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**INDIAN MARITIME UNIVERSITY**  
(A Central University, Govt. of India)  
**May/June 2018 End Semester Examinations**  
**DNS (Diploma in Nautical Science)**  
**Semester I**  
**Applied Mathematics (UD11T3101)**

**Date: 04.06.2018**

**Max. Marks: 70**

**Time: 2 Hrs**

**Pass Marks: 35**

**Note:** Question no. 1 and 2 are compulsory. Answer any 5 out of the remaining 8 questions. All questions carry equal marks. Use of approved type scientific calculator is permitted. Examination centers to supply 'Graph Sheets' to candidates (if required)

**Q. 1**

- a. In a spherical triangle JKL,  $j = 64^{\circ}18'$ ,  $k = 85^{\circ}47'$  and  $L = 93^{\circ}36'$ . Calculate K and side l.
- b. In a spherical triangle PZX, right angled at Z,  $p = 110^{\circ}20'$  and  $z = 84^{\circ}12'$ . Find the values of x and P. ( 5 + 5 marks )

**Q. 2**

- a. In a spherical triangle PQR,  $PQ = 52^{\circ}11'$ ,  $Q = 69^{\circ}47'$  and  $QR = 90^{\circ}$ , calculate P and side PR.
- b. In a spherical triangle LMN,  $L = 88^{\circ}24.5'$ ,  $n = 100^{\circ}09'$  and  $M = 97^{\circ}46'$ . Calculate N. ( 5 + 5 marks )

**Q. 3**

- a. Find the vector area and hence the magnitude of area of the triangle, the position vectors of whose vertices are  $2\hat{i} + \hat{j} - 3\hat{k}$ ,  $\hat{i} + 2\hat{j} + \hat{k}$ ,  $3\hat{i} + \hat{j} - 2\hat{k}$
- b. The forces  $2\hat{i} - 5\hat{j} + 6\hat{k}$ ,  $-\hat{i} + 2\hat{j} - \hat{k}$ ,  $2\hat{i} + 7\hat{j}$  act on a particle which displaces it from  $4\hat{i} - 3\hat{j} - 2\hat{k}$  to  $6\hat{i} + \hat{j} - \hat{k}$ . Find the total work done by these forces. ( 5 + 5 marks )

**Q. 4**

a. Solve the following linear programming problem graphically: Maximize

$$Z = 2x + 5y$$

Subject to :  $x + 4y \leq 24, 3x + y \leq 21, x + y \leq 9, x \geq 0, y \geq 0$

b: A person consumes two types of food A and B every day to obtain 8 units of protein , 12 units of carbohydrates and 9 units of fats which is his daily minimum requirement. One kg. of food A contains 2 units of proteins , 6 units of carbohydrates and one unit of fat. One kg. of food B contains , 1 unit of protein , 1 unit of carbohydrate and 3 units of fats. Formulate a linear programming problem so as to minimize the cost if one kg. of food A costs Rs. 42 and one kg. of food B costs Rs. 28. Find the daily minimum cost so as to meet daily diet requirements.

( 5 + 5 marks )

**Q. 5**

a. The foci of a hyperbola coincide with the foci of the ellipse  $\frac{x^2}{16} + \frac{y^2}{9} = 1$ . Find the equation of hyperbola if its eccentricity is  $\sqrt{2}$

b. Find the equation of the circle which has its centre at the point (3,4) and touching the line  $5x + 12y - 11 = 0$

( 5 + 5 marks )

**Q. 6**

a. A corn cob , shaped somewhat like a cone , has the radius of its broadest end as 2.1 cm and height of cone is 20 cm. If each  $1 \text{ cm}^2$  of the surface of the cob carries an average of four grains , find how many grains you would find on the entire cob ?

b. A stall keeper in one of the food stalls has a large cylindrical vessel of base radius 15 cm. filled up to a height of 32 cm. with orange juice. The juice is filled in small cylindrical glasses of radius 3 cm upto a height of 8 cm. and sold for Rs. 5 each. How much money does the stall keeper receive by selling the juice completely.

**Q. 7**

a. A river is 80 ft. wide. The depth 'd' in feet at a distance of x ft. from one bank is given by the following table. By using Simpson's (First Rule) 1/ 3 rd rule , find approximately the area of cross section.

x	0	10	20	30	40	50	60	70	80
d	0	4	7	9	12	15	14	8	3

b. Evaluate :  $\int_0^6 \frac{dx}{1+x^2}$  by using Simpson's 3/8 th Rule(Second Rule). (5+5 marks)

**Q. 8**

a. If  $\cos\theta = \frac{-3}{5}$ ,  $\pi < \theta < \frac{3\pi}{2}$  then find the value of  $\frac{\operatorname{cosec}\theta + \cot\theta}{\sec\theta - \tan\theta}$

b. A vertical tower stands on ground and is surmounted by a vertical flagpole of height 18 m. At a point on the ground, the angle of elevation of the bottom and the top of the flagpole are  $30^\circ$  and  $60^\circ$  respectively. What is the height of the tower?

( 5 + 5 marks )

**Q. 9**

a.  $y$  varies directly as  $x$  and inversely as the square of  $z$ , and when  $x = 32$ ,  $y = 6$  and  $z = 4$ . Find  $x$  when  $y = 10$  and  $z = 3$ .

b. The amount of oil used by a ship traveling at a uniform speed varies jointly with the distance and the square of the speed. If the ship uses 200 barrels of oil in traveling 200 miles at 36 miles per hour, determine how many barrels of oil are used when the ship travels 360 miles at 18 miles per hour. ( 5 + 5 marks )

**Q. 10**

a. Find the value of  $f(1.6)$  from the following table.

$x$	1	1.4	1.8	2.2
$f(x)$	3.49	4.82	5.96	6.5

b. Using Lagrange's formula, find the equation of the curve passing through the points  $(0, 18)$ ,  $(1, 10)$ ,  $(3, -18)$  and  $(6, 90)$  ( 5 + 5 marks )

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