

Indian Maritime University
(A Central University, Govt of India)
End Semester Examinations – June 2026
Programme Name: DNS
Semester: 1
Subject Code: UD11T6102
Subject Name: Mathematics

Date: 02.06.2026

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 Scientific 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 trigonometry ratio is equivalent to the Cotangent of ϕ ?
(A) Tangent(tan) (B) Sine(sin)
(C) Cosine (Cos) (D) Cosecant (Cosec)
2. The angle of depression of a car parked on the road from the top of a 150 m high tower is 30° . The distance of the car from the tower in meters is?
(A) 150 (B) $150/\sqrt{3}$
(C) $150\sqrt{3}$ (D) $50/\sqrt{3}$
3. In a right-angled spherical triangle LMN, if angle N = 95° then the side n cannot be
(A) Less than 90° (B) More than 90°
(C) More than 100° (D) Equal to 95°
4. Side of the spherical triangle is
(A) Less than 180° (B) Greater than 180°
(C) Equal to 180° (D) Greater than or equal to 180°
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 the cone is
 (A) $\pi r l$ (B) $\pi r(l + r)$ (C) πr^2 (D) $\pi r l^2$
7. In a data set the value of the observation that occurs most frequently is
 (A) Mean (B) Median (C) Mode (D) standard deviation
8. What is the probability of picking a face card from a pack of cards?
 (A) $3/13$ (B) $4/52$ (C) $1/12$ (D) $1/13$
9. Newton's Backward formula can be used for
 (A) Unequal intervals (B) Equal and Unequal intervals
 (C) Equal intervals (D) none of these
10. For using trapezoidal rule to evaluate any integration, the interval should be
 (A) Odd (B) multiples of three
 (C) Even (D) Any

Section B

Five Questions of 02 Marks each

11. Prove that $\sqrt{\frac{1+\sin \theta}{1-\sin \theta}} = \sec \theta + \tan \theta$.
12. In a spherical triangle XYZ, $x = 64^\circ$, $y = 33^\circ$ and $z = 37^\circ$. Find Z.
13. Find the median of the data : 25, 37, 31, 32, 32, 29, 30, 32, 29, 34.
14. Find the equation of the tangent to the circle $x^2 + y^2 + 10x + 2y + 13 = 0$ at the point $(-3, 2)$.
15. Find the unit vector in the direction of the vector $2\vec{i} + 3\vec{j} - 2\vec{k}$.

Section C

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

16. (a) Prove that $\cos^4 A - \sin^4 A + 1 = 2 \cos^2 A$. (5M)

(b) The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of a tower from the foot of the building is 60° . If the tower is 50m high, find the height of the building. (5M)

17. (a) Solve the spherical triangle LMN, $N = 90^\circ$, $\ell = 109^\circ 16'$ and $M = 38^\circ 45'$. (5M)

(b) In a spherical triangle AVM, $v = 92^\circ$, $m = 51^\circ 55'$, and angle $V = 91^\circ$. Using sine rule, find angle M. (5M)

18. (a) Find the equation of the parabola with vertex (4,1) and focus (4,-3). (5M)

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

19. (a) Find the Mean and median of the following data: (5M)

Income in 1000	0-8	8-16	16-24	24-32	32-40	40-48
No of persons	8	7	16	24	15	7

(b) A business man goes to hotel 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? (5M)

20 (a) The velocity of a particle at distance s from a point on its path is given by the table below. Estimate the time taken to travel 60 metres by using Simpson's $1/3^{\text{rd}}$ rule. (5M)

Distance S	0	10	20	30	40	50	60
Velocity v	47	58	64	65	61	52	38

(b) The table gives the distances in nautical miles of the visible horizon for the given heights in feet above the earth's surface: Find the value of y when $x=218$. (5M)

X (height)	100	150	200	250	300	350	400
Y (distance)	10.63	13.03	15.04	16.81	18.42	19.90	21.27

21. (a) Three forces $2\vec{i} + 3\vec{j} + 4\vec{k}$, $4\vec{i} - 2\vec{j} + 6\vec{k}$ and $-3\vec{i} - 5\vec{j} + 2\vec{k}$, when act on a particle at a point (4, 2, 3) displaces it to the point (8, 5, 4). Find the work done. (5M)
- (b) In a spherical triangle ABC, $a = 90^\circ$, $b = 78^\circ 14'$ and $c = 49^\circ 08'$. Find angle A and B. (5M)

22. (a) Compute the variance, standard deviation and coefficient of variation for given data. (5M)

Data x	10	15	20	25	30
Frequency f	15	10	15	6	4

- (b) By dividing into six equal parts, evaluate $\int_0^6 \frac{1}{1+x} dx$ by using Simpson's 3/8 th rule. (5M)
