

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI-HYDERABAD CAMPUS
SECOND SEMESTER 2020-21
COURSE HANDOUT

Date : 16.01.2021

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 F243
Course Title : Methods of Mathematical Physics I
Instructor-in-charge : **Subhash N Karbelkar**
Instructor : **Subhash N Karbelkar**

Scope and Objective :

MMP I is a course on mathematical methods used in physics. The emphasis will be on understanding the general principles and on methods which have not been covered in the various core Mathematics courses which the student has already undergone. Applications cover a wide range of physical problems.

This course deals with some of the mathematical methods which are used in many branches of theoretical physics. The mathematical methods to be discussed in this course are complex variable theory, Fourier transforms, Green's functions for partial differential equations, vector spaces and tensors.

Text Books:

Mathematical Methods for Physicists: Arfken, Weber, Harris, 7th edition, Academic Press, 2012.

Reference Books:

Mathematical Methods: a modern introduction to its foundations, Sadri Hassani, Springer

Course Plan:

Sections referred to are from the text book unless stated otherwise.

Number of lectures	Learning Objectives	Topics to be Covered	Chapter in the Text Book
2	Complex Analysis	Review of complex variables, Cauchy-Riemann conditions, Cauchy's integral theorem and formula	11.1-11.4
2	Laurent expansions	Laurent expansion, calculus of residues	11.5-11.7
3	Applications of complex analysis	Evaluation of integrals, gamma function	11.8-11.9
2	Fourier Transform	Definition and Properties of Fourier	20.3-20.4

		Transform,	
5	Fourier convolution and applications	Convolution Theorem and Applications in physics	20.4-20.6
3	Ordinary Differential equations	Series solutions , Frobenius method	7.3-7.5
2	ODEs continued	integral representations	Class notes
5	Sturm Lioville theory	Sturm Lioville theory, boundary value problems and properties of solutions	8.1-8.5
4	Partial Differential equations	Examples of PDEs: Continuity equation, diffusion equation, Wave equation, Poisson and Laplace equation, heat flow equation, Seperation of Variables, Boundary conditions.	9.1-9.7
4	Green's functions	solutions of one and multidimensional inhomogeneous DEs and PDEs	10.1-10.2
4	Vector Spaces	Gram Schmidt Orthogonalisation, operators and their transformations, invariants	Chapter 5
4	Matrices, Linear Operators, Hermitian matrices	eigenvalue problems, Hermitian matrices and their diagonalization	Chapter 6
4	Tensors	Covariant, contravariant tensors, invariants	Chapter 4

Evaluation Scheme:

EC No.	Component	Duration minutes	Weightage (%)	Date & time	Nature
1	Mid Sem Exam	90	30	02/03 1.30 - 3.00PM	Open book
2	2 Tut Tests (1 before and 1 after midsem)	30	30		Open book
3	Comprehensive exam	120	40	05/05 FN	Open book

Chamber Consultation Hours: To be announced in the class.

Notices: Will be displayed only on the CMS

Make-up Policy: Make-up will be given only in genuine cases, that is, illness leading to hospitalization.

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
PHY F243**