SIXTH SEMESTER

MATHEMATICS – VII

(4 Lectur hours per week + 2 hours of problem working classes)

1. Liner Algebra

Vector space – Examples – Properties – Subspaces – criterion for a subset to be a subspace – linear combination – linear independent and dependent subsets – Basis and dimensions– Standard results – 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 linear transformations.

Eigenvalues and Eigenvectors of a linear transformation – Interpretation in terms of matrices – Examples illustrating the concepts.   (18 Lecture hours)

2. Line and Multiple Integrals

Definition of a 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.   (15 Lecture hours)

3. Integral Theorems

Line, surface and volume integrals of vector functions – Green's theorem   in the plane (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.   (15 Lecture hours)

4. Calculus of Variations

Variation of a function $f = f(x, y, y^1)$ – 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.   (12 Lecture hours)

Books for study / reference :
1.   Finkbeiner : An introduction to Matrices and linear Transformations (Freeman and Co.)
2.   S.Lipschutz : Linear Algebra (Schaum series)
3.   C. Fox : An introduction to the Calculus of variations
                    (Oxford University Press)
4.   I.S. Sokelnikoff : Advanced Calculus (Me Graw Hill)

Suggested distribution of lecture hours :
1.   Linear Algebra and Calculus of Variations : 2 hours / week.
2.   Line and Multiple Integrals, and Integral Theorems : 2 hours / week.

Format of Question Paper

Question No.	Topic and No. of subdivisions to be set in the topic	No. of sub division to be answered	Marks for each sub-division	Maximum marks for the Question
I	**Linear Algebra:** Line and Multiple: 7 Integrals: 5 Integrals Theorems: 5 Calculus of Variations : 3 Total: 20	15	2	30
II	Linear Algebra : 6	4	5	20
III	Line and Multiple Integrals : 5	3	5	15
IV	Integral Theroems : 5	3	5	15
V	Calculus of Variations: 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