1. Solve the following differential equation

$$\frac{d^2y}{dx^2}-4\frac{dy}{dx}+4y=\frac{e^{2x}}{x}$$ (20)

2. Use $f(x)=\frac{x^2}{2}$, $-\pi \le x \le \pi$ and $f(x)=f(x+2\pi)$ to evaluate

$$1-\frac{1}{4}+\frac{1}{9}-\frac{1}{16}+-\ldots=\frac{\pi^2}{12}$$ (20)

by Fourier expansion.

3. Find the inverse Laplace transform as follows

$$f(t)=L^{-1}\{\frac{s}{(s^2+16)^2}\},$$ (20)

4. Evaluate the following integral

$$I=\int_C (1+y^2+z^2)ds,$$

where C : $\vec{r}=(t)\vec{i}+(\cos t)\vec{j}+(\sin t)\vec{k}$ and $0 \le t \le \pi$ (20)

5. Find the eigenvalue and eigenfunction of the following equation

$$\frac{d^2y}{dx^2}+\lambda y=0$$ (20)

with the following boundary conditions

$$y(0)=0 \text{ and } \left.\frac{dy}{dx}\right|_{x=1}=0$$