**Reg. No. :** | | | | | | | | | | | | |

# Question Paper Code : 37008

B.E./B.Tech. DEGREE EXAMINATION, JANUARY 2014.

First Semester

Marine Engineering

MA 6152 – MATHEMATICS FOR MARINE ENGINEERING – I

(Regulation 2013)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Find the equation of the sphere having the points $(2,-1,4)$ and $(-2,2,-2)$ as ends of diameter.

2. Define right circular cylinder.

3. Differentiate $y = (\sin x)^{\log x}$.

4. State Lagrange's mean value theorem.

5. If $x^3 + 3x^2y + 6xy^2 + y^3 = 1$, find $\frac{dy}{dx}$.

6. Find the critical points of $f(x, y) = 3x^2 - y^2 + x^3$.

7. Evaluate $\int x \tan^{-1} x \, dx$.

8. State the theorem of perpendicular axis.

9. Change the order of integration in $\int_0^2 \int_0^x f(x,y)\,dy\,dx$.

10. Sketch the region of integration for the double integral $\int_0^1 \int_0^{x^2} f(x,y)\,dy\,dx$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the equation of sphere having its centre on the plane $4x-5y-z=3$ and passing through the circle $x^2+y^2+z^2-2x-3y+4z+8=0$, $x^2+y^2+z^2+4x+5y-6z+2=0$. (8)

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

Or

(b) (i) Show that the plane $2x-2y+z+12=0$ touches the sphere $x^2+y^2+z^2-2x-4y+2z-3=0$ and find the point of contact. (8)

(ii) Find the equation to the right circular cone whose vertex is at $(2,-3,5)$, axis makes equal angles with the coordinate axes and semi-vertical angle is 30°. (8)

12. (a) (i) Find $\frac{dy}{dx}$ if $y=\sqrt{\frac{(x-1)(x-2)}{(x-3)(x-4)}}$. (8)

(ii) If $y=e^{a\sin^{-1}x}$ prove that $(1-x^2)y_{n+2}-(2n+1)xy_{n+1}-(n^2+a^2)y=0$. (8)

Or

(b) (i) Expand $\tan^{-1}x$ in powers of $x$ as far as the terms containing $x^5$. (8)

(ii) Evaluate $\lim_{x\to 0}\frac{(1+x)^{1/x}-e}{x}$. (8)

13. (a) (i) A rectangular box open at the top is to have volume of 32 cubic feet. Find the dimensions of the box requiring least material for its construction. (8)

(ii) If $u=x^y$ show that $\frac{\partial^3 u}{\partial x^2 \partial y}=\frac{\partial^3 u}{\partial x \partial y \partial x}$. (8)

Or

(b) (i) Verify the Euler's theorem for the function $u=\sin^{-1}\left(\frac{x}{y}\right)+\tan^{-1}\left(\frac{y}{x}\right)$. (8)

(ii) Examine for maximum and minimum values of $\sin x+\sin y+\sin(x+y)$. (8)

14\. (a) (i) Evaluate $\int \sin^{-1} x \frac{e^{\sin^{-1} x}}{\sqrt{1-x^2}} dx$. (8)

(ii) Determine the area between the cubic $y = x^3$ and the parabola $y = 4x^2$. (8)

Or

(b) (i) Find the volume of a sphere of radius '$a$'. (8)

(ii) Find the work done on a spring when you compress it from its natural length of 1 meter to a length of 0.75 meter if the spring constant is $k = 16$ $N/m$. (8)

15\. (a) (i) Change the order of integration in $I = \int_0^1 \int_{x^2}^{2-x} xy\, dy\, dx$. (8)

(ii) Find the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ by using double integration. (8)

Or

(b) (i) Evaluate $\iiint xyz dx dy dz$ over the positive octant of the sphere $x^2 + y^2 + z^2 = a^2$ by transforming into spherical polar coordinates. (8)

(ii) Compute the mass of a sphere of radius $b$ if the density varies inversely as the square of the distance from the centre. (8)

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

**Question Paper Code : 57497**

**B.E/B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016**

**First Semester**

**Marine Engineering**

**MA 6152 – MATHEMATICS FOR MARINE ENGINEERING – I**

**(Regulations 2013)**

**Time : Three Hours** **Maximum : 100 Marks**

**Answer ALL questions.**

**PART – A (10 × 2 = 20 Marks)**

1. Find the centre and radius of the sphere $x^2 + y^2 + z^2 - \frac{15}{7}x - \frac{25}{7}y - \frac{11}{7}z = 0$.

2. Find the equation of the cone whose vertex is at the origin and guiding curve is $\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{1} = 1, x + y + z = 1$.

3. State Taylor's theorem.

4. Evaluate $\lim_{x \to \infty} \frac{x^n}{e^x}$.

5. If $u = \sin^{-1} \frac{x + y}{\sqrt{x} + \sqrt{y}}$ find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$.

6. The base diameter and altitude of a right circular cone are measured as 4 cm and 6 cm respectively. The possible error in each measurement is 0.1 cm. Find approximately the maximum possible error in the value computed for the volume.

7. Calculate by double integration, the volume generated by the revolution of the cardiod $r = a(1 - \cos\theta)$ about it axis.

8. Evaluate $\int \frac{dx}{3x - 1}$.

9. Sketch the region of integration of the integral $\int_0^1 \int_{x^2}^{2-x} xy \, dx \, dy$.

10. State Steiner's theorem.

**PART – B (5 × 16 = 80 Marks)**

11. (a) (i) Show that the plane $2x - 2y + z + 12 = 0$ touches the sphere $x^2 + y^2 + z^2 - 2x - 4y + 2z = 3$ and find also the point of contact. **(8)**

(ii) Find the equation of the right circular cone whose vertex is the origin, whose axis is the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ and which has semi-vertical angle of 30°. **(8)**

**OR**

(b) (i) Find the equation of the right circular cylinder describe on the circle through the points (a, 0, 0), (0, a, 0), (0, 0, a) as guiding curve. **(8)**

(ii) Find the equation of the sphere which touches the plane $x - 2y - 2z = 7$ at the point (3, –1, –1) and passes through the point (1, 1, –3). **(8)**

12. (a) (i) Find the $n^{th}$ derivative of $\frac{1}{x^2 + a^2}$. **(6)**

(ii) Trace the curve $a^2y^2 = x^2 (2a - x)(x - a)$. **(10)**

**OR**

(b) (i) Find the Maclaurin's theorem with Lagrange's form of remainder for $f(x) = \cos x$. **(7)**

(ii) Find $\frac{dy}{dx}$ when (1) $y = \frac{1n\, x}{(1 + x^2)}$; (2) $y = a^x \log x$; (3) $y = \pi e^{3x} \sin 2x$. **(9)**

13. (a) (i) If $ax^2 + 2hxy + by^2 = 1$, show that $\frac{d^2y}{dx^2} = \frac{h^2 - ab}{(hx + by)^3}$. **(8)**

(ii) Discuss the maxima and minima of the function $f(x, y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$. **(8)**

**OR**

(b) (i) A rectangular box, open at the top, is to have a volume of 32 cc. Find the dimensions of the box, that requires the least material for its construction. **(10)**

(ii) If $z = f(x, y)$ where $x = r\cos\theta$ and $y = r\sin\theta$,prove that

$$\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = \left(\frac{\partial z}{\partial r}\right)^2 + \frac{1}{r^2}\left(\frac{\partial z}{\partial \theta}\right)^2.$$ **(6)**

14. (a) (i) Evaluate $\int x^2 e^{3x} dx$. **(6)**

(ii) Find the volume of the solid obtained by revolving the cissoid $y^2(2a - x) = x^3$ about it asymptote. **(10)**

**OR**

(b) (i) Find the limit, when $n \to \infty$, of the series

$$\frac{n}{n^2} + \frac{n}{n^2 + 1^2} + \frac{n}{n^2 + 2^2} + \dots\dots\dots + \frac{n}{n^2 + (n-1)^2}.$$ **(8)**

(ii) Find the area of the top of the curve $ay^2 = x^2(a - x)$. **(8)**

15. (a) (i) Evaluate $\int_0^1 \int_0^{\sqrt{(1-x^2)}} \int_0^{\sqrt{(1-x^2-y^2)}} xyz\, dx\, dy\, dz$ **(8)**

(ii) Find the volume of the portion of the sphere $x^2 + y^2 + z^2 = a^2$ lying inside the cylinder $x^2 + y^2 = ay$. **(8)**

**OR**

(b) (i) Using double integration, find the centre of gravity of a lamina in the shape of a quadrant of curve $\left(\frac{x}{a}\right)^{\frac{2}{3}} + \left(\frac{y}{b}\right)^{\frac{2}{3}} = 1$, the density being $\rho = kxy$, where k is constant. **(10)**

(ii) Compute the mass of a sphere of radius a if the density varies inversely as the square of the distance from the centre. **(6)**

---

**Reg. No. :** | | | | | | | | | | | | |

# Question Paper Code : 72063

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

First Semester

Marine Engineering

MA 6152 — MATHEMATICS FOR MARINE ENGINEERING – I

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the equation of the sphere which has (2, –1, 4) *and* (–2, 2, –2) as the extremities of a diameter.

2. Define right circular cone.

3. Differentiate $\tan(\log(\tan x))$ with respect to *x*.

4. State Taylor's theorem.

5. If $u = x^y y^x$, express *du* in terms of *dx and dy*.

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

7. Find the area of the cardiod $r = a(1 - \cos\theta)$.

8. State parallel axis theorem.

9. Change the order of integration in $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y} dydx$.

10. Write the formula for total mass of the lamina.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the equation of the sphere for which the circle $x^2 + y^2 + z^2 + 7y - 2z + 2 = 0,\ 2x + 3y + 4z = 8$ is a great circle. (8)

(ii) Find the equation of the right circular cone whose vertex is the origin and axis is the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ and which has semi-vertical angle 30°. (8)

Or

(b) (i) Find the equations of the spheres passing through the circle $x^2 + y^2 + z^2 - 6x - 2z + 5 = 0,\quad y = 0$ and touching the plane $3y + 4z + 5 = 0$. (8)

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

12. (a) (i) If $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \ldots}}}$, prove that $\frac{dy}{dx} = \frac{\cos x}{2y - 1}$. (8)

(ii) If $y = \sin^{-1} x$, prove that $(1 - x^2) y_{n+2} - (2n + 1) x y_{n+1} - n^2 y_n = 0$. (8)

Or

(b) (i) Expand $\log_e x$ in powers of $(x - 1)$ by using Taylor's series. (8)

(ii) Trace the curve $y^2(2a - x) = x^3$. (8)

13. (a) (i) If $u = x^2 \tan^{-1}\left(\frac{y}{x}\right) - y^2 \tan^{-1}\left(\frac{x}{y}\right)$, find $\frac{\partial u}{\partial y}$ and $\frac{\partial^2 u}{\partial x \partial y}$. (8)

(ii) A rectangular box open at the top is to have volume of 32 cubic feet. Find the dimensions of the box requiring least material for its construction. (8)

Or

(b) (i) If $u = \sin^{-1}\left[(x + 2y + 3z)/(x^8 + y^8 + z^8)\right]$, find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}$. (8)

(ii) In a triangle $ABC$, find the maximum value of $\cos A \cos B \cos C$. (8)

14. (a) (i) Evaluate $\int \frac{1}{\sqrt{x}\left(1+\sqrt{x}\right)^2}dx$ by substitution method. (8)

(ii) Find the area common to the parabola $y^2 = ax$ and $x^2 + y^2 = 4ax$. (8)

Or

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

(ii) A cup is made by rotating the area between $y = 2x^2$ and $y = x + 1$ with $x \geq 0$ around the $x$ axis. Find the volume of the material needed to make the cup. Units are cm. (8)

15. (a) (i) Change the order of integration in $\int_0^1 \int_y^{2-y} xy\,dx\,dy$. (8)

(ii) Using double integration, find the centre of gravity of a lamina in the positive quadrant of the curve $\left(\frac{x}{a}\right)^{2/3} + \left(\frac{y}{b}\right)^{2/3} = 1$, the density being $\rho = kxy$ where $k$ is a constant. (8)

Or

(b) (i) Using double integration, find the area bounded by the parabolas $y^2 = 4 - x$ and $y^2 = x$. (8)

(ii) Evaluate $\iiint \sqrt{1 - x^2 - y^2 - z^2}\,dx\,dy\,dz$ taken throughout the volume of the sphere $x^2 + y^2 + z^2 = 1$, by transforming into spherical polar coordinates. (8)

---

**Reg. No. :** | | | | | | | | | | | | |

# Question Paper Code : 77186

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

First Semester

Marine Engineering

MA 6152 — MATHEMATICS FOR MARINE ENGINEERING — I

(Regulation 2013)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the equation of the sphere whose center is $(2,-3,4)$ and radius is 5.

2. Define cone and what is vertex of a cone?

3. Evaluate $\underset{x\to 0}{Lt}\frac{\log x}{\cot x}$.

4. For a cardioid $r = a(1-\cos\theta)$, prove that $\phi = \theta/2$, where $\phi$ is the angle between the radius vector and the tangent at any point of the curve.

5. For a given function does limit exist at all its points? If it exists, is limit unique at any point?

6. Show that the function $f(x,y) = xy$, has a saddle point.

7. What is the value of the definite integral $\int_{-a}^{a}|x|\,dx$?

8. State the Guldinus theorem for surface areas.

9. Change the order of integration of $\int_{0}^{4a}\int_{x^2/4a}^{2\sqrt{ax}} dy\,dx$. [do not evaluate]

10. Sketch the region of integration for $I = \int_{0}^{1}\int_{x^2}^{2-x} xy\;dxdy$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the equation of the sphere which passes through the points $(1,-4,3)$, $(1,-5,2)$, $(1,-3,0)$ and whose center lies in the plane $x+y+z=0$. (8)

(ii) Show that the plane $2x-2y+z+12=0$ touches the sphere $x^2+y^2+z^2-2x-4y+2z-3=0$ and find its point of contact. (8)

Or

(b) (i) Find the center, radius and area of the circle in which the sphere $x^2+y^2+z^2+2x-2y-4z-19=0$ is cut by the plane $x+2y+2z+7=0$. (8)

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

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

(ii) Using Maclaurin's series, expand $\tan x$ upto the term containing $x^5$. (8)

Or

(b) (i) If $y^{1/m}+y^{-1/m}=2x$, prove that

$$\left(x^2-1\right)y_{n+2}+(2n+1)xy_{n+1}+\left(n^2-m^2\right)y_n=0.$$ (8)

(ii) Trace the curve $y=8a^3/\left(x^2+4a^2\right)$, given in its standard form. (8)

13. (a) (i) Show that $V(x,y,z)=\cos 3x\cos 4y\sinh 4z$ satisfies the Laplace's equation, $\frac{\partial^2 V}{\partial x^2}+\frac{\partial^2 V}{\partial y^2}+\frac{\partial^2 V}{\partial z^2}=0$. (8)

(ii) The altitude of a right circular cone is 15 cm and is increasing at 0.2 m/sec. The radius of the base is 10 cm and is decreasing at 0.3 cm/sec. How fast is the volume changing? (8)

Or

(b) (i) If $V=f(2x-3y,3y-4z,4z-2x)$, prove that $6V_x+4V_y+3V_z=0$. (8)

(ii) Find the dimensions of a rectangular box of maximum capacity whose surface area is given as 54 sq. units. Consider a closed box. (8)

14. (a) (i) Find the area of the segment cut off from the parabola $x^2 = 8y$ by the line $x - 2y + 8 = 0$. (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) A force of 1200 N compress a spring from its natural length of 18 cm to a length of 16 cm. How much work is done in compressing it from 16 cm to 14 cm? (8)

(ii) For the first quadrant area bounded by the curve $y = 1 - x^2$, find the moment of inertia with respect to $y$ axis and mass of the area. (8)

15. (a) (i) Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dxdy$ by changing to polar coordinates. (8)

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

Or

(b) Change the order of integration in $I = \int_0^1 \int_{x^2}^{2-x} xy\, dxdy$ and hence evaluate the same. (16)

**Reg. No. :**

# Question Paper Code : 80604

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016

First Semester

Marine Engineering

MA 6152 — MATHEMATICS FOR MARINE ENGINEERING – I

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Show that the plane $2x - 2y + z = 0$ touches the sphere $x + y^2 + z^2 + 2x + 2y - 7 = 0$.

2. Define right circular cylinder.

3. Find $\frac{dy}{dx}$ if $y = (\sin x)^{\log x}$.

4. Find the $n^{\text{th}}$ derivative of $\frac{1}{1-x^2}$.

5. If $u = x^4 + y^4 + x^2 y^2$, find $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$.

6. Using partial differentiation, find $\frac{dy}{dx}$ if $x^3 + y^3 = 3xy$.

7. Evaluate $\int \tan^{-1} x \; dx$.

8. Find the area bounded by the $x$-axis and the curve $y = \log x$, the lines $x = 1$ and $x = 2$.

9. Evaluate $\int_1^2 \int_0^x \frac{1}{x^2 + y^2} \, dy \, dx$.

10. Find the area of the circle $x^2 + y^2 = a^2$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the equation of the sphere passing through the points (1,–3, 4), (1,–5, 2), (1,–3, 0) and having its centre on the plane $x + y + z = 0$ .(8)

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

Or

(b) (i) Find the equation of the sphere passes through the circle $x^2 + y^2 + z^2 + 3x + y + 2z - 2 = 0$ and $x + 3y - 2z + 1 = 0$ and cuts orthogonally the sphere $x^2 + y^2 + z^2 + x - 3z - 2 = 0$. (8)

(ii) Find the equation of the cone whose vertex (1, 0, 2) and passing through the circle $x^2 + y^2 + z^2 = 4$, $x + y - z = 1$. (8)

12. (a) (i) Differentiating $n$ times the equation $x^2 y_2 + xy_1 + y = 0$ by Leibnitz's theorem and obtain the resulting equation. (8)

(ii) Trace the curve $y^2(2a - x) = x^3$. (8)

Or

(b) (i) Using Maclaurin's theorem, expand $\tan x$ in a series of ascending powers of $x$ as far as term containing $x^5$. (8)

(ii) Evaluate $\lim_{x \to 0} \frac{e^x + 2\sin x - e^{-x} - 4x}{x^5}$. (8)

13. (a) (i) If $u = \sin^{-1}\left(\frac{y}{x}\right)$, prove that $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$. (8)

(ii) Examine for maximum and minimum values of the function $y = (x - 2)^2 (x - 3)$. (8)

Or

(b) (i) If $u = \sin^{-1}\left(\frac{x^3 - y^3}{x + y}\right)$, show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2\tan u$. (8)

(ii) The radius of a sphere is found by measurement to be 18.5 inches with a possible error of 0.1 inch. Find the consequent error in the surface area and the volume as calculated from this measurement. (8)

14. (a) (i) Evaluate $\int x \sin^{-1} x \; dx$ and $\int \frac{e^{\tan^{-1} x}}{1+x^2} dx$. (8)

(ii) Find the area of an ellipse of semi axes $a$ and $b$ and deduce the area of a circle of radius $a$. (8)

Or

(b) (i) The area of the curve $x^{2/3} + y^{2/3} = a^{2/3}$ lying in the first quadrant revolves about the $x$-axis. Find the volume of the solid generated. (8)

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

15. (a) (i) Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} y^2 \, dx \; dy$ by changing the order of integration. (8)

(ii) Find the moment of inertia about $z$-axis of a homogeneous tetrahedron bounded by the planes $x = 0$, $y = 0$, $z = x + y$ and $z = 1$. (8)

Or

(b) (i) Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dx\,dy\,dz}{1-x^2-y^2-z^2}$ by changing to spherical polar coordinates. (8)

(ii) Find, by double integration, the centre of gravity of the area of the cardiod $r = a(1+\cos\theta)$. (8)