Information Technology University, Lahore, Pakistan

Electrical Network Analysis (EE-241)

Assignment # 4, Spring 2021

Submission Deadline: **Thursday May 20, 2021** Maximum Marks: 100

- Upload a single PDF file using CamScanner application on your mobile.

1. A current source $i_s(t) = 20 \cos 1000t$ A, a 100 Ω resistor and a 100 µF capacitor are in parallel. Find the instantaneous power associated witht the three components at $t = \frac{\pi}{2}$ ms, [10]

2. (a) Find the total instantaneous power $p(t)$, the average power **P** and the reactive power **Q** delivered from $v(t) = 230 \sin 50t$ to a parallel RLC circuit if $R = 1\,\text{k}\Omega$, $L = 1\,\text{mH}$ and $C = 1\,\mu\text{F}$. [5]

   (b) Draw the power triangle for part (a). Also mention whether the P.F. is leading or lagging. [5]

3. (a) Analyze the circuit to find the **complex power** being absorbed by each of the five elements in Figure 1. [5]

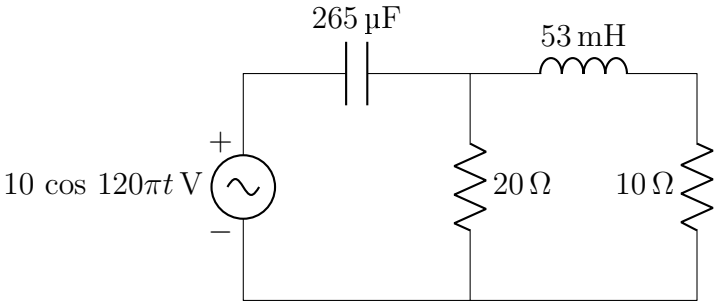

Figure 1: Circuit for problem 3a

   (b) Both sources are operating at the same frequency in Figure 2. Find the complex power generated by each source and complex power absorbed by each circuit element. [5]

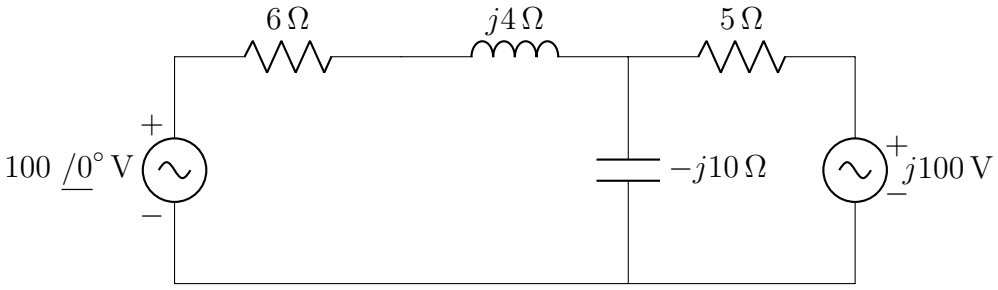

Figure 2: Circuit for problem 3b

4. (a) A sinusoidal voltage with $V_{eff} = 10\,\text{V}$ is connected across $Z_1 = (1+j)\,\Omega$. Find $i(t)$,I_{eff}, $p_1(t)$, P, Q, $p.f.$ and S. Draw the power triangle. [3]

   (b) Repeat part (a) if the load Z_1 is replaced by $Z_2 = (1-j)\,\Omega$. [3]

(c) Repeat if impedance Z_1 of part (a) is connected in parallel with impedance Z_2 of part (b). [4]

5. (a) How much capacitive power **Q** must be provided by the capacitor bank in Figure 3 to improve the $p.f.$ to 0.95 lagging if $Z_L = 3.5\underline{/25^\circ}\,\Omega$. [5]

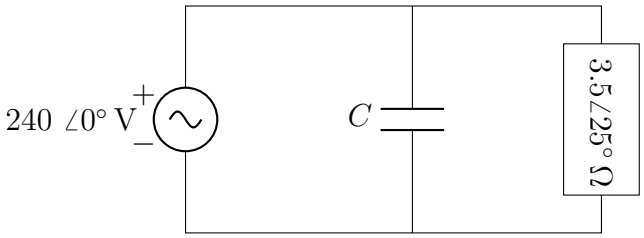

Figure 3: Circuit for problem 5a

(b) A load of $\mathbf{P} = 1000\,\text{kW}$ with $p.f. = 0.5$ lagging is fed by a 5 kV source. A capacitor is added in parallel such that the $p.f.$ is improved to 0.8. Find the reduction in current drawn from the generator. [5]

6. (a) Find the average power absorbed by each of the five elements in Figure 4. [5]

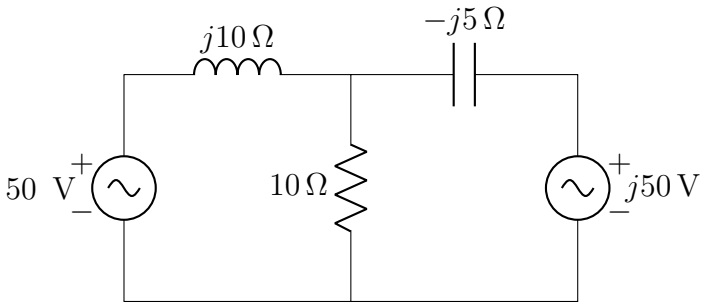

Figure 4: Circuit for problem 6a

(b) Find the average power being dissipated in 3 Ω resistor in Figure 5. What is the power being generated by the current souce? [5]

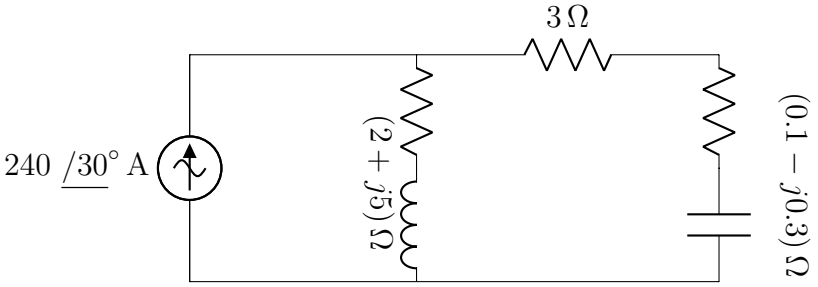

Figure 5: Circuit for problem 6b

7. A source of 230 V (r.m.s) is supplying three loads A, B and C in parallel:

Load A is 1.2 kVA with lagging $p.f.$ of 0.8

Load B is 1.6 kVA at lagging $p.f.$ of 0.9

Load C is 900 W at a $p.f.$ of unity. Find

(a) the amplitude of the source current. [4]

(b) the $p.f.$ at which the source is operating. [3]

(c) the complex power being furnished by the source. [3]

8. Find the complex power being delivered to the load that

(a) draws 500 VA at a leading $p.f.$ of 0.75. [3]

(b) draws 500 W at a leading $p.f.$ of 0.75. [3]

(c) draws -500 VAR at a $p.f.$ of 0.75. [4]

9. Given the circuit shown in Figure 6, find the complex power supplied by the source and the source power factor. If $f = 60$ Hz, find $v_s(t)$. [10]

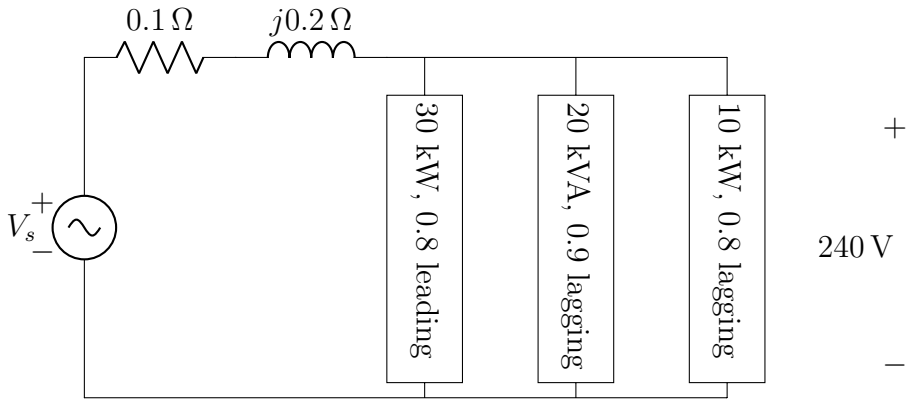

Figure 6: Circuit for problem 9

10. Find both the average and $r.m.s.$ value of each of the waveforms depicted in Figure 7. [10]

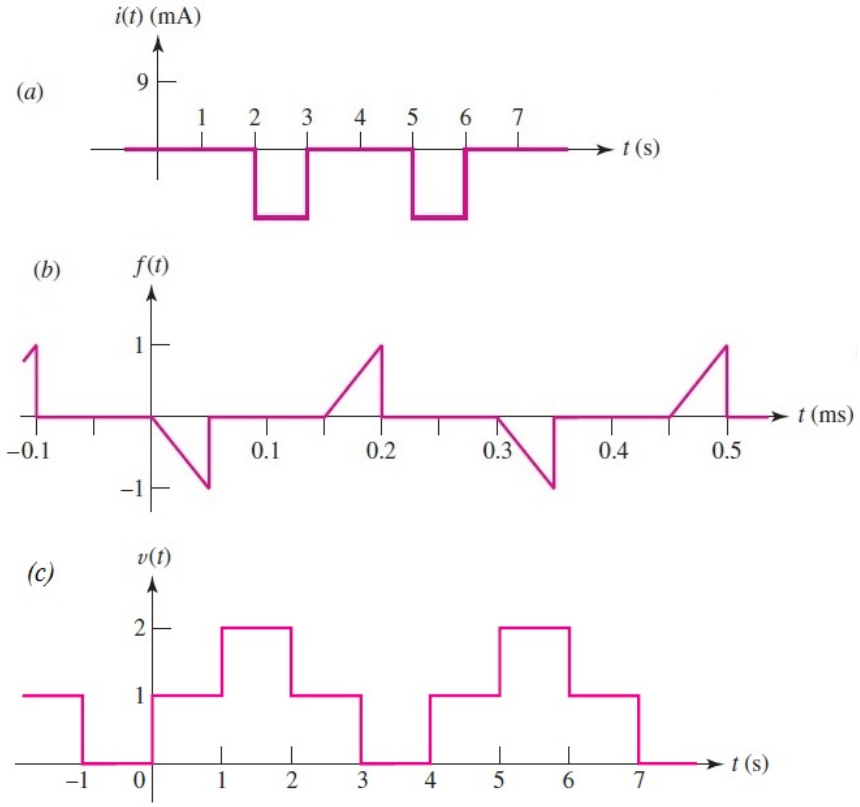

Figure 7: Timing Diagrams for problem 10