three variables by the simplex method. (Maximization and minimization)

Transportation problem:- North West rule, Vogel's method, Row minima method, Column minima method. (15 lecture hours)

3. SEQUENCES OF REAL NUMBERS

Definition of a sequence – Bounded sequences – limit of a sequences – convergent, divergent and oscillatory sequences – Monotonic sequences and their properties Cauchy's criterion. (12 lecture hours)

4. SERIES OF REAL NUMBERS

Definition of convergence, divergence and oscillation of series – properties of convergent series – properties of series of positive terms – Geometric series.

Tests for convergence of series – p – series – comparison of series – Cauchy's root test – D'Alembert's test, Raabe's test, - Absolute and conditional convergence – D'Alembert test for absolute convergence – Alternating series – Leibnitz test.

Summation of Binomial, Exponential, and Logarithmic series. (18 lecture hours)

5. DIFFERENTIAL CALCULUS

Recaptulation of Equivalence Class and partition of a set.

Definition of the limit of a function in ϵ -δ form – continuity – types of discontinuities – properties of continuous function on a closed interval (boundedness, attainment of bounds and taking every value between bounds). Differentiability. Differentiability implies Continuity – converse not true. Role's Theorem – Lagrange's and Cauchy's First Mean Value Theorems. Taylor's Theorem (Lagrange's form) - Maclaurin's expansion – Evaluation of limits by L'Hospital's rule. (15 lecture hours)

Suggested distribution of lecture hours

1. Groups Theory : 1 hour/ week
2. Linear Programming : 1 hour/ week
3. Sequences and series : 2 hours/week
4. Differential Calculus : 1 hour/ week

- Two hours of problem working classes are to be conducted in batches of not more than 15 students per teacher, in each batch.

Format of Question Paper: Semester 3

Q. No.	Topic and No. of subdivisions to be set in the topic		No. of subdivisions to be answered	Marks for each subdivision	Maximum Marks for the question
I	Group Theory	4			
	Linear Programming	3			
	Sequences	4	15	2	30
	Series	5			
	Diff. Calculus	4			
	Total	20			
II	Group Theory	4	2	5	10
III	Linear Programming	4	3	5	15
IV	Sequence	3	2	5	10
V	Series	5	3	5	15
VI	Diff. Calculus	4	2	5	10

Note: All questions are to be answered

Maximum Marks for the paper

Examination Marks: 90

Internal Assessment Marks: 10

Total Marks: 100

Books for Reference

1. Baumslag & Chandler Group Theory Schaum Series
2. Gupta Goyal Laplace and Fourier Transforms,Pragathi Prakashana Mandir
3. L S Srinath Linear Programming, East West
4. J B Fraleigh First course in Abstract Algebra, A Wesley
5. M D Raisinghania Advanced Differential Calculus, S Chand

FOURTH SEMESTER

MATHEMATICS - IV

(5 Lecture hours per week + 2 hours of problem working classes)

1. RINGS, INTEGRAL DOMAINS. FIELDS

Rings, Types of Rings properties of rings – Rings of integers modulo n – Subrings – Ideals, Principal, Prime and Maximal ideals in a commutative ring – examples and standard properties following the definition-Homomorphism, Isomorphism-Properties – Quotient rings – Integral Domain- Fields - properties following the definition – Fundamental Theorem of Homomorphism of Rings - Every field is an integral domain - Every finite integral domain is a field - Problems(18 lecture hours)

2. FOURIER SERIES

Trigonometric Fourier series of functions with period 2π and period $2L$ – Half-range cosine and sine series. (10 lecture hours)

3. DIFFERENTIAL CALCULUS

Continuity and differentiability of functions of two and three variables- Taylor's theorem and expansions of functions of two variables-Maxima and minima of functions of two variables. Method of Lagrange multipliers. (10 lecture hours)

4. INTEGRAL CALCULUS

Gamma and Beta functions-results following definitions-Relations connecting the two functions-duplication formula-Applications to evaluation of integrals.

(10 lecture hours)

5. DIFFERENTIAL EQUATIONS

Second and higher order ordinary linear differential equations with constant coefficients-complementary function-particular integrals (standard types)-Cauchy-Euler differential equation. Simultaneous linear differential equations (two variables) with constant coefficients. Solutions of second order ordinary linear differential equations with variable coefficients by the following methods:

(i) When a part of complementary function is given
(ii) Changing the independent variable
(iii) Changing the dependent variable
(iv) Variation of parameters
(v) Conditions for exactness and the solution when the equation is exact .

(15 lecture hours)

6. LAPLACE TRANSFORMS

Definition and basic properties-Laplace transforms of some common functions and standard results-Laplace transform of periodic functions-Laplace transforms of derivatives and the integral of a function-Laplace transforms, Heaviside function. Convolution theorem (Statement only) Inverse Laplace transforms-Laplace transform method of solving ordinary linear differential equations of first and second orders with constant coefficients. (12 lecture hours)

Suggested distribution of lecture hours

1. Ring Theory and Laplace Transform : 2 hours/ week
2. Differential Equations : 1 hour/ week
3. Fourier series, Differential and Integral Calculus: 2 hours/week

- Two hours of problem working classes are to be conducted in batches of not more than 15 students per teacher, in each batch.

Format of Question Paper: Semester 4

Q. No.	Topic and No. of subdivisions to be set in the topic		No. of subdivisions to be answered	Marks for each subdivision	Maximum Marks for the question
I	Rings	5			
	Fourier Series	3			
	Diff. Calculus	3			
	Integral Calculus	3	15	2	30
	Diff. Equations	4			
	Laplace Transform	2			
	Total	20			
II	Rings	5	3	5	15
III	Fourier Series	3	2	5	10
IV	Diff. and Integral	4	2	5	10
V	Diff. Equations	4	3	5	15
VI	Laplace Transforms	4	2	5	10

Note: All questions are to be answered

Maximum Marks for the paper

Examination Marks: 90

Internal Assessment Marks: 10

Total Marks: 100

Books for Reference

1. I N Herstein — Topics in Algebra ,Vikas
2. S Shanthinarayan — Differential Calculus ,S Chand
3. S Shanthinarayan — Integral Calculus,S Chand
4. M G Smith — Laplace Transform theory,Van – Nostrand

FIFTH SEMESTER
MATHEMATICS – V

(5 Lecture hours per week + 2 hours of problem working classes) **(75 hours)**

1. LINEAR ALGEBRA

Vector space – Examples – Properties – Subspaces – criterion for a subset to be a subspace –linear span of a set - linear combination – linear independent and dependent subsets – Basis and dimensions– Standard properties – Examples illustrating concepts and results.

Linear transformations – properties – matrix of a linear transformation – change of basis – range and kernel – rank and nullity – Rank – Nullity theorem – Non-singular and singular linear transformations - Standard properties – Examples. (22 Lecture hours)

2. GEOMETRY OF SPACE CURVES

Vector function of a single scalar variable – its interpretation as a space curve – derivative – tangent, normal and binormal vectors to a space curve – Serret Frenet formulas with proof – simple geometrical applications.Finding curvature and torsion .Parametric forms.

Vector function of two scalar variables – its interpretation as a surface – Tangent plane and Normal to a surface - Normal line – parametric curves on a surface – parametric curves on the surfaces of a right circular cylinder and sphere – cylindrical to spherical and spherical polar coordinates.

Definition of orthogonal curvilinear coordinates. Fundamental vectors or base vectors, Scale factors or material factors - quadratic differential form. Spherical curvilinear system : Cartesian, Cylindrical – conversion of Cylindrical to orthogonal Spherical polar coordinates. Theorem: The Spherical coordinate system is orthogonal curvilinear coordinate system. (without proof) No problems on conversions of one system to another. (20 lecture hours)

3 VECTOR DIFFERENTIAL CALCULUS

Scalar field – gradient of a scalar field, geometrical meaning – directional derivative – Maximum directional derivative – Angle between two surfaces - vector field – divergence and curl of a vector field – solenoidal and irrotational fields – scalar and vector potentials – Laplacian of a scalar field – vector identities. Standard properties, Harmonic functions, Problems. (15 lecture hours)

4. FOURIER TRANSFORMS

The Fourier integral, Different forms of F.I, Problems complex Four. Transform, Self reciprocals, slit functions Basic properties of F.T, Linear, Change of scale, Shifting, Modulation. Derivation of a Function Extension.

Fourier sine and cosine Transform and Inverses properties, self reciprocal. The derivatives – theorems and problems. (18 lecture hours)

Suggested distribution of lecture hours.

1. Linear Algebra : 2 hours /week.
2. Geometry of space curves and Vector Differential Calculus : 2. hours/week
3. Fourier Transforms. 1 hour/week

- Two hours of problem working classes are to be conducted in batches of not more han 15 students per teacher, in each batch.

Format of Question Paper: Semester 5 – PAPER V

Q. No.	Topic and No. of subdivisions to be set in the topic		No. of subdivisions to be answered	Marks for each subdivision	Maximum Marks for the question
I	Linear Algebra	6	15	2	30
	Geometrical Space	5			
	Vector Diffn.	5			
	Fourier Transforms	4			
	Total	20			
II	Linear Algebra	6	4	5	20
III	Geometrical Space	5	3	5	15
IV	Vector Diff. Calculus	5	3	5	15
V	Fourier Transforms	4	2	5	10

Note: All questions are to be answered

Maximum Marks for the paper

Examination Marks:	90
Internal Assessment Marks:	10
Total Marks:	**100**

Books for Reference

1. I N Herstein, Topics in Algebra, Vikas
2. B Spain, Vector Analysis, ELBS
3. D E Bournes P C Kendall, Vector Analysis
4. I N Sneddon, Fourier Transforms, Mc-Graw Hill

FIFTH SEMESTER

MATHEMATICS – VI

(5 lecture hours per week +2 hours of problem working classes) **75 hours**

1. TOTAL DIFFERENTIAL EQUATIONS, SIMULTANEOUS EQUATIONS AND PARTIAL DIFFERENTIAL EQUATIONS

Total differential equations-Necessary condition for the equation $Pdx + Qdy + Rdz = 0$ be integrable-Simultaneous equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$

Formation of partial differential equation .Equations of First Order Lagrange's linear equation – Charpits method Standard types of first order non-linear partial differential equation (By known substittution).

Solution of second order linear partial differential equations in two variables with constant coefficients by finding complementary function and particular integral

Solution of one – dimensional heat equations, Solution of one – dimensional wave equations using Fourier series. (25 lecture hours)

2. SPECIAL FUNCTIONS

Polynomial solution of Legendre differential equation – Legedre polynomials – generating function – Recurrence relations – Rodrigue's formula – orthogonality.
Series Solution of Bessel differential equation – Bessel function $J_n(x)$ – Recurrence relations – generating function – orthogonality. (15 lecture hours)

3. NUMERICAL ANALYSIS

Finite differences – Definition and properties of $\Delta, \nabla, \delta, \mu$ and E, the relation between them – The nth differences of a polynomial, Factorial notations, separation of symbols, divided differences and related theorems.

Newton – Gregory forward and backward interpolation formulae – Lagrange's and Newton's interpolation formulae for unequal intervals - Inverse interpolation.

Numerical differential using forward and backward difference formulae - Computation of first and second derivatives.

Numerical Integration : Quadrature formula – Trapezoidal rule -Simpson's 1/3 and 3/8 rule(without proofs) and problems. (20 lecture hours)

4. Mathematical Modeling

Basic concepts. Real world problems, (Physics. Chemistry, Biology etc) Approximation of the problem, Steps involved in modeling.

Mathematical models: Linear growth and decay model, Logistic model, model of Mass spring-dashpot (present in shock absorber. mechanical engineering problems)

Drug absorption from blood stream. Motion of a projectile. Current flow in electrical circuits, Vibration of string. (15 lecture hours)

Suggested distribution of lecture hours

1. Total and simultaneous Partial Differential Equations 2: hours /week
2. Special functions: 1 hour/week
3. Numerical Analysis and Mathematical Modelling : 2hours/ week

- Two hours of problem working classes are to be conducted in batches of not more than 15 students per teacher, in each batch.

Format of Question Paper: Semester 5 – PAPER VI

Q. No.	Topic and No. of subdivisions to be set in the topic		No. of subdivisions to be answered	Marks for each subdivision	Maximum Marks for the question
I	Total, Sim and p.d.e	6			
	Spl. Functions	5			
	Numerical Analysis	5	15	2	30
	Mathematical model	4			
	Total	20			
II	Total, Sim. and pde	6	4	5	20
III	Spl. Functions	5	3	5	15
IV	Numerical Analysis	5	3	5	15
V	Mathematical model	4	2	5	10

Note: All questions are to be answered

Maximum Marks for the paper

Examination Marks: 90

Internal Assessment Marks: 10

Total Marks: 100

Books for Reference

1. I N Sneddon, An Introduction to PDE, Mc-Graw Hill
2. M K Jain, Iyengar, Jain Numerical methods for scientific & Eng Computation, Wiley Eastern Ltd.
3. J N Kapur, Mathematical Modelling, Wiley Eastern Ltd.
4. Martin Braun, Differential Equns and its applications Springer Verlag
5. M D Raisinghania, Advanced Differential Calculus, S Chand
6. Saran, Sharma, Trivedi Special Functions, Pragathi Prakashana Mandir
7. Coleman C. S and Drew D A, Differential Equation Models, Springer Verlag

MATHEMATICS – VII

(5 Lecture hours per week + 2 hours of problem working classes) **(75 hours)**

1. COMPLEX ANALYSIS

Complex numbers - The complex plane-conjugate and modulus of a complex number- polar form-geometrical representation- Euler's formula: $e^{i\theta} = \cos\theta + i\sin\theta$

Function of a complex variable : Limit, continuity and differentiability.

Analytic function-Cauchy-Riemann equations in Cartesian and polar forms-Sufficiency conditions for analyticity in Cartesian form – standard properties of analytic functions-construction of analytic functions, given real or imaginary parts- Milne-Thomson method.

Transformations -definition of a conformal transformation. Examples.

Discussion of transformations : $w = z^2$. $w = \sin z$, $w = \cos z$, $w = e^z$, $w = \cosh z$,$w = \left(z + \frac{1}{z}\right)$

The bilinear transformation-cross ratio property-bilinear transformation transforms circles into circles or lines-problems thereon.

The complex line integral-Examples and properties. Cauchy's integral theorem (proof using Green's theorem) and its direct consequences. The Cauchy's integral formula for the function and the derivatives. Applications to evaluation of simple line integrals-Cauchy's inequality-Liouville's theorem-Fundamental theorem of algebra.

(30 lecture hours)

2. LINE AND MULTIPLE INTEGRALS

Definition of line integral and basic properties–examples on evaluation of line integrals. Definition of a double integral – its conversion to iterated integrals – evaluation of double integrals by change of order of integration and by change of variables – Computation of plane and surface areas, volume underneath a surface and volume of revolution using double integrals.

Definition of a triple integral and evaluation - change of variables – volume as a triple integral.

(20 Lecture hours)

3. INTEGRAL THEOREMS

Green's theorem (with proof). Direct consequences of the theorem.

The Divergence theorem (with proof) – Direct consequences of the theorem.

The Stokes' theorem (with proof) – Direct consequences of the theorem.

(10 Lecture hours)

4. TOPOLOGY

Topology Definition, Open sets, Accumulation Points, interior, Exterior, Boundary, neighbourhood system, bases and sub bases, Bolzano-Weirstrass theorem(without proof), close set Heine-Borel theorem (without proof) Completeness, Topology of the line and plane. (15 lecture hours)

Suggested distribution of lecture hours :

1. Complex Analysis : 2 hours / week.
2. Line and Multiple Integrals and Integral Theorems : 2 hours / week
3. Topology : 1hour/week

- Two hours of problem working classes are to be conducted in batches of not more than 15 students per teacher, in each batch.

Format of Question Paper: Semester 6 - PAPER VII

Q. No.	Topic and No. of subdivisions to be set in the topic	No. of subdivisions to be answered	Marks for each subdivision	Maximum Marks for the question
I	Complex Analysis (upto transformation) 5 Remaining 3 Line and Multiple Int. 5 Int. Theorems 3 Prob. Distribution 4 Total 20	15	2	30
II	Complex Analysis (upto transformation) 5	3	5	15
III	Complex Analysis Remaining 3	2	5	10
IV	Line and Multiple Int. 5	3	5	15
V	Int. Theorems 3	2	5	10
VI	Topology 4	2	5	10

Note: All questions are to be answered

Maximum Marks for the paper

Examination Marks: 90

Internal Assessment Marks: 10

Total Marks: 100

Books for Reference

1. S Shanthinarayana — Complex Analysis,S Chand
2. A R Vashista — Complex Analysis,Krishna Prakashana Mandir
3. Saxena — Finite Diff. Calculus & Numerical Analysis, S Chand
4. B Spain — Vector Analysis,ELBS
5. Seymour Lipschutz — General Topology, Schaum Series Chap 4 & 5

SIXTH SEMESTER
MATHEMATICS - VIII

(5Lecture hours per week + 2 hours of problem working classes) **(75 hours)**

1. PARTICLE DYNAMICS

a) Newton's laws of motion – Conservative forces and potential energy - Definitions of work, kinetic energy and power.

Motion of a particle in a uniform force field – simple harmonic motion – Two dimensional motion of projectiles, Inclined plane.

b) Tangential and Normal components of velocity and acceleration – Radial and Transverse components of velocity and acceleration - Constrained Motion of a particle under gravity along inside and outside of a circle.

Central force and central orbit – Theorem – Motion of a particle in a central force field, Both polar and Pedal forms – Determination of orbit from central forces and vice versa. (30 lecture hours)

2. CALCULUS OF VARIATIONS

Variation of a function $f = f(x, y, y')$ – variation of the corresponding functional – extremal of a functional – variational problem – Euler's equation and its particular forms – Examples – standard problems like geodesics, minimal surface of revolution, hanging chain, Brachistochrone problem –Isoperimetric problems. (15 Lecture hours)

3. NUMERICAL ANALYSIS

a) Solution of Algebraic and transcendental equations, method of successive bisection, method of false position and Newton-Raphson method.

Numerical solutions of non-homogeneous system - linear algebraic equations in 3 variables by Jacobi's and Gauss-Seidel methods-Computation of largest Eigen value of a square matrix by power method. Using Inverse Power Method Finding Least Eigen Value

b) Solution of initial value problems by ordinary linear first order differential equations by Taylor's series, Euler's, modified Euler's, Picard's Method, Runge-Kutta method order four

Difference Equations : Basic definitions, order and degree, solution, formation of 1^{st} and 2^{nd} order, linear difference equation with constant coefficients, rules for finding CF.

Form Fibonacci difference equation and solve. Finding PI when $f(E)\ y_n = a^n$, coskn, sinkn, a^n coskn, a^n sinkn, f(n), $a^n f(n)$. (30 lecture hours)

Suggested distribution of teaching work:

1. Particle Dynamics : 2 hours/week
2. Calculus of variation : 1 hour/ week
3. Numerical Analysis : 2 hours/week

- Two hours of problem working classes are to be conducted in batches of not more than 15 students per teacher, in each batch.

Format of Question Paper : Semester 6 - PAPER VIII

Q. No.	Topic and No. of subdivisions to be set in the topic	No. of subdivisions to be answered	Marks for each subdivision	Maximum Marks for the question
I	Partical Dynamics (upto projectile) (a) 4 Remaining (b) 4 Calculus of Variation 4 Numerical Analysis upto Eigen value (b) 4 Remaining part (NA)(b)4 Total 20	15	2	30
II	Partical Dynamics (upto projectile) 4	3	5	15
III	Partical Dynamics Remaining 4	2	5	10
IV	Calculus of Variation 3	2	5	10
V	Numerical Analysis upto Eigen value 4	2	5	10
VI	Remaining part (NA) 4	3	5	15

Note: All questions are to be answered

Maximum Marks for the paper

Examination Marks: 90

Internal Assessment Marks: 10

Total Marks: 100

Books for Reference

1. Choriton, Text book of Dynamics, Van – Nostrand
2. C Fox, An introduction to the calculus of variation Oxford university press
3. S. Armugam and Somasundaram, ISAAC, Numerical Methods SCITECH publications

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