INDIAN MARITIME UNIVERSITY

(A Central University, Govt of India)

END SEMESTER EXAMINATIONS- JUNE-JULY 2019

B SC (NAUTICAL SCIENCE)

SEMESTER-III

APPLIED MATHEMATICS-IV

(UG21T2303)

Date: 29.06.2019 **Max.Marks:70**

Time: 3 Hours **Pass Marks:35**

Answer any SEVEN questions. All questions carry equal marks.

1. a. Evaluate $\sqrt{5}$, $\frac{1}{31}$ correct to 4 decimal places by Newton's iteration method.

   b. Find a real root of the equation $x^3 - 2x - 5 = 0$ by the method of Regula Falsi Position correct to 3 decimal places.

   (5+5 marks)

2. a. Apply Gauss-Seidel iteration method to solve the equations $20x + y - 2z = 17; 3x + 20y - z = -18; 2x - 3y + 20z = 25$

   b. Find the missing values in the follwing table.

x	45	50	55	60	65
y	3	-	2	-	-2.4

   (5+5 marks)

3. a. The table gives the distance in nautical miles of the visible horizon for the given heights in feet above the earth's surface.

x=height	100	150	200	250	300	350	400
y=distance	10.63	13.03	15.04	16.81	18.42	19.90	21.27

Find the values of y when (i) $x = 218$ ft (ii) $x = 410$ ft

b. Find a polynomial which takes the following values

x	0	1	2	3
f(x)	1	2	1	10

(5+5 marks)

4. a. Use Lagrange's interpolation formula to find the value of y when $x = 10$, if the following values of x and y are given.

x	5	6	9	11
y	12	13	14	16

b. Evaluate $\int_0^{0.6} e^{-x^2}\, dx$ by taking 7 ordinates using Simpson's $\frac{1}{3}$rd rule.

(5 + 5 marks)

5. a. The velocity v of a particle at distance s from a point on its path is given by the table.

S ft	0	10	20	30	40	50	60
V ft/sec	47	58	64	65	61	52	38

Estimate the time taken to travel 60 ft by using Simpson's $\frac{1}{3}$rd rule.

b. A reservoir discharging water through sluices at a depth h ft below the water surface has a surface area A for various values of h as given below:

h ft	10	11	12	13	14
A sq. ft	950	1070	1200	1350	1530

If t denotes the time in minutes the rate of fall of the surace is given by

$$\frac{dh}{dt} = -\frac{48\sqrt{h}}{A}$$

Estimate the time taken for the water level to fall from 14 to 10 ft above the sluices.

(5+5 marks)

6. a. Compute the line integral $\int_c y^2dx - x^2dy$ about the triangle whose vertices are (1,0), (0,1) and (-1,0)

b. Using the line integral, compute the work done by the force

$\bar{F} = (2y+3)\hat{\imath} + xz\hat{\jmath} + (yz - x)\hat{k}$ when it moves a particle from the point (0,0,0) to the point (2, 1, 1) along the curve $x = 2t^2, y = t, z = t^3$.

(5+5 marks)

7. a. Verify Green's theorem for $\int_c (xy + y^2)dx + x^2dy$ where c is bounded by $y = x$ and $y = x^2$.

b. Evaluate $\int_c (x^2 - 2xy)dx + (x^2y + 3)dy$ around the boundary of the region defined by $y^2 = 8x$ and $x = 2$.

(5+5 marks)

8. a. Verify Stoke's theorem for $\bar{F} = (x^2 + y^2)\hat{\imath} - 2xy\hat{\jmath}$ taken around the rectangle bounded by the lines $x = \pm a, y = 0, y = b$

b. Using Stoke's theorem evaluate

$\int_c (x + y)dx + (2x - z)dy + (y + z)dz$ where c is the boundary of the triangle with vertices (2,0,0), (0,3,0), (0,0,6)

(5+5 marks)

9. a. Apply Stoke's theorem to evaluate $\int_c y\,dx + z\,dy + x\,dz$ where c is the curve of intersection of $x^2 + y^2 + z^2 = a^2$ and $x + z = a$

b. Evaluate $\int_s F \cdot ds$ where $F = 4xi - 2y^2j + z^2k$ and s is the surface bounding the regions $x^2 + y^2 = 4, z = 0$ and $z = 3$.

(5 + 5 marks)

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