# ED-613

M.A./M.Sc. 3rd Semester
Examination, March-April 2021

## MATHEMATICS

Paper - II

Partial Differential Equations and
Mechanics - I

*Time* : Three Hours] [*Maximum Marks* : 80

**Note** : Answer any **two** parts from each question. All questions carry equal marks.

### Unit-I

**1.** (*a*) State and prove the symmetry of Green's function.

(*b*) State and prove the Poisson formula for half-space.

(*c*) State and prove the mean value formula for Laplace equation.

**Unit-II**

**2.** (*a*) Derive the fundamental solution for heat equation.

(*b*) Obtain the solution for $n = 2$ of wave equation by spherical means.

(*c*) State and prove the Euler's-Poisson-Darboux equation for wave equation.

**Unit-III**

**3.** (*a*) Derive Kinetic energy in terms of generalized co-ordinates.

(*b*) State and prove the Donkin's theorem.

(*c*) Derive Lagrange's equation of first kind.

**Unit-IV**

**4.** (*a*) Prove that the Poisson identity

$[u, (v, w)] + [v, (w, u)] + [w, (u, v)] = 0$

(*b*) Find the shortest line on the surface of the sphere.

(*c*) Derive Euler's equation for one dependent variable.

**Unit-V**

**5.** (*a*) Find the attraction of a uniform circular disc, of radius $a$ and small thickness $k$, at a point $p$ on the axis of the disc at a distance $p$ from its centre.

(*b*) Find the potential of a thin uniform spherical shell at any point.

(*c*) Show that a family of right circular cones with common axis and vertex is a possible family of equipotential surfaces and find the potential function.

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