Problem 1.
In the circuit shown below, the Fourier series expansion of $v_s(t)$ is

$$v_s(t) = 3 + \frac{4}{\pi} \sum_{n=1}^{\infty} \frac{1}{n} \sin(n\pi t)$$

Find $v_o(t)$.

Problem 2.
The voltage across the terminals of a circuit is

$$v(t) = 30 + 20 \cos (60\pi t + 45^\circ) + 10 \cos (120\pi t - 45^\circ) \ \text{V}$$

If the current entering the terminal at higher potential is

$$i(t) = 6 + 4 \cos (60\pi t + 10^\circ) - 2 \cos (120\pi t - 60^\circ) \ \text{A}$$

find:
(a) the rms value of the voltage,
(b) the rms value of the current,
(c) the average power absorbed by the circuit.

Problem 3.
A series $RLC$ circuit has $R = 10 \ \Omega$, $L = 2 \ \text{mH}$, and $C = 40 \ \mu\text{F}$. Determine the effective current and average power absorbed when the applied voltage is

$$v(t) = 100 \cos 1000t + 50 \cos 2000t + 25 \cos 3000t \ \text{V}$$

Problem 4.
The periodic current waveform below is applied across a 2-k$\Omega$ resistor. Find the percentage of the total average power dissipation caused by the dc component.

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**ENGR 203**

**Spring 2018**

**Homework #7 (Due June 7)**
Problem 5.
The amplitude and phase spectra of a truncated Fourier series are shown in the figure below. (a) Find an expression for the periodic voltage using amplitude-phase form. See Eq. (17.10). (b) Is the voltage odd or even function of $t$?

![Figure showing amplitude and phase spectra](image)

Problem 6.
Given that

$$f(t) = \sum_{n=1}^{\infty} \left( \frac{20}{n^2 \pi^2} \cos 2nt - \frac{3}{n\pi} \sin 2nt \right)$$

plot the first five terms of the amplitude and phase spectra for the function.

Problem 7.
A certain band-limited periodic current has only three frequencies in its Fourier series representation: dc, 50 Hz, and 100 Hz. The current may be represented as

$$i(t) = 4 + 6 \sin 100 \pi t + 8 \cos 100 \pi t - 3 \sin 200 \pi t - 4 \cos 200 \pi t \ A$$

(a) Express $i(t)$ in amplitude-phase form.
(b) If $i(t)$ flows through a 2-$\Omega$ resistor, how many watts of average power will be dissipated?