Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2020-2021

Course Handout Part II

Date: 16-01-2020

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : *PHY F425*
Course Title : Advanced Mathematical Methods of Physics
Instructor-in-Charge : Rahul Nigam

Scope and Objective of the Course: The course will cover topics in advanced mathematics which find extensive applications in Theoretical Physics. Upon successful completion, students will have the knowledge and skills to:
1. Explain the fundamental concepts of a few special topics in theoretical physics.
2. Demonstrate accurate and efficient use of specific mathematical physics techniques.
3. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from theoretical physics.

Textbooks:

1. Lectures on Advanced Mathematical Methods for Physicists^**a** (Sunil Mukhi and N. Mukunda)
2. Gauge Fields, Knots and Gravity^**b** (John Baez and Javier Muniain)
3. Introduction to Green's Functions in Physics^**c** (Wijewardena Gamalath)
4. Principles of Advanced Mathematical Physics^**d** (Richtmyer, Robert D)

Reference books

1. Geometrical Methods of Mathematical Physics (Bernard F. Schutz)
2. Introduction to Topology (Bert Mendelson)
3. Elementary Differential Geometry (Christian Bar)
4. Introduction to Group Theory (H W Joshi)

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1-8	Introduction to Topology	Topology, Metric Spaces, Manifolds, Connected and compact spaces, Homeomosphisms, Homotopy	a.1-a.2, b.1

9-16	Differential Manifolds	Calculus on manifolds, Vector and Tensor fields, Differential Forms, Riemannian Geometry	a.3-a.4
17-20	Homology and Fibre Bundles	Simplical Homology, de Rham Cohomology, Vector bundles and Principal Bundles	a.5-a.6, b-1
21-29	Continuous Groups	Abelian, Non-abelian groups, Lie Groups, Representation, Dynkin Diagrams	a.7-a.9
30-38	Gauge Fields	De Rham Theory in Electromagnetism, Curvature and Yang Mills Equations	b.1-b.2
39-42	Green's Function	Application of Green's Function techniques	3.1-3.4

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid Sem Exam	90 mins	30	05/03 1.30 - 3.00PM	Open Book
Assignments (2)		15 each		
Comprehensive Exam	120 minutes	40	15/05 FN	Open Book

Chamber Consultation Hour: Will be announced during the class.

Notices: CMS

Make-up Policy: Student must inform prior to the exam and provide convincing proof for absence.

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.

INSTRUCTOR-IN-CHARGE
Rahul Nigam