

INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

December 2017 End Semester Examinations

Diploma in Nautical Science - First Semester - (August 2015 batch onwards)

Applied Mathematics (UD11T 3101)

Date: 04 Dec 2017

Maximum Marks : 70

Time: 2 Hrs

Pass Marks : 35

General Instructions:

- Question No 1 and 2 are compulsory
 - Answer any 5 out of the remaining 8 questions
 - All questions carry equal marks (10 Marks)
 - Use of approved type Scientific Calculator is permitted
 - Exam centres to provide **GRAPH SHEETS** to candidates(if required)
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1 (a) In spherical triangle PZX, Angle Z=89°, Side p= 110° 20' and Side z=84°12'. Find the value of angle P?

(b) In spherical triangle WXY, Angle W= 88°24.5', Side x=98°10' and Side y=100°09'. Find Side w?

(5+5 marks)

2 (a) In spherical triangle PQR, Side r= 52°11', Angle Q = 69°47' and Side p=90°. Find the values of P and R?

(b) In spherical triangle DEF, Angle D= 85°30', Angle E=100°29.6' and Side f =49°34'. Find the values Angle F?

(5+5 marks)

3 (a) Given $\vec{A} = 2\hat{i} + 2\hat{j} - \hat{k}$, $\vec{B} = 6\hat{i} - 3\hat{j} + 2\hat{k}$ find $\vec{A} \times \vec{B}$ and $\vec{A} \cdot \vec{B}$. Also find unit vector perpendiculars to both \vec{A} and \vec{B} . Determine the cos of the angle between \vec{A} and \vec{B} .

(b) A particle is acted on by constant forces $\mathbf{F}_1 = 3i + 2j + 5k$, $\mathbf{F}_2 = 2i + j + 3k$ and $\mathbf{F}_3 = i + 2j - 3k$ and is 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.

(5+5 marks)

4 (a) Solve the following linear programming problem graphically

$$\text{Min } Z = 25x + 20y$$

Subject to constraints

$$2x + y \geq 12$$

$$2x + 3y \geq 24$$

$$x, y \geq 0$$

(b) Solve the following linear programming problem by Simplex method

$$\text{Max } Z = 3x + 2y$$

Subject to constraints

$$x + 2y \leq 10$$

$$3x + y \leq 15$$

$$x, y \geq 0$$

(5+5 marks)

5 (a) Find the equation of a circle which passes through the points (2, - 2) and (3, 4) and has centre on the line $2x + 2y = 7$. Find its centre and radius

(b) Find the equation of a parabola whose focus is at the point (3, 2) and whose directrix is $2x - 3y + 1 = 0$.

(5+5 marks)

6 (a) 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 $\pi = 22/7$)

(b) A wheel of a cart makes 4 revolutions per second. If the diameter of the wheel is 84 cm, find its speed (Take $\pi = 22/7$)

(5+5 marks)

7 (a) Evaluate: $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's $\frac{3}{8}$ th rule taking $n=6$

(b) A curve is drawn to pass through the points which are given in following table

X	0	1	2	3	4	5	6
Y	0	2	2.5	2.3	2	1.7	1.5

Find the volume of revolution of the area about OX using Simpsons

$\frac{1}{3}rd$ rule

(5+5 marks)

8 (a) The angle of elevation of a jet plane from a point on the ground is 60° . After a flight of 30 seconds, the angle of elevation changes to 30° . If the jet is flying at a constant height of $3600\sqrt{3}$ metres, find the speed of the jet plane

(b) Prove that $\frac{\cos A}{1 - \tan A} + \frac{\sin A}{1 - \cot A} = \sin A + \cos A$ **(5+5 marks)**

9 (a) The resistance of a conducting wire varies directly as its length and inversely as its cross sectional area. A wire 100m long and 1 mm^2 cross sectional area has a resistance of 2Ω . What should be the resistance of a wire similar material 220m long and 1.5 mm^2 cross sectional area

(b) The volume of sphere varies directly as the cube of its radius. The volume of the sphere is 36π cc, when the radius is 3 cm. Find the volume of the sphere when the radius is 5 cm **(5+5 marks)**

10 (a) Estimate the value of $f(45)$ from the following data

x	40	50	60	70	80
$Y = f(x)$	31	73	124	159	190

(b) If $f(0)=1$, $f(1)=2$, $f(2)=1$, $f(3)=10$, using Lagrange's interpolation formula, find the cubic polynomial and hence find the value of $f(4)$.

(5+5 marks)
