

**SECOND SEMESTER 2023-2024**

# Course Handout Part II

09-01-2024

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. : MATH F343

## Course Title : Partial Differential Equations

## Instructor-in-Charge : Dr. G. Murali Mohan Reddy

*Instructors : Amit Kumar Pal, Shivangi Joshi*

**Scope and Objective of the Course:**

Enables one to understand the nature of partial differential equations, find solutions to these equations along with some applications in the field of Science and Engineering.

**Textbooks:**

1. Tyn Myint-U and Lokenath Debnath, Linear Partial Differential Equations for Scientists and Engineers, Birkhauser, 4th Edition.

**Reference books**

1. Ian N. Sneddon, Elements of Partial Differential Equations, International Series in Pure and Applied Mathematics.
2. T. Amarnath, An Elementary Course in Partial Differential Equations, Narosa Publishing House, 2nd Edition.
3. K. Sankara Rao, Introduction to Partial Differential Equations, PHI Learning Private Limited, 3rd Edition.

**Course Plan:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lecture No.** | **Learning objectives** | **Topics to be covered** | **Chapter in the Text Book** |
| 1-3 | Motivation for studying partial differential equations | Introduction of Partial differential equations | 1.1-1.6 |
| 4-6 | Introduction and overview of first order partial differential equations | Introduction, First order linear equations | 2.1-2.4 |
| 7-12 | Geometrical interpretation of first order PDEs, Canonical form of first order linear equations, To Find solutions of first order PDEs | Methods of Characteristics, Canonical Form, Method of Separation of variables, Charpit’s Method, Jacobi Method | 2.5-2.7,  R1-2.10-2.14 |
| 13 | Introduction of second order partial differential equations | Second order equations in two variables | 4.1 |
| 14-16 | To convert the second order differential equations into the standard form  Characterization of 2nd order PDE’s and its solutions | Canonical Form | 4.2 |
| 17-18 | To convert the second order differential equations into the standard form | Equations with constant Coefficients | 4.3, R1-3.4 |
| 19 | Difference between general solution of ODEs and PDEs | General solution | 4.4 |
| 20-24 | Solution of Homogeneous and inhomogeneous wave equations, D’Almbert Principle, Duhamel Principle, Spherical and cylindrical wave equations (self study) | Wave equation | 5.1-5.2,  5.3-5.6,  5.10-5.11 |
| 25-28 | To obtain the maximum and the minimum of solutions of PDEs | Maximum-minimum principles | 9.1-9.9 |
| 29-31 | Solution of Laplace equations in different domains with homogeneous boundary condition | Laplace Equation | 10.1-10.4 |
| 32-34 | Analysis and behavior of solutions of heat and wave equations in two dimensions and three dimensions | Heat and Wave Equations | 10.5-10.9 |
| 35-37 | Use of Fourier techniques in finding the solutions of PDEs | Fourier Transform | 12.2-12.6 |
| 38-39 | Use of Laplace techniques in finding the solutions of PDEs | Laplace Transform | 12.8-12.10 |
| 40 | Solution of PDEs in terms of Green’s functions | Green’s Functions | 11.1-11.5 |

**Evaluation Scheme:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **Duration** | **Weightage (%)** | **Date & Time** | **Nature of Component** |
| Quiz 1 | To be announced in the class | 10 | To announced in the class | Closed book |
| Project | To be announced in the class | 10 | To announced in the class | Open book |
| Mid-semester | 90 mins | 30 | 14/03 - 9.30 - 11.00AM | Closed book |
| Quiz 2 | To be announced in the class | 10 | To be announced in the class | Open Book |
| Comprehensive Exam | 180 mins | 40 | 13/05 FN | Closed book |

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

**Notices:**All notices about the course will be put only on CMS.

**Make-up Policy:**  Make up of evaluation components will be granted only in genuine cases. Permission must be taken in advance except in extreme cases.

**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**

**MATH F343**