FRB202

1. **Find *Laplace Transform* of each of the following functions, indicating the method used and showing the details.**

$$(a)\ f(t) = t\int_0^t e^{-3\tau}\sin(2\tau)\,d\tau \qquad (b)\ f(t) = 16t^2u(t-1)$$

2. **Find the *Inverse Laplace transform* for each of the following functions, indicating the method used and showing the details.**

$$(a)\ F(s) = \frac{1}{s(s^2-9)} \qquad (b)\ F(s) = e^{-5s}\tan^{-1}\left(\frac{s}{7}\right)$$

3. **Solve the following *initial value problems* (IVP's) using Laplace transform, showing the details.**

$$(a)\ u(t) = 4t^2 - \int_0^t u(t-\tau)\,e^{-\tau}d\tau$$

$$(b)\ y'' + 4y' + 5y = 50t,\ \ y(0) = 5,\ \ y'(0) = -5$$

4. **Obtain *Fourier expansion* of the following function, graph the corresponding periodic function.**

$$f(x) = \begin{cases} 0 & if\ -\pi < x < 0 \\ x^2 & if\ 0 < x < \pi \end{cases}$$

5. **Solve the *wave equation* $u_{tt} = a^2u_{xx}$ for the length $L = 1$ with $a^2 = 1$ where,**

$$u(0,t) = u(L,t) = u_t(x,0) = 0, u(x,0) = x$$

Using separation of variable method.

6. **Evaluate each of the following *double integrals.***

$$(a)\int_0^{\frac{\pi}{2}}\int_1^e \frac{\sin y}{x}\,dxdy \qquad (b)\int_0^2\int_0^{2-x}(x+y)\,dydx$$

$$(c)\int_0^{0.5}\int_{2x}^1 e^{y^2}\,dydx \qquad (d)\int_{-5}^{5}\int_0^{\sqrt{25-x^2}} x^2y\,dydx$$