

Indian Maritime University
(A Central University, Govt of India)

End Semester Examinations – December 2025

Programme Name: DNS

Semester: I

Subject Code: UD11T6102

Subject Name: MATHEMATICS

Date: 08.12.2025

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

General Instructions

- (i) All Sections (A, B & C) are to be attempted.
- (ii) Options, if any, are specified in respective section.
- (iii) Non-programmable calculators are permissible for use.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. The value of $\frac{\sin 7A - \sin 5A}{\cos 5A + \cos 7A} =$ _____
 - A. $\tan a$
 - B. $\tan 5A$
 - C. $\tan 7A$
 - D. $\cot A$
2. $\operatorname{Cosec} x - \cot x = 2$, then $\operatorname{Cosec} x$ is
 - A. $3/5$
 - B. $4/5$
 - C. 1
 - D. $5/4$
3. Which trigonometric concept is often used to solve right-angled and quadrantal spherical triangles?
 - A. Sine, cosine, and tangent
 - B. Haversine formula
 - C. Polar triangles
 - D. Napier's rules
4. For the oblique spherical triangle ABC, if $a = 80^\circ$, $c = 115^\circ$ and $A = 72^\circ$. Find angle C.

- A. 61°
B. 85°
C. 95°
D. 119°

5. The centre and radius of the circle $2x^2 + 2y^2 - x = 0$ are

- A. Centre $(\frac{1}{4}, 0)$, radius $\frac{1}{4}$
B. Centre $(4, 0)$, radius 4
C. Centre $(\frac{1}{2}, 0)$, radius $\frac{1}{2}$
D. Centre $(0, 2)$, radius 2

6. Total surface area of cone is = _____

7. The mode of the data set $\{1, 2, 2, 3, 4, 4, 4, 5, 5\}$ is

- A. 2
B. 3
C. 4
D. 5

8. Conditional probability $P(A/B)$ is defined as _____

9. Newton- Gregory Forward interpolation formula can be used _____

- A. only for equally spaced intervals
B. only for unequally spaced intervals
C. for both equally and unequally spaced intervals
D. for unequally intervals

10. If $\vec{a} = 3\hat{i} - 2\hat{j}$ and $\vec{b} = -\hat{i} + \hat{j}$, then the magnitude of $2\vec{a} - 3\vec{b}$ is,

- A. $\sqrt{130}$
B. $\sqrt{130}$
C. $\sqrt{130}$
D. $\sqrt{130}$

Section B.

Five Questions of 02 Marks each

11. Prove that $\sqrt{3} \operatorname{cosec} 20^\circ - \sec 20^\circ = 4$

12. In a spherical triangle ABC, $a = 39^\circ$, $b = 48^\circ$ and $C = 74^\circ$. Find c ?

13. Write the standard form of the equation of the ellipse with a vertex at $(-3, 4)$ and $(5, 4)$ and foci at $(-1, 4)$ and $(3, 4)$.

14. Calculate the Standard Deviation and coefficient of variation for the given data set: {2, 4, 4, 4, 5, 5, 7, 9}

15. Use Lagrange Interpolation formula to compute $f(2)$ for the data

$$f(0) = 1, f(1) = 3 \text{ and } f(3) = 55.$$

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. a) Prove that $(\operatorname{cosec} A - \cot A)^2 = \frac{1 - \cos A}{1 + \cos A}$ (05)

b) As observed from a fixed point on a bank of a river, the angle of elevation of a temple on the opposite bank has measure 30° . If the height of the temple is 20 m. Find the width of the river. (05)

17. a) In spherical triangle ABC, $a = 49^\circ 08'$, $b = 58^\circ 23.0'$, $C = 71^\circ 20'$.

Find side c, Angle B (05)

b) In spherical triangle PZX, Right-angled at Z, $p = 110^\circ 20'$ and $z = 84^\circ 12'$. Find the value of x and P (05)

18. a) Determine the equation of a circle if its centre is (8,-6) and it passes through the point (5,-2). (05)

b) Find the centre, the lengths of the axes, eccentricity and the foci of the ellipse, $\frac{(x-2)^2}{9} + \frac{(y+3)^2}{9/4} = 1$ (05)

19. a) Using Assumed mean method, calculate the mean for the following frequency distribution. (05)

Marks	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70
No. Of students	6	5	8	15	7	6	3

b) A business man goes to hotels X, Y, Z, 20%, 50%, 30% of the time respectively. It is known that 5%, 4%, 8% of the rooms in X, Y, Z hotels have faulty plumbing. What is the probability that business man's room having faulty plumbing is assigned to hotel Z? (05)

20. a) The sales for the last five years is given in the table below. Estimate the sales for the year 1979. (05)

Year	1974	1976	1978	1980	1982
Sales (in lakhs)	40	43	48	52	57

b) The curve is drawn to pass through the points which are given in the following table. (05)

x_i	1	1.1	1.2	1.3	1.4	1.5	1.6
f_i	1.543	1.669	1.811	1.971	2.151	2.352	2.577

Find the area bounded by the curve using

- (i) Simpson's $1/3^{\text{rd}}$ rule and
(ii) Simpson's $3/8^{\text{th}}$ rule.

21. In a spherical triangle XYZ, $X = 73^{\circ} 01'$, $y = 47^{\circ} 47'$, $x = 90^{\circ}$.

Calculate Y and Z.

(10)

22. a) Compute the mode of the given data set:

Class	Frequency
1000 - 3000	50
3000 - 5000	110
5000 - 7000	162
7000 - 9000	100
9000 - 11000	83
11000 - 13000	45
13000 - 15000	25
15000 - 17000	15
17000 - 19000	8
19000 - 21000	2

(05)

b) Three forces $2\hat{i} + 3\hat{j} + 4\hat{k}$, $4\hat{i} - 2\hat{j} + 6\hat{k}$, $-3\hat{i} - 5\hat{j} + 2\hat{k}$, when act on particle at a point (4, 2, 3) displaces it to the point (8, 5, 4).

Find the work done.

(05)

10) The angle of elevation is —

- a) The angle between the horizontal and the line of sight when looking downward**
- b) The angle between the horizontal and the line of sight when looking upward**
- c) The angle between two lines of sight**
- d) The angle between two horizontal line**

