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

June 2017 End Semester Examinations  
Diploma in Nautical Science – First Semester

**Applied Mathematics (UD11T 3101) - (August 2015 batch onwards)**

Date: 15.06.2017	Maximum Marks : 70
Time: 2 Hrs	Pass Marks : 35

(**Note:** Question No. 1 & 2 are Compulsory.  
Answer any 5 out of remaining 8 questions.)

1. a) In spherical triangle  $DEF$ ,  $d = 57^\circ 9'$ ,  $e = 83^\circ 12'$  and  $f = 71^\circ 08'$ . Calculate angle  $F$ .
- b) In spherical triangle  $PAV$  angle  $A = 31^\circ 48'$ , angle  $V = 90^\circ$  and side  $v = 66^\circ$ . Calculate side  $a$  and angle  $P$ .  
(5+5 marks)
2. a) In a spherical triangle  $ABC$ , sides  $a = 69^\circ 9'$ , and  $c = 90^\circ$  and angle  $C = 117^\circ 11'$ . Calculate angles  $A$  &  $B$ .
- b) In spherical triangle  $ABC$ , angles  $A = 81^\circ 24.3'$ , angle  $B = 61^\circ 31.7'$  and angle  $C = 102^\circ 58'$ . Calculate side  $a$ .  
(5+5 marks)
3. a) Find an unit vector normal to the plane of  $\vec{A} = 3\hat{i} - 2\hat{j} + 4\hat{k}$  and  $\vec{B} = \hat{i} + \hat{j} - 2\hat{k}$ .
- b) Given  $\vec{A} = 2\hat{i} + 2\hat{j} - \hat{k}$ ;  $\vec{B} = 6\hat{i} - 3\hat{j} + 2\hat{k}$  find cosine of the angle between  $\vec{A}$  and  $\vec{B}$ .  
(5+5 marks)
4. a) Solve the following linear programming problem graphically.  
Maximize  $Z = 3x + 4y$  subject to  

$$4x + 2y \leq 80$$

$$2x + 5y \leq 180$$

$$x, y \geq 0$$

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b) Solve the following linear programming problem graphically

Maximize  $Z = 3x + 5y$  subject to

$$x + 2y \leq 200$$

$$x + y \leq 150$$

$$x \leq 60$$

$$x, y \geq 0$$

(5+5 marks)

5. a) Find the equation of the circle touching both the co-ordinate axis and passing through  $(-8, -4)$ .

b) The girder of a railway bridge is a parabola with its vertex at the highest point 10 meters above the ends. If the span is 100 meters find the height of the bridge at 10 meters from the midpoint.

(5+5 marks)

6. a) The diameter of a metallic sphere is 6 cm. The sphere is melted and drawn into a wire of uniform circular cross-section. If the length of the wire is 36m find its radius.

b) 2 spheres each of diameter 10cm are melted down and recast into a cone with a height equal to the radius of the base. Find the height of the cone.

(5+5 marks)

7. a)

Evaluate  $\int_0^{0.6} \frac{dx}{1+x^2}$  using Simpson's  $\frac{1}{3}$  rule

b)

Evaluate  $\int_0^{0.6} e^{-x^2} dx$  using Simpson's  $\frac{1}{3}$  rule

(5+5 marks)

8. a) A 1.5m tall boy is standing at some distance from a 30m tall building. The angle of elevation from his eyes to the top of the building increases from  $30^\circ$  to  $60^\circ$  as he walks towards the building. Find the distance he walked towards the building.

b) Prove that  $\frac{1+\tan x}{1-\tan x} = \sec 2x + \tan 2x$

(5+5 marks)

9. a) The distance required to stop a car varies directly as the square of its speed. If 250 feet are required to stop a car travelling 60 miles per hour, how many feet are required to stop a car travelling 96 miles per hour.
- b) The weight of an object on Earth varies directly as the weight of the same object on the moon. A 300 pound object would weight 48 pounds on the moon. How much would a 65 pound object weight on the moon.

(5+5 marks)

10. a) Find the polynomial  $f(x)$  by using Lagrange's formula and hence find  $f(3)$ .

$x$	0	1	2	5
$f(x)$	2	3	12	147

- b) Given the values

$x$	5	7	11	13	17
$f(x)$	150	392	1452	2366	5202

Evaluate  $f(9)$  using Lagrange's Formula

(5+5 marks)

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