

## Diploma in Nautical Science

Semester I Applied Mathematics Subject Code: UD11T5101

Max. Marks: 70

Pass Marks: 35

Date: 06.06.2022

Time: 2 hours

Note: Part A & B (20 Marks) – are compulsory.  
Part C (50 Marks) - Answer any 5 questions from Q1 to Q7

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### i. Part A – 10 MCQs (10 X 01 Mark)

- A spherical triangle in which at least one side equals to  $90^\circ$  is called as,  
(a) Oblique triangle (b) Right angled spherical triangle  
(c) Quadrantal spherical triangle (d) Polar triangle
- The side of a spherical triangle is  
(a) Greater than or equal to  $180^\circ$  (b) Greater than  $180^\circ$   
(c) Less than  $180^\circ$  (d) Equal to  $180^\circ$
- For the parabola  $y^2 = -18x$  the length of latus rectum is,  
(a) 8 (b) 4 (c) 18 (d) -18
- The area of the circle centred at (1, 2) and passing through (4, 6) is  
(a)  $5\pi$  (b)  $10\pi$  (c)  $25\pi$  (d)  $35\pi$
- The length of the latus rectum of the ellipse  $3x^2 + 4y^2 = 12$  is ,  
(a) 4 (b) 3 (c) 2 (d) 6
- If the height of a circular cylinder is 20 cm and the radius of its base is 7 am then the volume of the cylinder is,  
(a)  $8880 \text{ cm}^3$  (b)  $8030 \text{ cm}^3$  (c)  $3080 \text{ cm}^3$  (d)  $8080 \text{ c}$
- The angle of depression of a car parked on the road from the top of a 150 m high tower is  $30^\circ$ . The distance of the car from the tower (in meters) is,  
(a)  $50\sqrt{3}$  (b)  $150\sqrt{3}$  (c)  $100\sqrt{3}$  (d) 75
- The unit vector parallel to  $3i + 4j$  is  
(a)  $\pm \frac{1}{5} (3i + 4j)$  (b)  $\pm \frac{1}{15} (3i + 4j)$  (c)  $\pm \frac{1}{25} (3i + 4j)$  (d)  $(3i + 4j)$
- Feasible region is the set of points which satisfy,  
(a) The objective functions (b) Some the given constraints  
(c) All of the given constraints (d) None of these
- Lagrange's interpolation formula  
(a) Equal intervals (b) Unequal intervals  
(c) Both equal and unequal intervals (d) None of these

**ii. Part B – 5 Short Questions (05 X 02 Marks)**

1. Find the surface area of a sphere of radius 7 cm.
2. Evaluate  $\frac{\tan 65^\circ}{\cot 25^\circ}$
3. If the vectors  $2i - j - k$  and  $\lambda i + j + 5k$  are perpendicular, then find value of  $\lambda$ .
4. The corner points of the feasible region determined by the system of linear constraints are  $(0, 10), (5, 5), (15, 15), (0, 20)$ . Let  $Z = px + qy$ , where  $p, q > 0$ . Find condition on  $p$  and  $q$  so that the maximum of  $Z$  occurs at both the points  $(15, 15)$  and  $(0, 20)$ .
5. Find the centre of the circle  $x^2 + y^2 - 2x + 4y = 8$ .

**iii. Part C – 7 Long Questions-Answer Any 5 (05 X 10 Marks)**

1. (2 x 5 = 10 Marks)
  - (a) In spherical  $\Delta ABC$ , If  $A = 81^\circ 24.3'$ ,  $B = 61^\circ 31.7'$  and  $C = 102^\circ 58'$ .
  - (b) In spherical triangle PQR,  $r = 71^\circ 08'$ ,  $Q = 19^\circ 06'$  and  $q = 83^\circ 12'$ . Find angle R.
2. (2 x 5 = 10 Marks)
  - (a) Solve the following linear programming problem graphically: Maximise  $Z = 4x + y$  and subject to the constraints:  $x + y \leq 50$ ,  $3x + y \leq 90$ ,  $x \geq 0$ ,  $y \geq 0$
  - (b) Solve the following linear programming problem graphically: Minimise  $Z = 200x + 500y$  subject to the constraints:  $x + 2y \geq 10$ ,  $3x + 4y \leq 24$ ,  $x \geq 0$ ,  $y \geq 0$ .
3. (2 x 5 = 10 Marks)
  - (a) Find  $|\vec{a} - \vec{b}|$ , if two vectors  $\vec{a}$  and  $\vec{b}$  are such that  $|\vec{a}| = 2$ ,  $|\vec{b}| = 3$  and  $\vec{a} \cdot \vec{b} = 4$ .
  - (b) Find a unit vector perpendicular to each of the vectors  $(\vec{a} + \vec{b})$  and  $(\vec{a} - \vec{b})$  where  $\vec{a} = i + j + k$  and  $\vec{b} = i + 2j + 3k$ .
4. (2 x 5 = 10 Marks)
  - (a) Find the equation of the circle which passes through the points  $(2, -2)$ , and  $(3, 4)$  and whose centre lies on the line  $x + y = 2$ .
  - (b) Find the equation of the ellipse, whose length of the major axis is 20 and foci are  $(0, \pm 5)$ .
5. (2 x 5 = 10 Marks)
  - (a) Cost of groundnuts is directly proportional to its weight. If cost of 5 kg groundnuts is 450 then find the cost of 1 quintal groundnuts. (1 quintal = 100 kg)
  - (b) The total surface area of a cone is 704 sq.cm and radius of its base is 7 cm, find the slant height of the cone.  $\pi = \frac{22}{7}$
6. (2 x 5 = 10 Marks)
  - (a) An observer at a distance of 10 m from a tree looks at the top of the tree, the angle of elevation is  $60^\circ$ . What is the height of the tree? ( $\sqrt{3} = 1.73$ )
  - (b)  $\sqrt{\frac{1 - \sin \theta}{1 + \sin \theta}} = \sec \theta - \tan \theta$

7. (2 x 5 = 10 Marks)

(a) Using the table

X	0	1	2	3	4	5	6
F(x)	1	5	8	10	18	25	30

Evaluate  $\int_0^6 f(x) dx$ , by Simpson's  $\frac{3}{8}$ th Rule.

(b) Find the polynomial interpolating data, by using Newton's forward interpolation formula.

x	0	1	2
y	0	5	2