Second Semester 2015–2016

Date: 4th Jan 2016

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: Mathematical Methods of Physics

Instructor-in-Charge: Niladri Sarkar

Course Description:

Linear Vector Spaces, Theory of Matrices and its Applications, Eigenvalue Problems, Strum-Liouville Theory, Curvilinear Coordinates, Tensor Analysis, Functions of a Complex Variable, Contour Integration and its Applications, Partial differential Equations and its solution by Separation of Variables, Integral Transforms and the Green's Function Method

Scope and Objective:

MMP is a course on mathematical methods used in solving ordinary and partial differential equations of physics. The emphasis will be on understanding the general principles and on methods of evaluations of the solutions. Applications cover a wide range of physical problems.

Text Books:

1. Mathematical Methods in Classical and Quantum Physics, Tulsi Daas and S. K. Sharma, Universities Press, India (**T1**)

Reference Books:

1. Mathematical methods for Physicists, G. B. Arfken, H. J. Weber and F. E. Harris, 7th Ed. Academic Press, Indian Print 2012. (**R1**)
2. Mathematics for Physicists, P. Dennery and A. Kryzwicki, Harper & Row, NY, 1967. **(R2)**
3. Mathematics of Classical and Quantum Physics, F. W. Byron, R. W. Fuller, Dover Publications (1992). **(R3)**
4. Complex Variables and Application, J. Brown, and R. Churchill. **(R4)**

Course Plan:

Lect No.	Learning Objective	Topics to be covered	Textbook Ref.
1-8	Linear vector space	Definition, Scalar product, Dual-Space, CS inequality, Real and Complex Vector Space, Linear Independence, Gram-Schmidt Orthogonalization, Operators and its Transformations	R2 2.1 – 2.13
9-12	Matrix Analysis and Function space	Matrix algebra, Eigenvalues, Eigenvectors, Orthogonal Transformations, Change of Basis, Space of Continuous Function, Hilbert space	R2 2.14 – 2.18 R2 3.1, 3.2
13-17	Eigenvalue Problems	Eigenvalue Equations, Matrix Eigenvalue Problems, Hermitian Eigenvalue Problems, Hermitian Matrix Diagonalization, Normal Matrices	R1 6.1 – 6.5
18-22	Strum-Liouville Theory	Hermitian Operators, ODE Eigenvalue Problems, Variation Method	R1 8.1-8.5
23-24	Curvilinear coordinates	Orthogonal coordinate systems	R1 3.10
25-26	Tensor Analysis	Covariant and Contravariant Tensors,	R1 4.1
27-31	Partial differential equations	First and Second order Equations, Separation of variables, Laplace and Poisson equations, Wave Equation, Diffusion equation	R1 9.1 – 9.7
32-37	Complex variables	Cauchy's Riemann Conditions, Cauchy's Integral Theorem and Formula, Taylor and Laurent Series, Singularities, Calculus of Residues, Evaluation of Definite Integrals	R1 Chap. 11
38-42	Integral Transforms and Green's Function	Fourier and Inverse Fourier Transform One Dimensional Problems	R1 20.1, 20.2 R1 10.1

Evaluation Scheme:

No.	Evaluation Component	Duration	Weightage	Date & Time
1	Tutorials/Assignments (Assignments are to be submitted on or before the due date)	20 Mins	30%	
2	Mid-Term (Closed book)	90 Mins	35%	16/3 2:00 - 3:30 PM
3	Compre. Exam. (Open + closed book*)	3 Hrs	40%	7/5 FN

***Open Book**: Only the books listed in the handout and handwritten notes allowed.

Chamber Consultation Hours: To be announced in the class.

Notices: Will be uploaded on the Physics Department Notice Board and on Nalanda as well.

Make-up Policy: Make-up will be given only in genuine cases, that is, illness leading to hospitalization or going out of station with prior permission. **No make-ups for the tutorials.**

Instructor-in-charge