



**INSTRUCTION DIVISION
SECOND SEMESTER 2015-2016
Course Handout (Part II)**

Date: 04/01/2016

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 Number : MATH F343
Course Title : Partial Differential Equations
Instructor-In-Charge : Devendra Kumar

1. Course Description

Non linear equations of first order, Charpit's Method, Method of Characteristics; elliptic, parabolic and hyperbolic partial differential equations of order 2, maximum principle, Duhamel's principle, Green's function, Laplace transform & Fourier transform technique, solutions satisfying given conditions, partial differential equations in engineering & science.

2. Scope and Objectives

The study of partial differential equations (PDEs) is a fundamental subject area of mathematics which links important strands of pure mathematics to applied and computational mathematics. Indeed, PDE's are omnipresent in almost all applications of mathematics where they provide a natural mathematical description of phenomena in the physical, natural and social sciences. This course gives an extensive exposure to the methods of finding analytical solutions to Partial differential equations along with few applications in the areas of Science and Engineering.

3. Textbook

T1. Tyn Myint-U and Lokenath Debnath, *Linear Partial Differential Equations for Scientists and Engineers*, Birkhauser, 4th Edition, 2007.

4. Reference Book(s)

R1. Ian N. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, 2002.

R2. T. Amarnath, *An Elementary Course in Partial Differential Equations*, Narosa Publishing House, 2nd Edition, 2003.

R3. Walter A. Strauss, *Partial Differential Equations, An introduction*, John Wiley & Sons, 2nd Edition, 2007.

R4. K. Sankara Rao, *Introduction to Partial Differential Equations*, PHI Learning Private Limited, 3rd Edition, 2011.

R5. Harumi Hattori, *Partial Differential equations: Methods, Applications and Theories*, World Scientific, 2013.

5. Course Plan

Lec. No.	Topics to be covered	Learning Objectives	Reference to Text Book
1-2	Introduction of Partial differential equations	Motivation for studying partial differential equations	1.1-1.6
3-4	Introduction, First order linear equations	Introduction and overview of first order partial differential equations	2.1-2.4





5-8	Methods of Characteristics, Canonical Form, Method of Separation of variables, Charpit's Method, Jacobi Method	Geometrical interpretation of first order PDEs, Canonical form of first order linear equations, To find solutions of first order PDEs	2.5-2.7, R1-2.10-2.14
9	Second order equations in two variables	Introduction of second order partial differential equations	4.1
10-11	Canonical Form	To convert the second order differential equations into the standard form, Characterization of 2nd order PDE's and its solutions	4.2
12-13	Equations with constant Coefficients		4.3, R1-3.4
14	General solution	Difference between general solution of ODEs and PDEs	4.4
15-21	Wave equation	Solution of homogeneous and inhomogeneous wave equations, D'Alembert principle, Duhamel principle, Spherical and cylindrical wave equations	5.1-5.2, 5.3-5.6, 5.10-5.11
22-26	Maximum-minimum principles	To obtain the maximum and the minimum of solutions of PDEs	9.1-9.9
27-29	Laplace Equation	Solution of Laplace equations in different domains with homogeneous boundary condition	10.1-10.4
30-32	Heat and Wave Equations	Analysis and behavior of solutions of heat and wave equations in two and three dimensions	10.5-10.9
33-36	Green's Functions	Solution of PDEs in terms of Green's functions	11.1-11.5
37-38	Fourier Transform	Use of Fourier techniques in finding the solutions of PDEs	12.2-12.11
39-40	Laplace Transform	Use of Laplace techniques in finding the solutions of PDEs	12.8-12.10

6. Evaluation Scheme:

ECNo.	Evaluation Component	Duration	Weightage %	Date	Nature of Component
1.	Mid Semester Exam	90 min.	35	14/3 9:00 - 10:30 AM	Closed Book
2.	Class Performance Tests (Quizzes/Assignments)		20	To be announced in the class	Closed Book/ Open Book
5.	Comprehensive Exam	180 min.	45	3/5 FN	Closed Book/ Open Book

7. **Notices:** All notices about the course will be put on Nalanda Website.

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



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9. **Make UP Policy:** (i) NO MAKE UP will be given in Class Performance Tests under any circumstances. (ii) Make up of other evaluation components will be granted only in genuine cases. Permission must be taken in advance except in extreme cases. (iii) No MAKE-MAKE-UP will be entertained.

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