



ANNA UNIVERSITY OF TECHNOLOGY, COIMBATORE
B.E./ B.TECH. DEGREE EXAMINATIONS: NOV / DEC 2010
REGULATIONS: 2008
THIRD SEMESTER

080100008 - TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS
(COMMON TO CIVIL / EEE / EIE IICE / ECE / BIOMEDICAL / BIOTECH /
AERO / AUTO / CSE IIT / MECHANICAL / CHEMICAL / FT / TT / TC )

Time: 3 Hours

Max.Marks: 100

PART - A

(20 x 2 = 40 Marks)

ANSWER ALL QUESTIONS

- 1. State the conditions for f(x) to have Fourier series expansion.
2. Write a0, an in the expansion of x+x^3 as Fourier Series in (-pi, pi).
3. Expand f(x)=1 in a sine series in 0<x< pi
4. Find Root Mean Square value of the function f(x) = x in the interval (0, pi).
5. Define Fourier Transform Pair.
6. Find Fourier Cosine transform of e^-2x.
7. If F(S) is the Fourier Transform of f(x), show that the Fourier Transform of e^i ax f(x) is F(S + 0).
8. State Parseval's Identity for Fourier Transform.
9. Eliminate the arbitrary constants a & b from z = (x^2 + 0)(y^2 + b).
10. Form the POE by eliminating the functions from z = f(x + t) + g(x - t).
11. Find the complete integral q = 2px.
12. Solve (0^3-300,2+20,3) z = 0.

- 13. Find the nature of POE 4u\_xx+4u\_xy+ U\_yy+ 2u\_x- U\_y=0.
14. What are the various solutions of one dimensional Wave Equation?
15. A string is stretched and fastened to two points 'l' apart. Motion is started by displacing the string into the form y=Yo Sine(pi\*x/l) from which it is released at time t=0. Formulate this problem as the boundary value problem
16. A rod of length 20cm whose one end is kept at 30°C and the other end is kept at 70°C is maintained so until steady state prevails. Find the steady state temperature.
17. Find Z[e^-an].
18. Prove that Z[nJ] = (z-1)^-2
19. Prove that Z[f(n + 1)] = zF(z) - zf(0)
20. State Initial and Final value theorem on Z- transform.

PART-B

(5 x 12 = 60 Marks)

ANSWER ANY FIVE QUESTIONS

21(a) If f(x) = (pi-x) find the Fourier Series of the period 2pi in the interval (0,2pi).

Hence deduce that 1 - 1/3^5 + 1/5^5 - 1/7^5 + ... = pi^5/4 (8)

(b). Find the Fourier expansion of f(x) = x in the interval (- pi, pi) (4)



22. Show that the Fourier Transform of  $f(x) = \begin{cases} a^2 - x^2 & |x| \leq a \\ 0 & \text{otherwise} \end{cases}$  is

$$2 \int_0^a \frac{\sin ax - a \cos ax}{a^3} dx$$

Hence deduce that  $\int_0^{\infty} \frac{\sin t - t \cos t}{t^3} dt = \frac{1}{4}$

Using Parseval's Identity show that  $\int_0^{\infty} \frac{(\sin t - t \cos t)^2}{t^6} dt = \frac{1}{15}$

x	0	1	2	3	4	5	6
f(x)	9	18	24	28	26	20	9

26(b) Find the Fourier transform of  $f(x) = \begin{cases} 1-|x| & |x| \leq 1 \\ 0 & \text{otherwise} \end{cases}$

23(a) Solve  $(mz-ny)p + (nx-lz)q = ly-mx$  (6)

(b) Solve  $(0^3 + 020'_{00}2_{0}3)z = e^x \cos 2Y$  (6)

24. A string of length  $l$  is initially at rest in its equilibrium position and motion is started by giving each of its points is given a velocity  $V = \begin{cases} e^{-x} & 0 \leq x \leq l/2 \\ 0 & l/2 \leq x \leq l \end{cases}$ . Find the displacement function  $y(x,t)$ .

25 (a) Evaluate  $\int_{z^2+7z+10}^z \frac{1}{z} dz$  (6)

(b) Using z-transforms solve  $u(n+2) - 5u(n+1) + 6u(n) = 4^n$  given that  $u(0)=0, u(1)=1$  (6)

26(a) Find the constant term and the coefficient of the first sine and cosine terms in the Fourier expansion of  $y=f(x)$  as given in the following table:- (6)

hence find the value of  $\int_0^{\pi} \sin 4x dx$  (6)

27. A metal bar 30cm long 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 then suddenly reduced to 0°C and kept so. Find the resulting temperature  $u(x,t)$  taking  $x=0$  at A.

28(a) Solve  $p(l+q) = qz$  (6)

(b) Using Convolution theorem, evaluate  $Z^{-1} \left[ \frac{2z}{(z-1)(z-3)} \right]$  (6)

\*\*\*\*\*THE END\*\*\*\*\*