Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. (Full Time) - END SEMESTER EXAMINATIONS, APRIL / MAY 2024

II Semester

MA5252 & ENGINEERING MATHEMATICS - II

(Regulation 2019)

Time: 3hrs Max.Marks: 100

CO 1	To acquaint the students with the concepts of vector calculus which naturally arises in many engineering problems.
CO 2	To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
CO 3	To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
CO 4	To acquaint the students with Differential Equations which are significantly used in Engineering Problems.
CO 5	To make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

BL – Bloom's Taxonomy Levels

(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analyzing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1.	Find the directional derivative of the function $\phi(x,y,z) = 4xz^2 + x^2yz$ at $(1,-2,1)$ in the direction of $2\vec{i} + 3\vec{j} + 4\vec{k}$.	2	1	L1
2.	Find a such that $(3x - 2y + z)\vec{i} + (4x + ay - z)\vec{j} + (x - y + 2z)\vec{k}$ is solenoidal.	2	1	L2
3.	Show that $u = 2x(1 - y)$ is harmonic.	2	2	L2
4.	Find the invariant points of the transformation $w = \frac{2z+6}{z+7}$.	2	2	L1
5.	Evaluate $\int_C e^z\, dz$ where C is $\lvert z\rvert = 1$.	2	3	L1
6.	Find the residue of $f(z) = \frac{4}{z^3(z-2)}$ at a simple pole.	2	3	L2
7.	Solve $(2D^2 - 4D + 1)y = 0$.	2	4	L2
8.	Solve $(D^2 - 2D + 2)y = 4$.	2	4	L1
9.	Find $L[2^t]$.	2	5	L2
10.	Find the inverse Laplace transform of $\frac{e^{-2s}}{s-3}$.	2	5	L1

PART- B (5 x 13 = 65 Marks)

Q. No			Questions	Marks	CO	BL
11.	a.		Verify Gauss divergence theorem for $\vec{F} = x^2\vec{i} + y^2\vec{j} + z^2\vec{k}$ over the cuboid $x = 0,\ x = 1,\ y = 0,\ y = 2,\ z = 0,\ z = 3$.	13	1	L3
			OR			
	b.	i.	Prove that $\vec{F} = (6xy + z^3)\vec{i} + (3x^2 - z)\vec{j} + (3xz^2 - y)\vec{k}$ is irrotational and find its scalar potential.	7	1	L3
		ii.	Find the angle between the surfaces $x^2 - y^2 - z^2 = 11$ and $xy + yz - zx = 18$ at $(6,4,3)$.	6	1	L4
12.	a.	i.	Find the analytic function $f(z) = u + iv$ if $3u + 2v = y^2 - x^2 + 16xy$.	7	2	L3
		ii.	If $f(z)$ is an analytic function, prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)\lvert f(z)\rvert^2 = 4\lvert f'(z)\rvert^2$.	6	2	L4
			OR			
	b.	i.	Find the bilinear transformation which maps the points $z = 0, 1, \infty$ into $w = i, 1, -i$ respectively.	7	2	L3
		ii.	Find the image of the quadrant $x > 0,\ y > 1$ under the mapping $w = \frac{1}{z}$.	6	2	L4
13.	a.	i.	Using Cauchy integral formula evaluate $\int_C \frac{(4-3z)}{z(z-1)(z-2)}dz$ where C is the circle $\lvert z\rvert = \frac{3}{2}$.	7	3	L3
		ii.	Obtain Taylor's series to represent the function $\frac{5z+7}{(z+2)(z+3)}$ in the region $\lvert z\rvert < 2$.	6	3	L4
			OR			
	b.	i.	Evaluate $\int_0^{2\pi} \frac{d\theta}{2-\cos\theta}$ using contour integration.	7	3	L3
		ii.	Find the Laurent's series of $f(z) = \frac{5z+7}{z^2+5z+6}$ valid in the region $\lvert z\rvert > 3$.	6	3	L4
14.	a.	i.	Solve by the method of undetermined coefficients $(D^2 + 4)y = \sin 2x$.	7	4	L3
		ii.	Solve $(x^2D^2 - xD + 4)y = x^2\sin(\log x)$.	6	4	L4
			OR			
	b.	i.	Solve: $(2x+3)^2\frac{d^2y}{dx^2} - 2(2x+3)\frac{dy}{dx} - 12y = 6x$.	7	4	L4
		ii.	Solve: $(D^4 - 2D^2 + 1)y = (x+1)e^{2x}$	6	4	L4
15.	a.	i.	Find the Laplace transform of periodic function $f(t) = \begin{cases} t, & 0 \le t \le a \\ 2a - t, & a \le t \le 2a \end{cases}$ and $f(t + 2a) = f(t)$.	7	5	L4

		ii.	Find $L^{-1}\left\{\frac{1}{(s^2+a^2)^2}\right\}$ by using convolution theorem.	**6**	5	L3
OR						
	b.	i.	Solve by using Laplace transform $y'' + 4y' + 4y = te^{-t}$, given that $y(0) = 0$, $y'(0) = 1$.	**7**	5	L4
		ii.	Evaluate using Laplace transform $\int_0^\infty te^{-2t} \sin 3t \, dt$.	**6**	5	L3

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q. No			**Questions**	**Marks**	**CO**	**BL**
16.	a.	i.	Using Green's theorem, find the area between $y = x^2$ and $y = x$.	**7**	1	L6
		ii.	Solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$ by the method of variation of parameters.	**8**	4	L5