

ANNA UNIVERSITY COIMBATORE

B.E. / B.TECH. DEGREE EXAMINATIONS : DECEMBER 2009

REGULATIONS : 2007

THIRD SEMESTER

070030008 - ENGINEERING MATHEMATICS III

(COMMON TO EEE / ECE / EIE / ICE / FT / TT / TC / MECHATRONICS / MEDICAL ELECTRONICS)

TIME : 3 Hours

Max.Marks : 100

PART - A

(20 x 2 = 40 MARKS)

ANSWER ALL QUESTIONS

1. If $f(x) = x^2 + x$ is expressed as a Fourier series in the interval $(-2, 2)$ to which value this series converges at $x=2$.
2. If $f(x) = x^2 - 2$ in $(-\pi, \pi)$, then find the value of b_n .
3. Find the RMS value of $f(x) = x^2$ in $(-1, 1)$.
4. State the parseval's identity for the function $f(x)$ as Fourier series in $(0, 2l)$.
5. If $f(x) = F(s)$, then find $F[f(x-a)]$
6. Find the Fourier sine transform of $\frac{1}{x}$.
7. Find the Fourier transform of $e^{-|t|}$
8. Show that $F_s[xf(x)] = \frac{d}{ds}[F_s(s)]$
9. Find $Z\left[\frac{1}{n!}\right]$.
10. Find $Z[te^{-at}]$
11. Prove that $Z[nf(n)] = -z \frac{d}{dz} F[z]$
12. Find $Z\left[\frac{1}{n(n+1)}\right]$
13. Form partial differential equation by eliminating the arbitrary constants a and b from the equation $(x-a)^2 + (y-b)^2 = z^2 \cot^2 \alpha$.

14. Find the singular integral of $z = px + qy + pq$.
15. Find the solution of $px - qy = x$.
16. Find the particular integral of $(D^2 - 4DD' + 3D'^2)z = e^{x+y}$
17. Classify the equation $(1+x^2)u_{xx} + (5+2x^2)u_{yy} + (4+x^2)u_{xy} = 2\sin(x+y)$
18. Write the physical meaning for the constant term in one dimensional heat equation.
19. Write all the three possible solutions of one dimensional heat equation.
20. Find the steady state temperature of the rod of the length l whose ends are kept at 0°C and 100°C .

PART - B

(5 x 12 = 60 MARKS)

ANSWER ANY FIVE QUESTIONS

21. a Find the Fourier series for the function $f(x) = (\pi - x)^2$ in $(0, 2\pi)$ 6
 b Find the Fourier sine series for $f(x) = (x-1)^2$ in $(0, 1)$ 6
22. a Find the Fourier series for $f(x) = x^2$ in $(-\pi, \pi)$, hence deduce the value of $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \dots$ 6
 b Find the Fourier cosine transform of $\frac{e^{-ax}}{x}$ 6
23. Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & \text{if } |x| \leq 1 \\ 0, & \text{if } |x| > 1 \end{cases}$
 Hence find the value of $\int_0^\infty \frac{\sin s - s \cos s}{s^3} \cos \frac{s}{2} ds$

24. a Solve $z = px + qy + \sqrt{1 + p^2 + q^2}$ 6

b Solve $(D^2 + 3DD' + 2D'^2)z = x + y$ 6

25. a Solve $(3z - 4y)P + (4x - 2z)Q = 2y - 3x$ 6

b Find $Z[r^n \cos n\theta]$ 6

26. a Find $Z^{-1}\left[\frac{z^2}{(z-a)(z-b)}\right]$ 6

b Solve $y(n+2) - 3y(n+1) + 2y(n) = 2^n$ given that $y(0) = 0$, $y(1) = 0$ 6

27. A tightly stretched string with fixed end points $x = 0$ and $x = l$ initially at rest in its equilibrium position. It is set vibrating string giving each point a velocity $\lambda x(l-x)$, find the displacement.

28. A bar 10cm long with insulated sides, has its ends A and B kept at 20°C and 40°C respectively, until steady state conditions prevail, that is until the temperature at any interior point no longer changes with time. The temperature at A is then suddenly raised to 50°C and at the same instant that at B is lowered to 10°C . Find the subsequent temperature function $u(x,t)$ at any time

*****THE END*****