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 α, β, γ. 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 co-ordinates. 2

(d) Define the finite Fourier cosine transform. 2

(e) Write relation between Fourier and Hankel transform. 2

(f) Define equimomental system. 2