Reg. No.																

Question Paper Code	13325

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Second Semester

Civil Engineering

(Common to Electronics and Communication Engineering, Electrical and Electronics Engineering, Electrical 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) (20 × 1 = 20 Marks)

Answer ALL Questions

No.	Question	Marks	K – Level	CO
1.	The directional derivative of $\Phi = xyz$ at $(1,1,1)$ in the direction of $\vec{i}+\vec{j}+\vec{k}$ is (a) $\sqrt{3}$ (b) 3 (c) 1 (d) $\sqrt{5}$	1	K2	CO1
2.	The vector field $\vec{F}$ is irrotational, (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
3.	If C is constant, then grad $C =$ (a) 0 (b) 2 (c) 1 (d) $\frac{C^2}{2}$	1	K2	CO1
4.	If S is an open surface bounded by a simple closed C and if $\vec{F}$ is continuous functions with continuous partial derivatives in S, then (a) $\oint_C \vec{F}.\overrightarrow{dr} = \iint_S div\, \vec{F}.\vec{n}\, dS$ (b) $\oint_C \vec{F}.\overrightarrow{dr} = \iint_S curl\, \vec{F}.\vec{n}\, dS$ (c) $\oint_C \vec{F}.\overrightarrow{dr} = \iiint_S div\, \vec{F}.\vec{n}\, dS$ (d) $\oint_C \vec{F}.\overrightarrow{dr} = \iiint_S curl\, \vec{F}.\vec{n}\, dS$	1	K1	CO1
5.	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
6.	The particular integral of differential equation $(D-1)^2y = e^x sin\, x$ is (a) $e^x tanx$ (b) $-e^x cosx$ (c) $-e^x sinx$ (d) None of these	1	K2	CO2
7.	If the complementary function of $y'' + y = \tan x$ is $y(x) = c_1y_1 + c_2y_2$, then the Wronskian of $y_1(x)\&y_2(x)$ is (a) 4 (b) 3 (c) 2 (d) 1	1	K2	CO2
8.	The nature of roots for differential equation $(D^2+9)y = 0$ is (a) Complex conjugates (b) Real and distinct (c) Real and equal (d) None of the above	1	K1	CO2
9.	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	CO3
10.	If v is a harmonic conjugate of u in some domain D, then which one of the following is incorrect (a) $f(z) = u + iv$ is analytic in domain D (b) u is a harmonic conjugate of v (c) u and v both are harmonic (d) u and v both satisfy C-R Equations	1	K1	CO3
11.	Necessary and sufficient condition for $w = f(z)$ to be 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	CO3
12.	The transformation $w = \frac{az+b}{cz+d}$ where a,b,c,d are complex numbers is bilinear transformation if (a) $ad = bc$ (b) $ac + bd = 0$ (c) $ad - bc \neq 0$ (d) $a + b = c + d$	1	K1	CO3

13. The poles of $f(z)=\frac{z^2+1}{1-z^2}$ is *1 K2 CO4*
(a)1 (b) -1 (c) ± 1 (d) 0

14. If f is analytic in a simply connected domain D, then for every closed contour C lying in D, $\int_C f(z)dz=$ *1 K2 CO4*
(a) 1 (b) 0 (c) -1 (d) $2\pi i$

15. The Singularity of $f(z)=\frac{z+3}{(z-1)(z-2)}$ are *1 K2 CO4*
(a) 1,3 (b) 1,0 (c) 1,2 (d) 2,3

16. If C is unit circle, then $\int_C \frac{dz}{z}=$ *1 K2 CO4*
(a) 1 (b) $2\pi i$ (c) $4\pi i$ (d) 0

17. Laplace transform of $f(t)$ is given by *1 K1 CO5*
(a) $F(s)=\int_0^\infty e^{-st} f(t)\,dt$ (b) $f(t)=\int_0^\infty e^{-st}F(s)ds$
(c) $F(s)=\int_0^\infty e^{st} f(t)dt$ (d) None of these.

18. $L[K]=$ *1 K1 CO5*
(a) $\frac{K}{S}$ (b) K (c) S (d) None of these.

19. $L^{-1}\left[\frac{1}{s-a}\right]=$ *1 K1 CO5*
(a) e^{at} (b) t^a (c) a^t (d) None of these.

20. Laplace Transforms of $\delta(t-a)$ is *1 K1 CO5*
(a) $e^{\delta s}$ (b) e^{as} (c) e^{-as} (d) $e^{\delta t}$

PART - B (10 × 2 = 20 Marks)
Answer ALL Questions

21. Prove that $\vec{F}=yz\,\vec{i}+zx\,\vec{j}+xy\,\vec{k}$ is irrotational. *2 K2 CO1*
22. State Gauss divergence theorem. *2 K1 CO1*
23. Solve$(D^2+1)y=e^{-x}$. *2 K2 CO2*
24. Transform $(x+2)^2\frac{d^2y}{dx^2}-(x+2)\frac{dy}{dx}+y=3x+y$ in to differential equation with constant coefficients. *2 K2 CO2*
25. Check whether $w=\bar{z}$ is analytic everywhere. *2 K2 CO3*
26. Find the invariant points of the bilinear transformation $w=\frac{1+z}{1-z}$. *2 K2 CO3*
27. Expand $\frac{1}{z-2}$ at $z=1$ in Taylor's series. *2 K2 CO4*
28. Discuss the nature of the singularity of the function $\frac{e^{\frac{1}{z}}}{(z-a)^2}$. *2 K2 CO4*
29. State and prove First Shifting property. *2 K1 CO5*
30. Verify the Initial value theorem for the function $f(t)=ae^{-bt}$. *2 K2 CO5*

PART - C (6 × 10 = 60 Marks)
Answer ALL Questions

31. 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 $\vec{F}=\nabla\phi$. *10 K3 CO1*

OR

b) Verify Gauss Divergence theorem for $\vec{F}=4xz\,\vec{i}-y^2\vec{j}+yz\,\vec{k}$ over the cube Bounded by $x=0, x=1, y=0, y=1, z=0, z=1$. *10 K3 CO1*

32. a) Solve $(D^2+5D+4)y=4e^{-x}+x$. *10 K3 CO2*

OR

	b)	Solve $(D^2+4)y = sec\,2\,x$ by the method of variation of parameters.	10	K3	CO2
33.	a)	Determine the analytic function whose real part is $\frac{\sin 2x}{\cosh 2y-\cos 2x}$.	10	K3	CO3
		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.	10	K3	CO3
34.	a)	Expand $\frac{1}{z^2-3z+2}$ in the region (i) $1<\lvert z\rvert<2$ (ii) $\lvert z-1\rvert<1$ and (iii) $\lvert z\rvert>2$.	10	K3	CO4
		OR			
	b)	Evaluate $\int_0^{2\pi}\frac{d\theta}{13+5\sin\theta}$ by using contour integration.	10	K3	CO4
35.	a)	Find the Laplace transform of the periodic function $f(t)=\begin{cases} t & 0\le t\le a \\ 2a-t, & a<t\le 2a\end{cases}$ and $f(t+2a)=f(t)$.	10	K3	CO5
		OR			
	b)	Using Laplace transform, solve $(D^2-3D+2)y=e^{-3t}$ given $y(0)=1$ and $y'(0)=-1$.	10	K3	CO5
36.	a) i)	Evaluate $\int_C\frac{\sin\pi z^2+\cos\pi z^2}{(z-1)(z-2)}dz$, Where $C: \lvert z\rvert=3$ by using Cauchy's integral formula.	5	K3	CO4
	ii)	Find $L[te^{-t}\sin t]$.	5	K3	CO5
		OR			
	b) i)	Discuss the nature of the singularity of the function $\frac{\sin z-z}{z^3}$.	5	K3	CO4
	ii)	Find $L\left[\frac{1-e^t}{t}\right]$.	5	K3	CO5