Reg. No.																

Question Paper Code	14233

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Second Semester

Electronics and Communication Engineering

(Common to Electrical and Electronics Engineering & Electronic Instrumentation and Control Engineering)

24BSMA202 – DIFFERENTIAL EQUATIONS, COMPLEX VARIABLES AND TRANSFORMS

Regulations - 2024

Duration: 3 Hours — Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

No.	Question	Marks	K – Level	CO
1.	omplementary function of $(D^2-4D+3)y=0$ is (a) $C.F=C_1e^x+C_2e^x$ (b) $C.F=C_1e^{3x}+C_2e^x$ (c) $C.F=C_1e^{3x}-C_2e^x$ (d) $C.F=C_1e^{-3x}+C_2e^{-x}$	1	K2	CO1
2.	Find the order of the differential equation $30\frac{d^2y}{dx^2}+2\frac{dy}{dx}+6y=0$ is 4 (b) 3 (c) 2 (d) 6	1	K1	CO1
3.	A function u is said to be harmonic if and only if (a) $u_x+u_y=0$ (b) $u_{xx}+u_{yy}=0$ (c) $u_{xx}-u_{yy}=0$ (d) $u_{xy}+u_{yx}=0$	1	K1	CO2
4.	Necessary and sufficient condition for $w=f(z)$ to be an analytic in the region R is ((a) $u_x=v_y,\ u_y=-v_x$ (b) $u_x=-v_y,\ u_y=-v_x$ (c) $u_x=v_y,\ u_y=v_x$ (d) $u_{xx}=v_y,\ u_{yy}=-v_x$	1	K1	CO2
5.	If f(z) is an analytic function within a closed curve and if a is any point within C, then (a) $\frac{1}{2\pi i}\int_C \frac{f(z)}{z-a}dz=f'(a)$ (b) $\frac{1}{2\pi i}\int_C \frac{f(z)}{z-a}dz=f(a)$ (c) $2\pi i\int_C \frac{f(z)}{z-a}dz=f'(a)$ (d) $2\pi i\int_C \frac{f(z)}{z-a}dz=f(a)$	1	K1	CO3
6.	Residue of $f(z)=\frac{z^3}{(z-1)^4(z-2)(z-3)}$ at $z=3$ is (a) $\frac{101}{16}$ (b) -8 (c) $\frac{27}{16}$ (d) 0	1	K2	CO3
7.	A function $f(t)$is said to be periodic if (a) $f(t-p)=f(t)$ (b) $f(t-p)=f(p)$ (c) $f(t+p)=f(p)$ (d) $f(t+p)=f(t)$	1	K1	CO4
8.	Change of scale property is (a) $L(f(at))=\frac{1}{a}F\left(\frac{s}{a}\right)$ (b) $L(f(at))=\frac{1}{s}F\left(\frac{s}{a}\right)$ (c) $L(f(t))=\frac{1}{s}F\left(\frac{s}{a}\right)$ (d) $L(f(t))=\frac{1}{a}F\left(\frac{s}{a}\right)$	1	K1	CO4
9.	If $F[f(x)]=F(s)$ then $F[f(ax)]=$ (a) $\frac{-1}{a}\frac{F(s)}{a}$ (b) $\frac{1}{a}\frac{F(s)}{a}$ (c) $\frac{1}{a}F\left(\frac{s}{a}\right)$ (d) $F\left(\frac{s}{a}\right)$	1	K1	CO5
10.	What is the Z-transform of $[2024^n]$, $n\geq 0$ (a) $\frac{z}{z-2024}$ (b) $\frac{1}{z-2024}$ (c) $\frac{1}{z+2024}$ (d) $\frac{z}{z+2024}$	1	K2	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

No.	Question	Marks	K – Level	CO
11.	Solve $(D^2+5D+4)y=0$.	2	K3	CO1
12.	Find the particular integral of $(D^2-4)y=e^{2x}$.	2	K2	CO1
13.	Find the value of m if $u=2x^2-my^2+3x$ is harmonic.	2	K2	CO2
14.	Prove that an analytic function whose real part is constant must itself be a constant.	2	K2	CO2
15.	State Cauchy's Integral Theorem.	2	K1	CO3

16. Evaluate $\int_C \frac{dz}{z+4}$, where C is the circle $|z| = 2$. 2 K3 CO3

17. Find $L[t^2 e^{-3t}]$. 2 K2 CO4

18. State Convolution Theorem in Laplace Transform. 2 K1 CO4

19. Define Fourier Integral theorem. 2 K1 CO5

20. Define convolution theorem for Fourier transforms. 2 K1 CO5

21. Find $Z\left[\frac{1}{n}\right]$. 2 K2 CO6

22. Find the difference equation from the relation $y_n = a + b.3^n$. 2 K2 CO6

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23. a) Solve $(D^2+4)y = \sec 2x$ by the method of variation of parameters. 11 K3 CO1

OR

b) Solve $((1+x)^2D^2 + (1+x)D + 1)y = 4\,cos[log(1+x)]$. 11 K3 CO1

24. a) Find the analytic function $f(z) = u + iv$ given that $u - v = e^x(cosy - siny)$. 11 K3 CO2

OR

b) Find the bilinear transformation that maps the points $z = 0, 1, \infty$ of the z- plane into the points $w = -5, -1, 3$ of the w- plane. Also find its fixed (Invariant) points. 11 K3 CO2

25. a) Evaluate $\int_C \frac{z^2}{(z-1)^2(z+2)}dz$, where C is the circle $|z| = 3$, using Cauchy's Residue theorem. 11 K3 CO3

OR

b) Find the Laurent's series expansion of $f(z) = \frac{7z-2}{z(z-2)(z+1)}$ in $1 < |z+1| < 3$. 11 K3 CO3

26. a) Using Laplace transform, solve $(D^2 - 3D + 2)y = e^{-3t}$ given $y(0) = 1$ and $y'(0) = -1$. 11 K3 CO4

OR

b) Using convolution theorem, evaluate $L^{-1}\left[\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right]$. 11 K3 CO4

27. a) Find the Fourier transform of $f(x) = \begin{cases} 1-|x| & , |x| < 1 \\ 0 & , |x| > 1 \end{cases}$ 11 K3 CO5

and hence deduce that $(i) \int_0^\infty \frac{sin^2 t}{t^2}dt \quad (ii) \int_0^\infty \frac{sin^4 t}{t^4}dt$.

OR

b) Evaluate $\int_0^\infty \frac{dx}{(x^2+a^2)(x^2+b^2)}$ using Fourier transforms. 11 K3 CO5

28. a) Find inverse Z-transform of $\left[\frac{3z}{(z-1)(z-2)}\right]$ by residue method. 11 K3 CO6

OR

b) Solve: $u_{n+2} + 4u_{n+1} + 3u_n = 3^n$ given that $u_0 = 0, u_1 = 1$. Using Z transform. 11 K3 CO6