Physics 341/Maths 316 Spring Semester 2023

Mathematical Methods (3 credits)

Physics 341: This course meets the Bachelor of Arts and Bachelor of Sciences Honours (majors in Physics) degree requirements.

Course Goals:

The course of Phys-341 (Methods of Mathematical Physics) is for junior or senior undergraduate students. It is a required course in the pre-professional program for majoring in Physics

The course will be offered (at FCC campus) during the winter-spring semester.

Course Objectives:

1. To develop the mathematical background of student in vectors, tensors, matrices and some of their uses in the world of physics
2. To give basic understanding of group theory and complex variables used in physics
3. To give the understanding of Differential equations and their uses in Physics
4. Introduction to special functions, Fourier Series, Fourier Transforms
5. Solution of Boundary value problems and their uses

Course content:

I. Vector Analysis:

Review of vectors Algebra, Vector differentiation and gradient, System of Coordinates, Divergence and Gauss's theorem, Green's theorem in the plane, Curl and Stoke's theorem, Polar coordinates.

II. Fourier Series:

Definition and general properties, Fourier series of various physical functions, Uses and application of Fourier series.

III. Integral Transforms:

Integral transform, Fourier transform, Elementary Laplace transform and its application.

IV. Special Functions:

Gamma functions, Beta functions, Generating functions, Bessel functions, Spherical Bessel functions, Legendre polynomials,

V. Boundary Value Problems and Green's Functions:

Boundary value problems in Physics, Non-homogeneous boundary value problems and Green's functions, Green's functions for one dimensional problems, Eigenfunction expansion of Green's function, Construction of Green's functions in higher dimensions.

Required texts:

- G. Arfken, Mathematical Physics, 2nd ed, Academic Press, 1970.

Suggested reading

- R. Bronson, 'Differential Equations' Schaum's Outline Series, McGraw Hill, New York.
- C.W. Wong, 'Introduction to Mathematical Physics', Oxford

University, Press, New York (1991).

- Chattopadhyay, 'Mathematical Physics', Wiley Eastern Limited,

New Delhi, (1990).

Learning outcomes:

Duration: one semester 16 weeks including examinations and preparation time

Contact time: Three lessons/hours per week.

Break up of marks/credits

	% credit/marks
Quizzes	15
Assignments / tests / participation / project work etc.	15
Mid-term test/examination	30
Final examination	40
Total	**100**

Minimum attendance requirement: 67%.

Note: ***All examination, tests and assignments shall be cumulative, i.e. may or may not contain material from previous assignments and tests.***

Attendance is mandatory, and will be recorded. Homework assignments can be done in teams, but all team members MUST turn in an individual set of homework solutions neatly written or typed. Late homework will NOT be accepted unless it is accompanied by proof of an extenuating circumstance.

Note: 1. Absences will be approved ONLY in the case of extenuating circumstances (a submitted copy of a doctor's certificate, etc., is REQUIRED as proof). Non-approved absences will erode your course grade dependant upon number of violations.

2. There are NO makeup exams.

Required Work:

- Attend ALL classes. Arrive on time and stay the entire period.
- Read all assignments, and submit all homework on time.
- Take both exams.
- Explore, be attentive, interact - pose questions to each other and figure things out.