B.E. / B.Tech. Electronics & Communication / Telecommunication Engineering
(Model Curriculum) Semester-III

SE101 / 001 - Mathematics-III

P. Pages : 2 **GUG/S/25/13906B**

Time : Three Hours Max. Marks : 80

Notes :
1. All questions are compulsory.
2. All questions carry equal marks.
3. Non-programmable calculator is permitted.

1. a) Find $L\left\{\frac{1-\cos t}{t^2}\right\}$. **8**

b) Evaluate $\int_0^\infty t^3 \cdot e^{-t} \cdot \sin t \cdot dt$ **8**

OR

2. a) Evaluate $\int_0^\infty \frac{e^{-4t} - e^{-2t}}{t} dt$ **8**

b) Find the Laplace transform of $\sin\sqrt{t}$. **8**

3. a) Evaluate $L^{-1}\left\{\frac{5s-2}{s^2(s-2)(s-1)}\right\}$. **8**

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

OR

4. a) Find $L^{-1}\left\{\frac{1}{(s-2)(s-3)^2}\right\}$ using convolution theorem. **8**

b) Find $L^{-1}\left\{\frac{s}{s^4+s^2+1}\right\}$. **8**

5. a) Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & |x| \le 1 \\ 0, & |x| > 1 \end{cases}$ and Hence find **8**

$$\int_0^\infty \left(\frac{\sin x - x\cos x}{x^3}\right)\cos\left(\frac{x}{2}\right) dx$$

b) Using Fourier integral, show that **8**

$$\int_0^\infty \frac{\sin \pi\lambda \cdot \sin \lambda x}{1-\lambda^2} d\lambda = \begin{cases} \left(\frac{\pi}{2}\right)\sin x, & 0 \le x \le \pi \\ 0, & x > \pi \end{cases}$$

OR

6. a) Find Fourier sine and cosine transform of $2e^{-5x} - 5ex^{-2x}$. **8**

b) If $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2-x, & 1 < x < 2 \\ 0, & x > 2 \end{cases}$ show that the Fourier integral given by **8**

$$f(x) = \frac{4}{\pi}\int_0^\infty \frac{1}{\lambda^2}\cos\lambda(1-\cos\lambda)\cos\lambda x d\lambda$$

7. a) Solve $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$ **8**

b) $\left(D^3 - 7DD'^2 - 6D'^3\right)z = \sin(x+2y) + x^2y$. **8**

OR

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

b) Solve $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial y} + 2u$, given $u = 0$, $\frac{\partial u}{\partial x} = 1 + e^{-3y}$ when $x = 0$, Using variable method. **8**

9. a) Find the inverse matrix $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 3 & 4 \\ 1 & 4 & 3 \end{bmatrix}$ by partition method. **8**

b) Find a matrix B which reduces $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ to a diagonal form by transformation $B^{-1}AB$. Hence find diagonal form of A. **8**

OR

10. a) Find the eigen values, eigen vectors and model matrix B for the matrix $A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$ **8**

b) Use Sylvester's theorem to show that $3\tan A = (\tan 3)A$, Where $A = \begin{bmatrix} -1 & 4 \\ 2 & 1 \end{bmatrix}$ **8**

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