INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

May/June End Semester Examinations
B.Sc. (Nautical Science) First Semester
(AY 2013– 2016 batches only)

Applied Mathematics - I (UG21T2104)

Date : 09.06.2017 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. Find the nth derivative of $\cos x \cos 2x \cos 3x$

   b. If $y = a\cos(\log x) + b\sin(\log x)$ prove that

   $x^2 y_{n+2} + (2n+1)\, xy_{n+1} + (n^2 + 1)y_n = 0$

   (4+6 marks)

2. a. Verify Lagrangi's mean value theorem for

   $f(x) = (x-1)(x-2)(x-3)\ in\ (0,4)$

   b. Expand $\log(1+x)$ as a Maclaurin's series.

   (4+6 marks)

3. a. If $z = e^{ax+by}\, f\,(ax-by)$ prove that $b\frac{\partial z}{\partial x} + a\frac{\partial z}{\partial y} = 2ab\, z$

   b. If $u = \sin^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$ prove that $x\,\frac{\partial u}{\partial x} + y\,\frac{\partial u}{\partial y} = \frac{1}{2}\tan u$

   (4+6 marks)

4. a. Verify Euler's theorem for $f\,(x,y) = 3x^2yz + 5xy^2z + 4z^4$

   b. If $u = x\log(xy)$ where $x^3 + y^3 + 3xy = 1$, find $\frac{du}{dx}$ as total derivative.

   (4+6 marks)

5. a. Discuss the maxima and minima of
$f\ (x,y) = x^3y^2(1-x-y)$

b. Find the minimum value of $x^2+ y^2 + z^2$ given $xyz = 8$

(5+5 marks)

6. a. Express $\frac{2-\sqrt{3i}}{1+i}$ in form of $a + ib$

b. What is the locus of $Z\bar{Z} + (1+i)Z + (1-i)Z = 0$

(4+6 marks)

7. a. Prove that $(1+i)^n + (1+i)^n = 2^{\frac{n}{2}+1}\cos\frac{n\pi}{4}$

b. If α, β are the roots of $x^2 - 2x + 4 = 0$
prove that $\alpha^n + \beta^n = 2^{n+1}\cos\frac{n\pi}{3}$

(5+5 marks)

8. Expand $\sin^7\theta\ cost^3\theta$ in a series of sine multiples .

(10 marks)

9. a. Find $\tan hx$ if $5\sin hx - \cos hx = 5$.

b. If $u = \log\tan\left(\frac{x}{4} + \frac{\theta}{2}\right)$ prove that $\tan h\ \frac{u}{2} = \tan\frac{\theta}{2}$.

(5+5 marks)

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