Department of Mathematics
Faculty of Mathematics & Computer Science
M.Sc. (Applied Mathematics), 2nd Semester

Course Code	AM 204
Course Name	Partial Differential Equations and Applications
Course Credits	04

Course objectives:

To be able to solve various types of partial differential equations, understand the theory underlying the solution techniques, conversant with methods of applying partial differential equations in various physical phenomenons. Applications with Mathematica programming for partial differential equations.

Minimum pre-requisites:

AM 103 Ordinary Differential Equations & Applications

Course structure:

The method of (Fourier, Fourier cosine, Fourier sine, Laplace, Mellin, Hankel) integral transforms for the solution of partial differential equations.
Laplace equation: The occurrence of Laplace equation in physics, singular solution for the Laplace equation, maximum-minimum principle, uniqueness for boundary value problems, Cauchy problem, Dirichlet and Neumann problems for upper-half plane, Poisson's integral formula, Dirichlet exterior problem for a circle, Neumann problem for a circle, Green's function-, theory of Green's function for Laplace's equation, Dirichlet problem for a half-plane, Dirichlet problem for a sphere and semi-infine space.
Wave equation: The occurrence of wave equation in physics, D'Alembert's solution, uniqueness for initial-boundary value problem for the wave equation, Duhamel's principle, singular solution for the wave equation, Helmholtz's first and second theorems, Green's function for wave equation.
Diffusion equation: The occurrence of Diffusion equation in physics, Elementary solution for the diffusion equation, heat conduction problems both for finite and infinite rods, uniqueness for the heat conduction equation of initial-boundary value problem type, Duhamel's principle for heat equation, Green's function for diffusion equation.
Lab Components: Analytical and graphical solutions to elliptic, parabolic and hyperbolic equations using Mathematica.

Reading suggestions:

- I. N. Sneddod, Elements of Partial Differential Equations, Dover publication, 2006.
- L. Debnath, Nonlinear Partial Differential Equations

- Tyn Myint-U and L. Debnath, Linear Partial Differential Equations for Scientists & Engineers, Birkhauser, 2007.
- Partial Differential Equations: An Introduction with Mathematica and MAPLE - Ioannis P. Stavroulakis, Stepan A. Tersian, (World Scientific) 2004

Evaluation and weightage:

- Mid-semester Test (40%),
- End-semester Test (40%),
- Quiz & assignments (20%).