

INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)
END SEMESTER EXAMINATION-DECEMBER 2019
B.Sc(Nautical Science)
Semester – II
Applied Mathematics
(UG21T3201)

Date: 31.12.2019

Max Marks: 70

Time: 3 Hrs

Pass Marks : 35

Note: Part A is compulsory.
Answer any 6 from remaining 7 questions of Part B.

PART A

(5 x 2 = 10 marks)

1. a. Evaluate $\text{div } \vec{F}$ and $\text{curl } \vec{F}$ at the point (1, 1, 1) for

$$\vec{F} = 3x^2\hat{i} + 5xy^2\hat{j} + 5xyz^2\hat{k}.$$

- b. Solve $\cos^2 x \frac{dy}{dx} + y = \tan x$.

- c. Derive a partial differential equation from $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$

- d. Prove $\nabla = \Delta E^{-1}$.

- e. Find Laplace transform of $\cos(3t + 5)$.

PART B

2. a. Find the values of a and b such that the surface $ax^2 - byz = (a + 2)x$ and $4x^2y + z^3 = 4$ cut orthogonally at (1, -1, 2)

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

(5+5 marks)

3. a. Solve $(D^3 + 1)y = \cos(2x - 1)$.

- b. Solve $(x^2 + y^2 + 2x)dx + 2y dy = 0$.

(5+5 marks)

4. a. Solve $q^2 = z^2 p^2 (1 - p^2)$.

- b. Solve $(p^2 + q^2)y = qz$.

(5+5 marks)

5. a. Prove that

$$u_0 + u_1x + u_2x^2 + \dots \infty = \frac{u_0}{1-x} + \frac{x\Delta u_0}{(1-x)^2} + \frac{x^2\Delta^2 u_0}{(1-x)^3} + \dots \infty$$

- b. Hence sum the series $1.2 + 2.3x + 3.4x^2 + \dots \infty$
(5+5 marks)

6. a. Find Laplace transform of $\int_0^t \frac{e^{-t} \sin t}{t} dt$.

- b. Find inverse Laplace transform of $\log\left(\frac{s+1}{s-1}\right)$.
(5+5 marks)

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

- 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. Apply GAVSS Seidel iteration to solve the following equations.

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

- b. Solve by the method of variation of parameters

$$\frac{d^2y}{dx^2} + 4y = \tan x$$

(5+5 marks)
