

INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)

June 2017 End Semester Examinations
B. SC (Nautical Science – First Semester)

Nautical Mathematics – UG21T 3102)
(AY 2016 - 17 batch onwards)

Date: 06.06.2017
Time: 3 Hrs

Maximum Marks : 70
Pass Marks : 35

Answer any 7 Questions.

All questions carry equal marks.

1.
 - a. In a spherical triangle ABC , side $a = 49^\circ 8'$ side $b = 58^\circ 23'$ and angle $C = 71^\circ 20'$. Calculate angle B
 - b. In spherical triangle RST side $t = 80^\circ 32'$ side $r = 60^\circ 40'$ and angle $T = 90^\circ$. Calculate angle S and side s .

(5+5 marks)
2.
 - a. In spherical triangle DEF , angle $D = 64^\circ 36'$, side $e = 90^\circ$ and angle $E = 76^\circ 47'$. Calculate side f and angle F .
 - b. In spherical triangle ABC , angle $A = 81^\circ 24.3'$ angle $B = 61^\circ 31.7'$ angle $C = 102^\circ 58'$. Calculate side C .

(5+5 marks)
3.
 - a. Find the n th derivative of $e^x(2x + 3)^3$
 - b. If $y = \sin^{-1} x$ prove that $(1 - x^2)y_{n+2} - (2n + 1)2y_{n+1} - n^2y_n = 0$

(4+6 marks)
4.
 - a. Verify Rolle's theorem for $f(x) = (x + 2)^3(x - 3)^4$ in $(-2, 3)$
 - b. Using Maclaurin's series expand $\sec x$ till 3 non zero terms.

(4+6 marks)
5.
 - a. If $\sin u = \frac{x+2y+3z}{\sqrt{x^8+y^8+z^8}}$, then show that
$$xu_x + yu_y + zu_z = -3 \tan u$$
 - b. Examine $f(x, y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$ for extreme values.

(5+5 marks)

6. a.

Evaluate $\int_0^1 \int_{e^x}^e \frac{dydx}{\log y}$ by changing the order of integration.

b.

$$\text{Prove that } \int_0^1 \frac{xdx}{\sqrt{1-x^5}} = \frac{1}{5} \beta \left(\frac{2}{5}, \frac{1}{2} \right)$$

(6+4 marks)

7. a. Calculate the volume of the solid bounded by the planes $x = 0, y = 0, z = 0, x + y + z = 1$

b.

$$\text{Prove that } \int_0^{\pi/2} \sqrt{\tan \theta} + \sqrt{\sec \theta} d\theta = \frac{1}{2} \Gamma\left(\frac{1}{4}\right) \left\{ \Gamma\left(\frac{3}{4}\right) + \frac{\sqrt{\pi}}{\Gamma\left(\frac{3}{4}\right)} \right\}$$

(6+4 marks)

8. a. Find the locus of Z given by $|3z - 1| = |Z - 3|$

b. Prove that $\frac{(\cos 5\theta - i \sin 5\theta)^2 (\cos 7\theta + i \sin 7\theta)^{-3}}{(\cos 4\theta - i \sin 4\theta)^9 (\cos \theta + i \sin \theta)^5} = 1$

(5+5 marks)

9. a. Find $\tan hx$, if $5 \sin hx - \cos hx = 5$.

b. Expand $\cos^8 \theta$ in a series of cosines of multiples of θ

(5+5 marks)
