

EE 201 - THEORY OF ELECTRICITY

Time Allowed: Three Hours

December 2001

Answer ALL Questions. All Questions carry equal marks. Total marks for all Questions = 70

1. A coil, of resistance R and Inductance L , is connected in series with a capacitor across a variable-frequency source. The voltage is maintained constant at 300 mV and the frequency is varied until a maximum current of 5 mA flows through the circuit at 6 kHz. If, under these conditions, the Q factor of the coil is 105, calculate the values of R , L and C .
- 2 a) State Maximum Power Transfer Theorem.
b) For the circuit shown in Fig. Q2, determine the impedance of the load which will dissipate maximum power, and determine the maximum power.

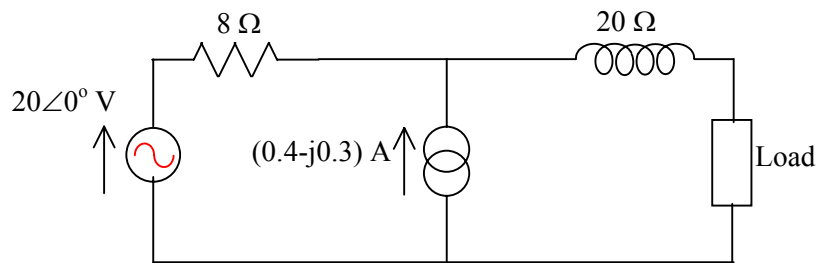


Fig. Q2

- 3 A balanced delta connected load of series combination of resistance 75Ω and inductance 150 mH in each arm is fed from a balanced three phase, 400 V, 50 Hz supply. If the line resistance and inductance of each connecting wire are 1Ω and 10 mH respectively, determine the line current and the voltage supplied to the load.
- 4 For the circuit shown in Fig. Q4, convert all the voltage sources to equivalent current sources. Write down the branch-node incidence matrix and the branch admittance matrix. Show how the nodal admittance matrix is determined.

Show how nodal matrix analysis may be used to determine voltages at Point A and B.

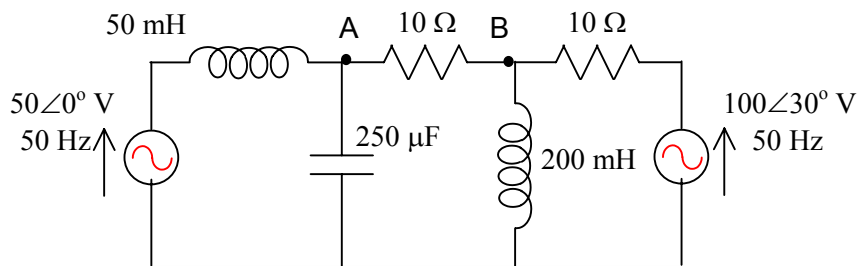


Fig. Q4

- 5 a) For the circuit shown in Fig. Q5, determine the currents in all the branches using mesh analysis.

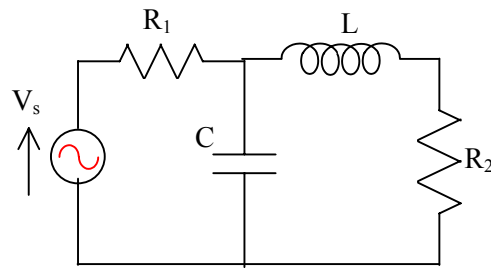


Fig.Q5

$$\begin{aligned} V_s &= 100 \sin(100t + \pi/6) \text{ V} \\ L &= 40 \text{ mH} \\ R_1 &= 5 \Omega \\ R_2 &= 15 \Omega \\ C &= 200 \mu\text{F} \end{aligned}$$

- b) Determine the Sequence Components of the following voltages.

$$V_a = 200 \angle 0^\circ, \quad V_b = 100 \angle -90^\circ \quad \text{and} \quad V_c = 150 \angle 150^\circ \text{ volt}$$

- 6 For the voltage waveform shown in Fig. Q6, determine the Fourier series to three significant terms. Determine also the form factor and the peak factor of the voltage waveform.

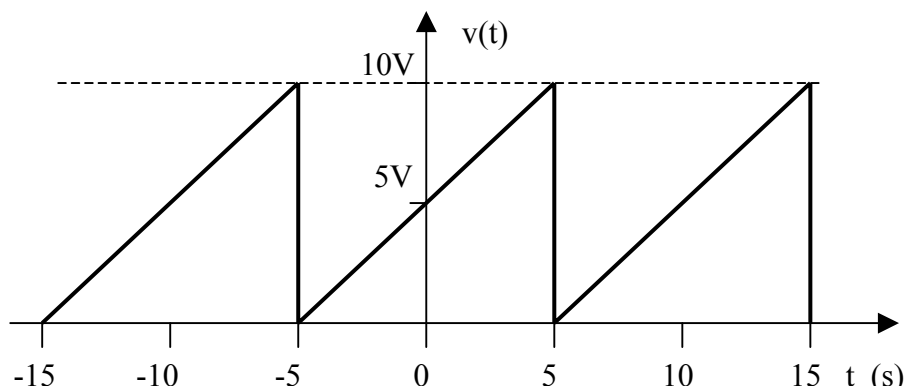


Fig. Q6

- 7 Switch S in Fig. Q7 is closed at time $t=0$. Obtain the expressions for the voltage v and current i when $C = 3 \mu\text{F}$.

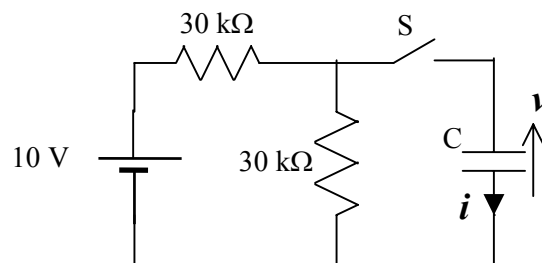


Fig.Q7