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

SE101 / 001 - Mathematics-III

P. Pages : 3 **GUG/W/24/13906B**

Time : Three Hours * 5 5 1 8 * Max. Marks : 80

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

1. a) State & prove multiplication by t property of Laplace Transform. **8**

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

OR

2. a) Find the Laplace Transform of **8**

$$f(t) = \begin{cases} t\,; & 0 < t < c \\ 2c - t, & c < t < 2c \end{cases}$$

Where $f(t) = f(t + 2c)$

b) Express **8**

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

In terms of unit step function & hence find its L.T.

3. a) Using partial fraction method, find **8**

$$L^{-1}\left[\frac{s^2 + 2s + 3}{\left(s^2 + 2s + 2\right)\left(s^2 + 2s + 5\right)}\right]$$

b) Using convolution theorem find **8**

$$L^{-1}\left[\frac{s}{(s-2)(s+2)^2}\right]$$

OR

4. a) Solve $\left(D^2+2D+5\right)y = e^{-t}\cdot\sin,$ given $y(0)=0, y'(0)=1$. **8**

b) Find $L^{-1}\left[\cot^{-1}\left(2/s^2\right)\right]$. **8**

5. a) Express the function $f(x)=\begin{cases}1, & |x|<1\\ 0, & |x|>1\end{cases}$ as a Fourier integral & hence evaluate **8**

$$\int_0^\infty \frac{\sin\lambda\cdot\cos\lambda x}{\lambda}\,d\lambda$$

b) Find the f(x) if its sine transform is $\frac{e^{-a\lambda}}{\lambda}$. Hence deduce the inverse sine transform of $1/\lambda$. **8**

OR

6. a) Evaluate the integral $\int_0^\infty \frac{dx}{\left(a^2+x^2\right)\left(b^2+x^2\right)}$ by using Parseval's Identity. **8**

b) Find Fourier sine transform of $e^{-|x|}$ & hence show that $\int_0^\infty \frac{x\sin mx}{1+x^2}dx = \frac{\pi}{2}e^{-m}, m>0.$ **8**

7. a) Form the partial differential equation by eliminating the arbitrary function from **4**
$z=(x+y)\phi\left(x^2-y^2\right)$

b) Solve $\frac{\partial^2 z}{\partial x,\partial y}=\sin x\cdot\sin y$ for which $\frac{\partial z}{\partial y}=-2\sin y$ where $x=0$ & $z=0$ when y is an odd multiple of $\pi/2$. **4**

c) Solve $xq = yp + xe^{x^2+y^2}$ **8**

OR

8. a) Solve $x\left(y^2-z^2\right)\frac{\partial z}{\partial x}+y\left(z^2-x^2\right)\frac{\partial z}{\partial y}=z\left(x^2-y^2\right)$ **8**

b) Solve the following partial differential equation by method of separation of variables **8**
$\frac{\partial u}{\partial x}=4\frac{\partial u}{\partial y}$, given $u(0,y)=8e^{-3y}$.

9. a) Test the consistency & solve **8**

$5x + 3y + 7z = 4$

$3x + 26y + 2z = 9$

$7x + 2y + 10z = 5$

b) Solve by matrix method **8**

$x'' - 5x' - 6x = 0$ given $x(0) = 2$

$x'(0) = 0$

OR

10. a) If $M = \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$ find $m^2 - 3m + 1$ by Sylvester's theorem. **8**

b) Verify Cayley-Hamilton's theorem for the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ & hence obtain A^{-1}. **8**

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