

Roll No.

(07/21-II)

11715

M. Sc. Mathematics (5 Years)

EXAMINATION

(For Batch 2017 & Onwards)

(Tenth Semester)

BOUNDARY VALUE PROBLEMS

MTHCE-5007

Time : Three Hours

Maximum Marks : 70

Note : The candidates are required to attempt *Five* questions in all, selecting the compulsory question and *one* question from each Unit. All questions carry equal marks.

Compulsory Question

1. (a) Define initial value problems and give example.

- (b) Define self-adjoint differential equation.
- (c) Define Laplace and Poisson equation.
- (d) Define exterior Neumann problems.
- (e) Define Volterra integral equation with convolution type kernel.
- (f) Define Steady stokes flow.
- (g) Define Laplace transform and its two properties. 2×7=14

Unit I

2. (a) Transform the problem $y'' + xy = 1$, $y(0) = y(1) = 0$ to an integral equation. 7

(b) Reduce the Bessel equation :

$$x^2 \left(\frac{d^2 y}{dx^2} \right) + x \frac{dy}{dx} + (\lambda x^2 - 1) y = 0$$

with end conditions $y(0) = 0$, $y(1) = 0$ to Fredholm integral equation. 7

3. Find the modified Green's function for the system $y'' = 0$, $-1 < x < 1$ subject to the boundary conditions $y(-1) = y(1)$, $y'(-1) = y'(1)$. 14

Unit II

4. (a) Define Newtonian, single layer and double layer potentials in detail. 7
 (b) Discuss Exterior Dirichlet problem. 7
5. (a) Define Interior Neumann problem. 7
 (b) State and prove Poisson Integral formula. 7

Unit III

6. (a) Obtain electrostatic potential due to a thin circular disc. 7
 (b) State and prove convolution theorem. 7
7. (a) Define Hilbert transform and deduce first form of Hilbert transform. 7

- (b) Explain three part boundary value problem. 7

Unit IV

8. (a) Discuss steady stokes flow in an unbounded medium. 7
 (b) Discuss steady Oseen flow. 7
9. (a) Discuss crack problems in elasticity. 7
 (b) Solve the problem of the diffraction of a plane wave by a soft sphere, taking spherical co-ordinates. 7