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INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)

December 2016 End Semester Examinations
Diploma in Nautical Science - First Semester (2015 batch onwards)

Applied Mathematics (UD11T3101)

Date : 14.12.2016

Maximum Marks: 70

Time: 2 Hrs

Pass Marks : 35

NOTE: Question No.1 &2 are compulsory. Answer any 5 out of remaining 8 questions.

All Questions carry equal marks. (7 x 10 = 70 marks)

Use of approved type Scientific Calculator is permitted.

Exam centers to supply graph sheets to candidates if required

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1. a) In spherical triangle WXY, $W = 88^{\circ}24.5'$, $x = 98^{\circ}10'$, $y = 100^{\circ}09'$. Find w .
b) In spherical triangle RST, $t = 80^{\circ}32'$, $r = 60^{\circ}40'$ and $T = 90^{\circ}$. Calculate R . (5+5)
2. a) In spherical triangle CDE, $c = 87^{\circ}10'$, $d = 62^{\circ}37'$, $e = 100^{\circ}10'$. Calculate C .
b) In spherical triangle PQR, $r = 52^{\circ}11'$, $Q = 69^{\circ}47'$ and $p = 90^{\circ}$. Calculate q . (5+5)
3. a) If $\vec{a} = 5\mathbf{i} - \mathbf{j} - 3\mathbf{k}$ and $\vec{b} = \mathbf{i} + 3\mathbf{j} - 5\mathbf{k}$ then show that the vectors $\vec{a} + \vec{b}$ & $\vec{a} - \vec{b}$ are perpendicular.
b) Find the torque about the point $2\mathbf{i} + \mathbf{j} - \mathbf{k}$ of a force represented by $4\mathbf{i} + \mathbf{k}$ acting through the point $\mathbf{i} - \mathbf{j} + 2\mathbf{k}$. (5+5)
4. a) Solve the given linear programming problem graphically,
Maximize profit $Z = 7X + 5Y$
Subject to,
 $2X + Y \leq 100$, $4X + 3Y \leq 240$, $X, Y \geq 0$
b) +Solve the given Linear programming problem by Simplex method,
Maximize profit $Z = 2X + 6Y$
Subject to: $X + Y \leq 6$, $4X + 3Y \leq 12$, $X, Y \geq 0$ (5+5)
5. a) Two boats are observed by a parasailer 75m above a lake. The angles of depression are 12.5° and 7° . How far apart are the boats?
b) Prove that $\sqrt{\frac{1-\cos A}{1+\cos A}} = \operatorname{cosec} A - \cot A$ (5+5)

6. a) Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ using Simpson's 1/3 rd Rule taking $h = \frac{1}{4}$

b) The velocity v (km/min) of a moped which starts from rest, is given at fixed intervals of time t (min) as follows:

t	0	2	4	6	8	10	12	14	16	18	20
v	0	10	18	25	29	32	20	11	5	2	0

Estimate approximately the distance covered in 20 minutes. (5+5)

7. a) Find the equations of the tangent and normal to the circle $x^2 + y^2 - 2x - 10y + 1 = 0$ at the point $(-3, 2)$

b) A cable of a suspension bridge is a parabola. The roadway is 5m below the lowest point of cable. The span of the bridge is 50m and the top of the piers are 15m above the roadway. Find the semi-latus rectum of the parabola. If the load is supported by vertical chains at interval of 5m, find the length of the chain which is 5m away from either of the piers.

(5+5)

8. a) The length of the minute hand of a clock is 14cm. Find the area swept by the minute hand in 5 minutes. Take $\pi = 3.14$.

b) A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14mm and the diameter of the capsule is 5mm.

Find its surface area. Take $\pi = 3.14$ (5+5)

9. a) The intensity of light produced by a light source varies inversely as the square of the distance from the source. If the intensity of light produced 3 feet from a light source is 750 units, find the intensity of light produced 5 feet from the same source.

b) Variable M varies directly as variable t and inversely as variable s . If $M = 24$ when $t = 3$ and $s = 2$, find M when $t = 5$ and $s = 8$. (5+5)

10. a) Evaluate $f(15)$, given the following table of values: (5+5)

X	10	20	30	40	50
Y = f(x)	46	66	81	93	101

b) Using Lagrange's interpolation formula, find $y(2)$ for the following data:
 $y(1) = -3, y(3) = 9, y(4) = 30, y(6) = 132$
