NS

Indian Maritime University

(A Central University1, Govt of India9)

End Semester Examinations – December 2024

Programme Name: B Sc (NS)

Semester: I

Subject Code: UG21T6102

Subject Name: Mathematics

Date: 12.12.2024	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 $\vec{a} = \hat{\imath} + 2\hat{\jmath} - 3\,\hat{k}$, $\vec{b} = 3\hat{\imath} - \hat{\jmath} + 2\,\hat{k}$ then the angle between the vectors $\vec{a} + \vec{b}$ & $\vec{a} - \vec{b}$ is

a) $30°$ b) $45°$ c) $60°$ d) $90°$

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. If a circle whose centre is (1, -3) touches the line 3x-4y=5 then the radius of the circle is

a) 2 b) 4 c) $\frac{5}{2}$ d) $\frac{7}{2}$

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6. The surface area of two spheres are in the ratio 1:2. The ratio of their volume is

a) $\sqrt{2}:1$ b) $1:2\sqrt{2}$ c) $1:8$ d) $1:4$

7. The mode of the data set {1,2,2,3,4,4,4,5,5} is =_____(Fill up the blank)

8. Two dies 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

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. $\Delta(\log x) =$

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

Section B

Short Questions: [5x2=10]

11. In a spherical triangle LMN, M=33°14′, m=80°5′, n=70°12′. Calculate N using sine formula.

12. Find the coordinates of focus & equation of directrix of the parabola $5y^2 = 24x$.

13. Write the standard form of the equation of the ellipse with vertices 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 and f(3) = 55.

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Section C

Answer the following (Any five out of seven)

16. a) Prove that $\frac{\sec 8A-1}{\sec 4A-1}=\frac{\tan 8A}{\tan 2A}$ (05)

b) A statue, 1.6 m tall, stands on the top of a pedestal. From a point on the ground, the angle of elevation of the top of the statue is 60° and from the same point the angle of elevation of the top of the pedestal is 45°. Find the height of the pedestal. (05)

17. a) In a spherical triangle RST, $t = 80°32,\ r = 60°\ 40',\ T = 90°$.

Calculate angle S & angle R. (05)

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. (05)

18. a) Determine the equation of a circle if its center is (8,-6) and it passes through the point (5,-2). (04)

b) Find the centre , the lengths of the axes, eccentricity and the foci of the ellipse $\frac{(x-2)^2}{9}+\frac{(y+3)^2}{9/4}=1$ (06)

19. a) Find the mean & standard deviation of the following given data: (07)

Groups	Frequency
0-10	14
10-20	13
20-30	27
30-40	21
40-50	15

b) If $P(E) = 0.4,\ P(F) = 0.35$ & $P(E \cup F) = 0.55$ find P(E/F). (03)

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20. a) Using an appropriate formula for interpolation estimate the number of students who obtained less than 45 marks from the following data: (05)

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 (05)

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

Calculate Y and Z. (05)

b) A rescue team is trying to locate a lost ship, which could be in either Area A or Area B. From past data, the probability that a lost ship is in Area A is 60%, and the probability that it is in Area B is 40%. A surveillance plane is sent to look for the ship, and it has a 75% chance of detecting a ship if it is in Area A, and a 50% chance of detecting it if it is in Area B. If the plane detects a ship, what is the probability that the ship is in Area A? (05)

22. a) Compute the mode of the given data set: (05)

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. (05)