Tutorial Sheet 3: Single Phase AC Networks

Q1. (a) Calculate the (i) rms value, (ii) average value, (iii) form factor and (iv) peak factor of the signal x(t) as shown in Fig 1(a).

(b) The waveform of the Fig. 1(b) is derived from a sine function and has zero value when the sine function is negative and also from t=0 to t=0.1 and for the corresponding interval of each period. Find the rms value and the average value of this waveform.

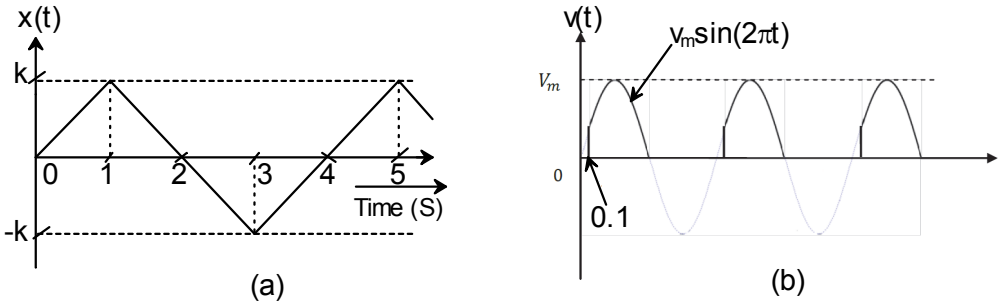

Fig. 1

Q2. For the circuit of Fig. 2, calculate I_2, I_3, V_1 and V_2. Draw suitable phasor diagrams to represent them. Calculate the active and reactive powers absorbed by each parallel branch and also the active and reactive power supplied by the current source.

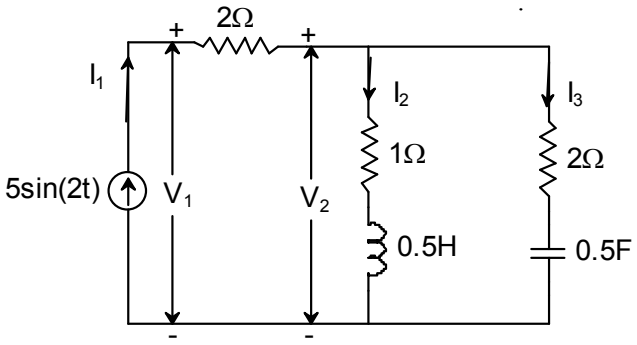

Fig. 2

Q3. (a) In the circuit shown in Fig. 3, the magnitudes of V_L and V_C are twice that of V_R. Calculate the inductance of the coil.

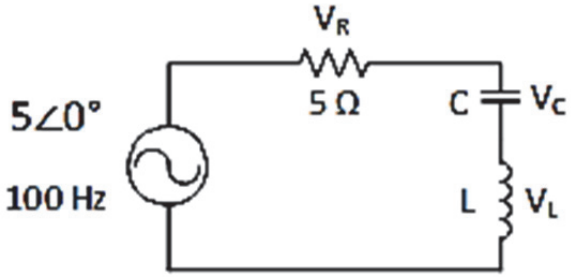

Fig. 3

Q4. Draw the phasor diagram for current in the circuit, V_{AB} and V_{AC}, when 200 V, 50 Hz source is connected across the circuit shown in Fig. 4. Indicate the angles and magnitudes in the diagram with supply voltage as reference.

(a) Calculate the reactive power drawn by the circuit.

(b) Find the value of capacitance to be connected in parallel across the circuit to raise the overall power factor of the combination to unity.

(c) Calculate the current and real power drawn by the combination.

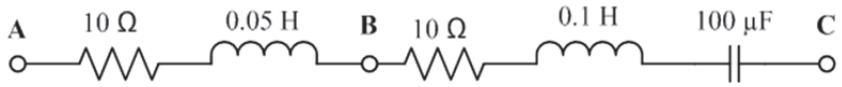

Fig. 4

Q5. Calculate the current through the j5Ω impedance of Fig. 5 using (a) Mesh Analysis, (b) Nodal Analysis and (c) Superposition theorem.

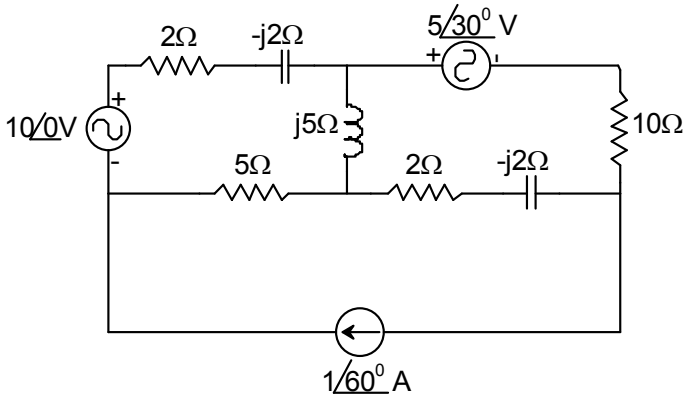

Fig. 5

Q6. Find I_L and the voltage across the current source in Fig. 6 using (a) Thevenin's theorem (b) Norton's theorem

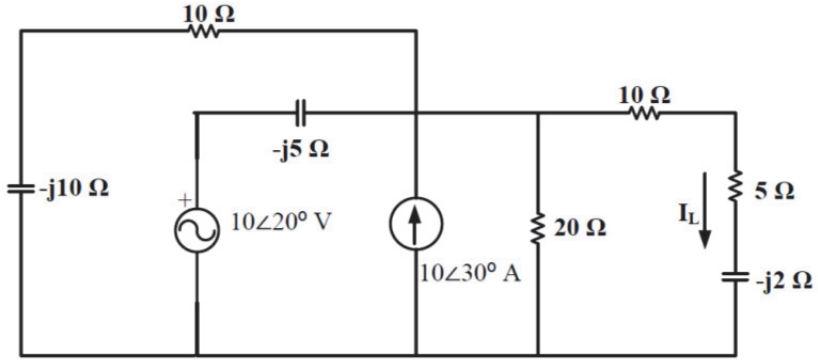

Fig. 6

Q7. If G_2 of Fig. 7 supplies 5 kW at 0.707 pf lagging, find amount of power supplied by G_1 with pf.

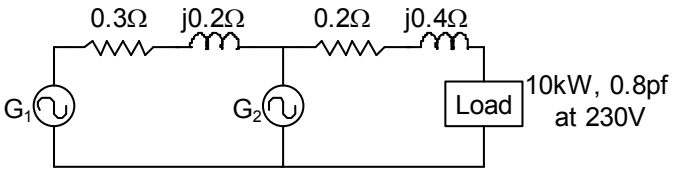

Fig. 7

Q8. Assuming both the voltage sources are in phase, the value of R for which maximum power is transferred from circuit A to circuit B in Fig. 8 is

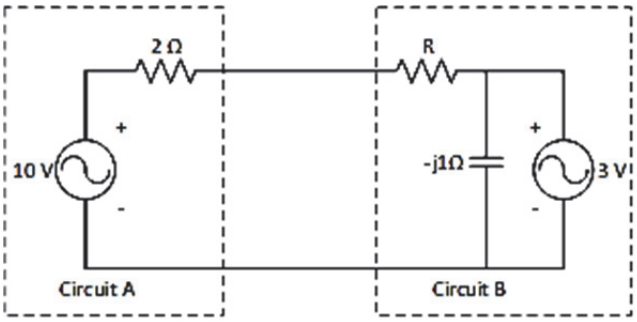

Fig. 8

Q9. (a) A single phase, 100V, 50Hz source supplies a single phase load having impedance of 10Ω and power factor of 0.8 (lag) through a line of impedance Z_{line} = (2+j6)Ω, as shown in Fig. 9. A pure capacitor is connected in parallel (shunt) with the load. Two voltmeters, V_1 and V_2, are connected at the source and load terminals respectively as shown in the figure. Find the minimum value of the capacitance (C_{sh}) such that the readings of the two voltmeters are exactly same. Find the load current ($\bar{I}_L$) and the source current ($\bar{I}_S$) under this condition.

(b) Taking the source voltage as the reference, draw a phasor diagram showing the load terminal voltage, source current, load current and the current into the capacitor ($\bar{I}_C$).

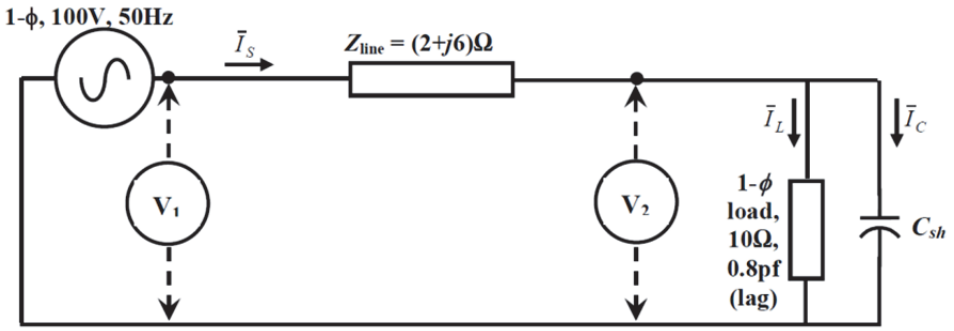

Fig. 9