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B.E., DEGREE EXAMINATIONS: JUNE 2013

Third Semester

MAT104: ENGINEERING MATHEMATICS III

(Common to Aero/Auto/Civil/ECE/EEE/EIE/MCE/ME)

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

Answer ALL Questions:-

PART A (10x1=10 Marks)

1. The Complete integral of Z - Px = qy + pq is

(a) z – bx = ay + ab (b) z = ax + by - ab

(c) z = - ax - by – ab (d) z + bx = ay + ab

2. Solve $\left(D^2 - 4DD^1 + 4D^{1^2}\right)$ z = 0 .

(a) z = $f_1(y+2x)+x\ f_2(y+2x)$ (b) z = $f_1(y-2x)+x\ f_2(y-2x)$

(c) z = $f_1(y+2x)+\ f_2(y+2x)$ (d) z = $f_1(y-2x)-\ f_2(y-2x)$

3. The value of b $_n$ in the Fourier expansion x sinx in $(-\pi,\pi)$ is

(a) π (b) 0 (c) $-\frac{1}{2}$ (d) $\frac{2}{n^2-1}$

4. The value of a_0 in the half range cosine series f (x) = x in $(0,l)$ is

(a) o (b) $\frac{2}{l}$ (c) l (d) $\frac{l}{2}$

5. $f_{xx} - 2f_{xy} = 0$, $x > 0, y > 0$ is

(a) parabolic (b) Elliptic (c) quadratic (d) Hyperbolic

6. In the one dimensional wave equation $\frac{\partial^2 u}{\partial x^2} = a^2 \frac{\partial^2 u}{\partial x^2}$, a^2 stands for?

(a) $a^2 = \frac{T}{m}$ (b) $a^2 = \frac{m}{T}$ (c) $a^2 = \frac{k}{sp}$ (d) $a^2 = \frac{sp}{k}$

7. Change of scale property is $F[f(ax)] =$ _______

(a) $F\left(\frac{s}{a}\right)$ (b) $F\left(\frac{a}{s}\right)$ (c) $\frac{1}{a}F\left(\frac{a}{s}\right)$ (d) $\frac{1}{a}F\left(\frac{s}{a}\right)$

8. Fourier Cosine transform of e^{-x} is

(a) $F_c\left(e^{-x}\right)=\frac{1}{s^2+1}$

(b) $F_c\left(e^{-x}\right)=\frac{1}{s\ \ +1}$

(c) $F_c\left(e^{-x}\right)=\sqrt{\frac{2}{\pi}}\frac{1}{s^2+1}$

(d) $F_c\left(e^{-x}\right)=\sqrt{\frac{2}{\pi}}\frac{1}{s\ \ +1}$

9. z(1) =

(a) $\frac{z}{z+1}$ (b) $\frac{z}{z-1}$ (c) $\frac{z}{z-a}$ (d) $\frac{z}{z+a}$

10. $z^{-1}\left(\frac{1}{z-a}\right)=$

(a) a^{n-1} (b) na^{n-1} (c) na^{n} (d) a^{n}

PART B (10x2= 20 Marks)

11. Form the partial differential equation by eliminating the arbitrary constants from

$z=(x-a)^2+(y-b^2)+1$

12. Find P.I of $\left(D^3-3D^2D'+4D'^3\right)z=e^{x\ +2y}$

13. Find the Value of a_n in the cosine Series expansion of f (x) = K in (0,10)

14. Define Root mean square value of a function.

15. What are the possible solutions of one dimensional wave equation?

16. Find the steady state temperature distribution in a rod of length 20cm, whose ends A & B are kept at 30^0c and 70^0c respectively.

17. If F(s) is the Fourier transform of f (x), then find the Fourier transform of $f(x-a)$.

18. State the convolution theorem for Fourier Transforms.

19. Find $z\left(\frac{a^n}{n!}\right)$.

20. Find the z – transform of (n+1)(n+2) .

PART C (5x14= 70 Marks)

21. a) (i) Form the partial differential equation by eliminating the arbitrary Functions f and g from $z=(2x+y)+g(3x-y)$. (7)

(ii) Solve$(D^2-DD'-2D'^2)z = 2x+3y+e^{3x+4y}$. (7)

(OR)

b) (i) Solve (y - xz) P+ (yz - x) q = (x+y) (x-y). (7)

(ii) Solve$(D^3-7DD'^2-6D'^3)z = x^2y+\sin(x+2y)$. (7)

22. a) (i) Obtain the Fourier Series to represent the function

$f(x) = |x|, -\pi < x < \pi$ and deduce $1+\frac{1}{3^2}+.....=\frac{\pi^2}{8}$. (9)

(ii) Find the sine series of $f(x) = x$ in $(0,l)$. (5)

(OR)

b) (i) Expand x $(2\pi - x)$ as a Fourier series in $(0,2\pi)$ (7)

(ii) Find the Fourier Series expansion of period 2π for the function y =f(x) Which is defined in $(0,2\pi)$by means of the table of values given below. Find the series up to the second harmonic. (7)

x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π
y	1.0	1.4	1.9	1.7	1.5	1.2	1.0

23. a) A String is tightly Stretched and its ends are fastened at two points x=0 and x=l. The mid point of the string is displaced transversely through a small distance 'b' and the string is released from rest in that position. Find an expression for the transverse displacement of the string at any time during the subsequent motion.

(OR)

b) A rod of length l has its ends A and B kept at 0 ^{0}C and 100 ^{0}C until steady state condition prevail. If the temperature at B is reduced suddenly to 0 ^{0}C and kept so while that of A is maintained, find the temperature u (x,t) at a distance x from A and at time t.

24. a) Show that the Fourier transform of

$$f(x) = \begin{cases} a^2 - x^2 & |x| < a \\ 0 & |x| > a > 0 \end{cases} is\ 2\sqrt{\frac{2}{\pi}}\left(\frac{\sin as - as\cos as}{s^3}\right)$$

Hence deduce that $\int_0^\infty \frac{\sin t - t\cos t}{t^3} dt = \frac{\pi}{4}$. Using Parseval's identity show that

$$\int_0^\infty \left(\frac{\sin t - t\cos t}{t^3}\right)^2 dt = \frac{\pi}{15}$$

(OR)

b) (i) Show that the Fourier transform of f(x) = $e^{\frac{-x^2}{2}}$ is $e^{\frac{-s^2}{2}}$. (7)

(ii) Using Parseval's identity calculate $\int_0^\infty \frac{x^2}{(a^2 + x^2)} dx$ if a > 0. (7)

25. a) (i) Find $z\left[\frac{1}{(n+1)(n+2)}\right]$. (7)

(ii) y(n+2) – 7y(n+1) + 12y(n) = 2^n given (7)

y(0) = y(1) = 0.

(OR)

b) (i) Find $z[\cos n\theta]$ and $z[\sin n\theta]$. (7)

(ii) Using convolution theorem, find the $Z^{-1}\left[\frac{z^2}{(z-4)(z-3)}\right]$ (7)

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