No. of Printed Pages : 03 **Roll No. ....**

CC312

M.Sc. EXAMINATION, May 2019

(Third Semester)

(B. Scheme) (Re-appear)

MATHEMATICS

MAT603B

Partial Differential Equations

Time : 3 *Hours*] [*Maximum Marks :* 100

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Define partial differential equation and find the solution of non-homogeneous transport equation. **10**

(b) Define Laplace equation and obtain fundamental solution for Laplace equation. **10**

2. (a) State and prove Harnack's inequality. **10**

(b) Show that the solution of Poisson's equation inunique. **10**

Unit II

3. Construct the Green function for half space. **20**

4. Find the solution of equation :

$$u_{tt} - \Delta u = f(x, t) \text{ in } \mathrm{R}^3 \times (0, \infty)$$

$$u - 0 = u_t = 0, \text{ on } \mathrm{R}^3 \times (t = 0)$$ **20**

Unit III

5. Solve the Hamilton Jacobi equation :

$$\mu_t + \mathrm{H}(\mathrm{D}\mu) = 0, \text{ in } \mathrm{R}^n \times (0, \infty)$$

where H is Hamilton. **20**

6. (a) Explain Hope-Lax formula. **10**

(b) Solve the Quasi-Linear parabolic equation :

$$\mu_t = 9\Delta u + b|\mathrm{D}\mu|^2 = 0, \text{ in } \mathrm{R}^n \times (0, \infty)$$

$$\mu = g, \text{ on } \mathrm{R}^n \times (t = 0)$$

using Cole-Hopf transformation. **10**

Unit IV

7. State and prove Plancherel's theorem. **20**

8. (a) What is potential functions and derive the Bernoulli's equation for unsteady motion. **10**

(b) Define plane and travelling wave and obtain the exponential solution of :

$$u_t - \Delta u = 0$$ **10**