

# Indian Maritime University

( A Central University, Govt of India)

May-June 2018 End Semester Examinations

## B Sc (Nautical Science)

Semester-II

### Applied Mathematics-II (UG21T2204)

Duration:3 Hrs

Max Marks:70 Marks

Date: 12.06.2018

Pass Marks:35 Marks

**Note: Answer any Seven Questions out of Nine Questions.**

**All questions carry equal marks.**

Q.1 a) Prove that,

i)  $[B \times C \ C \times A \ A \times B] = [ABC]^2$

ii)  $A \times \{B \times (C \times D)\} = B \cdot D(A \times C) - B \cdot C (A \times D)$  (5 Marks)

b) A particle moves along the curve  $x = t^3 + 1$ ,  $y = t^2$ ,  $z = 2t + 3$  where  $t$  is the time. Find the components of its velocity and acceleration at  $t = 1$  in the direction  $I + J + 3K$ . (5 Marks)

Q.2 a) Find a unit vector normal to the surface  $x^3 + y^3 + 3xyz = 3$  at the point  $(1,2,-1)$ . (5 Marks)

b) Find  $div F$  and  $curl F$  at the point  $(1,2,3)$  given  $F = 3x^2i + 5xy^2j + 5xyz^3k$ . (5 Marks)

Q.3 a) Calculate  $curl(grad f)$  given  $f(x, y, z) = x^2 + y^2 - z$ . (5 Marks)

b) If  $uF = \nabla v$ , where  $u$  and  $v$  are scalar fields and  $F$  is a vector field, show that  $F \cdot curl F = 0$  (5 Marks)

Q.4 a) Show that the vector  $\nabla\phi \times \nabla\psi$  is solenoidal. (5 Marks)

b) Find the value of  $a$  if the vector  $(ax^2y + yz)i + (xy^2 - xz^2)j + (2xyz - 2x^2y^2)k$  has zero divergence. Find the curl of the above vector which has zero divergence. (5 Marks)

Q.5 a) Solve the equation  $(x^2 + y^2 - a^2)x dx + (x^2 - y^2 - b^2)y dy = 0$  (5 Marks)

b) Solve  $(1 - x^2)\frac{dy}{dx} + 2xy = x\sqrt{1 - x^2}$  (5 Marks)

Q.6 a) Solve  $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = e^{-x} \sin x + x e^{3x}$ . (5 Marks)

b) Solve  $\frac{d^3y}{dx^3} - 5\frac{d^2y}{dx^2} + 7\frac{dy}{dx} - 3y = e^{2x} \cosh x$ . (5 Marks)

Q.7 a) Solve by the method of variation of parameters  $\frac{d^2y}{dx^2} + a^2y = \operatorname{cosec} ax$  . (5 Marks)

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

Q.8 a) Solve by the method of undetermined coefficients:

$\frac{d^2y}{dx^2} - 3 \frac{dy}{dx} + 2y = x^2 + e^x$  . (5 Marks)

b) Solve  $(1+x)^2 \frac{d^2y}{dx^2} + (1+x) \frac{dy}{dx} + y = 2 \sin[\log(1+x)]$  . (5 Marks)

Q.9 a) Solve  $\cos^2 x \frac{dy}{dx} + y = \tan x$  . (6 Marks)

b) Solve  $\frac{d^3y}{dx^3} - 3 \frac{d^2y}{dx^2} + 3 \frac{dy}{dx} - y = 0$  . (4 Marks)

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