INDIAN MARITIME UNIVERSITY

(A Central University, Govt of India)

Dec'24 ESE

Diploma in Nautical Science

Semester I

APPLIED MATHEMATICS

Subject Code : UD11T5101

Max.Marks : 70 Pass Marks :35

Date: 06.12.2024 Time: 3 hours

Note: Section A (20 Marks)-Q.1 & Q.2 are compulsory.

Section B (50 Marks)-Answer any 5 questions from Q.3 to Q.9

Use of Non-programmable Scientific Calculator is permitted.

Section-A

Q.1 Choose the correct alternatives from the following. (1×10=10Marks)

a) Haversine 180^0= --------

A) ½ B) 0 C) 1 D) -1

b) The point of intersection of two great circles is a ---------

A) circumference B) diameter C) radius D) arc

c) The angle between the vectors $\hat{\imath} - \hat{\jmath}$ and $\hat{\jmath} - \hat{k}$ is

A) 60^0 B) 120^0 C) -60^0 D) 150^0

d) The length of the latus rectum of ellipse $3x^2+y^2 = 12$ is

A) 4 B) 3 C) 8 D) $\frac{4}{\sqrt{3}}$

e) Which is the side of the cube whose surface area is 384 m^2 ?

A) 5m B) 6m C) 8m D) 10m

f) If f(0)=5 , f(1)=6 , f(3)=14 .For estimation of f(2) , which formula is useful ?

A) Newtons forward interpolation B) Newtons backward interpolation

C) Simpson's formula D) Lagrange's interpolation

g) By dividing [o ,1] in to four equal parts , using Simpson's 1/3 rd rule ,what will be the width h ?

A) ¼ B) 4 C) 2 D) ½

h) If $x \alpha y^2$ then

A) $x=y^2$ B) $x=ky^2$ C) $xy^2=1$ D) $xy^2=k$

i) If SinA=1/2 and CosB=1/2 then A+B = ?

A) 0^0 B) 30^0 C) 60^0 D) 90^0

j) According to Napier's rule of circular parts , Sine middle parts eual to the product of ---------

A) Tan of two adjacent parts B) Cosine of two adjacent parts

C) Tan of two opposite parts D) Sine of two opposite parts

Q.2 Solve following examples. (2 × 5 = 10 Marks)

a) In spherical triangle ABC , $a=67^0$,$b=54^0$, $A=39^0$.Find B by sine formula.

b) Area of a sector of a circle of radius 15 cm is 30 cm^2 .find the length of the arc of the sector.

c) If x varies as y and x=12 when y=29 , find x when y=25.

d) Find the equation of tangent to the circle $x^2+y^2=25$ at the point (2,3).

e) Three consecutive ordinates in a ship's water plane , spaced 6 meters apart , are 14m , 15m and 15.5m respectively .Find the area between the first two ordinates by using Simpson's 5/8 th rule.

Section-B

Q.3 (2×5=10 Marks)

a) In spherical triangle RST, $r=66^0 41'$, side $s=104^0 10'$ and $t=54^0 56'$.Find angle R.

b) If $\bar{a}$= i+2j-3k , $\bar{b}$= 3i-j+2k. Show that $\bar{a}+\bar{b}$ is perpendicular to $\bar{a}-\bar{b}$ .Find the angle between $2\bar{a}+\bar{b}$ and $\bar{a}+2\bar{b}$.

Q.4 (2×5=10 Marks)

a) In spherical triangle ABC ,angle C=90^0 ,side c=$69^0 25' 11''$, B=$63^0 25' 03''$ then find angle A.

b) Find the work done by resultant of the forces 3i+4j-5k , i+j+k and 2i-4j+7k is displacing a particle from the point (1,2,4) to the point (3,4,7)

Q.5 (2×5=10 Marks)

a) In spherical triangle PZX, angle X=$85^0 18'$, side x=90^0 and side z=$73^0 12'$. Calculate angle Z.

b) Find the equation of parabola whose focus is S(2,-3) and directrix is the line 2y=3.

Q.6 (2×5=10 Marks)

a) A metal parallelepiped of measures 16m×11m×10m was melted to make coins .How many coins were made if the thickness and diameter of each coin was 2mm and 2 cm respectively ?

b)Show that $\frac{tanx}{secx+1} + \frac{secx+1}{tanx} = 2\,cosecx$

Q.7 (2×5=10 Marks)

a) A Vessel's fuel consumption varies as the cube of the speed and when the speed is 15 knots the consumption is 30 tonnes ,find the consumption when the speed is increased by one knot.

b) From the top of the lighthouse , an observer looks at a ship and finds the angle of depression to be 30^0 . If the height of the lighthouse is 100 metres , the how far the ship is from the lighthouse ?

Q.8 (2×5=10 Marks)

a) If $\bar{a} + \bar{b} + \bar{c} = 0$, $|\bar{a}| = 3$, $|\bar{b}| = 5$ and $|\bar{c}| = 7$ the find the angle between $\bar{a}$ and $\bar{b}$.

b) A particle is moving in such a way that its displacement s at a time t is given by $s=2t^2+5t+20$, find the velocity and acceleration after 2 seconds.

Q.9 (2×5=10 Marks)

a) Using Simpson"s 3/8 th rule , evaluate $\int_0^1 \frac{1}{1+x}\,dx$ with h=1/3 as width.

b) If f(1)=3 , f(2)=7 , f(5)=31.Estimate f(4) by Lagrange's interpolation formula.
