Reg. No. :

Question Paper Code : MA8101

B.E./B.Tech. DEGREE EXAMINATION, 2017

First Semester

Marine Engineering

MA 8101 : MATHEMATICS FOR MARINE ENGINEERING – I

(Regulations 2017)

Time : Three Hours Maximum : 100 Marks

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Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Find the equation of the sphere whose centre is (1, 2, 3) and radius 5.
2. What is the equation of the axis of the cylinder $x^2 + y^2 = 25$?
3. Evaluate the $\lim_{x\to 0}\left(\frac{1}{\sin x} - \frac{1}{x}\right)$, if it exists.
4. Using Maclaurin's series, expand f(x) = sinx upto the term containing x^5.
5. Find $\frac{dy}{dx}$, if $x^2 + xy + y^2 = 1$.
6. If $u = x^y$, then find $\partial u / \partial x$ and $\partial u / \partial y$.
7. Evaluate the integral $\int_0^3 (x - 1)dx$ by interpreting in terms of areas.
8. Show that $\int_0^a f(x)dx = \int_0^a f(x - a)dx$.
9. Sketch the region of integration of the integral $\int_0^1\int_0^x f(x, y)dy\,dx$.
10. What is the formula for the moment of inertia of a solid about x-axis ?

PART – B **(5×16=80 Marks)**

11. a) i) Find the equation of the cone which passes through the three coordinate axes and the two lines $\frac{x}{1} = \frac{y}{-2} = \frac{z}{3}$ and $\frac{x}{3} = \frac{y}{-1} = \frac{z}{1}$. **(8)**

ii) Find the equation of the right circular cylinder of radius 2 whose axis passes through (1, 2, 3) and has direction ratios 2, – 3, 6. **(8)**

(OR)

b) i) Find the equations of the tangent planes to the sphere $x^2 + y^2 + z^2 - 4x - 2y - 6z + 5 = 0$ which are parallel to the plane $x + 4y + 8z = 0$. **(8)**

ii) Find the equation of the right circular cone whose vertex is at the origin, whose axis is $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ having semi vertical angle 60°. **(8)**

12. a) i) Expand the function f(x) = in (x) in powers of (x – 1) upto fourth terms, using Taylor's series. **(8)**

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

(OR)

b) i) If $y = \left(\sin^{-1}x\right)^2$, then show that $\left(1-x^2\right)y_{n+2} - (2n+1)xy_{n+1} - n^2 y_n = 0$, using Leibnitz's theorem. **(8)**

ii) Find the values of 'a' and 'b' such that $\lim_{x \to 0} \frac{x(1 + a\cos x) - b\sin x}{x^3} = 1$. **(8)**

13. a) i) If $u = x^2 \tan^{-1}(y/x) - y^2 \tan^{-1}(x/y)$, then prove that $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$. **(8)**

ii) Expand $f(x, y) = e^x \sin y$ in powers of x and y up to third degree terms by using Taylor's series. **(8)**

(OR)

b) i) If z = f(x,y), where $x = e^u \cos v$ and $y = e^u \sin v$, then show that $x\frac{\partial z}{\partial v} + y\frac{\partial z}{\partial u} = e^{2u}\frac{\partial z}{\partial y}$. **(7)**

ii) Find the volume of the greatest rectangular parallelopiped that can be inscribed in the ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$, using Lagrange's method. **(9)**

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14. a) i) A particle moving along a straight line such that its velocity at time t is $v(t) = t^2 - t - 6$ m/sec. Find the displacement of the particle during the time period $1 \leq t \leq 4$, and also find the distance traveled during this time period. **(8)**

ii) Find the volume formed by the revolution of the loop of the curve

$y^2 = x^2 (3a - x)/(a + x)$, about the x-axis. **(8)**

(OR)

b) i) Evaluate the integral $\int_0^1 \frac{\ln(1+x)}{1+x^2} dx$. **(8)**

ii) Find the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. **(8)**

15. a) i) Find the area between the circle $x^2 + y^2 = a^2$ and the straight line $x + y = a$ lying in the first quadrant by using double integration. **(8)**

ii) Find the coordinates of the centre of gravity of the positive octant of the sphere $x^2 + y^2 + z^2 = a^2$ whose density is kxyz. **(8)**

(OR)

b) i) Evaluate integral $\int_0^1 \int_{x^2}^{2-x} xy \, dy \, dx$ by changing the order of integration. **(8)**

ii) Find the volume bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$. **(8)**

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