23MA808 **INTRODUCTION TO TENSOR CALCULUS** **3-1-0-4**

Course objective:

Tensor analysis contains tools and definitions used within modelling of continuous media, field equations in physics, electromagnetism, elasticity theory and theory of general relativity.

PROGRAMME OUTCOME – PG

After completion of the programme, the student will be able to

PO1 : Students acquire sound analytical and practical knowledge to formulate and solve challenging problems.

PO2 : Students will be able to read and identify mathematical and computational methods in order to solve comprehensive problems.

PO3 : Students are well prepared to take jobs in schools and colleges as Mathematic Teachers and Professors, Software Industries, Research and Development Organizations.

PO4 : Students to purse higher studies in Mathematical and Computing Sciences and to clear Competitive exams like SET/ NET/ TET etc.

PO5 : Students to learn and apply Mathematics in real life situations aiming at service to the society.

PROGRAMME SPECIFIC OUTCOME

The students at the time of graduation will

PSO1 : Provide Strong foundation and inculcate ample knowledge on topics in pure and applied mathematics, empowering the students to pursue higher degrees at reputed academic institutions.

PSO2 : Advanced mathematical topics provide opportunities to research students for communication and discussion.

PSO3 : Demonstrate the highest standard of ethics in research.

PSO4 : Provide scope for interaction with international researchers and developing collaborations.

PSO5 : Provide knowledge of a wide range of mathematical techniques and application of mathematical methods/tools in other scientific and engineering domains.

PSO6 : Nurture problem solving skills, thinking, creativity through assignments, project work.

Upon the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand concept of tensor variables and difference from scalar or vector variables.	K2
CO2	Derive base vectors, metric tensors and strain tensors in an arbitrary coordinate system.	K3
CO3	Investigate the Christoffel symbols which provide a concrete representation of the connection of (pseudo-)Riemannian geometry in terms of coordinates on the manifold.	K4
CO4	Apply Riemannan-Christoffel tensor to problems of differential geometry, electrodynamics and relativity.	K5
CO5	Interpret tensor representation from interdisciplinary areas.	K6

Unit 1

Introducing Tensors, Scalars or Vectors, Vector Division, Moment of inertia.

Unit 2

Redefining scalars and vectors, Cartesian Tensors, Scalars, Tensors, Summation Convention.

Unit 3

Quotient Rule, Non-Cartesian Tensors, Metric Tensors, Spherical Polar Co-ordinate System, Cylindrical coordinate system.

Unit 4

Algebraic Operation of Tensors, Definition of Contravariant and Co variant vector, Co variant vector, Addition & Subtraction of Tensors, Symmetric and Anti Symmetric Tensors, Contraction, Outer Product or Direct Product.

Unit 5

Pseudo Scalars and Pseudo Vectors and Pseudo Tensors, Pseudo Vectors, Pseudo scalars, General Definition, Pseudo Tensor

Text Book:

Tensor Calculus by A. A. Shaikh, U.C. De, J. Sengupta

Evaluation Pattern:

Internal Assessment: Midterm exam: 1 x 30 = 30

Quizzes, assignments, etc: = 20

50

End-semester Examination: = 50

100