**Course title: Partial Differential Equations**

**Course code: Math 485**

**Credit hours: 3 Contact hrs: 3 Tutorial hrs: 2**

**Prerequisite: Math 382 Course category: Compulsory**

Aims

The course introduces students to the concepts and analytical methods for solving partial

differential equations. It builds on the previous core mathematics courses to develop more advanced ideas

in differential and integral calculus.

**Course description**

This course discusses basic concepts of partial differential equations (PDE), some techniques of solutions of first order PDE, Fourier series, second order PDE and analytical methods of solutions

**Course objectives**

On completion of the course, successful students will be able to:

* define Fourier series of periodic functions,
* expand periodic functions in terms of sine and cosine,
* compute Fourier series,
* determine the order and classification of PDEs
* solve PDEs,
* model some physical problems using PDEs,
* apply Fourier and Laplace transforms for solving PDEs,
* solve one dimensional heat flow and wave equations,
* solve Laplace equations,
* understand generalized functions,
* apply generalized functions.

**Course outline**

**Chapter1: Fourier series and orthogonal functions (7hrs.)**

1.1 Orthogonal functions

1.2 Fourier series

1.2.1 Fourier series of functions with period 2

1.2.2 Fourier series of functions with arbitrary period

1.2.3 Fourier series of odd and even functions

1.3 Complex form of Fourier series

**Chapter 2: Introduction to partial differential equations (11hrs.)**

2.1 Definitions and basic concepts

2.2 Classification of PDEs

2.3 Definition of initial/boundary value problems

2.4 Well-posedness of a problem

2.5 Modelling some physical problems using PDEs

**Chapter 3: First order partial differential equations (10hrs.)**

3.1 Solution of first order PDEs with constant coefficients

3.2 Solution of a first order PDEs with variable coefficients

3.3 Charpit’s method

3.4 Application of a first order PDEs to fluid flow problems

**Chapter 4: Fourier transforms (8hrs.)**

4.1 .Fourier integral

4.2 .Fourier transform and its inverse

4.3 Properties of Fourier transform

4.4 Fourier sine and cosine transforms

4.5 Convolution

**Chapter 5: Second order partial differential equations (10hrs.)**

5.1 Definition and classification of second order PDEs

5.2 Method of separation of variables

5.3 One dimensional heat and their solutions by using methods of Fourier transform

5.4 One dimensional wave equations and their solutions by using methods of Fourier transform

5.5 The potential (Laplace) equation

5.6 Fourier and Laplace transforms, applied to other PDEs

**Teaching –learning methods**

Three contact hours of lectures and two hours of tutorials per week. Students do home assignments

**Assessment method:**

Assignments / quizzes / 20%

Mid semester examination 30%

Final examination 50%

**Textbook: -** I.N. Sneddon, Elements of partial differential equations

**References: -**

* R. C. Mcowen, Partial differential equations, methods and applications, Pearson education,

INC, 2003

* H. M. Lieberstein, Theory of partial differential equations, Academic press, 1972
* R. B. Gunther & J. W. Lee, Partial differential equations of physics, Dover, 1996