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

101 / 001 - Engineering Mathematics-III

P. Pages : 2 **GUG/W/23/13906B**

Time : Three Hours * 7 4 9 3 * Max. Marks : 80

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

1. a) Find Laplace Transform of $\frac{e^{-at}-e^{-bt}}{t}$, hence evaluate $\int_0^\infty \frac{e^{-at}-e^{-bt}}{t}\,dt$. **8**

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

OR

2. a) Given $L\left\{\sqrt[2]{\frac{t}{\pi}}\right\}=\frac{1}{s^3/2}$, show that $L\left\{\frac{1}{\sqrt{\pi t}}\right\}=\frac{1}{\sqrt{s}}$. **8**

b) Find the Laplace of the following. **8**

i) $t(3\sin 2t-2\cos 2t)$ ii) $\int_0^t x^2e^{-x}dx$

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

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

OR

4. a) Use convolution theorem to find Laplace inverse of the following function. **8**

$$\frac{1}{(s-2)(s+2)^2}$$

b) Solve the equation $\frac{dx}{dt}-y=e^t, \frac{dy}{dt}+x=\sin t$, given $x(0)=1, y(0)=0$. **8**

5. a) Express $f(x)=\begin{cases}1, & |x|<1\\ 0, & |x|>1\end{cases}$ as Fourier integral and find $\int_0^\infty \frac{\sin\lambda.\cos\lambda x}{\lambda}d\lambda$ **8**

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

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

OR

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

b) Prove that Parseval identities. **8**

i) $\int_0^\infty \overline{f}_c(s)\overline{g}_c(s)ds = \int_0^\infty f(x)g(x)dx$ ii) $\int_0^\infty \overline{f}_s(s)\overline{g}_s(s)ds = \int_0^\infty f(x)g(x)dx$

7. a) Eliminating the arbitrary constant function ϕ from the relation $\phi\left(x^3-y^3,\ x^2-z^2\right)=0$ and find the partial differential equation. **8**

b) Solve $\left(x^2-y^2-yz\right)p+\left(x^2-y^2-zx\right)q=z(x-y)$. **8**

OR

8. a) From the partial differential equation by eliminating arbitrary constant from the equation $xyz=f\left(x^2+y^2+z^2\right)$ **8**

b) Solve $\left(x^2-y^2-yz\right)p+\left(x^2-y^2-zx\right)q=z(x-y)$ **8**

9. a) Find inverse of the following matrices by partitioning method. **8**

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

b) Test the consistency and solve. **8**

$2x-y-z=2,\ x+2y+z=2,\ 4x-7y-5z=2$

OR

10. a) 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**

b) Find the eigen value eigen vector and model matrix for the matrix. **8**

$$A=\begin{bmatrix}-2 & 2 & -3\\ 2 & 1 & -6\\ -1 & -2 & 0\end{bmatrix}$$

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