May- June- 2011
F.E. Sem - I
2008 pattern.

[3961] – 101

F.E. (Semester – I) Examination, 2011

ENGINEERING MATHEMATICS – I

(2008 Pattern)

Time: 3 Hours | Max. Marks: 100

Instructions : *1) Answers to the* ***two*** *Sections should be written in* ***separate*** *books.*

2) ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*

3) Black figures to the ***right*** *indicate* ***full*** *marks.*

4) ***Use*** *of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

5) Assume suitable data, ***if necessary****.*

SECTION – I

1. A) Reduce the following matrix A to its normal form and hence find its rank, **5**

$$A = \begin{bmatrix} 2 & -1 & -1 & -3 \\ 2 & 4 & -1 & 0 \\ 4 & -3 & 2 & -1 \end{bmatrix}$$

B) Examine the consistency of the system of linear equations and solve if consistent : **6**

$x + y + z = 6$

$2x - 2y + 3z = 7$

$x - y + 2z = 5$

$3x + y + z = 8$

P.T.O.

C) Verify Cayley Hamilton theorem for the matrix 7

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

OR

2. A) Find Eigen values and Eigen vectors for the matrix 7

$$A = \begin{bmatrix} 4 & 0 & 1 \\ -2 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix}$$

B) Examine whether the following vectors are linearly dependent. If so, find the relation between them :

$X_1 = (-4, 1, 0)$, $X_2 = (3, 1, 2)$, $X_3 = (1, 1, 1)$ 5

C) Show that the matrix 6

$$A = \begin{bmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{bmatrix}$$ is orthogonal matrix, hence find A^{-1}.

3. A) If z_1 and z_2 and origin represent on the Argand diagram, vertices of an equilateral triangle, show that 6

$$\frac{1}{z_1^2} + \frac{1}{z_2^2} = \frac{1}{z_1 z_2}$$

B) If $\cos\alpha + \cos\beta + \cos\gamma = \sin\alpha + \sin\beta + \sin\gamma = 0$ show that $\cos 2\alpha + \cos 2\beta + \cos 2\gamma = \sin 2\alpha + \sin 2\beta + \sin 2\gamma = 0$ 5

C) Show that for n positive integer

$(\cosh x + \sinh x)^n = \cosh nx + \sinh nx$ 5

OR

4. A) Solve : $x^4 - x^3 + x^2 - x + 1 = 0$ 5

B) Prove that real part of the principal value of

$i^{\log(1+i)}$ is $e^{\frac{-\pi^2}{8}} \cos\left(\frac{\pi}{4}\log 2\right)$. 5

C) If P log (a+ib) = (x + iy) log m, Prove that

$$\frac{y}{x} = \frac{2\tan^{-1}\frac{b}{a}}{\log(a^2+b^2)}.$$ 6

5. A) If $y = x^2 e^{3x} \cos 4x$.

then find n^{th} order differential coefficient of y w.r. t. x 5

B) If $y = a\cos(\log x) + b\sin(\log x)$ 5

then prove that $x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$