

Reg. No.

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B. E / B. TECH.DEGREE EXAMINATION, MAY 2023
 First Semester
MA18152-MATHEMATICS FOR MARINE ENGINEERING-I
 (Marine Engineering)
 (Regulation 2018 & 2018A)

TIME: 3 HOURS

MAX. MARKS: 100

- CO 1 Apply the basic concepts of analytical geometry in marine engineering problems.
- CO 2 Use rules of differentiation to differentiate functions.
- CO 3 Apply differentiation to solve maxima and minima problems.
- CO 4 Perform integration to compute arc lengths, volumes of revolution and surface areas of revolution.
- CO 5 Apply integration to compute multiple integrals, area, moment of inertia, integrals in polar coordinates, in addition to change of order.

PART- A (10x2=20Marks)
 (Answer all Questions)

	CO	RBT LEVEL
1 Find the centre and radius of the sphere $x^2 + y^2 + z^2 - 2x - 4y - 6z - 2 = 0$	1	2
2 Find the equation to the cone with vertex at the origin and passing through the curve $x^2 + y^2 = 9, z = 3$.	1	2
3 If $f(x) = x^3 - 8x + 10$, find $f'(2)$.	2	2
4 Find the n^{th} derivative of $\sin(2x + 3)$	2	2
5 If $u = \frac{x}{y} + \frac{y}{z} + \frac{z}{x}$, find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z}$.	3	2
6 A flat circular plate is heated so that the temperature at any point (x, y) is $u(x, y) = x^2 + 2y^2 - x$. Find the coldest point on the plate.	3	1
7 Evaluate $\int \frac{\sin(\log x)}{x} dx$	4	2
8 Find the average value of $f(x) = x^2$ in the interval $[-1, 2]$	4	2
9 Sketch the region of integration for $\int_0^y \int_0^x ye^{-x} dx dy$	5	2
10 Evaluate $\int_0^1 \int_0^2 \int_0^3 z dz dy dx$	5	2

PART- B (5x 14=70Marks)

	Marks	CO	RBT LEVEL
11(a) (i) Find the equation of the cone whose vertex is at the origin and guiding curve is $x^2 - 2y + z^2 = 4x + 9, x - y + z = 7$.	(7)	1	3
(ii) Find the equation of the sphere having the circle $x^2 + y^2 + z^2 + 10y - 4z - 8 = 0, x + y + z = 3$ as a great circle.	(7)	1	3
(OR)			
11(b) (i) Find the centre and radius of the circle given by $x^2 + y^2 + z^2 + 2x - 2y - 4z - 19 = 0$ and $x + 2y + 2z + 7 = 0$.	(7)	1	3
(ii) Find the equation of the right circular cylinder of radius 2 and having as axis of the line $\frac{x-1}{2} = \frac{y-2}{1} = \frac{z-3}{2}$.	(7)	1	3
12(a) (i) Find the n^{th} derivative of $\sin h 3x \sin 5x$.	(7)	2	3
(ii) If $y = \sin(\sin x)$ then prove that $\frac{d^2 y}{dx^2} + \tan x \frac{dy}{dx} + y \cos^2 x = 0$	(7)	2	3
(OR)			
12(b) (i) Find the first 3 terms in the Maclaurin series for $2x e^{-x}$	(7)	2	3
(ii) If $y = a \cos(\log x) + b \sin(\log x)$ then prove that $x^2 y_2 + x y_1 + y = 0$.	(7)	2	3
13(a) (i) If $u = \log(x^3 + y^3 + z^3 - 3xyz)$, prove that $\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z}\right)^2 u = -\frac{9}{(x+y+z)^2}$	(7)	3	3
(ii) If $u = f\left[\frac{y-x}{xy}, \frac{z-x}{xz}\right]$ show that $x^2 \frac{\partial u}{\partial x} + y^2 \frac{\partial u}{\partial y} + z^2 \frac{\partial u}{\partial z} = 0$	(7)	3	3
(OR)			
13(b) (i) Find the maxima and minima of the function $f(x, y) = x^2 + y^2 - 4x - 2y + 10$.	(7)	3	3
(ii) Find the maximum value of $x^m y^n z^p$ subject to the condition $x + y + z = a$.	(7)	3	3
14(a) (i) Find the first and second moment of area under $y = 1 + x + x^2$ from $x = 0$ to $x = 2$ about y -axis..	(7)	4	3

(ii) Find the area between the curve $y^2 = 4x$ and the line $2x - 3y + 4 = 0$. (7) 4 3

(OR)

14(b) (i) Find the centroid of the region bounded by $y = x^2$ and $y = \sqrt{x}$. (7) 4 3

(ii) Evaluate $\int \left(\frac{\cos 2x - \cos 2\alpha}{\cos x - \cos \alpha} \right) dx$ (7) 4 3

15(a) (i) Change the order of integration and hence evaluate (7) 5 3

$$\int_0^a \int_x^a (x^2 + y^2) dy dx$$

(ii) Evaluate $\int_0^1 \int_0^{2-z} \int_0^{1+y} dx dy dz$ (7) 5 3

(OR)

15(b) Find the volume of the sphere $x^2 + y^2 + z^2 = a^2$ without transformation. (14) 5 3

PART- C (1x 10=10Marks)

(Q.No.16 is compulsory)

16 Find the extreme values of the function

$$f(x, y) = x^3 + y^3 - 3x - 12y + 20$$

Marks	CO	RBT LEVEL
(10)	3	3
