Reg. No. :

Question Paper Code : 80204

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

First Semester

Marine Engineering

MA 8101 – MATHEMATICS FOR MARINE ENGINEERING – I

(Regulation 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the equation of the sphere, having the points $(-4, 5, 1)$ and $(4, 1, 7)$ as ends of a diameter.

2. If $\frac{x}{1}=\frac{y}{1}=\frac{z}{k}$ is a generator of the cone $x^2+y^2-z^2=0$, find the value of k.

3. Find the derivative of $y=\sqrt{x^2+1}$.

4. Use L'Hospital's rule to find $\lim_{x\to 0}\frac{3x-\sin x}{x}$.

5. Find $\frac{\partial f}{\partial y}$ if $f(x, y)=y\sin xy$.

6. If $x^y=y^x$, find $\frac{dy}{dx}$.

7. Evaluate $\int x^2e^x\, dx$.

8. State theorems of parallel and perpendicular axes.

9. Evaluate $\int_1^2\int_2^5 xy\, dx\, dy$.

10. Evaluate $\int_0^a\int_0^b\int_0^c xyz\, dx\, dy\, dz$.

PART B — (5 × 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 circle. (8)

(ii) Find the equation the right circular cone with vertex at the origin, having z axis as the axis of the cone and α as the semivertical angle. (8)

Or

(b) (i) Find the equation of the sphere passing through the points $A(1, 5, -1)$, $B(4, -1, 2)$, $C(0, -2, 3)$ and $D(2, 0, 1)$. (8)

(ii) Find the equation of the right circular cyclinder whose axis is $\frac{x}{2} = \frac{y}{3} = \frac{z}{6}$ and radius 5. (8)

12. (a) (i) If $y = e^{ax} \sin bx$, prove that $y_2 - 2ay_1 + (a^2 + b^2)y = 0$. (8)

(ii) Expand $\log_e x$ in powers of $(x - 1)$ and hence evaluate $\log_e 1.1$ correct to 4 decimal places. (8)

Or

(b) (i) Find the n^{th} derivative of $\frac{x}{(x-1)(2x+3)}$. (8)

(ii) Find the equation of the normal at any point θ to the curve $x = a(\cos\theta + \theta\sin\theta)$, $y = a(\sin\theta - \theta\cos\theta)$. Verify that these normals touch a circle with its centre at the origin and whose radius is constant. (8)

13. (a) (i) If $v = (x^2 + y^2 + z^2)^{-1/2}$, prove that $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 v}{\partial z^2} = 0$. (8)

(ii) Find the maxima and minima of $xy(a - x - y)$. (8)

Or

(b) (i) Show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2u \log u$, where $\log u = \frac{x^3 + y^3}{3x + 4y}$. (8)

(ii) A rectangular box, open at the top, is to have a given quantity of 32c.c. Find the dimensions of the box which requires least material for its construction. (8)

14. (a) (i) Evaluate $\lim_{n\to\infty}\left\{\left(1+\frac{1}{n}\right)\left(1+\frac{2}{n}\right)\ldots\left(1+\frac{n}{n}\right)\right\}^{1/n}$. (8)

(ii) Find the volume formed by the revolution of loop of the curve $y^2(a+x)=x^2(3a-x)$, about the x–axis. (8)

Or

(b) (i) Find the area of the loop of the curve $ay^2 = x^2(a-x)$. (8)

(ii) Find the M.I. of the area bounded by the curve $r^2 = a^2\cos 2\theta$ about its axis. (8)

15. (a) (i) Find the volume of the sphere $x^2+y^2+z^2=a^2$, using spherical polar co-ordinates. (8)

(ii) Find area of the portion of the cylinder $x^2+z^2=4$ lying inside the cylinder $x^2+y^2=4$. (8)

Or

(b) (i) Change the order of the integration $\int_0^1\int_{x^2}^{2-x} xy\, dy\, dx$ and evaluate the same. (8)

(ii) Using double integration, find the centre of gravity of the area of the cardioid $r = a(1+\cos\theta)$. (8)