

ANNA UNIVERSITY COIMBATORE

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

REGULATIONS - 2007

THIRD SEMESTER

070030008 - ENGINEERING MATHEMATICS III

(COMMON TO MECHATRONICS / EEE / ECE / MEDICAL ELECTRONICS / ICE / EIE / FASHION /
TEXTILE TECH. / TEXTILE CHEMISTRY)

TIME: 3 Hours

Max. Marks: 100

PART - A

(20 x 2 = 40 MARKS)

ANSWER ALL QUESTIONS

1. Find the constant term in the Fourier series corresponding to $f(x) = \cos^2 x$ expressed in the interval $(-\pi, \pi)$
2. State Parseval's theorem on Fourier series
3. State the Dirichlet's conditions for the existence of Fourier series for $f(x)$
4. Define root mean square of $f(x)$ over the range (a, b)
5. Find the Fourier transform of $f(x) = \begin{cases} 1, & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$
6. State convolution theorem on Fourier transform
7. Give a function which is self reciprocal with respect to Fourier sine transform
8. State Fourier Integral theorem
9. Find $Z(a^n)$.
10. State the initial value theorem.
11. Find the z - transform of $\frac{1}{n(n+1)}$
12. Form the difference equation from the relation $y_n = A(2)^n + B(3)^n$

13. Form the PDE by eliminating a & b from $z = a(x + y) + b$
14. Solve $\sqrt{p} + \sqrt{q} = x + y$
15. Solve $(D^2 + 3DD^1 + 2D^1^2)z = 0$
16. Solve $(D - D^1)(D + 2D^1 + 1)z = 0$
17. Classify the following Partial differential equations
(i) $u_{xx} = u_{yy}$ (ii) $u_{xy} = u_x u_y + xy$
18. What is the constant a^2 in the wave equation $u_{tt} = a^2 u_{xx}$
19. Write the steady state heat flow equation in two dimension in Cartesian.
20. An insulated rod of length 60 cm has its ends A and B maintained at 20°C and 80°C respectively. Find the steady state solution of the rod.

PART - B

(5 x 12 = 60 MARKS)

ANSWER ANY FIVE QUESTIONS

21. Express $f(x) = \frac{1}{2}(\pi - x)$ as a Fourier series with period 2π in the interval $(0, 2\pi)$ and hence deduce the value of the series $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$ 8+4
22. a) Expand $f(x) = \begin{cases} 1 & 0 \leq x \leq l/2 \\ -1 & l/2 \leq x \leq l \end{cases}$ as a Fourier cosine series 6

22. b) Obtain the sine series for $f(x) = x$ in $0 < x < \pi$ and hence deduce that 6

$$\sum_{n=1}^{\infty} \frac{1}{n^2} = \pi^2/6$$

23. a) Find the Fourier Transform of the function $f(x)$ is defined by 8

$$f(x) = \begin{cases} 1 - x^2 & \text{if } |x| < 1 \\ 0 & \text{if } |x| > 1 \end{cases}$$

b) Hence prove that $\int_0^{\infty} \left(\frac{\sin s - s \cos s}{s^3} \right) \cos \frac{s}{2} ds = \frac{3\pi}{16}$ 4

24. a) Find Fourier Sine Transform of e^{-ax} , $a > 0$ 6

b) Using convolution theorem evaluate $\int_0^{\infty} \frac{dx}{(x^2 + a^2)(x^2 + b^2)}$ 6

25. a) State and prove Final value theorem in z – transforms 6

b) Find the Z-Transform of $\frac{2n+3}{(n+1)(n+2)}$ 6

26. Using Z – Transforms, solve $y_n + 3y_{n-1} = 4y_{n-2} = 0$, $n \geq 2$, given $y_0 = 3$, $y_1 = 2$.

27. a) Solve : $(x^2 + y^2 + yz)p + (x^2 + y^2 - xz)q = z(x + y)$ 6

b) Find Singular Integral of $z = px + qy + \sqrt{1 + p^2 + q^2}$ 6

28. A uniform string is stretched and fastened to two points ' ℓ ' apart. Motion is started by displacing the string into the form of the curve $y = kx(\ell - x)$ and then released from this position at time $t = 0$. Find the displacement of the point of the string at a distance x from one end at time.

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