

Roll No.

(05/24)

11672

M.Sc. (2 Year) EXAMINATION

(For Batch 2017 to 2020 Only)

(Fourth Semester)

MATHEMATICS

MTHCC-2402

Partial Differential Equations

Time : Three Hours

Maximum Marks : 70

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. 1 is compulsory. All questions carry equal marks.

(Compulsory Question)

1. (a) Define PDE of K th order. Give its example.
- (b) Define Harmonic function and its properties.

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- (c) Define Green's Function.
- (d) Define Potential Function.
- (e) Describe physical interpretation of heat equation.
- (f) Describe Poisson's formula for $n = 2$ and $n = 3$.
- (g) Define plane and traveling waves.

2×7=14

Unit I

- 2. (a) Describe Poisson equation and its solution.
- (b) State and prove Harnack's inequality.
- 3. (a) Describe fundamental solution of Laplace equation.
- (b) Assume u is harmonic in U . Then u is analytic in U .

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Unit II

- 4. (a) Explain Dirichlet principle with convergence.
- (b) Describe fundamental solution of heat equation.
- 5. (a) State and prove Duhamel's principle.
- (b) Prove that there exists at most one solution $u \in C^2(\bar{U})$ of :

$$-\nabla u = f \text{ in } U$$

$$u = g \text{ on } \partial U$$

Unit III

- 6. (a) State and prove Euler-Poisson Darbax equation.
- (b) State and prove Poisson's formula for $n = 3$.

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7. (a) Describe uniqueness of solution of wave equation.
- (b) Describe characteristic equations for fully non-linear first order PDE.

Unit IV

8. (a) Describe Laplace transform and its properties.
- (b) Describe Cole-Hop transform.
9. (a) Describe similarity solutions of plane and traveling waves.
- (b) Describe Barenblatt's solution for Porous medium equation.