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Question Paper Code: 93026

B.E./B.Tech. DEGREE EXAMINATION, DEC 2021

Third Semester

Chemical Engineering

19UMA326- Transform Techniques and Partial Differential Equations

(Regulation 2019)

(Common to Agriculture ,Biomedical and Bio technology)

Duration: Three hours   Maximum: 100 Marks

Answer All Questions

PART A - (10x 1 = 10 Marks)

1. The term (a1cos x + b1 sinx) in fourier series is called -----------   CO6-U

    (a) First harmonic   (b) Second harmonic

    (c) Third harmonic   (d) Fourier Coefficients

2. The root mean square value of f(x) in (0, l) is---------   CO1- App

    (a) l   (b) ½   (c) $l/\sqrt{3}$ (d) 2l

3. $F_s[e^{-ax}]=$ __   CO2- App

    (a) $\sqrt{\dfrac{2}{\pi}}\left(\dfrac{a}{s^2+a^2}\right)$
    (b) $\sqrt{\dfrac{2}{\pi}}\left(\dfrac{s}{s^2+a^2}\right)$
    (c) $\sqrt{\dfrac{2}{\pi}}\left(\dfrac{a^2}{s^2+a^2}\right)$
    (d) $\sqrt{\dfrac{2}{\pi}}\left(\dfrac{s^2}{s^2+a^2}\right)$

4. In Modulation property, F[f(x) cos ax]=   CO6- U

    (a) $\dfrac{1}{2}[F(s+a)-F(s-a)]$
    (b) $\dfrac{1}{2}[F(s+a)+F(s-a)]$

    (c) $[F(s\,\square\,a)\,\square\,F(s\,\square\,a)]$
    (d) $F(s+a)+F(s-a)$

5. The difference equation of $z(e^{an})$ CO3- App

   (a) $\dfrac{z}{z+e^a}$ (b) $\dfrac{z^2}{z+e^a}$ (c) $\dfrac{z}{z-e^a}$ (d) $\dfrac{z^2}{z-e^a}$

6. The Z transform of $n2^n$ is ___   CO6- U

   a) $\dfrac{2z}{(z-2)^2}$ b) $\dfrac{z}{(z-2)^2}$ c) $\dfrac{2z}{(z+2)^2}$ d) $\dfrac{z}{(z+2)^2}$

7. The general solution of $2r + 5s - 3t = 0$ is   CO4- App

   (a) $f_1(y + 3x) + f_2(2y -x)$ (b) $f_1(3y + x) + f_2(y +2x)$

   (c) $f_1(y - 3x) + f_2(2y - x)$ (d) none of these

8. The particular integral of $\left(D^2 + 3DD' - 4D'^2\right)z = \sin y$ is ___   CO4- App

                                         (c) sin y   (d) -sin y

   (a) $\dfrac{1}{2}\sin y$ (b) $\dfrac{1}{4}\sin y$

9. In a one dimensional wave equation, $c^2 =$ ___.   CO6- U

   (a) T^2/m^2 (b) T/m   (c) T/m^2 (d) T^2/m

10. An insulated rod of length 60 cm has its ends at A and B kept at $20^{\circ}C$ and   CO5- App
$80^{\circ}C$ respectively, then its steady state solution is

   (a) x-20   (b) 4x+20   (c) x+20   (d) x+60

<div align="center">PART – B (5 x 2= 10Marks)</div>

11. State Dirichlet's conditions   CO6- U
12. Find $F_c\left[e^{-ax}\right]$ CO6- U
13. Find $z\left[\dfrac{1}{n!}\right]$ CO3-App
14. Solve $\sqrt{p} + \sqrt{q} = 1$ CO4- App
15. Write the three Possible solutions of the one dimensional wave equations   CO6- U

<div align="center">PART – C (5 x 16= 80Marks)</div>

16. (a) The table of values of the function $y = f(x)$ is given below: CO1- App   (16)

X	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
y:	1.0	1.4	1.9	1.7	1.5	1.2	1.0

   Find a Fourier series up to the third harmonic to represent $f(x)$ in
terms of x

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(b) (i) Calculate the Fourier series expansion for $f(x) = x + x^2$ in $(-\pi, \pi)$ CO1 - Ana   (8)

    (ii) Find the Fourier Sine Series of $f(x) = x$ in $(0, l)$ CO1 -Ana   (8)

17. (a) Show that the Fourier transform of   CO2 -App   (16)

$$f(x) = \begin{cases} a^2 - x^2 & |x| < a \\ 0 & |x| > a \end{cases} \quad is \quad 2\sqrt{\frac{2}{\pi}}\left[\frac{\sin sa - sa \cos sa}{s^3}\right] \quad \text{Hence deduce}$$

$$\int_0^\infty \frac{\sin t - t\cos t}{t^3} dt = \pi/4$$

Using Parseval's identity show that $\int_0^\infty \left(\frac{\sin t - t\cos t}{t^3}\right)^2 dt = \pi/15$

Or

(b) (i) Evaluate $\int_0^\infty \frac{x^2 dx}{(x^2 + a^2)^2}$ CO2 -App   (8)

    (ii) Evaluate $\int_0^\infty \frac{dx}{(x^2 + 9)(x^2 + 4)}$ CO2 -App   (8)

18. (a) (i) Find the $z^{-1}\left[\frac{12z^2}{(3z-1)(4z-1)}\right]$ using convolution theorem   CO3- App   (8)

    (ii) Solve $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ $given$ $y_0 = y_1 = 0$ CO3- App   (8)

Or

(b) (i) Evaluate $Z[r^n\cos n\theta]$ and $Z[r^n \sin n\theta]$ CO3- App   (8)

    (ii) Evaluate $z^{-1}\left[\frac{z^3}{(z-1)^2(z-2)}\right]$ using partial fraction.   CO3- App   (8)

19. (a) (i) Solve $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$ CO4-App   (8)

    (ii) Solve $(D^2 - 4DD' + 4D'^2)z = e^{2x+y} + \sin(3x + 4y)$ CO4-App   (8)

Or

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(b) (i) Solve $z = px + qy + p^2 q^2$ CO4 -App   (8)

(ii) Form the partial differential equation by eliminating the arbitrary function f and g in $z = x^2 f(y) + y^2 g(x)$ CO4 -App   (8)

20. (a) A String is stretched and fastened to two points l apart .Motion is started by displacing the string into the form y=K x(l-x) from which it is released at t=0.Find the displacement of any point at a distance 'x' at any time 't'.   CO5- App   (16)

Or

(b) A bar of 10cm long with insulated sides has its ends A and B kept at 20° c and 40^Oc respectively. Until steady state condition prevails. The temperature at A is then suddenly raised to 50^Oc and at the same instant B is lower to 10^Oc and maintained thereafter. Find the subsequent temperature distribution in the bar.   CO5- App   (16)

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