

INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)

May/June 2016 End Semester Examinations
B.Sc. (Nautical Science) - Second Semester (2013 batch onwards)

Applied Mathematics Paper – II (T 2204)

Date : 15.06.2016

Time: 3 Hrs

Maximum Marks: 70

Pass Marks : 35

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

1 a) If $A = i - 2j - 3k$, $B = 2i + j - k$, $C = i + 3j - k$, find

i) $AX(BXC)$

ii) $(AXB) \times (BXC)$

b) If $P = 5t^2i + t^3j - tk$ and $Q = 2i \sin t - j \cos t + 5tk$, find i) $\frac{d}{dt} (P \cdot Q)$; ii) $\frac{d}{dt} (PXQ)$.

c) A particle moves along a curve $x = e^{-t}$, $y = 2 \cos 3t$, $z = 2 \sin 3t$ where t is the time variable.

Determine its velocity and acceleration vectors and also the magnitudes of velocity and acceleration

at $t = 0$.

(3+3+4 marks)

2 a) Find the values of constants a, b, c so that the directional derivative of

$p = axy^2 + byz + cz^2x^3$ at $(1, 2, -1)$ has a maximum magnitude 64 in the direction parallel to the Z-axis.

b) Calculate i) $\text{curl}(\text{grad } f)$, given $f(x, y, z) = x^2 + y^2 - z$.

ii) $\text{curl}(\text{curl } A)$ given $A = x^2yi + y^2zj + z^2yk$. (5+5 marks)

3 a) Find the angle between the surfaces

$x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point $(2, -1, 2)$.

b) If $V = \frac{xi+yj+zk}{\sqrt{x^2+y^2+z^2}}$ show that $\nabla \cdot V = \frac{2}{\sqrt{x^2+y^2+z^2}}$ and $\nabla \times V = 0$. (5+5 marks)

4 Solve the following differential equations.

a) $(x+1) \frac{dy}{dx} - y = e^{3x}(x+1)$.

b) $\frac{dy}{dx} - y \tan x = y^2 \sec x$.

c) $\frac{dy}{dx} + x \sin 2y = x^3 \cos^2 y$.

(2+4+4 marks)

5. a) Solve $\frac{d^2y}{dx^2} - y = e^x + x^2e^x$.

b) Solve $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = e^{2x} - \cos^2x$. (5 +5 marks)

6. a) By using method of variation of parameters, solve $\frac{d^2y}{dx^2} + y = \sec x$.

b) Solve the differential equation $(3x + 2)^2 \frac{d^2y}{dx^2} + 5(3x + 2) \frac{dy}{dx} - 3y = x^2 + x + 1$. (5 +5 marks)

7. a) By using method of undetermined coefficients solve, $(D^2 + 2D + 4)y = 2x^2 + 3e^{-x}$.

b) Solve $x^2 \frac{d^2y}{dx^2} + 3x \frac{dy}{dx} + y = \frac{1}{(1-x)^2}$ (5 +5 marks)

8. a) Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = (1 - e^x)^2$.

b) Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 4\cos^2x$. (5+5 marks)

9. a) By using method of variation of parameters, solve $\frac{d^2y}{dx^2} + y = \tan x$.

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