Reg. No. :

Question Paper Code : 25131

B.E./B.Tech. DEGREE EXAMINATION, DECEMBER/JANUARY 2019.

First Semester

Marine Engineering

MA 8101 – MATHEMATICS FOR MARINE ENGINEERING – I

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the equation of the sphere whose centre is $(1, 2, -2)$ and which passes through the point $(3, 1, -3)$.

2. Define a right circular cone.

3. Find $\frac{dy}{dx}$ *if* $x = a(\cos t + t \sin t), y = a(\sin t - t \cos t)$.

4. State Maclaurin's series.

5. Express the total differential of u in terms of those of x and y if $u = \sin(xy^2)$.

6. Obtain the stationary point of $f(x, y) = x^2 + y^2 + 6x + 12$.

7. Write the formula for the volume of revolution about the $x - axis$.

8. Calculate the root mean square of $f(x) = \sin x \, in \, 0 \le x \le 2\pi$.

9. Change the order of integration in $\int_0^1 \int_{x^2}^{2-x} xy \; dydx$.

10. State the theorem of perpendicular axis.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) 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 scale. (8)

(ii) Obtain the equation of the cone with vertex as the origin and which passes through the curve $x^2 + y^2 + z^2 = 16,\ x + y + z = 1$. (8)

Or

(b) (i) Find the centre and radius of the circle $x^2 + y^2 + z^2 - 2x - 4y - 6z - 2 = 0$ and $x + 2y + 2z - 20 = 0$. (8)

(ii) Find the equation of the right circular cylinder of radius 3 and axis is the line $\frac{x-1}{2} = \frac{y-3}{2} = \frac{z-5}{-1}$. (8)

12. (a) (i) If $y = (\sin^{-1} x)^2$, then show that $(1 - x^2)y_{n+2} - (2n+1)xy_{n+1} - n^2 y_n = 0$. (8)

(ii) Evaluate $\lim_{x\to\pi/2}(\sin x)^{\tan x}$. (8)

Or

(b) (i) Obtain the Taylor series expansion for $\log_e x$ in powers of $(x - 1)$. (8)

(ii) Trace the curve $xy^2 = 4a^2(a - x)$. (8)

13. (a) (i) If $u = \cos^{-1}\left(\frac{x^5 - 2y^5 + 6z^5}{\sqrt{ax^3 + by^3 + cz^3}}\right)$, then show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = -\frac{7}{2}\cot u$. (8)

(ii) Show that the rectangular solid of maximum value that can be inscribed in a sphere $x^2 + y^2 + z^2 = r^2$ is a cube. (8)

Or

(b) (i) If $y^{x^y} = \sin x$, then find $\frac{dy}{dx}$. (8)

(ii) Find the percentage error in the area of an ellipse when an error of 1.5% is made in measuring its major and minor axes. (8)

14\. (a) (i) Find the volume formed by the revolution of the semicircle $x^2 + y^2 = a^2$ about the x axis. (8)

(ii) Evaluate $\int \frac{(\sin^{-1} x)^2}{\sqrt{1-x^2}} dx$. (8)

Or

(b) (i) Find the formula for the first moment of area of a circular area about an axis touching its edge in terms its diameter D. (8)

(ii) Find the area enclosed between the curve $x^2 = 4y$ and the line $x = 4y - 2$. (8)

15\. (a) (i) Derive the standard formula for the second moment of area and radius of gyration for a rectangle of length L and breadth B about an axis through its centroid and parallel to the long edge. (8)

(ii) Change the order of integration in $\int_0^b \int_0^{\frac{a}{b}(b-y)} xy \, dx dy$ and hence evaluate it. (8)

Or

(b) (i) Find the mass of the tetrahedron bounded by the co-ordinates planes and the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$, the variable density $\rho = \mu xyz$. (8)

(ii) Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} \int_0^{\sqrt{a^2-x^2-y^2}} xyz \; dz \, dy \, dx$ by transforming into spherical polar coordinates. (8)
