

Special Theory of Relativity - Video course

COURSE OUTLINE

This is a half a semester (20 Lecture) course on Special Theory of Relativity, which revolutionized our concept of physics in the last century by unifying concept of space and time, electricity and magnetism and mass and energy. In this course we will explore and explain many of the (often) counter-intuitive but fundamental principles of the Special Theory.

COURSE DETAIL

S.No	Topics and contents	Number of Lectures
1.	Inertial Frames, Universality of Newton's second law in all inertial frames, Classical Relativity, Does universal rest (ether) exists?	1
2.	Michelson Morley Experiment.	1
3.	Postulates of Special Theory of Relativity, Concept of transformation, Galilean Transformation, Simultaneity of two events in different inertial frames of reference and its frame dependence.	1
4.	Lorentz Transformation.	1
5.	Length Contraction and Time dilation with examples.	1
6.	Velocity Transformation, Relative velocity with examples, Time like and Space Like intervals, Causality.	1
7.	Need to redefine Momentum, Vector and Four-Vectors.	1
8.	Proper time interval, Velocity and Momentum-Energy Four Vector.	1



NP-TEL

NPTEL

<http://nptel.iitm.ac.in>

Physics

Pre-requisites:

None for the first ten lectures. For the portion on relativistic formulation of electrodynamics, exposure to a first course on Electromagnetism (Griffiths' level) is required.

Additional Reading:

1. R. P. Feynmann, "Six Not So Easy Pieces", Basic Books (2005).
2. A. Einstein, "Meaning of Relativity".
3. J. L. Synge, "Relativity- The Special Theory", North-Holland (1972).

Hyperlinks:

University of Illinois. "Special Relativity."

<http://www.ncsa.uiuc.edu/Cyberia/NumRel/SpecialRel.html>

Coordinators:

Prof. Shiva Prasad

Department of Physics IIT Bombay

9.	Mass-Energy Relationship, Relationship between new energy and momentum.	1
10.	Relativistic Dynamics.	1
11.	Mass-Energy Relationships, zero mass particles.	1
12.	Geometry of Space-time, space-like and time-like interval, Light cone.	2
13.	Four Dimensional form of Maxwell's equations.	2
14.	Four dimensional Vector Potential.	1
15.	Stress- Energy Momentum Tensor and Conservation Laws.	1
16.	Lagrangian formulation of Electrodynamics.	2
17.	Relativistic treatment of Radiation.	1
	Total number of lectures	20

References:

1. David Bohm, " Special Theory of Relativity ", Benjamin (1965).
2. A. K. Ghatak, "Special Theory of Relativity " (2009).
3. Robert Resnick, " Introduction to Special Relativity ", John Wiley (1965).
4. R. A. Mould, " Basic Relativity ", Springer-Verlag (1994).
5. A. P. French, " Special Relativity", Chapman & Hall (1968).
6. E. F. Taylor and J. Wheeler, "Spacetime Physics- Introduction to Special Relativity", 2nd Edn., W. H. Freeman (1992)