Relativity: Syllabus

Aims:

To give students an understanding of the theory of special relativity and the ability to use the theory to solve problems related to the motion of bodies.

Objectives:

On completion of the course, students will:

- understand that the Michelson-Morley experiment demonstrates that the speed of light is isotropic in any given inertial frame (lecture 1),
- be able to state the fundamental postulates of special relativity (lecture 1),
- understand qualitatively the distinction between covariance and invariance of physical quantities (lecture 1),
- understand an inertial frame consisting of a set of observers (lecture 2),
- be able to demonstrate qualitatively the origin of the relativity of simultaneity (lecture 3),
- be able to derive time dilation using light clocks (lecture 3),
- be able to relate space and time separations measured in different inertial frames using the Lorentz transformations (lecture 4),
- be able to add two relativistic velocities (lecture 4),
- be familiar with the concept of a space-time diagram and its use in solving simple problems in special relativity (lecture 5),
- be able to derive and apply the relativistic Doppler effect (lecture 7),
- understand the concept of a four-vector, and be able to use them in relativistic calculations (lecture 8),
- know the expressions for relativistic energy and momentum and show their relationship to their Newtonian counterparts (lecture 8),
- understand that relativistic energy includes non-mechanical energy such as binding energy (lecture 8),
- be able to calculate relativistic energy and momentum in one-dimensional two-body collisions given initial data (lecture 9),
- be able to calculate energy and momentum of particles (including photons) in one frame given their values in another frame (lecture 9).