

**INDIAN MARITIME UNIVERSITY**  
 (A Central University Government of India)  
**END SEMESTER EXAMINATIONS- DECEMBER 2018**  
**DIPLOMA IN NAUTICAL SCIENCE**  
**SEMESTER - I**  
**Applied Mathematics (UD11T3101)**

Date: 26-12-2018

Max. Marks: 70

Time: 02 hours

Pass. Marks: 35

**Note: Q.No.1 and 2 are Compulsory.** Answer any 5 out of 7 Questions.

All questions carry equal marks.

Use of non programmable type Scientific Calculator is allowed.

1. a. In spherical triangle  $CDE$ , Calculate the angle  $C$  if sides  
 $C = 87^{\circ}10'$ ,  $d = 62^{\circ}37'$ ,  $e = 100^{\circ}10'$ .
- b. In spherical triangle  $RST$ , sides  $t = 80^{\circ}32'$ ,  $r = 60^{\circ}40'$  and  
 angle  $T = 90^{\circ}$ . Calculate angle  $P$ . (5+5 marks)
2. a. In spherical triangle  $PQR$  side  $p = 73^{\circ}5'$ , side  $q = 90^{\circ}$  and side  
 $r = 79^{\circ}12'$ . Calculate angle  $P$ . (Napier)
- b. In spherical triangle  $PQR$  angles  $P = 100^{\circ}35'$ ,  
 $Q = 103^{\circ}46'54''$  and side  $r = 94^{\circ}34'$ . Calculate angle  $R$ . (Polar  
 Triangle) (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 perpendicular to both  $\vec{A}$  and  $\vec{B}$ . Determine  
 the angle between  $\vec{A}$  and  $\vec{B}$ .
- b. A particle is acted on by constant forces  
 $\vec{F}_1 = 3\hat{i} + 2\hat{j} + 5\hat{k}$ ,  $\vec{F}_2 = 2\hat{i} + \hat{j} + 3\hat{k}$  and  $\vec{F}_3 = \hat{i} + 2\hat{j} - 3\hat{k}$  and is  
 displaced from a point whose position vector is  $2\hat{i} - \hat{j} - 3\hat{k}$  to a  
 point whose position vector is  $4\hat{i} - 3\hat{j} + 7\hat{k}$ . Calculate the work  
 done. (5+5 marks)

4. Solve the following Linear programming problems graphically.

a. Maximize  $Z = 3x + 4y$  subject to

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

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

$$x, y \geq 0$$

b. 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. 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.

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

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

b. A wheel of a cart makes 4 revolutions per second. If the diameter of the wheel is 84 cm, find its speed. (5+5 marks)

7. a. Evaluate

$$\int_0^{0.6} \frac{dx}{1+x^2}$$

using Simpsons  $\frac{1}{3}$ rd rule. Taking  $h = 0.1$

b. Evaluate  $\int_0^{\frac{\pi}{2}} \sin x \, dx$ . Using Simpson's  $\frac{1}{3}$ rd rule by dividing interval into 4 equal parts. (5+5 marks)

8. a. The angles of the elevation of the top of a tower from the top and foot of a pole of height 10 m are  $30^\circ$  and  $60^\circ$ . Find the height of the tower.

b. From a shipment head of height 200 m, the angle of depression of a boat is observed to be  $45^\circ$ . Find its distance from the ship.

(5+5 marks)

9. a. If 10 men do some work in 4 days then in how many days the same work will be done by 7 men.

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. Estimate the value of  $f(3)$  from the values in the following table using Lagrange's interpolation.

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

b. Given the values

$x$	5	7	11	13	17
$f(x)$	150	329	1452	2366	5202

Construct a polynomial for the above data.

(5+5 marks)

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