First Semester 2016-2017

Course Handout

Date:18/07/2016

Course Number : PHY F315

Course Title : THEORY OF RELATIVITY

Instructor-in-Charge : TAPOMOY GUHA SARKAR

Scope & Objective of the Course:

This course aims to expose the students to Special Theory of Relativity and an introduction to General theory of Relativity. A knowledge of basic Newtonian mechanics is assumed.

Text Book:

T: Robert Resnick, Introduction to Special Relativity, John Wiley & Sons, 2002.

Reference Books:

R1: Gravitation and Cosmology: Principles and Applications of the General Theory of Relativity,

Steven Weinberg, John Wiley.

R2: A First Course in General Relativity, Bernard F. Schutz, Cambridge University Press.

R3: J. L. Martin, General Relativity, Prentice Hall 1996.

R4: James B. Hartle, Gravity: An Introduction to Einstein's General Relativity, Pearson.

Course Plan :

Lecture No.	Learning Objectives	Topics to be covered	Reference
1-3	The notion of Space and time. Pre-relativity ideas. "Null Result" : Experimental background of the theory of special relativity.	Galilean Transformations, Michelson-Morley experiment, postulates of special relativity, invariance of the interval.	Text Book : Sec. 1.1 - 1.10 Class notes.
4 - 7	Relativistic kinematics	Lorentz transformation, dilation and contraction, Doppler Effect, Twin Paradox.	Class notes
8 - 12	Relativistic dynamics	Relativistic Momentum, The relativistic force law, and the dynamics of a particle, The equivalence of mass and energy	Text Book : Sec. 3.1 - 3.7
13-17	Relativistic formulation of electromagnetism	The Transformation for **E** & **B**, The field of a uniformly moving point charge	Text Book : Sec. 4.1 - 4.8
18 -22	Tensor algebra & calculus	Contravariant & Covariant tensors, Tensor fields, Elementary operations with tensors, The affine connections, geodesics, The curvature tensor	Text Book : Sec. 5.1 - 5.9 , R4
23-25	The principles of general relativity	The principle of equivalence, The principle of general covariance	class notes
26-30	The field equations of	The equation of geodesic	class notes and R4

	general relativity	deviation, The vacuum field equations of general relativity, The full field equations of general relativity	
31 - 36	The Schwartzschild solution	Stationary solutions, Spherically symmetric solutions, The Schwarzschilds solution and its properties	R4 and class notes
37-40	Experimental tests of general relativity and introductory cosmology	Advance of the perihelion of Mercury, Bending of light, Gravitational red shift. Cosmological princple and the FRW metric.	R4 and class notes

Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage (%)	Date, Time & Venue	Nature of Component
1	Midterm	90 mins.	30	7/10 2:00 - 3:30 PM	Closed Book
3	Tutorials/Assignments		30	TBA	Open Book/ Take home
4	Comprehensive Exam	3 hours.	40	12/12 FN	Closed Book + Open book

Chamber Consultation Hour: To be announced in the class.

Notices: Notices and solutions will be displayed only on PHYSICS/FDIII notice board.

Make-up Policy [STRICT]No Make-ups for tutorial tests. Make up for regular tests will be given only to genuine cases, *i.e.* (i) Sickness leading to *hospitalization*, (ii) out-of-station with prior *intimation to/permission from* the IC.

Instructor-in-Charge