SATHYABAMA UNIVERSITY
(Established under section 3 of UGC Act, 1956)

Course & Branch: B.E /B.Tech- Common to ALL Branches
Title of the paper: Engineering Mathematics – IV
Semester: IV Max. Marks: 80
Sub.Code: 6C0054/401 Time: 3 Hours
Date: 22-04-2008 Session: FN

PART – A (10 x 2 = 20)

Answer All the Questions

1. Find Fourier series given $f(x) = x$ in $-\pi \le x \le \pi$.

2. Define complex form of Fourier Series.

3. Form Partial differential equation by eliminating 'f' from $z = f(x^3 - y^3)$

4. Find the complete solution of $\sqrt{p} + \sqrt{q} = x + y$.

5. State any two assumptions in the derivation of one dimensional wave equation.

6. Define α^2 in $u_t = \alpha^2 u_{xx}$.

7. State the two dimensional heat equation in Cartesian as well as polar co-ordinates.

8. Write the three positive solutions of the Laplace equation in polar co-ordinates.

9. State Convolution Theorem of Fourier Transform.

10. If $F\{f(x)\} = \bar{f}(s)$ then Prove that $F\{f(ax)\} = \frac{1}{|a|}\bar{f}\left(\frac{s}{a}\right)$

PART – B (5 x 12 = 60)

Answer All the Questions

11. Find the fourier Series expansion of f(x) of period 'l'.

$$f(x) = \begin{cases} x & \left(0, \frac{l}{2}\right) \\ l - x & \left(\frac{l}{2}, l\right) \end{cases}$$

Hence deduce the sum of the series $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^4}$

(or)

12. Find first three harmonics in the Fourier Series of y = f(x)

x	0	1	2	3	4	5	6
y	1.0	1.4	1.9	1.7	1.5	1.2	1.0

13. Solve $(y + z)\, p + (z + x)\, q = x + y$.

(or)

14. Solve $(D^2 - 2DD' + D'^2)z = x^2 y^2 e^{x+y}$ where $D = \frac{\partial}{\partial x}, D' = \frac{\partial}{\partial y}$.

15. Solve $y_{tt} = a^2 y_{xx}$ $0 \le x \le l$, $t > 0$ subject to $y(0, t) = 0$ $y(l, t) = 0$, $y_t(x, 0) = 0$

$$y(x,0) = \begin{cases} kx & 0 \le x \le l \\ k(l - x & \frac{l}{2} \le x \le l \end{cases}$$

(or)

16. A rod of length 20cm has its ends A and B kept at 30°C and 90°C respectively until steady state conditions prevail. If the temperature at each end is then suddenly reduced to 0°C and maintained so, find the temperature u(x, t) at a distance 'x' from A, at any time 't'.

17. An uniformly ling metal plate in the form of an area is enclosed between the lines y = 0 and y = π for positive values of x. The temperature is zero along the edges y = 0 and y = π and the edge at infinity. If the edge x = 0 s kept at temperature 'ky', find the steady state temperature distribution in the plate.

(or)

18. A semi circular plate of radius a has its boundary dimeter kept at temperature zero and circumference at f(θ) = k, 0 < θ < π. Find the steady state temperature at any distribution point of the plate.

19. Find Fourier Transform of the distribution

$$f(x) = \begin{cases} 1-|x| & |x| \le 1 \\ 0 & |x| > 1 \end{cases}$$

Hence evaluate $\int_0^\infty \frac{\sin^4 t}{t^4} dt$

(or)

20. Find Fourier Sine and Cosine Transform of e^{-ax} a > 0, and hence find Fourier Sine Transform of $\frac{x}{x^2 + a^2}$ and Fourier cosine transform of $\frac{1}{x^2 + a^2}$