

Indian Maritime University
(A Central University, Govt of India)
End Semester Examinations – December 2024
Programme Name: DNS
Semester: I
Subject Code: UD11T6102
Subject Name: Mathematics

Date: 09.12.2024

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

General Instructions

- (i) All Sections (A, B & C) are to be attempted.
- (ii) Options, 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. For an angle of $(90^\circ - \phi)$, which trigonometric ratio is equivalent to the cotangent of ϕ ?

- A) Tangent (tan)
- B) Sine (sin)
- C) Cosecant (csC)
- D) Cosine (cos)

2. In the graph of the sine function, what is the maximum value it can attain?

- A) 0
- B) 1
- C) -1
- D) 2π

3. Which of the following is a characteristic of a great circle on a sphere?

- A) It is smaller than all other circles on the sphere.
- B) It has its center at the center of the sphere.
- C) It is always parallel to the equator.
- D) It is a type of small circle.

4. What characterizes a quadrantal spherical triangle?

- A) It has four sides.
- B) It has a side measuring 90 degrees.
- C) It is smaller than other spherical triangles.
- D) It has an angle measuring 90 degrees.

5. If the eccentricity of a conic section is $8/11$, then the conic will be

- A) Circle
- B) parabola
- C) ellipse
- D) hyperbola

6. The area of sector which subtends an angle of 60° at center of circle whose radius is 18 cm is

- A) 148 cm^2
- B) 214 cm^2
- C) 169.71 cm^2
- D) 175.05 cm^2

7. In a data set the value of the observation that occurs most frequently is called

- A) Mean
- B) Median
- C) Mode
- D) Deviation

8. The probability of an event that is certain to happen is:

- A) 0
- B) 0.5
- C) 1
- D) -1

9. For Interpolation with unequal intervals, which of the following methods is used?

- A) Newton's forward interpolation
- B) Newton's backward interpolation
- C) Lagrange's interpolation formula
- D) Simpson's formula

10. The scalar product of the vectors $5\hat{i} + 3\hat{j} - 3\hat{k}$ and $3\hat{i} - 4\hat{j} + 7\hat{k}$ is ____

- a) 15
- b) -15
- c) 10
- d) -18

Section B

Five Questions of 02 Marks each

11. Express $30^{\circ}15'30''$ into radians.
12. In a spherical triangle AVM, if sides $v=92^{\circ}$, $m=51^{\circ}55'$ and angle $V=91^{\circ}$. Using sine rule calculate the acute angle M.
13. Find the curved surface area of a cone with height 12cm and base Radius 3.5cm.
14. Find the mean and mode for the following data : 25 , 37 , 31 , 32 , 32 , 29 , 30 , 32 , 29 , 34 .
15. Given Data: Draft 4m: Displacement 8000 tons and Draft 6m: Displacement 12000 tons. Find the value of displacement for 5m draft using linear interpolation.

Section C

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

16. a) In spherical triangle ABC, $a = 49^{\circ} 08'$, $b = 58^{\circ} 23.0'$, $C = 71^{\circ} 20'$. Find A.
b) In spherical triangle PQR, $PQ = 52^{\circ} 11'$, $Q = 69^{\circ} 47'$ and $QR = 90^{\circ}$. Calculate P, and R. **(5+5 Marks)**

17. a) A solid toy is in the form a hemi sphere surmounted by a right circular cone. The height of cone is 2 centimeter and the diameter of the base of the cone is 4 centimeter. Determine the volume of the toy. If a right circular cylinder circumscribes the toy. Find the difference of the volume of the toy and cylinder (Take $\pi = 3.14$)

b) A toy is in the form of a cone mounted on a hemisphere of diameter 7 cm. The total height of toy is 15.5 cm. Find the total surface area and volume of the toy. Take $\pi = 22/7$. **(5+5 Marks)**

18. a) A vertical tower stands on ground and is surmounted by a vertical flagpole of height 18 m. At a point on the ground, the angle of elevation of the bottom and the top of the flagpole are 30° and 60° respectively. What is the height of the tower?

b) As the angle of elevation of the sun increases from 30° to 60° , the length of the shadow of a building gets reduced by 10 m. Find the height of the building. **(5+5 Marks)**

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

Class	1000 -	3000	5000	7000	9000 -	11000
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	3000	–	–	–	11000	–
		5000	7000	9000		13000
Frequency	50	110	162	100	83	45

b) Calculate the standard deviation of the following data set: 240.12 , 240.13 , 240.15 , 240.12 , 240.17 , 240.15 , 240.17 , 240.16 , 240.22 , 240.21

(5+5 Marks)

20. a) For the following table of values, estimate $f(7.5)$

x	1	2	3	4	5	6	7	8
y= f(x)	1	8	27	64	125	216	343	512

b) Given that :

x	4.0	4.2	4.4	4.6	4.8	5.0	5.2
logx	1.3863	1.4351	1.4816	1.5261	1.5686	1.6094	1.6487

Evaluate $\int_4^{5.2} \log x \, dx$ by Simpson's 3/8 th Rule.

(5+5 Marks)

21. a) Show that : $\cos^4 A - \sin^4 A + 1 = 2 \cos^2 A$

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

(5+5 Marks)

22. a) Two sets of candidates are competing for the positions on the board of directors of a company. The probabilities that the first and second sets will win are 0.6 and 0.4 respectively. If the first set wins, the probability of introducing a new product is 0.8 and corresponding probability if the second set wins is 0.3. What is the probability that the product will be introduced?

b) Find the values of 'a' for which the vectors $(3\hat{i} + 2\hat{j} + 9\hat{k})$ and

$(\hat{i} + a\hat{j} + 3\hat{k})$ are i) Perpendicular ii) Parallel.

(5+5 Marks)