Indian Maritime University

(A Central Unixversity, Govt of India)

Sep/Oct'25 SE

Programme Name: B Sc (NS)

Semester: I

Subject Code: UG21T6102

Subject Name: Mathematics

Date: 08.09.2025	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, are specified in respective section.
(iii) Use of scientific calculator is permitted.

Section A

Multiple choice questions/fill up the blanks [10x1=10]

1.cosec x- cot x = 2, then cosec x is

A.3/5 B.4/5 C.1 D.5/4

2. If tan A = 1/2 and tan B = 1/3, then the value of A + B is

A. π/6 B. π C. 0 D. π/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. What is Lune? Ans _____

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

A. Centre $\left(\frac{1}{4}, 0\right)$,radius $\frac{1}{4}$ B. Centre (4,0) ,radius 4

C. Centre $\left(\frac{1}{2}, 0\right)$,radius $\frac{1}{2}$ D. Centre (0,2) ,radius 2

6) Two die are thrown simultaneously. What is the probability of obtaining sum of the numbers less than 11?

a) $\frac{17}{18}$ b) $\frac{11}{12}$ c) $\frac{1}{12}$ d) none of these

7) $\Delta(\log x) =$

a) $\log\left(\frac{x+h}{x}\right)$ b) $\log\left(\frac{x}{x+h}\right)$ c) $\log(x+h)$ d) $\log x$

8) Simpson's $\frac{1}{3}^{rd}$ rule is applicable when number of equal subintervals(n) is

a) odd numbers b) even numbers

c) even or odd d) none of these

9) If $\vec{a} = \hat{\imath} + 2\hat{\jmath} - 3\,\hat{k}$, $\vec{b} = 3\hat{\imath} - \hat{\jmath} + 2\,\hat{k}$ then the angle between the vectors $\vec{a}+\vec{b}$ & $\vec{a}-\vec{b}$ is

a) $30°$ b) $45°$ c) $60°$ d) $90°$

10) Write a Lagrange's interpolation formula.

Section B

Short Questions: [5x2=10]

11. Prove that $\sqrt{3}$ cosec 20^0 – sec 20^0 = 4

12. In a spherical triangle ABC, a = 39^0, b = $48^0$and C = 74^0. Find c?

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

14. If $P(E) = 0.4$, $P(F) = 0.35$ & $P(E \cup F) = 0.55$ find P(E/F)

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

f(0) = 1, f(1) = 3 and f(3) = 55.

Section C

Answer the following (Any five out of seven)

16a) Prove that $\frac{\sec 8A-1}{\sec 4A-1}=\frac{\tan 8A}{\tan 2A}$ **(5 Marks)**

b) A vertical pole and a vertical tower are on the same level ground. From the top of the pole the angle of elevation of the top of the tower is $60°$ and the angle of depression of the foot of the tower is $30°$ .Find the height of the tower if the height of the pole is 20 m **(5 Marks)**

17. a) In spherical triangle ABC, a = 49^0 08′, b = 58^0 23.0′, C = 71^0 20'.

Find c, B . **(5 Marks)**

b) In spherical triangle PZX, right angled at Z, p = 110^0 20′ and z = 84^0 12′. Find the value of x and P. **(5 Marks)**

18 a) Find the equation of the ellipse in standard form if, the length of major axis is 10 & the distance between foci is 8. **(5 Marks)**

b) A copper rod of diameter 1cm & length 8cm is drawn into a wire of length 18 m of uniform thickness. Find the thickness of the wire. **(5 Marks)**

19. a) Using assumed mean method, calculate the mean for the following frequency distribution. (5 Marks)

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? **(5 Marks)**

20. a) Using an appropriate formula for interpolation estimate the number of students who obtained less than 45 marks from the following data: **(5 Marks)**

Marks:	30-40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

b) Evaluate $\int_1^2 \frac{1}{x}\,dx$, using Simpson's 1/3rd ruletaking h= 0.25 **(5 Marks)**

21. a) In a spherical triangle XYZ, X = $73^0 01'$, y = $47^0 47'$, x = 90^0.

Calculate Y and Z. **(5 Marks)**

b) The diameter of a metallic sphere is 6 cm. It is melted and drawn into a wire having diameter of the cross-section as 0.2 cm. Find the length of the wire **(5 Marks)**

22. a) Compute the mode of the given data set: **(5 Marks)**

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

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. **(5 Marks)**