

# BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

Hyderabad campus  
First Semester 2021-2022  
Course Handout

Date: 07.09.2021

**Course Number** : PHY F431  
**Course Title** : Geometrical methods of physics  
**Instructor** : Subhash Karbelkar

**Scope & Objective of the course:** The course is designed to provide students with a introduction to the geometrical methods of physics. These include tensors and differential forms on manifolds and examples from physics such as Riemannian geometry, classical and quantum mechanics, electrodynamics, gravitation and gauge theories.

**Text Book:** Geometrical methods of mathematical physics, Bernard Schutz, Cambridge, 1980

## Reference Books/E materials:

Gravitation by Miesner Thorne Wheeler, Freeman and Company, 1973.

## Course Plan:

Number of lectures	Learning Objectives	Topics to be covered	Chapter in the Text Book
6	Differentiable manifolds	Manifolds, vectors on manifolds, fibre bundles, one forms	2.1 TO 2.21
6	Tensors	Tensors and tensor fields, metric tensor	2.22 to 2.31
5	Differential forms	Algebra and integral calculus	4.1 to 4.13
5	Differential forms	Differential calculus of forms and its applications	4.14 to 4.29
5	Application to classical mechanics	Hamiltonian mechanics	5.4 to 5.10
5	Applications to electrodynamics	Maxwell equations using differential forms	5.11 to 5.14
8	Riemannian manifolds	Covariant derivatives, metric connections, affine connection and the equivalence principle	6.1 to 6.13
2	Gauge theories	Connections and gauge theories	6.14

## Evaluation Scheme:

<b>EC No.</b>	<b>Evaluation Component</b>	<b>Duration</b>	<b>Weightage (%)</b>	<b>Date, Time</b>	<b>Remarks</b>
1.	Assignment Set 1		15		Open book*** Before midsem
2.	Assignment set 2		15		Open Book*** After midsem
3	Midsem	90 Min	35	18/10/2021 9.00 - 10.30AM	Open book
4	Comp. Exam	2 Hours	35	11/12 FN	Open Book

\*\*\* : Will be assigned throughout the semester as and when a coherent topic is covered. Assigned tasks with deadline before the midsem will constitute the assignment 1 and that with later deadline will be considered as assignment 2.

**Chamber Consultation Hour:** To be announced in the class.

**Notices:** Will be displayed **ONLY** in CMS.

**Make-up Policy:** It is applicable to the following two cases and it is permissible on production of evidential documents.

**(i)** Debilitating illness.

**(ii)** prior permission from the IC

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.