**Reg. No. \_\_\_\_\_\_\_\_**

**Karunya University**

**(Karunya Institute of Technology and Sciences)**

(Declared as Deemed to be University under Sec.3 of the UGC Act, 1956)

**Supplementary Examination - June 2011**

**Subject Title: MATHEMATICS - IV Time: 3 hours**

**Subject Code: MA234 Maximum Marks: 100**

#### **Answer ALL questions**

**PART – A (10 x 1 = 10 MARKS)**

1. Find the Fourier constant ao for f(x) = C in the interval (0, 2π).

2. Define RMS value of f(x) in (a, b).

3. Form a partial differential equation by eliminating the arbitrary constants a and b from

Z = (x+a) (y+b).

4. Find the particular integral of (D2 – DD′) Z = e2x+y.

5. How many boundary conditions are required to solve ?

6. In one dimensional heat equation, the constant α2 = \_\_\_\_\_\_.

7. Write the two dimensional heat equation.

8. Define steady state temperature distribution.

9. Define infinite Fourier transform.

10. If F(f(x)) = F(s) then F(f(ax)) = \_\_\_\_\_\_.

**PART – B (5 x 3 = 15 MARKS)**

11. Find the half range Fourier sine series of f(x) = x in (0, π).

12. Find the complete integral of p – x2 = q + y2.

13. A tightly stretched string with fixed end points x = 0 and x = *l* is initially at rest in its equilibrium position. If it is set vibrating, giving each point a velocity Vosin . Write down all the boundary and initial conditions.

14. Write all the three possible solutions of steady state two dimensional heat equation in the Cartesian form.

15. Find the finite Fourier sine transform of f(x) = .

**PART – C (5 x 15 = 75 MARKS)**

16. a. Express f(x) = (π-x)2 as a Fourier series of periodicity 2π in 0 < x < 2π and hence deduce the sum . (8)

b. Find the half range cosine series of f(x) = *l*x – x2 in (0, *l*). (7)

(OR)

17. a. Compute the first three harmonics of the Fourier series of f(x), given by the following table: (10)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| X | 0 | π/3 | 2π/3 | π | 4π/3 | 5π/3 | 2π |
| f(x) | 1.0 | 1.4 | 1.9 | 1.7 | 1.5 | 1.2 | 1.0 |

b. Find the complex form of the Fourier series of f(x) = e-x in -1 < x < 1. (5)

[P.T.O]

18. a. Solve z = px + qy + . (8)

b. Solve  (7)

(OR)

19. a. Solve x(z2 – y2) p + y (x2 –z2) q = z (y2 –x2). (8)

b. Solve  (7)

20. A string is stretched and fastened to two points ‘*l*’ apart. Motion is started by displacing the string into the form y(x, 0) = yo sin3 from which it is released at time t = 0. Find the displacement of the string at any subsequent time.

(OR)

21. A bar 10cm long with insulated sides has its ends A and B kept at 20°C and 80°C respectively until steady state conditions prevail. The temperature at each end is suddenly reduced to 0°C and kept so. Find the temperature u(x,t) at a distance x from A and at time t.

22. A semicircular plate of radius ‘a’ cm has insulated faces and heat flows in plane curves. The bounding diameter is kept at 0°C and the circumference is maintained at the temperature given by u(a, θ) = . Find the steady state temperature distribution.

(OR)

23. A rectangular plate with insulated surface is 10cm wide and so long compared to its width, that it may be considered infinite length without introducing appreciable error. If the temperature at short edge y = 0 is given by u = 20x, 0 ≤ x ≤ 5

= 20(10 –x), 5 ≤ x ≤ 10 and all the other three edges are kept at 0°C. Find the steady state temperature at any print of the plate.

24. a. Find the Fourier transform of f(x) given by f(x) = and hence evaluate . (10)

b. Find the finite Fourier cosine transform of f(x) = eax in (0, *l*). (5)

(OR)

25. a. Find the Fourier sine and cosine transform of e-ax and hence deduce the inversion formula.

(8)

b. Using Parseval’s identity, evaluate (i)  (ii)  (7)