Reg. No.																

Question Paper Code	13753

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Second Semester

Civil Engineering

(Common to Electrical and Communication Engineering, Electrical and Electronics Engineering, Electronics and Instrumentation Engineering, Instrumentation and Control Engineering, Mechanical Engineering & Mechanical and Automation Engineering)

20BSMA201 - ENGINEERING MATHEMATICS - II

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) 10 × 1 = 10 Marks)

Answer ALL Questions

No.	Question	Marks	K – Level	CO
1.	The vector field $\vec{F}$ is irrotational, if (a) $\nabla.\vec{F}=\vec{0}$ (b) $\nabla\times\vec{F}=\vec{0}$ (c) $\nabla.\vec{F}=0$ (d) $\nabla\times\vec{F}=0$	1	K1	CO1
2.	Find the value of a, if the vector $\vec{F}=(3x-2y+z)\vec{i}+(4x+ay-z)\vec{j}+(x-y+2z)\vec{k}$ is solenoidal. (a) 0 (b) 6 (c) -5 (d) -6	1	K2	CO1
3.	What is the complete solution of $(D^2+3D+2)y=0$? (a) $y(x)=c_1e^{-x}+c_2e^{-2x}$ (b) $y(x)=c_1e^{x}+c_2e^{2x}$ (c) $y(x)=c_1e^{-x}+xc_2e^{2x}$ (d) $y(x)=c_1e^{-x}+c_2e^{2x}$	1	K2	CO2
4.	The two linear integral solutions of $(D^2+1)y=\operatorname{cosec} x$ are $u(x)=cosx, v(x)=sinx$, then the Wronkian(W) is (a) 0 (b) -1 (c) 2 (d) 1	1	K2	CO2
5.	The function $\frac{z^2-4}{z^2+1}$ is analytic at (a) $z=\pm i$ (b) $z=1$ *and* 1 (c) $z=\pm 1$ (d) $z=0$	1	K2	CO3
6.	If $u=e^x\sin y$ is an analytic function, then $u_x(z,0)$ is (a) 0 (b) 1 (c) e^z (d) $\sin y$	1	K2	CO3
7.	The Singularity of $f(z)=\frac{z+3}{(z-1)(z-2)}$ are (a) 1,3 (b) 1,0 (c) 1,2 (d) 2,3	1	K2	CO4
8.	Find the value of the integral $\int_c dz$ where c is the unit circle $\|z\|=1$ (a) 0 (b) 2 (c) $2\pi i$ (d) $4\pi i$	1	K2	CO4
9.	Find the Inverse Laplace transform of $\frac{1}{s-a}$ is (a) e^{at} (b) e^{-at} (c) 0 (d) 1	1	K1	CO5
10.	If $L[f(t)]=F(s)$, then $L[f'(t)]=$ (a) sf(0) – f(0) (b) sF(s) – f(0) (c) F(s) – f(0) (d) sF(0) – f(s)	1	K1	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

No.	Question	Marks	K – Level	CO
11.	Suppose the scalar potential $\phi=xyz$, then find grad ϕ at (1,1,1)	2	K1	CO1
12.	Show that $\vec{F}=(x+2y)\vec{i}+(y+3z)\vec{j}+(x^2-2z)\vec{k}$ is solenoidal.	2	K2	CO1
13.	State Stoke's theorem.	2	K1	CO1
14.	Solve $y'''+2y''+y'=0$.	2	K3	CO2
15.	Solve $(D^2+5D+4)y=0$.	2	K3	CO2

16.	Find the particular integral of $(D^2 - 2D + 5)y = e^x \sin 2x$.	2	K1	CO2
17.	Determine whether the function $2xy\vec{i} + (x^2 - y^2)\vec{j}$ is analytic or not.	2	K2	CO3
18.	Find the invariant points of the bilinear transformation $w = \frac{z-1}{z+1}$.	2	K1	CO3
19.	State Cauchy's integral theorem.	2	K1	CO4
20.	Find the residue of the function $f(z) = \frac{z}{(z-1)^2}$ at its pole.	2	K1	CO4
21.	Find $L\left[t^{-1/2}\right]$.	2	K1	CO5
22.	State the final value theorem for Laplace transforms.	2	K1	CO5

PART - C (6 × 11 = 66 Marks)
Answer ALL Questions

23.	a)	Show that $\vec{F} = (6xy + z^3)\vec{i} + (3x^2 - z)\vec{j} + (3xz^2 - y)\vec{k}$ is irrotational vector and find the scalar potential ϕ such that $\vec{F} = \nabla\phi$.	11	K3	CO1
		OR			
	b)	Verify Green's theorem in a plane for $\int_C [(3x^2 - 8y^2)dx + (4y - 6xy)dy]$, where C is the boundary of the region defined by $x = y^2,\ y = x^2$.	11	K3	CO1
24.	a)	Solve the ordinary differential equation $(\mathrm{D}^2 - 3\mathrm{D} + 2)\mathrm{y} = 7\cos\mathrm{x} + 3\mathrm{x}^2$	11	K3	CO2
		OR			
	b)	Solve $(D^2 + 4)y = \sec 2x$ by the method of variation of parameters.	11	K3	CO2
25.	a)	Show that the function $u = 2x - x^3 + 3xy^2$ is harmonic and find the conjugate harmonic function v and the analytic function of $f(z)$.	11	K3	CO3
		OR			
	b)	Find the bilinear transformation that maps the points $0, -1, i$ onto $i, 0, \infty$.	11	K3	CO3
26.	a)	Evaluate $\int_C \frac{\cos \pi z^2}{(z-1)(z-2)} dz$, where C is $\lvert z \rvert = 3$ by using Cauchy's integral formula.	11	K3	CO4
		OR			
	b)	Find the Laurent's series expansion $f(z) = \frac{z}{(z+1)(z+2)}$ in the region $\lvert z \rvert < 1$, and $1 < \lvert z \rvert < 2$	11	K3	CO4
27.	a)	Obtain the Laplace transform of the function $f(t) = \begin{cases} \sin t & for \quad 0 < t < \pi \\ 0 & for \quad \pi < t < 2\pi, \end{cases}$ $for \quad f(t + 2\pi) = f(t)$.	11	K3	CO5
		OR			
	b)	Apply convolution theorem to find the inverse Laplace transforms of $\frac{s^2}{(s^2 + a^2)(s^2 + b^2)}$	11	K3	CO5

28. a) (i) Using contour integration, evaluate $\int_0^{\infty} \frac{x^2}{(x^2+9)(x^2+4)} dx$ — 6 K3 CO4

(ii) Find $L[te^{-t} \sin t]$. — 5 K3 CO5

OR

b) (i) Evaluate $\int_C \frac{\cos \pi z^2 + \sin \pi z^2}{(z+1)(z+2)} dz$, where C is $|z| = 3$ by using Cauchy's residue theorem. — 6 K3 CO4

(ii) Find $L\left[\frac{\cos at - \cos bt}{t}\right]$. — 5 K3 CO5