

INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)
END SEMESTER EXAMINATIONS- JUNE/JULY 2019
B. SC. (NAUTICAL SCIENCE)
SEMESTER-II
APPLIED MATHEMATICS II
(UG21T2204)

Date: 01-07-2019
Time: 3Hrs

Max.Marks: 70
Pass Marks: 35
Marks: 7 x 10 =70

Attempt any SEVEN questions out of 9.
All questions carry equal marks.

1.
 - a. A particle moves along a curve $x = t^3 + 1; y = t^2; z = 2t + 3$ where t is the time. Find the component of its velocity and acceleration at $t = 1$ in the direction $\hat{i} + \hat{j} + 3\hat{k}$.
 - b. If $u = x + y + z, v = x^2 + y^2 + z^2, w = xy + yz + zx$, prove that $\text{grad } u, \text{grad } v, \text{grad } w$ are coplanar.
(5+5 marks)

2.
 - a. Find an unit vector normal to the surface $xy^3z^2 = 4$ at the point $(-1, -1, 2)$.
 - b. Find the directional derivatives of $f(x, y, z) = xy^2 + yz^3$ at the point $(2, -1, -1)$ in the direction of vector $\hat{i} + 2\hat{j} + 2\hat{k}$.
(5+5 marks)

3.
 - a. Find the directional derivatives of $\phi = 5x^2y - 5y^2x + \frac{5z^2x}{2}$ at the point P $(1, 1, 1)$ in the direction of the line $\frac{x-1}{2} = \frac{y-3}{-2} = z$
 - b. Find the angle between the surfaces $x^2 + y^2 + z^2 - 9 = 0$ and $x^2 + y^2 - z - 3 = 0$ at $(2, -1, 2)$
(5+5 marks)

4.
 - a. Find the value of a if the vector $(ax^2y + yz)\hat{i} + (xy^2 - xz^2)\hat{j} + (2xyz - 2x^2y^2)\hat{k}$ has zero divergence. Find the curl of the above vector which has zero divergence.
 - b. For a solenoidal vector \vec{F} , show that $\text{Curl Curl Curl Curl } F = \nabla^4 \vec{F}$
(5+5 marks)

5. a. Solve $(x + y + 1)^2 \frac{dy}{dx} = 1$
b. Solve $(x^2 - y^2)dx - xy dy = 0$
- (5+5 marks)

6. a. Solve $\frac{dy}{dx} = -\left(\frac{x+y \cos x}{1+\sin x}\right)$
b. Solve $e^y \left(\frac{dy}{dx} + 1\right) = e^x$
- (5+5 marks)

7. a. Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 25y = e^{2x} + \sin x + x$
b. Use the method of variation of parameter, solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$.
- (5+5 marks)

8. a. Solve by the method of variation of parameter the following differential equation $(D^2 - 1)y = \frac{2}{1+e^2}$
b. Solve by undetermined coefficient the following differential equation $(D^2 + 1)y = \sin x$.
- (5+5 marks)

9. a. Solve $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = \log x$
b. Solve $x^2 \frac{d^2y}{dx^2} - 4x \frac{dy}{dx} + 6y = x^2$
- (5+5 marks)
