

Roll No

94063

B. Sc. (Hons.) Mathematics 5th Semester  
Old/New Scheme  
Examination – February, 2022

METHODS OF APPLIED MATHEMATICS

Paper : BHM-355

Time : Three Hours ]

[ Maximum Marks : 60

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

Note : Attempt five questions in all, selecting one question from each Section. Q. No. 9 (Section-V) is compulsory. All questions carry equal marks.

SECTION – I

1. (a) Find the solution of three dimensional Laplace equation in cylindrical co-ordinates. 6

- (b) Discuss the heat conduction in a semi-infinite bar. 6

2. (a) Obtain the solution of wave equation in cylindrical co-ordinates by the methods of separation of variables. 6

- (b) Determine the temperature distribution in the infinite cylinder  $0 \leq l \leq a$ , when the initial temperature is  $Q(l, 0) = f(l)$  and the surface  $l = a$  is maintained at zero temperature. 6

SECTION – II

3. (a) Discuss the wave motion along a semi-infinite string. 6

- (b) Discuss heat conduction in an infinite cylinder. 6

4. Obtain the Fourier series solution of the heat equation in case of : 12

(i) Ends of the bar kept at temperature zero.

(ii) Temperature in a bar with insulated ends.

**SECTION – III**

5. (a) Obtain the Hankel transform of derivatives. 6  
 (b) State Hankel's transform. Find the zero-order Hankel transform of  $\frac{\delta(r)}{r}$ . 6
6. (a) Find Fourier sine transform of the function : 6  

$$f(x) = e^{-3x} + e^{-4x}$$
  
 (b) Solve  $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$  with boundary condition  $\frac{\partial u}{\partial x} = 0$ , when  $x = 0$ ,  $x = \pi$  and  $u = f(x)$ , when  $t = 0$ ,  $0 < x < \pi$ . 6

**SECTION – IV**

7. (a) State and prove parallel axis theorem. 6  
 (b) Find M. I. (moment of inertia) of the body about a line whose direction ratio are  $\alpha, \beta, \gamma$ . 6
8. (a) Prove that principal axis are mutually orthogonal. 6  
 (b) A square of side  $a$  has particle of masses  $m, 2m, 3m, 4m$  at its vertices. Find the moments and product of inertia at the centre of square and find the direction of principal axis. 6

**SECTION – V**

9. (a) Write down any two operational property of Hankel transform. 2  
 (b) Find the infinite Fourier sine transform of function  $f(x) = x$ . 2  
 (c) State Laplace equation in spherical polar coordinates. 2  
 (d) Define the finite Fourier cosine transform. 2  
 (e) Write relation between Fourier and Hankel transform. 2  
 (f) Define equipomental system. 2