Reg. No. | | | | | | | | | | | | | | |

B.E / B.TECH. DEGREE EXAMINATIONS, MAY 2023
Second Semester
MA18252-MATHEMATICS FOR MARINE ENGINEERING-II
(Marine Engineering)
(Regulation 2018 & 2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

CO 1	Understand the concepts of ordinary differential equations in the field of engineering.
CO 2	Understand the procedure to solve higher order differential equations and apply real time engineering problems.
CO 3	Acquire the concepts of vector calculus for solving problems.
CO 4	Understand the concepts of analytic functions which are widely used in marine engineering problems.
CO 5	Acquire knowledge in Laplace transforms which are used in efficiently solving the problems that occur in various branches of engineering disciplines.

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

		CO	RBT LEVEL
1	Find the differential equation of the coaxial circles of $x^2+y^2+2ax+c^2=0$ where c is constant and a is a variable.	1	2
2	Form the differential equation of simple harmonic motion given by $x = A\cos(nt+\alpha)$.	1	2
3	Find the particular integral of $(D^2+2D+1)\,y = e^{-x}\cos x$.	2	2
4	Transform the equation $(x^2D^2 + xD)\,y = x$ into a differential equation with constant coefficients.	2	2
5	Evaluate a, b, c so that $\vec{A}=(x+y+az)\vec{i}+(bx+2y-z)\vec{j}+(-x+cy+2z)\vec{k}$ is irrotational .	3	2
6	If $\vec{V}=(x+3y)\vec{i}+(y-2z)\vec{j}+(x+\lambda z)\vec{k}$ is solenoidal, find λ.	3	2
7	Show that the function $f(z) = \bar{z}$ is nowhere differentiable.	4	2
8	Find the image of $2x+y-3=0$ under the transformation $w=z+2i$.	4	2
9	Find L $[\,e^{-3t}cos2t]$	5	2
10	Find $L^{-1}\left(\frac{s}{(s+2)^2}\right)$	5	2

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PART- B (5 x 14 = 70 Marks)

			Marks	CO	RBT LEVEL
11(a)	(i)	Solve $(1+e^{x/y})dx + e^{x/y}(1-x/y)dy = 0$.	(7)	1	3
	(ii)	Solve $(x^2-y^2)dx - xydy = 0$.	(7)	1	3
		(OR)			
11(b)	(i)	Solve $x\frac{dy}{dx}+y=x^3y^6$.	(7)	1	3
	(ii)	Find the orthogonal trajectory of family of curves $r^n = a\sin n\theta$.	(7)	1	3
12(a)	(i)	Solve $(D^2+9)y = \sin 3x + \cos 3x$.	(7)	2	3
	(ii)	Solve $(D^2 + a^2)\,y = \tan ax$ by the method of variation of parameters.	(7)	2	3
		(OR)			
12(b)	(i)	Solve $[(2x+5)^2D^2-6(2x+5)D+8]y = 6x$.	(7)	2	3
	(ii)	Solve $x' + 2x + 3y = 0$; $y' + 3x + 2y = 2e^{2t}$.	(7)	2	3
13(a)		Verify the Gauss Divergence theorem for $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ over the cube bounded by $x=0,\ x=1,\ y=0,\ y=1,\ z=0, z=1$.	(14)	3	3
		(OR)			
13(b)		Verify Stoke's theorem for $\vec{F} = (y-z+2)\vec{i} + (yz+4)\vec{j} - xz\vec{k}$ *over the* open surface of the cube $x=0, y=0, z=0, x=2, y=2, z=2$ above the xy plane.	(14)	3	3
14(a)	(i)	If f(z) = u(x,y) + iv(x,y) is an analytic then prove that family of curves u(x,y) = a and v(x,y) = b cut orthogonally.	(7)	4	3
	(ii)	Find the image of the infinite strips (i) $\frac{1}{4} < y < \frac{1}{2}$ (ii) $0 < y < \frac{1}{2}$ under the transformation w = 1/z.	(7)	4	3
		(OR)			
14(b)	(i)	Determine the analytic function whose real part is $\frac{\sin 2x}{\cosh 2y - \cos 2x}$	(7)	4	3
	(ii)	Find the bilinear transformation that maps the points $z = 1, i, -1$ onto the points $w = i, 0, -i$. Hence find the image of $\lvert z\rvert < 1$.	(7)	4	3
15(a)	(i)	Find the Laplace transform of $e^{-4t}\int_0^t t\sin 3t\,dt$.	(7)	5	3

			Marks	CO	RBT Level
	(ii)	Find the Laplace transform of $f(t) = \begin{cases} a\sin\omega t, 0 \le t \le \frac{\pi}{\omega} \\ 0, \frac{\pi}{\omega} \le t \le \frac{2\pi}{\omega} \end{cases}$ and $f(t + 2\pi/\omega) = f(t)$.	**(7)**	**5**	**3**

(OR)

15(b)	**(i)**	Find the inverse Laplace transform using convolution theorem of $\frac{2}{(s+1)(s^2+4)}$.	**(7)**	**5**	**3**
	(ii)	Using Laplace transform solve $y'' - 2y' + y = e^t, y(0) = 2, y'(0) = 1$.	**(7)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16	Show that $\vec{F} = (y^2 + 2xz^2)\vec{i} + (2xy - z)\vec{j} + (2x^2z - y + 2z)\vec{k}$ is irrotational and hence find its scalar potential.	**(10)**	**3**	**3**

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