INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

May/June End Semester Examinations
B.Sc. (Nautical Science) Second Semester
(AY 2013-14 to 2015- 16 batches only)

Applied Mathematics - II (UG21T2204)

Date : 08.06.2017 Maximum Marks: 70
Time: 3 Hrs Pass Marks : 35

Note: Answer any SEVEN Questions.
All questions carry equal marks. (7 x 10 = 70 marks)

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1. a. Solve $x\frac{dy}{dx} + \cot y = 0$ if $y = \frac{\pi}{4}$ when $x = \sqrt{2}$

   b. $\frac{dy}{dx} - x\tan(y - x) = 1$

   (5+5 marks)

2. a. Solve $\frac{dy}{dx} + \frac{x + y\cos x}{1 + \sin x} = 0$

   b. Solve $xdx + ydy = \frac{a^2(xdy - ydx)}{(x^2 + y^2)}$

   (5+5 marks)

3. a. Solve $\frac{d^2y}{dx^2} - \frac{3dy}{dx} + 2y = xe^{3x} + \sin 2x$

   b. Solve $\frac{d^3y}{dx^3} + y = 0$

   (6+4 marks)

4. Use the method of variation of parameters to solve

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

   b. $\frac{d^2y}{dx^2} + y = \sin x$ (5+5 marks)

5. Solve $\frac{x^2d^2y}{dx^2} - 2x\ \frac{dy}{dx} - \ 4y = x^2 + \ 2\log x$ (10 marks)

6. a. 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 $\hat{\imath} + \hat{\jmath} + \ 3\hat{k}$.

   b. Find an unit vector normal to the surface $xy^3z^2 = 4$ at the point $(-1, -1, 2)$. (5+5 marks)

7. a. Find the angle between the surfaces $x^2 + \ y^2 + \ z^2 = 9$; $x^2 + \ y^2 - \ z - 3 = 0$ at the point $(2, -1, 2)$

   b. Evaluate div F and curl F at the point $(1, 2, 3)$ given $= x^2yz\hat{\jmath} + xy^2z\hat{\jmath} + xyz^2\hat{k}$. (5+5 marks)

8. a. if $u = x^2 + \ y^2 + \ z^2$ and $\bar{V} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$

   show that $div\ (u\bar{V}) = \ 5u$

   b. If $\bar{A}$ is a constant vector and $\bar{R} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ show that $grad\ (\hat{A} \cdot \hat{R}) = \bar{A}$ (5+5 marks)

9. a. If $u = x + y + z;\ v = x^2 + \ y^2 + \ z^2\ ; w = yz + zx + xy$, show that grad u, grad v, grad w are coplanar.

   b. Find the value of a if the vector

   $(ax^2y + yz)\hat{\imath} + \ (xy^2 - \ xz^2)\hat{\jmath} + (2xyz - 2x^2y^2)\hat{k}$ has zero divergence. (5+5 marks)

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