B.E. Electrical (Electronics & Power) Engineering / Electronics Engineering / Electronics & Telecomm. / Comm. Engineering / Instrumentation Engineering (CBCS Pattern)
Third Semester

3BEEE01 / 3BEEN01 / 3BEET01 / 3BEIE01
Applied Mathematics - III

P. Pages : 3 **GUG/W/18/11486**

Time : Three Hours Max. Marks : 80

* 3 5 7 1 *

Notes : 1. All questions carry equal marks.
2. Use of non programmable calculator is permitted.

1. Solve :

a) Find $L\left\{e^{-t}\,t^2\cos 3t\right\}$ **4**

b) Find $L\left\{\int_0^t e^t \dfrac{\sin t}{t}\,dt\right\}$ **4**

c) Express $f(t) = \begin{cases} \cos t, & 0 < t < \pi \\ \cos 2t, & \pi < t < 2\pi \\ \cos 3t, & t > 2\pi \end{cases}$ **8**

in terms of unit step function and hence find its Laplace transform.

OR

2. Solve :

a) Solve $\dfrac{d^2y}{dt^2} + 9y = \cos 2t,\ t > 0$, given that $y(0) = 1$ and $y\left(\dfrac{\pi}{2}\right) = -1$ **8**

b) Find $L^{-1}\left\{\dfrac{1}{(s^2+2s+5)^2}\right\}$ by convolution theorem. **8**

3. a) Use method of partitioning to find A^{-1} if $A = \begin{bmatrix} 2 & 3 & 4 \\ 4 & 3 & 1 \\ 1 & 2 & 4 \end{bmatrix}$ **8**

b) Show that the equations **8**
3x + 4y + 5z = a
4x + 5y + 6z = b
5x + 6y + 7z = c
Have no solution unless a + c = 2b hence solve them if a = 1, b = 2, c = 3.

OR

4. a) Show that the vectors **5**

$X_1 = (1, 2, 4)$, $X_2 = (2, -1, 3)$, $X_3 = (0, 1, 2)$, $X_4 = (-3, 7, 2)$ are linearly dependent.

Also find the relation between them.

b) Show that the transformation **4**

$y_1 = x_1 \cos\theta - x_2 \sin\theta$

$y_2 = x_1 \sin\theta + x_2 \cos\theta$

is orthogonal. Hence find inverse transformation.

c) Find the modal matrix B corresponding to matrix **7**

$$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$$

Also write the diagonal matrix.

5. a) Verify Caley Hamilton theorem and hence find A^{-1}, where $A = \begin{bmatrix} 1 & 2 & 4 \\ 2 & 1 & 2 \\ 4 & 2 & 1 \end{bmatrix}$ **8**

b) Use Sylvester's theorem to show that $e^A = e^x \begin{bmatrix} \cos h\, x & \sin h\, x \\ \sin h\, x & \cos h\, x \end{bmatrix}$, where $A = \begin{bmatrix} x & x \\ x & x \end{bmatrix}$ **8**

OR

6. a) Find the largest eigen value and corresponding eigen vector for the matrix $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ **8**

b) Solve $\frac{d^2y}{dt^2} - 3\frac{dy}{dt} - 10y = 0$ given y(0) = 3 $y'(0) = 15$ by matrix method. **8**

7. a) Solve : **3**

i) $xq = yp + x\, e^{(x^2 + y^2)}$

ii) $y^2 p - xy\, q = x(z - 2y)$ **5**

b) Solve : **8**

$$\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^3 z}{\partial x\, \partial y^2} + 2\frac{\partial^3 z}{\partial y^3} = (x + 2y)^{½}$$

OR

8. a) Solve $\frac{\partial^2 z}{\partial x^2} + 2\frac{\partial^2 z}{\partial x\, \partial y} + \frac{\partial^2 z}{\partial y^2} = 2\cos y - x \sin y$ **8**

b) Solve using method of separation of variables, $4\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}=3u$, given that $u=3e^{-y}-e^{-5y}$ when x = 0. **8**

9. a) Obtain Fourier series for **8**

$$f(x)=\begin{cases}\pi x, & 0\le x\le 1\\ \pi(2-x), & 1\le x\le 2\end{cases}$$

Hence show that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots\ldots$

b) Find half range cosine series for sinx in the interval $0<x<\pi$ **8**

OR

10. a) Find Fourier transform of $f(x)=\begin{cases}1, & \text{for } |x|<1\\ 0, & \text{for } |x|>1\end{cases}$, **8**

hence find $\int_0^\infty \frac{\sin x}{x}dx$.

b) Using Fourier integral, show that $\int_0^\infty \frac{1-\cos\pi\lambda}{\lambda}\sin\lambda x\,d\lambda=\begin{cases}\pi/2 & 0<x<\pi\\ 0 & x>\pi\end{cases}$ **8**

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