

Module Code: MATH-425
Module Title: **Special Theory of Relativity**
Module Rating: 3 Cr. Hours

Introduction

- Fundamental concepts

Derivation of Special Relativity

- Einstein's formulation of special relativity
- The Lorentz transformation
- Length contraction, time dilation and simultaneity
- The velocity addition formulae
- Three dimensional Lorentz transformations

The Four-Vector Formulation of Special Relativity

- The four-vector formalism
- The Lorentz transformations in 4-vectors
- The Lorentz and Poincare groups
- The null cone structure
- Proper time

Applications of Special Relativity

- Relativistic kinematics
- The Doppler shift in relativity
- The Compton effect
- Particle scattering
- Binding energy, particle production and particle decay

Electromagnetism in Special Relativity

- Review of electromagnetism
- The electric and magnetic field intensities
- The electric current
- Maxwell's equations and electromagnetic waves
- The four-vector formulation of Maxwell's equations

Recommended Books

1. M. Saleem and M. Rafique, *Special Relativity* (Ellis Horwood, 1992)
2. W. G. V. Rosser, *Introductory Special Relativity* (Taylor & Francis, 1991)
3. W. Rindler, *Introduction to Special Relativity* (Oxford, 1991)
4. A. Qadir, *An Introduction to Special Theory of Relativity* (World Scientific 1989)
5. G. Barton, *Introduction to the Relativity Principle* (Wiley, 1999)
6. W. Rindler, *Introduction to Special Relativity* (Clarendon Press, Oxford, 1991)