Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – December 2023

Programme Name: DNS

Semester: I

Subject Code: UD11T5101

Subject Name: Applied Mathematics

Date: 15.12.2023	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) Use of non-programmable scientific calculator is allowed.

Section A

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

1. The side of a spherical triangle is
a. Less than 180^0 b. Greater than 180^0
b. Equal to 180^0 d. Greater than or equal to 180^0

2. Measure of the side of a spherical triangle is the
   a. measure of angle subtended by it at the centre of the sphere.
   b. measure of angle subtended by it at the surface of the sphere.
   c. measure of angle subtended by it at its poles.
   d. measure of angle subtended by it at the opposite vertex of the spherical triangle.

3. For the Parabola $y^2 = 18x$ the length of latus rectum is
a. 8 b. 4
c.18 d. -18

4. The area of circle, centred at (1,2) and passing through (4,6) is
a.5∏ b. 10∏
c.25∏ d. 35∏

5. If the height of the circular cylinder is 20 cm and the radius of its base is 7 cm. the volume of cylinder is

a.8880 cm^3 b. 8030 cm^3

c.3080 cm^3 d. 8080 cm^3

6. A cube A has side thrice as long as that of cube B. Then the ratio of the volume of cube A to that of cube B is,

a. 1:3 b. 27:1 c. 1:27 d. 3:1

7. If y varies directly as x and y =10 when x=7,then the constant of proportionality is,

a. 7/5 b. 1/10 c. 7/10 d. 10/7

8. Newton's forward interpolation formula can be used for,

a. equal intervals b. unequal intervals

c. Both equal and unequal intervals d. None of these

9. From a distance of 150 feet from the foot of the vertical flagstaff the angle of elevation to the top is found to be 30^0, the height of the flagstaff in feet is

a.259.81 b. 86.60 c.75 d. 300

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

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

Section B

5 Short answer questions (02 Mark Each)

11) Find the component of force $\bar{f} = 4\hat{\imath} + \hat{\jmath} - 3\hat{k}$ along the vector $2\hat{\imath} - \hat{\jmath} - 2\hat{k}$.

12) In a spherical triangle PQR, $side\ p = 73°5'$, $side\ q = 90°$ and $side\ r = 79°12'$

Calculate angle P.

13) The height and the slant height of a cone are 21 cm and 28 cm respectively. Find the volume of the cone.

14) A machine in a soft drink factory fills 840 bottles in six hours. How many bottles will it fill in five hours?

15) State the Supplemental Theorem of polar triangle.

Part C (Answer any Five out of Seven)
Each Question is for 10 Marks (Each subquestion carry 5 maarks)

16. a) In spherical triangle WXY, W = $88^0 24.5'$, x=$98^0 10'$, y=$100^0 09'$. Find w and X.

b) In spherical triangle PQR, PQ=$52^0 11'$, Q=$69^0 47'$ and QR=90^0. Calculate PR.

17. a) Find the equation of the standard ellipse whose length of latus rectum =5 and eccentricity = 2/3.

b) Find the equation of the circle which passes through the points (3,7), (5,5) and has its centre on the line $x - 4y = 1$.

18. a) A particle is acted on by constant force F_1=3i+2j+5k, F_2 = 2i+j+3k and F_3= i+2j-3k and displaced from a point whose position vector is 2i-j-3k to a point whose position vector is 4i-3j+7k. Calculate the work done.

b) Find the vector whose length is 3 and which is perpendicular to the vector $\bar{a} = 3\hat{\imath} + \hat{\jmath} - 4\hat{k}$ and $\bar{b} = 6\hat{\imath} + 5\hat{\jmath} - 2\hat{k}$.

19. a) A copper rod of diameter 1 cm and length 8 cm is drawn into a wire of length 18 m of uniform thickness. Find the thickness of the wire.

b) Find the area bounded by the curve, from the following table, and The x-axis from x=7.47 to x=7.53.

x	7.47	7.48	7.49	7.50	7.51	7.52	7.53
f(x)	1.93	1.95	1.98	2.01	2.02	2.06	2.07

20 a) Prove that, $\frac{\cos A}{1-\tan A} + \frac{\sin A}{1-\cot A} = \sin A + \cos A$

b) From a point on the roof of a house ,11 meters high it is observed that the angles of depression of the top and foot of a lamp post are $30°$ and $60°$ respectively. What is the height of the lamp post?

21. a) Evaluate $\int_{-3}^{3} x^4\, dx$ using Simpson's 3/8th rule.

b) From the given data estimate f(3) by using Lagrange's interpolation formula: $f(0) = 2$, $f(1) = 3$, $f(2) = 12$, $f(5) = 147$

22. a) The volume of sphere varies directly as the cube of its radius.

The volume of the sphere is 36 cm^3 when the radius is 3 cm.

Find the volume of the sphere when the radius is 5 cm.

b) In spherical triangle PVM, side $v = 92°$,side $m = 51°55'$ and angle $V = 90°$. Find side p and angle P.