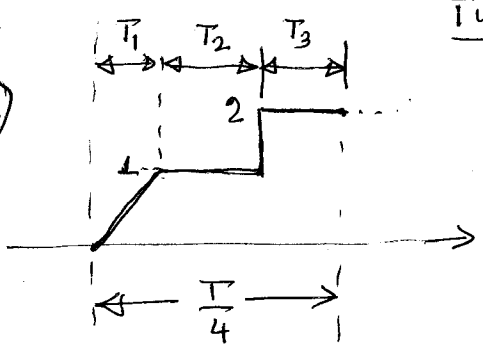
Tutorial

Q1



A periodic signal $x(t)$ is shown over quarter of a period T.

(i) Sketch $x(t)$ over a complete period so that it has quarter wave symmetry.

(ii) Comment on the presence of odd/even harmonics and sine/cosine terms.

Q2

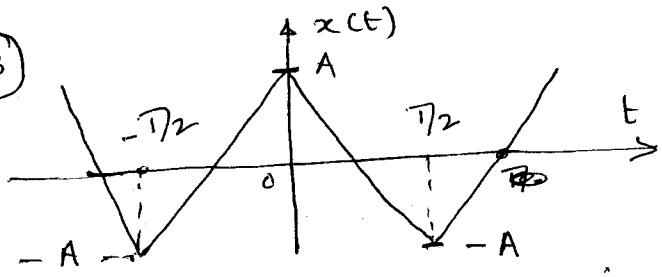
~~$x(t) = 6 \sin 2\omega t + 2\cos(4\omega$~~

$$x(t) = 6 \sin 2t + 2\cos(4t + \pi/6) + 4 \sin(6t - \pi/4)$$

(i) Is it a periodic signal? If yes find out its fundamental period and fundamental angular frequency.

(ii) Express $x(t)$ in terms complex Fourier series form. Sketch $|C_K|$ and phase ϕ_K.

Q3



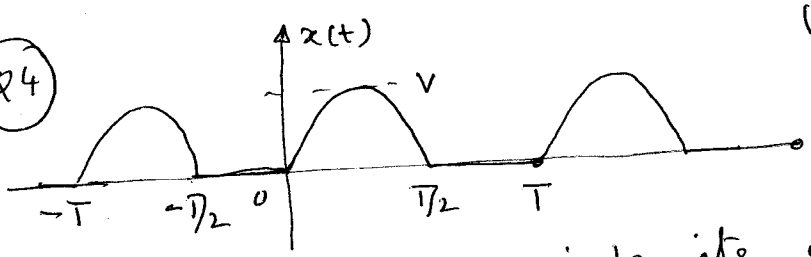
(i) Obtain F.S coefficients d.c value, a_K and b_K

(ii) Get Complex Fourier co-efficients C_K

(iii) From C_K calculated in part (ii) get a_K and b_K. Check with results obtained in part (i).

(iv) Get C_K by appropriately differentiating $x(t)$ (till periodic impulse signal is obtained).

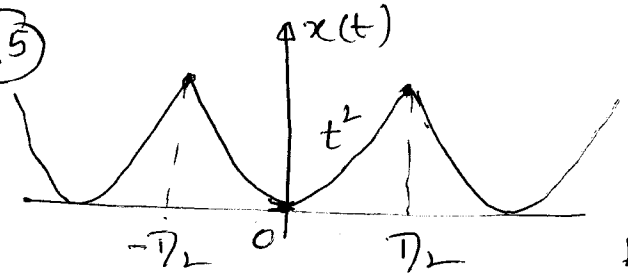
Q4



(i) $x(t)$ is $\frac{1}{2}$ wave sinusoidal rectifier output signal. Calculate the Fourier series co-efficients.

(ii) Now express $x(t)$ into its odd and even parts and sketch them. Get F.S co-efficients of the odd and the even parts separately and add them together to get F.S coefficients of $x(t)$. Compare the result as obtained in part (i)

(Q5)



We want to get the F.S co-eff. of $x(t)$ i.e., c_k, a_k & b_k. Adopt a suitable method to obtain them. Also calculate P_{av}.

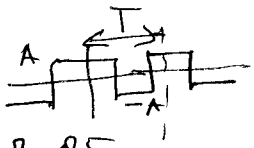
(Q6) Some interesting infinite series sum can be (shown below) rather easily obtained by using the ideas of Fourier series.

(i) $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots \infty = ?$

(ii) $\frac{1}{2^2} + \frac{1}{4^2} + \frac{1}{6^2} + \cdots \infty = ?$

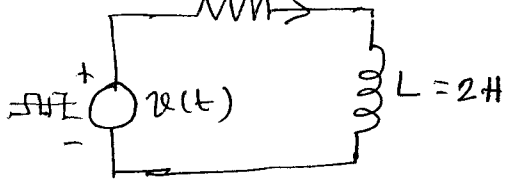
(iii) If (i) & (ii) are obtained then we can find easily $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots \infty = ?$ find out :-

Hints:- you may try Fourier analysis of

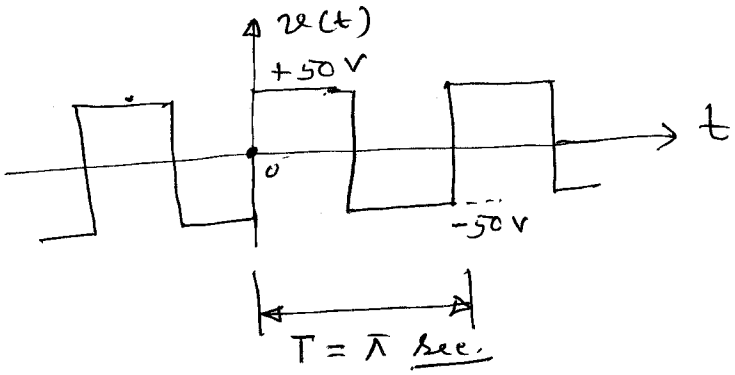


and a wave of Q3 or parabolic wave of Q5

(Q7)



~~Periodic~~ $v(t)$ applied to the R-L ckt. is periodic in nature as shown below.



We want to find out the steady state $i(t)$.

Consider only first 3 predominant (!) harmonics.

Complete this table:

order of harmonics	Maxm. value of current	Phase angle
fund: K = 1		

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