KUMARAGURU college of technology
character is life

Register Number:…………..….

B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2013)

Third Semester

U13MAT304: PARTIAL DIFFERENTIAL EQUATIONS AND FOURIER ANALYSIS

(Common to CE & ME)

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. If $z = ax + by$, it will produce P.D.E. of order :
   a) One b) Two
   c) Zero d) four
2. The degree of the PDE $(u_{xx})^2 + u_{yy} + u_x u_y = 0$ is___________
3. If f(x) is discontinuous at x=x_0, then the sum of the Fourier series is
   a) 1 b) 2
   c) $\frac{1}{2}\left(f(x_{0+}) + f(x_{0-})\right)$ d) f(x_0)
4. If $f(x) = |x|$, in $(-\pi, \pi)$, then b_n=-----------------
5. $u_{xx} + u_{yy} = 0$ is of the class:
   a) elliptic b) parabolic
   c) hyperbolic d) conic
6. For one dimensional heat equation , the steady state solution is_______
7. Unsteady state means :
   a) PDE b) Time-independent
   c) Time dependent d) zero
8. The steady state form of two dimensional heat equation in polar form is_______
9. If $F(f(x)) = F(S)$ then $F(1)$ *is*
   a) 1 b) $\frac{-1}{is}$
   c) $\frac{1}{is}$ d) is

10. If $F(f(x)) = F(S)$ then $F(f(x-2)) = ------$

PART B (10 x 2 = 20 Marks)

11. Form the PDE from $z = f(2x-6y)$

12. Solve, $p^2 + q^2 = k^2$, to find the complete integral.

13. If $f(x) = x^2 \sin x$ in $(-\pi, \pi)$, then find the value of a_0, a_n

14. State the Dirichlet's conditions for a function to be expanded as a Fourier series.

15. Write an example for PDE of the type of parabolic.

16. State an unsteady state solution for one dimensional heat equation.

17. What is steady state?

18. Write the Laplace equation in cartesian form.

19. If $F(f(x)) = F(S)$, show that $L(f(ax)) = \frac{1}{a} F(\frac{S}{a})$

20. Write the Fourier cosine transform of 1/x.

PART C (5 x 14 = 70 Marks)

21. A string is stretched and fastened to two points $x = 0$ and $x = l$ is initially rest in its equilibrium position. If it is set vibrating giving each point a velocity $\lambda x(l-x)$.Find the displacement at any subsequent time.

22 a) i) Solve $z^2(p^2 + q^2 + 1) = c^2$ (7)

ii) Solve $(D^2 + DD' - 6D'^2)z = e^{x-y} + \cos(2x + y)$ (7)

(OR)

22. b) i) Solve : $r + s - 6t = y \cos x$ (7)

ii) Solve $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$ (7)

23 a) i) Find the Fourier series expansion of $f(x) = |x|$ in the interval $(-\pi, \pi)$ (7)

ii) Obtain the half range sine series for $f(x)=\begin{cases} cx, & 0\le x\le \frac{l}{2} \\ c(l-x), & \frac{l}{2}\le x\le l \end{cases}$ (7)

(OR)

23. b) i) Obtain the Fourier series expansion of $f(x)=x^2-2$ in the interval $(-2, 2)$ (6)

ii) Obtain the Fourier series for y=f(x) up to second harmonic for the following data: (8)

x	0	1	2	3	4	5
f(x)	9	18	24	28	26	20

24 a) An infinitely long plane uniform plate is bounded by two parallel edges and an end right angles to them, The breadth is π and this end is maintained at temperature u_0 and other edges are kept at 0^oc. Find the steady state temperature distribution.

(OR)

24. b) The bounding diameter of a semi-circular plate of radius 10 cm is kept at 0° c and the temperature along semi-circular boundary at u_0 until steady state conditions prevails. Find the temperature distribution in the plate.

25. a) i) Find the Fourier transform of $f(x)=\begin{cases} 1-x^2, & |x|<1 \\ 0, & |x|>1 \end{cases}$ (7)

ii) Find the Fourier sine transform of e^{-ax}, a>0. (7)

(OR)

b) i) Find the Fourier transform of $f(x)=\begin{cases} a^2-x^2, & |x|<a \\ 0, & |x|>a>0 \end{cases}$ (7)

ii) Find the Fourier cosine transform of e^{-4x} (7)

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