KUMARAGURU
college of technology
character is life

B.E / B.TECH DEGREE EXAMINATIONS: JUNE 2015

(Regulation 2009)

Third Semester

MAT104: ENGINEERING MATHEMATICS – III

(Common to AE/AUE/CE/ECE/EEE/EIE/ME/MCE)

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The complete solution of $z = px + qy + \sqrt{pq}$ is
   a) $z = ax + by + \sqrt{a^2}$ b) $z = ax + by + \sqrt{b^2}$
   c) $z = ax + by + \sqrt{ab}$ d) $z = bx + ay + \sqrt{ab}$

2. The particular solution of $\left(D^2 - 2DD' + D'^2\right)z = e^{x-y}$
   a) $\frac{1}{4}e^{x-y}$ b) $\frac{1}{4}e^{y-x}$
   c) $\frac{1}{2}e^{x-y}$ d) $\frac{1}{2}e^{y-x}$

3. The value of a_0 in the expansion of $x + x^3$ as Fourier series in $(-\pi, \pi)$ is
   a) 1   b) 0
   c) π d) $-\pi$

4. The R.M.S value of $f(x) = 1 - x$ in $0 < x < 1$ is
   a) 3/2   b) 2/3
   c) 1/3   d) 1/2

5. The pde $4u_{xx} = u_t$ is of
   a) Parabolic type   b) Elliptic type
   c) Hyperbolic type   d) Classic ty pe

6. The pde $u_{xx} + u_{yy} = 0$ is called
   a) Parabolic equation   b) Hyperbolic equation
   c) Laplace equation   d) Elliptic equation

7. Fourier transform of f(ax) is
   a) $\frac{1}{s}F\left(\frac{s}{a}\right)$ b) $\frac{1}{a}F\left(\frac{s}{a}\right)$
   c) $F\left(\frac{s}{a}\right)$ d) $F\left(\frac{a}{s}\right)$

8. The Fourier sine transform of $\frac{1}{x}$ is

a) $\sqrt{\dfrac{2}{\pi}}$ b) $\sqrt{\dfrac{\pi}{2}}$

c) $\sqrt{\dfrac{1}{\pi}}$ d) $\sqrt{\dfrac{1}{2\pi}}$

9. The Z-transform of 1 is

a) $\dfrac{z}{z-1}$ b) $\dfrac{z}{1-z}$

c) z   d) z - 1

10. The inverse Z-transform of $\frac{1}{z-2}$ is

a) 2^{n-2} b) 2^{n}

c) 2   d) 2^{n-1}

PART B (10 x 2 = 20 Marks)

11. Form the partial differential equation by eliminating arbitrary constants from
$z = a^2 x + ay^2 + b$.

12. Solve the partial differential equation $pq = x$

13. Find b_n in the expansion of x^2 as a Fourier series in $(-\pi, \pi)$.

14. Define the root-mean square value of a function $f(x)$ in $(0, 2\pi)$.

15. Classify the partial differential equation $4\dfrac{\partial^2 u}{\partial x^2} = \dfrac{\partial u}{\partial t}$.

16. A rod of length 20 cm whose one end is kept at $30^0 C$ and the other end is kept at $70^0 C$ is maintained so until steady state condition prevails. Find the steady state temperature.

17. Write the Fourier transform pair.

18. Find the Fourier cosine transform of e^{-2x}.

19. Find the Z-transform of $\frac{1}{n!}$

20. Form the difference equation by eliminating arbitrary constants from $U_n = A2^{n+1}$.

PART C (5 x 14 = 70 Marks)

21. a) (i) Form the PDE by eliminating the arbitrary function $\emptyset$ from (7)
$$\emptyset(x^2 + y^2 + z^2, ax + by + cz) = 0$$

(ii) Solve $(3z - 4y)p + (4x - 2z)q = 2y - 3z$. (7)

(OR)

b) (i) Solve $p(1 + q) = qz$. (7)

(ii) Solve $(D^2 + DD' - 6D'^2)z = x^2 y + e^{3x+y}$ (7)

\

22. a) (i) Expand in Fourier series of periodicity 2π of $f(x) = x^2$ for $0 < x < 2\pi$. (7)

(ii) Expand $f(x) = sinx, 0 < x < \pi$ in a Fourier cosine series (7)

b) (i) Find the Fourier series expansion of $f(x) = 1 - x^2$ in the interval (-1,1). (7)

(ii) Compute the first harmonic of the series of f(x0 given the following table. (7)

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1.0

23. a) A tightly stretched string with fixed end points x = 0 and x = l is initially in a position given by $y(x,0) = 3x(l-x)$. If it is released from rest from this position, find the displacement y at any time and at any distance from the end x = 0

(OR)

b) The ends A and B of a rod l cm long have their temperature are kept at 20^0C and 40^0C until steady state conditions prevail. The temperature of the end B is suddenly reduced to 10^0C and that of A is increased to 50^0C. Find the temperature distribution in the rod after time t

24. a) Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2 & in\ |x| \leq 1 \\ 0 & in\ |x| > 1 \end{cases}$. Hence

(i) Prove that $\int_0^\infty \frac{\sin s - s\cos s}{s^3} \cos\frac{s}{2}\,ds = \frac{3\pi}{16}$

(ii) Evaluate $\int_0^\infty \frac{x\cos x - \sin x}{x^3}\,dx$

(OR)

b) Find the Fourier sine and cosine transform of e^{-x}. Hence evaluate

$\int_0^\infty \frac{dx}{(x^2+1)^2}$ and $\int_0^\infty \frac{x^2}{(x^2+1)^2}\,dx$.

25. a) (i) Find the Z – transform of $f(n) = \frac{2n+3}{(n+1)(n+2)}$. (7)

(ii) Find the inverse Z – transform of $\frac{10z}{z^2 - 3z + 2}$ (7)

(OR)

b) (i) Find the inverse Z- transform of $\frac{z^2 - 3z}{(z-5)(z+2)}$ using residue theorem. (7)

(ii) Solve $y_{n+2} + 4y_{n+1} + 3y_n = 2^n$ with $y_0 = 0$ and $y_1 = 1$ using Z – transform (7)

****