

Seat  
No.

Total No. of Questions : 8]

[Total No. of Printed Pages : 4

[4261]-1

F. E. Examination - 2012  
ENGINEERING MATHEMATICS - I  
(2012 Pattern)



Time : 2 Hours]

[Max. Marks : 50

**Instructions :**

- (1) Attempt **four** questions : Q. No. 1 or 2, Q. No. 3 or 4, Q. No. 5 or 6 and Q. No. 7 or 8.
- (2) Figures to the right indicate full marks.
- (3) Assume suitable data if necessary.
- (4) Neat diagrams must be drawn wherever necessary.
- (5) Use of electronic non-programmable calculator is allowed.

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**Q.1) (A)** Examine the consistency of the system of the following equations. If consistent, solve system of equations : [04]

$$x + y + z = 3$$

$$x + 2y + 3z = 4$$

$$x + 4y + 9z = 6$$

**(B)** Find Eigen Values and Eigen Vector corresponding to highest Eigen Value for the matrix : [04]

$$A = \begin{bmatrix} 1 & 1 & -2 \\ -1 & 2 & 1 \\ 0 & 1 & -1 \end{bmatrix}$$

- (C) If  $\tan \log (x - iy) = a - ib$  and  $a^2 + b^2 \neq 1$ , then prove that  $\tan \log (x^2 + y^2) = \frac{2a}{1 - a^2 - b^2}$ . [04]

OR

- Q.2) (A) Examine for Linear Dependence or Independence of Vectors  $(2, 2, 7, -1)$ ,  $(3, -1, 2, 4)$  and  $(1, 1, 3, 1)$ . [04]

- (B) Solve :  $x^7 + x^4 + i(x^3 + 1) = 0$ . [04]

- (C) A square lies above real axis in Argand diagram and two of its adjacent vertices are the origin and the point  $2 + 3i$ . Find the complex number representing other vertices. [04]

- Q.3) (A) Test convergence of the series : (Any One) [04]

(a)  $\frac{2}{9} + \frac{2 \cdot 5}{9 \cdot 13} + \frac{2 \cdot 5 \cdot 8}{9 \cdot 13 \cdot 17} + \dots$

(b)  $\sum_{n=1}^{\infty} \left(\frac{1}{n}\right) \sin\left(\frac{1}{n}\right)$

- (B) Expand  $3x^3 - 2x^2 + x - 6$  in powers of  $(x - 2)$ . [04]

- (C) Find  $n^{\text{th}}$  derivative of  $x^2 e^x \cos x$ . [04]

OR

- Q.4) (A) Solve : (Any One) [04]

(a)  $\lim_{x \rightarrow 1} (1 - x^2)^{\frac{1}{\log(1-x)}}$

(b) Find  $a$  and  $b$ , if  $\lim_{x \rightarrow 0} \frac{a \sinh x + b \sin x}{2x^3} = \frac{8}{6}$ .

- (B) Show that : [04]

$$x \operatorname{cosec} x = 1 + \frac{x^2}{6} + \frac{7}{360} x^4 + \dots$$

(C) Prove that  $n^{\text{th}}$  derivative of  $y = \tan^{-1}x$  is

$$(-1)^{n-1} (n-1)! \sin n \left( \frac{\pi}{2} - y \right) \sin^n \left( \frac{\pi}{2} - y \right). \quad [04]$$

**Q.5) Solve any two :**

(a) If  $u = \log(\sqrt{x^2 + y^2 + z^2})$ ,

then prove that

$$(x^2 + y^2 + z^2) \left( \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} \right) = 1. \quad [06]$$

(b) If  $u = \frac{x^2 y^2 z^2}{x^2 + y^2 + z^2} + \cos \left( \frac{xy + yz}{x^2 + y^2 + z^2} \right)$ ,

then find the value of

$$x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z}. \quad [07]$$

(c) If  $u = x^2 - y^2$ ,  $v = 2xy$  and  $z = f(u, v)$ , then show that

$$x \frac{\partial z}{\partial x} - y \frac{\partial z}{\partial y} = 2\sqrt{u^2 + v^2} \frac{\partial z}{\partial u}. \quad [06]$$

OR

**Q.6) Solve any two :**

(a) If  $ux + vy = 0$  and  $\frac{u}{x} + \frac{v}{y} = 1$ ,

then show that

$$\left( \frac{\partial u}{\partial x} \right)_y - \left( \frac{\partial v}{\partial y} \right)_x = \frac{x^2 + y^2}{y^2 - x^2}. \quad [06]$$



