ANNA UNIVERSITY COIMBATORE

B.E. / B.Tech. DEGREE EXAMINATION – DEC 2008

THIRD SEMESTER

SM 301 – ENGINEERING MATHEMATICS III

(Common to CIVIL/CSE/AERONAUTICAL/ IT)

Time: Three hours **Maximum: 100 marks**

PART A – (20 x 2 = 40 marks)

Answer ALL questions

1. Form the partial differential equation by eliminating a and b from $z = a(x+y)+b$
2. Solve $\sqrt{p}+\sqrt{q}=x+y$
3. Give the general solution of $\frac{\partial^2 z}{\partial x \partial y}=0$
4. Solve $\left(D^2+3DD'+2D'^2\right)z=0$
5. State Dirichlet's conditions
6. $f(x)=x^2, 0\le x\le 2$ which one of the following is correct

   (a) an even function (b) an odd function (c) neither even nor odd
7. Define root mean square value of a function f(x) over the range (a, b)
8. Define Harmonic Analysis
9. Classify the partial differential equation $\frac{\partial^2 u}{\partial x^2}+2\frac{\partial^2 u}{\partial x \partial y}+\frac{\partial^2 u}{\partial y^2}=e^{2x+3y}$
10. State the assumptions involved in deriving one dimensional wave equation
11. Write the various possible solutions of the Laplace equation in two dimensions
12. A infinitely long uniform plate is bounded by the edges *x=0* ,*x=l* and the ends right angles to them. The breadth of the edge *y=0* is *l* and is maintained at f(*x*) .All the other edges are kept at $0^{\circ}C$. Write down the boundary condition in mathematical form.

13. If F_C (fx) = $F_C(s)$, then prove that F_s (x f(x)) = $-\frac{d}{ds}(F_C(s))$
14. Give a function which is self reciprocal under Fourier sine and cosine transforms
15. State the modulation theorem in Fourier transform
16. State the Parseval's identity on Fourier transform
17. Define unit impulse sequence and find its Z transform
18. Define the convolution of two sequences
19. Give the inverse Z transform of $\frac{z^2}{z^2+4}$
20. From the difference equation $y_{n+1}-y_n=2^n, y_0=1$,Find y_n in terms of z.

PART A (5x12 = 60 marks)

Answer any five questions

21. (a) Form the partial differential equation by eliminating the functions f *and* g from $z=f(x+2y)+xg(x+2y)$ (6)

    (b) Solve $yp+xq=z$ (6)

22. (a) Solve $p^2x^2+q^2y^2=z^2$ (6)

    (b) Solve $\left(D^3-2D^2D'\right)z=\sin(x+2y)+3x^2y$ (6)

23. (a) Find the Fourier series of $f(x)=\begin{cases} l-x, & 0\le x\le l \\ 0, & l\le x<2l \end{cases}$ (6)

    (b) Find the Cosine series of $f(x)=x^2$ *in* $(0,\pi)$ (6)

24. (a) Give the sine series of $f(x)=1,$ *in* $(0,\pi)$ and Prove that $\sum_{1,3..}^{\infty}\frac{1}{n^2}=\frac{\pi^2}{8}$ (6)

(b) Find the Fourier series up to second Harmonic for the following data (6)

x:	0	60	120	180	240	300	360
f(x):	1	1.4	1.9	1.7	1.5	1.2	1

25. A string is stretched and fastened to two points l apart. Motion is started by displacing the string into the form of the curve $y = k\left(lx - x^2\right)$ and then released from rest in this position. Find the displacement $y(x,t)$. (12)

26. Find the steady state temperature distribution in a square plate bounded by the lines $x = 0, y = 0, x = 20, y = 20$. It's surfaces are insulated ,satisfying the boundary conditions $u(0, y) = u(20, y) = u(x,0) = 0 \text{ and } u(x,20) = x(20 - x)$. (12)

27. (a) Find the Fourier transform of $f(x) = \begin{cases} a - |x|, |x| < a \\ 0 \quad ,|x| > a \end{cases}$ (6)

(b) Evaluate $\int_0^\infty \frac{x^2 dx}{\left(a^2 + x^2\right)\left(b^2 + x^2\right)}$ using Parseval's identity (6)

28. (a) (i) Find the Z transform of the sequence $f_n = \frac{1}{n+1}$ (3)

(ii) Find the inverse Z transform of F(z) = $\frac{2z^2 + 4z}{(z-2)^2}$ using residue theorem. (3)

(b) Solve the difference equation $y_{n+2} - 7y_{n+1} + 12y_n = 2^n \text{ with } y_0 = 0, y_1 = 0$ using Z transform.

(6)

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