Date.....

Ques 3:- Solve $\int e^{2x} \sin 3x \, dx$.

Solve

$$I = \int \underset{I}{e^{2x}} \cdot \underset{II}{\sin 3x} \, dx$$

$$= e^{2x} \int \sin 3x \, dx - \int \left\{ \frac{d}{dx} e^{2x} \int \sin 3x \, dx \right\} dx$$

$$= e^{2x} \frac{(-\cos 3x)}{3} - \int 2e^{2x} \frac{(-\cos 3x)}{3} dx$$

$$= \frac{-e^{2x}}{3} \cos 3x + \frac{2}{3} \int e^{2x} \cos 3x \, dx$$

$$= \frac{-e^{2x}}{3} \cos 3x + \frac{2}{3} \left[e^{2x} \int \cos 3x \, dx - \int \frac{d}{dx} e^{2x} \int \cos 3x \, dx \right]$$

$$= \frac{-e^{2x} \cdot \cos 3x}{3} + \frac{2}{3} \left[\frac{e^{2x} \cdot \sin 3x}{3} - \int 2e^{2x} \frac{\sin 3x}{3} \right]$$

$$= -e^{2x} \cos 3x + \frac{2}{9} e^{2x} \sin 3x - \frac{4}{9} \int e^{2x} \sin 3x \, dx$$

$$= \frac{-e^{2x} \cdot \cos 3x}{3} + \frac{2}{9} e^{2x} \sin 3x - \frac{4}{9} I + C$$