B.Sc. Engg. (CSE)/ HDCSE, 2nd Sem. Date: October 31, 2016 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Semester Final Examination — Summer Semester, A.Y. 2015-2016
Course No.: Phy 4241 — Time: 3 Hours
Course Title: Electrical Engineering Fundamentals — Full Marks: 150

There are 8 **(eight)** questions. Answer **any 6 (six)** questions. All questions carry equal marks. Marks in the margin indicate full marks. Programmable calculators are not allowed. Do not write on this question paper. Assume suitable values for any missing data.

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1. a) The voltage across a 2 F capacitor is shown in Fig. 1(a). Find and draw the current wave shape through the capacitor. 10

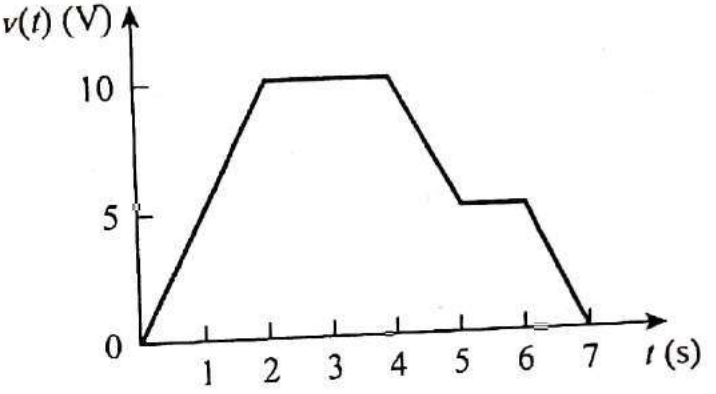

Fig. 1(a)

b) Draw the complete phasor diagram for the circuit in Fig. 1(b). 15

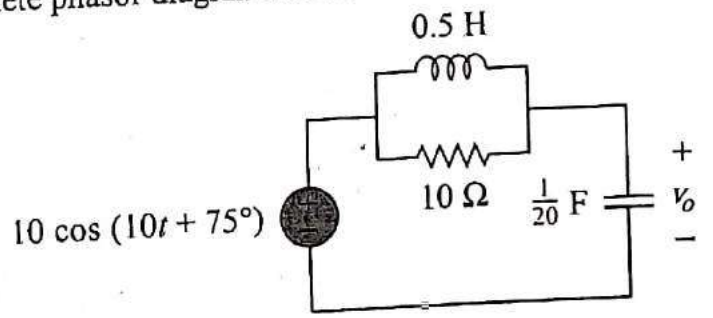

Fig. 1(b)

2. a) For the circuit in Fig. 2(a), find out i, i_L, v_C, energy stored in the capacitor and inductor under dc conditions. 10

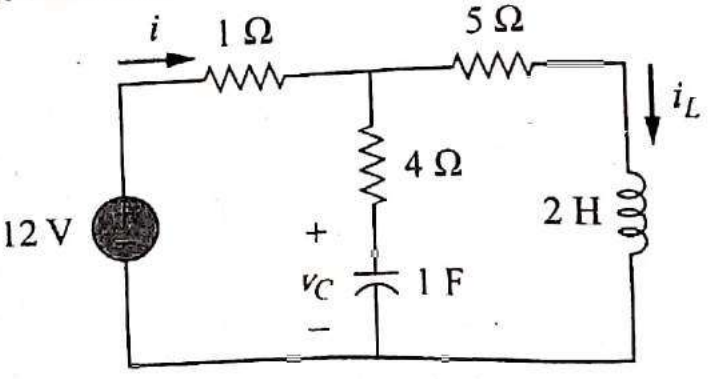

Fig. 2(a)

b) The voltage across a load is $v(t) = 60\cos(\omega t - 30^0)$ V and current through the element in the direction of the voltage drop is $i(t) = 1.5\cos(\omega t + 50^0)$ mA. Find: (i) the complex power and apparent power (ii) the real power and reactive power (iii) the power factor and load admittance. 15

3. a) Use nodal analysis to obtain all the node voltages in the circuit of Fig. 3(a). 15

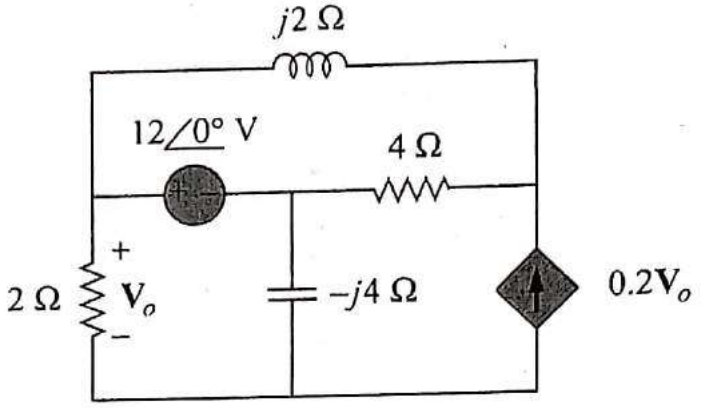

Fig. 3(a)

b) Given $i(t) = 3\cos(\omega t + 30^0)$ and $v(t) = -5\sin(\omega t - 20^0)$, find (i) $i(t) + v(t)$ in phasor form (ii) phase difference between $i(t)$ and $v(t)$. 10

4. a) Find out the phasor currents I_1 and I_2 in the circuit of Fig. 4(a). 15

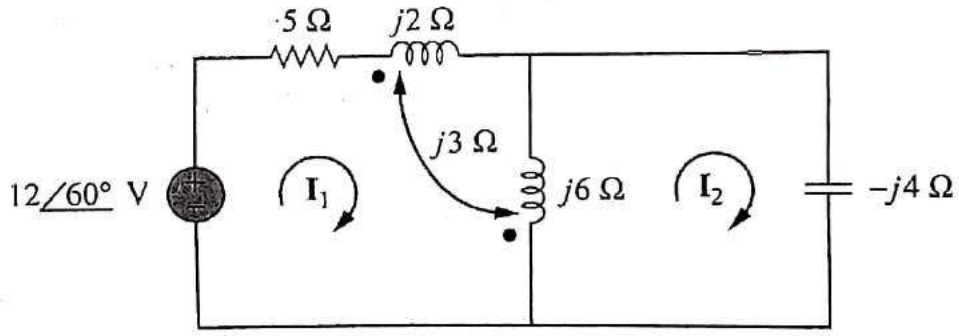

Fig. 4(a)

b) How can you improve the power factor of a capacitive load? Derive the equation to find out the value of the capacitor or inductor needed in this process with proper circuit diagrams. 10

5. a) Use superposition to find out I_x in the circuit of Fig. 5(a). 10

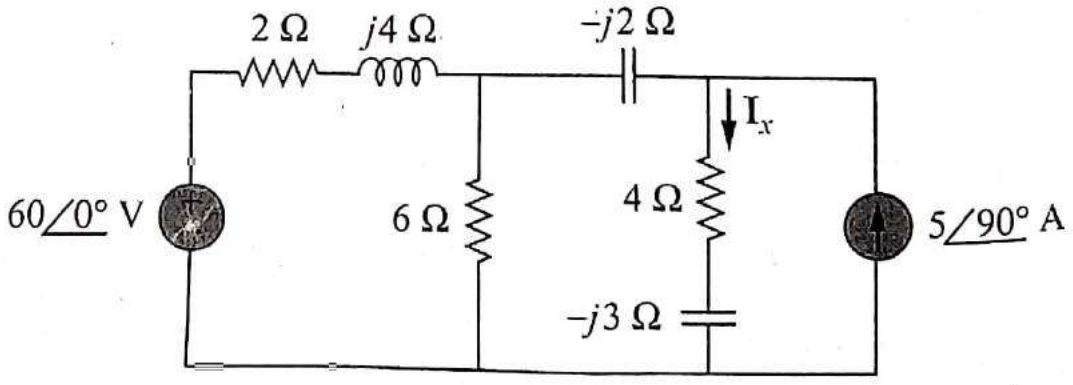

Fig. 5(a)

b) For a balanced wye-delta system, determine the expressions for all phase voltages, line voltages, phase currents and line currents for the negative sequence along with phasor diagrams. 15

a) For the circuit in Fig. 6(a), find out the values of v_0 and i_0. 10

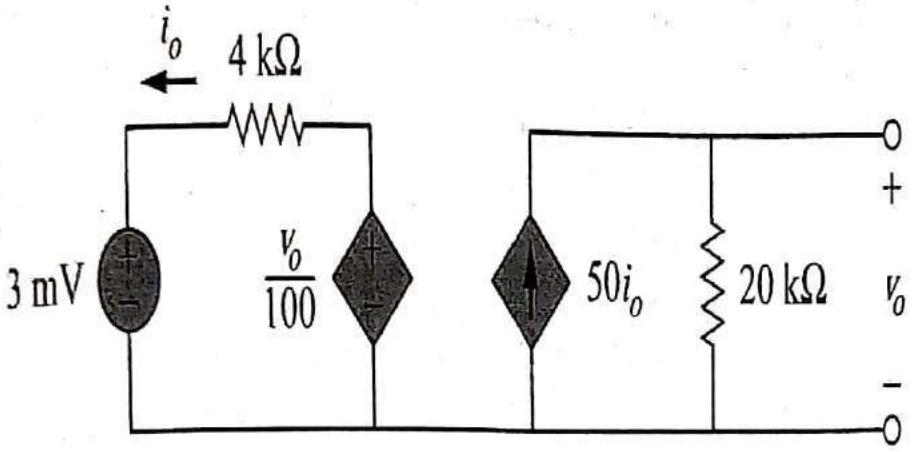

Fig. 6(a)

b) A balanced Y-connected load with a resistance of 40 Ω and reactance of 25 Ω is supplied by a balanced, positive sequence Δ-connected source with a line voltage of 210 V. Calculate the phase currents and phase voltages. Use V_{ab} as reference. 10

c) Can instantaneous power have a negative value? If yes, when and why? If not, why? 05

a) Use source transformation to calculate i_0 in the circuit of Fig. 7(a). 15

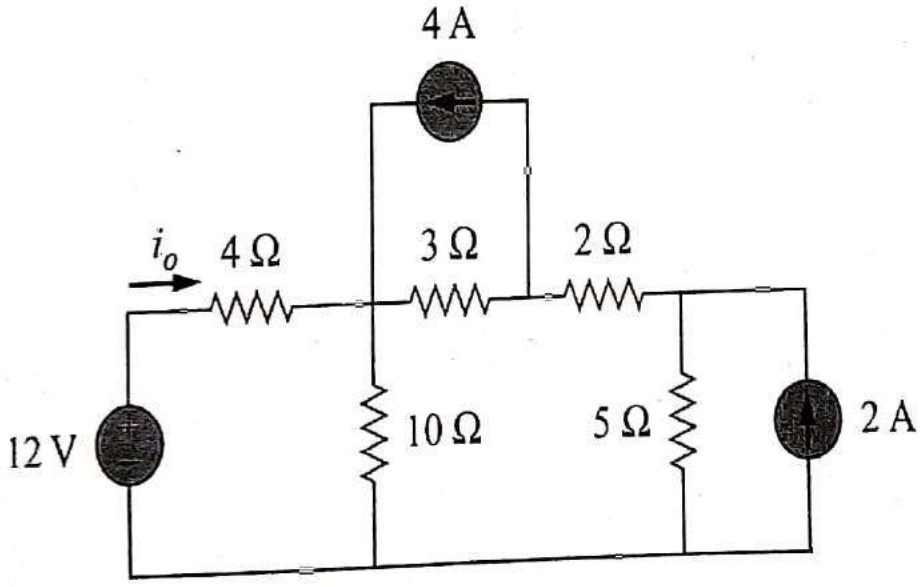

Fig. 7(a)

b) A doughnut shaped core of an unknown material having a relative permeability of 877.56 has been wounded with copper wires. The inner radius of the doughnut is 0.21 m and the outer radius is 0.39 m. A magnetizing force of 150 At/m has been applied to the core which has produced a flux of magnitude 4.5×10^{-4} Wb. Determine the magnitude of the current induced and the total number of turns. 10

8. a) Assume you have 5 electric bulbs each with 60 W capacities to enlighten a badminton court. The supply is 220 V dc. You can connect them in series, in parallel or a hybrid between these two. Of these three possible connections, which one would you choose and why?

b) Determine the value of i in the circuit of Fig. 8(b).

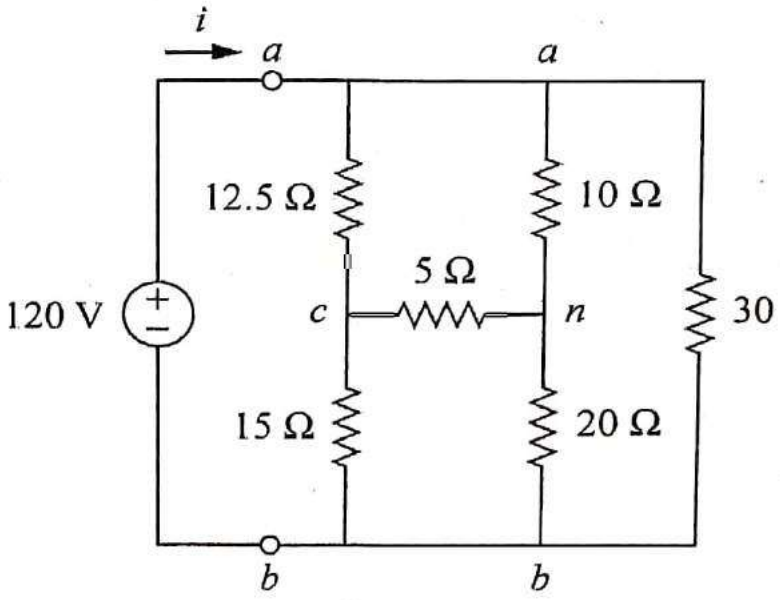

Fig. 8(b)