

SNS COLLEGE OF ENGINEERING Coimbatore – 641 107



TOPIC : 3 - PROBLEMS BASED ON FULL RANGE SERIES (0, 2L)

Formula for fourier series in (0,21) $f(x) = \frac{a_0}{2} + \frac{z}{n_{z_1}} a_n \frac{\cos n\pi x}{\lambda} + \frac{z}{n_{z_1}} b_n \frac{\sin n\pi x}{\lambda}$ where $a_0 = \frac{2}{b \cdot a} \int_{0}^{b} f(x) dx$ $a_n = \frac{2}{b-a} \int_{a}^{b} f_{ixv} \cos \frac{m\pi}{2} dx$ $b_n = \frac{2}{b-a} \int_{a}^{b} f_{ixv} \sin \frac{m\pi x}{2} dx.$ Problems based on (0,2l): 1. Expand fix = { l-x , 0 < 2 ≤ l 4 nence deduce that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots = \frac{7}{4}$. Sol: $a_0 = \frac{2}{2l} \int (l - x) dx$ $= \frac{1}{l} \left(l \alpha - \frac{\chi^2}{2} \right)_0^l$ $= \frac{1}{l} \left(l^2 - \frac{l^2}{2} \right)$ $=\frac{l^2}{1l}$

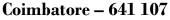




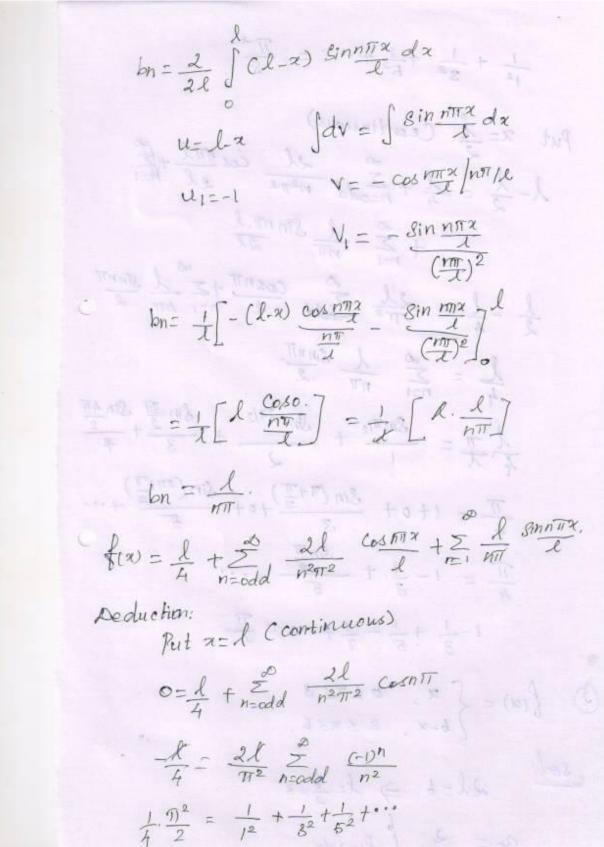
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an= 2 / fra) cosmin da $= \frac{2}{2l} \int \alpha \, d\alpha \, (l-\alpha) \, \cos \frac{n \pi \, \alpha}{l} \, d\alpha$ $= \frac{1}{e} \int (l-x) \cos \frac{n\pi x}{e} dx.$ u= l-x Jolv= CosnTr dr $u_{1} = -1 \qquad V = \underbrace{\underbrace{\underset{l}{\mathcal{I}}}_{l}}_{l}$ $V_1 = -\frac{\cos(\pi i)^2}{(\pi i)^2}$ $\alpha_n = \frac{1}{2} \left[\begin{array}{ccc} cl \cdot x \end{array} & \frac{\sin \frac{m\pi}{2}}{\frac{m\pi}{2}} & \frac{\pi}{\pi} & \frac{\cos \frac{\pi\pi}{2}}{\left(\frac{n\pi}{2}\right)^2} \end{array} \right]_0^{-1}$ $\begin{bmatrix} -\frac{\cos n\pi l}{x} + \frac{\cos o}{(n\pi)^2} \end{bmatrix}$ $= \frac{1}{4} \left[- \frac{(-1)^n l^2}{n^2 \pi^2} + \frac{l}{n^2 \pi^2} \right]$ $= \frac{l^{k}}{d \cdot n^{2} \pi^{2}} \left[1 - (-1)^{n} \right]$ an $= \int \frac{2l}{n^{2} \pi^{2}} \quad \text{if } n \text{ isodd} + \int \frac{2l}{n^{2} \pi^{2}} \quad \text{if } n \text{ iseren} + \int \frac{2l}{n^{2} \pi^{2}} \int \frac{2l}{n^{2}} \int \frac{2$

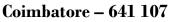










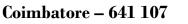




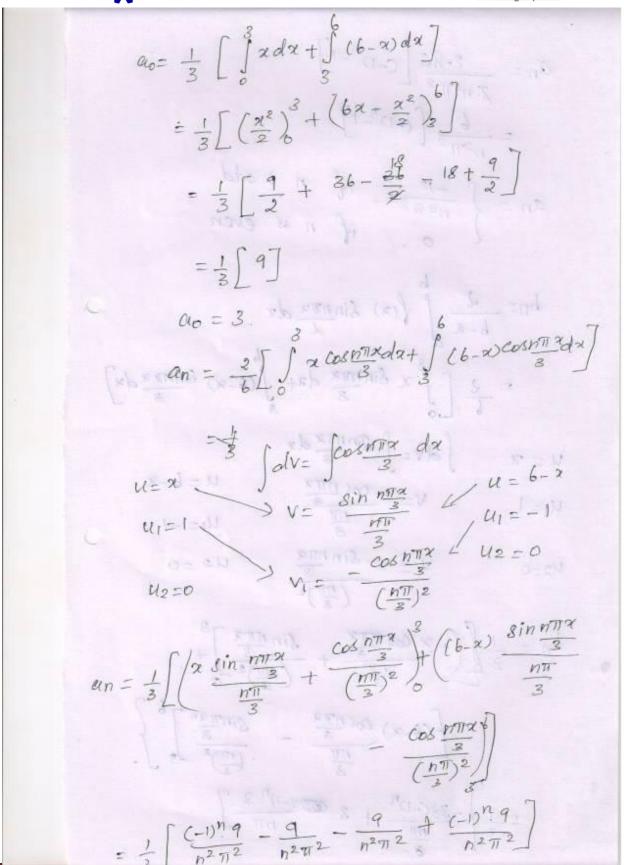
 $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots = \frac{\pi^2}{8}$ Put $x = \frac{l}{2}$ Ceontinuous) $l - \frac{l}{2} = \frac{l}{4} + \frac{2}{n = odd} \frac{2l}{n^2 \pi^2} \cos \frac{\pi \pi l}{2l} + \frac{q}{h = 1}$ t ne nit Sin nt.l $\frac{1}{2} - \frac{1}{4} = \frac{2l}{\pi^2} \sum_{n=cold}^{\infty} \frac{\cos n\pi}{2} + \sum_{n=1}^{\infty} \frac{l}{n\pi} \frac{\sin n\pi}{2}$ $\frac{l}{h} = \sum_{n=1}^{\infty} \frac{l}{n\pi} \frac{s_{1n} n\pi}{2}$ $\frac{1}{1} = \frac{\sin \pi / 2}{1} + \frac{3}{1} + \frac{3}{1} + \frac{3}{3} + \frac{3}{7} + \frac{3}{7}$ $\frac{\overline{n}}{4} = (+ o + \frac{\sin(\overline{n} + \frac{\pi}{2})}{3} + o + \frac{\sin(\overline{n} + \frac{\pi}{2})}{5} + \cdots$ $\frac{\overline{n}}{4} = 1 - \frac{1}{3} + \frac{3n\frac{\pi}{2}}{5} + \cdots$ $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{7} = \frac{1}{7}$ $() f(x) = \begin{cases} x, & 0 \le x \le 3 \\ 6 - x, & 3 \le x \le 6 \end{cases}$ $sol: \qquad 2l = b \Rightarrow l = \frac{b}{2} = 3.$ ao = 2 | fix)dx

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$$\begin{aligned} a_{n} &= \frac{2 \cdot 93}{7 \cdot n^{2} \pi^{2}} \left[\begin{array}{c} c_{-1} y^{n} - 1 \end{array} \right] \\ &= \frac{6}{n^{2} \pi^{2}} \left[\begin{array}{c} c_{-1} y^{n} - 1 \end{array} \right] \\ a_{n} &= \int \frac{-12}{n^{2} \pi^{2}} \int \frac{16}{n^{2}} n & \text{is odd} \\ a_{n} &= \int \frac{-12}{n^{2} \pi^{2}} \int \frac{16}{n^{2}} n & \text{is even} \\ b_{n} &= \frac{2}{b-a} \int \frac{6}{d} f(x) & \delta \ln \frac{n\pi x}{2} dx \\ &= \frac{2}{b-a} \int \frac{6}{d} f(x) & \delta \ln \frac{n\pi x}{2} dx \\ &= \frac{2}{b} \left[\int_{0}^{\beta} x & \delta \ln \frac{n\pi x}{3} dx + \int_{0}^{b} (6-x) & \delta \ln \frac{n\pi x}{3} dx \right] \\ u &= x & \int dv = \int \frac{8 \ln \pi \pi x}{\pi^{2}} dx \\ u_{1} &= 1 & V = -\frac{\cos n\pi x}{\pi^{2}} & u_{2} = b - x \\ u_{1} &= 1 & V = -\frac{\cos n\pi x}{\pi^{2}} & u_{2} = 0 \\ &= \frac{1}{3} \int \left[\left(-x \frac{\cos n\pi x}{\pi^{2}} + \frac{\sin n\pi x}{\pi^{2}} - \frac{\sin n\pi x}{\pi^{2}} \right]_{0}^{3} + \int \left[\frac{6}{(6-x)} \frac{\cos n\pi x}{\pi^{2}} - \frac{8}{n\pi^{2}} \right]_{0}^{6} \int \\ &= \frac{1}{3} \left[\left(-\frac{336 - t^{n}}{\pi^{2}} + 3 \left(\frac{\cos (-1)^{n} \cdot 3}{n\pi} \right) \right] \end{aligned}$$

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 $= \frac{1}{3} \begin{bmatrix} 0 \end{bmatrix}$ $b_n = 0.$ $\therefore \int (\pi) = \frac{3}{2} + \sum_{n=0}^{\infty} \frac{-12}{n^2 \pi^2} \cos \frac{n \pi \pi}{3}$