

Reg. No. 

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**B.E./ B. TECH.DEGREE EXAMINATIONS, MAY 2023**

Second Semester

**MA22251 – APPLIED MATHEMATICS-II**

(Common to all branches except Marine)

(Regulation2022)

TIME:3 HOURS

MAX. MARKS: 100

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Interpret the fundamentals of vector calculus and execute evaluation of line, surface and volume integrals using Gauss, Stokes and Green’s theorems.	3
CO 2	Solve first order linear, homogeneous differential equations and use series solution method to solve second order differential equations	3
CO 3	Determine the methods to solve differential equations using Laplace transforms and Inverse Laplace transforms.	3
CO 4	Explain Analytic functions and Categorize transformations	3
CO 5	Perform Complex integration to evaluate real definite integrals using Cauchy integral theorem and Cauchy's residue theorem.	3

**PART- A(20x2=40Marks)**

(Answer all Questions)

	CO	RBT LEVEL
1. If $\phi = 2x^2 - 3y^2 + 4z^2$ then find $Curl(grad \phi)$ .	1	2
2. Find a unit normal vector to the surface $2x^2 + y^2 + 2z = 3$ at $(2, 1, -3)$ .	1	2
3. Find the constant ‘a’ so that $\vec{F} = (axy - z^3)\vec{i} + (a - 2)x^2\vec{j} + (1 - a)xz^2\vec{k}$ is conservative vector field.	1	3
4. Evaluate $\iint_S \vec{F} \cdot \hat{n} ds$ where $\vec{F} = 2x\vec{i} + 3y\vec{j} + 4z\vec{k}$ and S is unit sphere.	1	3
5. Solve $\frac{dy}{dx} = e^{3x-2y} + x^2e^{-2y}$ .	2	2
6. Solve $(D^3 + 4D^2 + 4D)y = 0$	2	2
7. Solve for x and y: $\frac{dy}{dt} = x$ ; $\frac{dx}{dt} = y$	2	2
8. Find the particular integral of $(D^2 + 9)y = \sin 3x$	2	2
9. If $L(f(t)) = \frac{s+2}{s^2+4}$ , find $\int_0^\infty f(t)dt$	3	2
10. Find $L^{-1}\left(\frac{1}{(s+1)^4}\right)$	3	2
11. Find $L[\sin(2t)\sin(3t)]$	3	2

12. Find $L\left[\frac{1-e^t}{t}\right]$	3	2
13. Check whether the function $v = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ is harmonic or not.	4	2
14. Find the invariant points of the transformation $w = \frac{z-1}{z+1}$ .	4	2
15. Check whether the function $f(z) = \frac{(x-iy)}{x^2+y^2}$ is analytic or not.	4	2
16. Find the image of $2x + y - 3 = 0$ under the transformation $w = z + 2i$ .	4	2
17. Using Cauchy Integral formula evaluate $\int_C \frac{\cos(\pi z^2)}{z-2} dz$ where C is $ z-1 =2$ .	5	2
18. Evaluate $\int_C \frac{z^2}{(z-\pi)} dz$ where C is $ z =2$ .	5	2
19. Discuss the nature of singularity of $\frac{z-\sin z}{z^2}$	5	2
20. Find the residue of $f(z) = z^2 e^{1/z}$ at its singularity.	5	2

**PART- B (5x 10=50Marks)**

	Marks	CO	RBT LEVEL
21. (a) (i) Find the directional derivative of $xy^2 + yz^3$ at $(2, -1, 1)$ in the direction of the normal to the surface $x \log z - y^2 + 4 = 0$ at $(-1, 2, 1)$ .	(6)	1	3
(ii) Find the scalar potential of conservative force field $\vec{F} = (y^2 + 2xz^2)\vec{i} + (2xy - z)\vec{j} + (2x^2z - y + 2z)\vec{k}$ .	(4)	1	3
(OR)			
(b) Verify Stoke’s theorem for $\vec{F} = (y - z + 2)\vec{i} + (yz + 4)\vec{j} - zx\vec{k}$ where S is the open surface of the rectangular parelloiped formed by the planes $x = 0, x = 2, y = 0, y = 2$ and $z = 2$ above the XY-plane.	(10)	1	3
22. (a) Solve the following differential equations by the method of variation parameter $(D^2 + 16)y = \operatorname{cosec}(4x)$	(10)	2	3
(OR)			
(b) Solve $((2x+3)^2 D^2 - 2(2x+3)D - 12)y = 6x$	(10)	2	3
23. (a) Find the Laplace transform of the rectangular-wave function $f(t) = \begin{cases} t, & 0 \leq t \leq a \\ 2a-t, & a \leq t \leq 2a \end{cases}$ and $f(t+2a) = f(t)$	(10)	3	3
(OR)			
(b) Solve the differential equation $y'' + 5y' + 6y = e^{-t}, y(0) = 0, y'(0) = 0$ using Laplace transform.	(10)	3	3

24. (a) Find the analytic function  $f(z)=u+iv$  where  $u + v = \frac{\sin 2x}{\cosh 2y - \cos 2x}$  (10) 4 3

(OR)

(b) Find the bilinear transformation which maps the points  $z = 0, -1, i$  onto  $w = i, 0, \infty$ . Also find the image of  $|z| < 1$ . (10) 4 3

25. (a) Find the Laurent's series expansion of  $f(z) = \frac{z^2 - 1}{z^2 + 5z + 6}$  in the region (10) 5 3

(i)  $|z| < 2$  (ii)  $2 < |z| < 3$  (iii)  $|z| > 3$

(OR)

(b) Using contour integration evaluate  $\int_0^{2\pi} \frac{d\theta}{5 - 3\cos\theta}$  (10) 5 3

**PART- C (1x 10=10Marks)**

(Q.No.26 is compulsory)

Marks	CO	RBT LEVEL
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26. Determine the residue at each pole of the function  $f(z) = \frac{z^2}{(z-1)^2(z+2)}$ . (10) 5 3

Hence evaluate  $\int_C f(z) dz$  where C is (i)  $|z| = \frac{3}{2}$  (ii)  $|z| = 3$

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