Subject Code : P8MAE6

TENSOR ANALYSIS AND SPECIAL THEORY OF RELATIVITY

UNIT I

Invariance - Transformations of coordinates and its properties - Transformation by invariance - Transformation by covariance and contra variance - Covariance and contra variance - Tensor and Tensor character of their laws - Algebras of tensors - Quotient tensors - Symmetric and skew symmetric tensors – Relative tensors.

UNIT II

Metric Tensor - The fundamental and associated tensors - Christoffel's symbals - Transformations of Chrisffel's symbols- Covariant Differentiation of Tensors - Formulas for covariant Differentiation- Ricci Theorem - Riemann -Christoffel Tensor and their properties.

UNIT III

Einstein Tensor - Riemannian and Euclidean Spaces (Existence Theorem) – The e-systems and the generalized Kronecker deltas - Application of the e-systems.

UNIT IV

Special Theory of Relativity: Galilean Transformation - Maxwell's equations - The ether Theory – The Principle of Relativity Relativistic Kinamatics : Lorentz Transformation equations - Events and simultaneity - Example Einstein Train - Time dilation - Longitudinal Contraction -Invariant Interval - Proper time and Proper distance – World line - Example - twin paradox - addition of velocities - Relativistic Doppler effect.

UNIT V

Relativistic Dynamics : Momentum – energy – Momentum-energy four vector – Force – Conservation of Energy – Mass and energy – Example – inelastic collision – Principle of equivalence – Lagrangian and Hamiltonian formulations .
Accelerated Systems : Rocket with constant acceleration – example – Rocket with constant thrust .

TEXT BOOK(S)

[1] I.S. Sokolnikoff, Tensor Analysis, John Wiley and Sons, New York, 1964
[2] D. Greenwood, Classical Dynamics, Prentice Hall of India, New Delhi, 1985

UNIT I	Chapter 2 : Sections 18 to 28 of [1]
UNIT II	Chapter 2 : Sections 29 to 37 of [1]
UNIT III	Chapter 2 : Section 38 to 41 of [1]
UNIT IV	Chapter 7 : Sections 7.1 and 7.2 of [2]
UNIT V	Chapter 7 : Sections 7.3 and 7.4 of [2]

REFERENCE(S)

1. J.L. Synge and A.Schild, Tensor Calculus, Toronto, 1949.
2. A.S. Eddington, The Mathematical Theory of Relativity, Cambridge University Press, 1930.
3. P.G. Bergman, An Introduction to Theory of Relativity, New York, 1942.
4. C.E. Weatherburn, Riemannian Geometry and Tensor Calculus, Cambridge, 1938