Q. Code: 139763

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

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

Second Semester

MA22252 – APPLIED MATHEMATICS II FOR MARINE ENGINEERS

(Marine Engineering)

(Regulation 2022)

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

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Apply the basic concepts of ordinary differential equations and its applications in marine engineering problems.	**3**
CO 2	Apply various techniques in solving differential equations.	**3**
CO 3	Solve gradient, divergence and curl of a vector point function and related identities, evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems.	**3**
CO 4	Recognize fundamental properties of analytic functions and construct simple conformal maps.	**3**
CO 5	Apply Laplace transforms to solve differential equation.	**3**

PART- A (20 x 2 = 40 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Solve $x^{-4}\frac{dy}{dx} = e^{-3y}$	**1**	**2**
2.	Form the differential equation from the following equation $y = A_1\, cos3x + A_2 sin3x$	**1**	**2**
3.	Find the integrating factor of $\frac{dy}{dx} + \frac{y}{x} = x$	**1**	**2**
4.	Find the general solution of the differential equation $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$	**1**	**2**
5.	Solve $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0.$	**2**	**2**
6.	Find the Particular Integral of $(D^2 - 4D + 4)y = e^{2x+3}$	**2**	**2**
7.	Solve $(D^2 - 4)y = 2.$	**2**	**2**
8.	Solve $(x^2 D^2 - x D + 1)\, y = 0$	**2**	**2**
9.	Determine the constant $'a'$ such that the vector $\vec{F} = (x + z)\,\vec{i} + (3x + ay)\,\vec{j} + (x - 5z)\vec{k}$ has its divergence to be zero.	**3**	**2**
10.	What is the greatest rate of increase of $\phi = x\,y\,z^2$ at (1, 0, 3)?	**3**	**2**
11.	Prove that $\vec{F} = x^2\,\vec{i} + y^2\,\vec{j} + z^2\,\vec{k}$ is a conservative vector field.	**3**	**2**
12.	Find a unit normal to the surface $x^2y + 2xz^2 = 8$ at the point $(1,0,2)$.	**3**	**2**
13.	Is $f(z) = z^3 + z$ is analytic? Justify.	**4**	**2**
14.	Show that $u = 2x - x^3 + 3xy^2$ is harmonic.	**4**	**2**
15.	Show that an analytic function with constant real part is constant.	**4**	**2**
16.	Find the invariant points of $f(z) = z^2$	**4**	**2**
17.	*Find* $\int_0^\infty e^{-t}\, sin2tdt$	**5**	**2**

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		Marks	CO
18.	Find L $[t^2 e^{-2t}]$	5	2
19.	Find $L^{-1}\left(\frac{s}{(s+4)^2}\right)$	5	2
20.	Verify the final value theorem for $f(t) = 3e^{-2t}$	5	2

PART- B (5 x 10 = 50 Marks)

		Marks	CO	RBT LEVEL
21. (a)	Solve $\frac{dy}{dx} = \left(\frac{y}{x} sec^2 \frac{y}{x} - tan\frac{y}{x}\right) cos^2 \frac{y}{x}$	(10)	1	3
	(OR)			
(b)	Find the orthogonal trajectory of the cardioids $r = a(1 - cos\theta)$	(10)	1	3
22. (a)	Solve $(D^2 + a^2)y = \tan ax$ by method of variation of parameter.	(10)	2	3
	(OR)			
(b)	Solve $(1+x)^2 \frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 4\cos[\log(1+x)]$.	(10)	2	3
23. (a)	Show that $\vec{F} = (6xy + z^3)\vec{\imath} + (3x^2 - z)\vec{\jmath} + (3xz^2 - y)\vec{k}$ is irrotational and find its scalar potential.	(10)	3	3
	(OR)			
(b)	Verify Green's theorem for $\int_C (x^2dx + xydy)$ where C is the curve in the XY plane given by $x = 0, y = 0, x = a, y = a\ (a > 0)$.	(10)	3	3
24. (a)	Find the bilinear transformation which maps the points $-1, 0, 1$ in the z plane onto the points $0, i, 3i$ in the w plane.	(10)	4	3
	(OR)			
(b)	Find the analytic function $f(z) = u + iv$ whose real part is $u = e^x(xcosy - ysiny)$	(10)	4	3
25. (a)	Find the inverse Laplace transform of the following functions using convolution theorem $\frac{s}{(s^2+a^2)^2}$	(10)	5	3
	(OR)			
(b)	Solve the following differential equations using Laplace transform $y'' - 2y' + 2y = 0$ given that $y(0) = 1, y'(0) = 1$	(10)	5	3

PART- C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	Solve $\frac{d^2y}{dx^2} + \frac{1}{x}\frac{dy}{dx} = \frac{12logx}{x^2}$	(10)	2	3

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