Ref. No.: EX/EE/T/121/2017

B.E. Electrical Engineering First Year Second Semester Examination, 2017

Principles of Electrical Engineering- II

Time: Three Hours **Full Marks: 100**

(50 Marks for each part)

Use a separate Answer Script for each Part

PART-I

Answer *Any Three* Questions

(TWO MARKS FOR WELL ORGANIZED ANSWERS)

Q1a) State and explain Milman's Theorem for **"n"** number of current and voltage sources. **8**

Q1b) In the network shown in Fig.1 the resistance is changed from 4 ohm to 2 ohm. Find the change in current by direct calculation and verify by the Compensation theorem. **8**

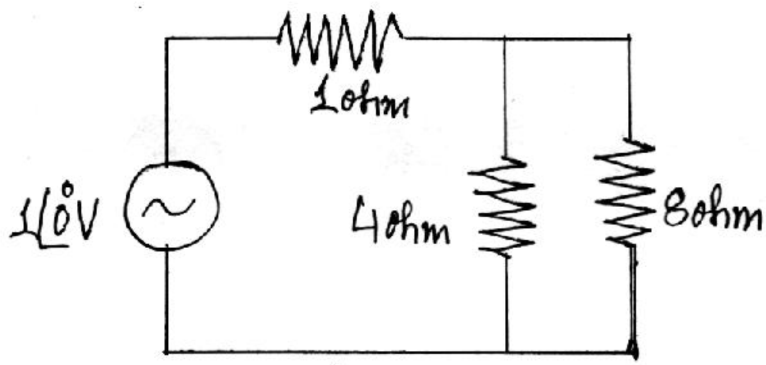

Fig. 1

Q.2a) Derive the expression for coupling co-efficient **K** between two inductively coupled coils in terms of L_1, L_2 and **M**. All symbols carry their usual meanings. What do you mean by loosely coupled and tightly coupled circuits? Why **DOT** convention is used in magnetically coupled circuits? **3+2+3**

Q.2b) In the coupled circuit shown in Fig,2 calculate (i) the self- impedance of primary and secondary circuit, (b) the impedance reflected into the primary circuit, (c) the equivalent primary impedance and (d) the primary and secondary current. **8**

[Turn over

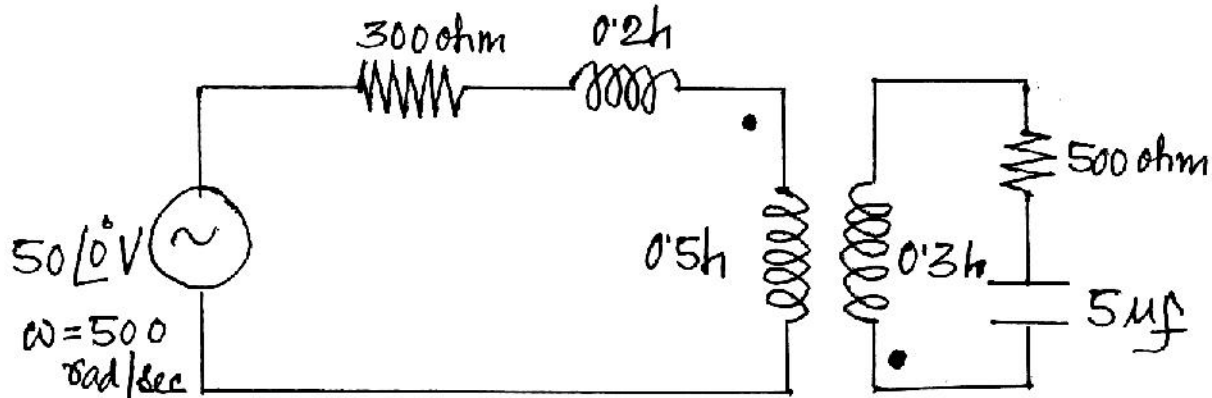

Fig. 2

Q.3a) What are the importance of graphical analysis of electrical circuits? **4**

Q.3b) The generator in Fig.3 has the characteristic shown in Table I. Graphically determine the operating voltage and the current. Also determine the two currents I_1 and I_2. **12**

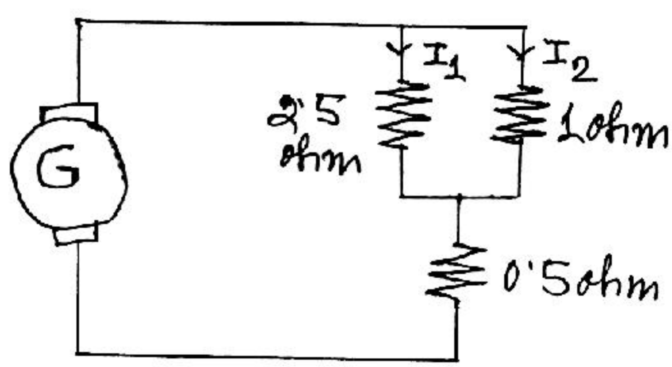

Table I

Fig. 3

V(volt)	138	135	130	128	118	102	95
I(amp.)	0	20	40	60	80	100	110

Q.4a) In an equivalent circuit of a transformer the magnetising current component (I_m) is represented to flow through a reactor whereas the active component of current (I_{h+e}) is shown to pass through a resistor. State whether the statement is true or false. Justify your answer with reasons. **5**

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Q.4b) Draw and explain the phasor diagram of a single phase transformer under loaded secondary. **5**

Q.4c) The primary current of a single phase transformer takes 1A at power factor of o.4 when connected across a 200 volt, 50hz supply and the secondary is open circuited. The number of turns on the primary is twice that on secondary. A load taking 50A at a lagging power factor of 0.8 is now connected across the secondary. Neglecting voltage drops in the transformer, determine the primary current. **6**

Q.5a) Draw the locus diagram of series R-L-C circuit with varying **C**. **C** is varied to produce resonance in the circuit containing R = 100 ohm, X_L = 200 ohm and f = 50 hz. Find the voltage drop across **C** at resonance and also when the drop across C is maximum. The impressed voltage on the circuit is 1000 volt. **8**

Q.5b) A parallel circuit is shown in the Fig.4. Draw the locus diagram showing the variation of total current as the inductance is changed from 0 to ∞. From the diagram, find (i) the inductance required for a total current of 5A and (ii) the maximum power. **8**

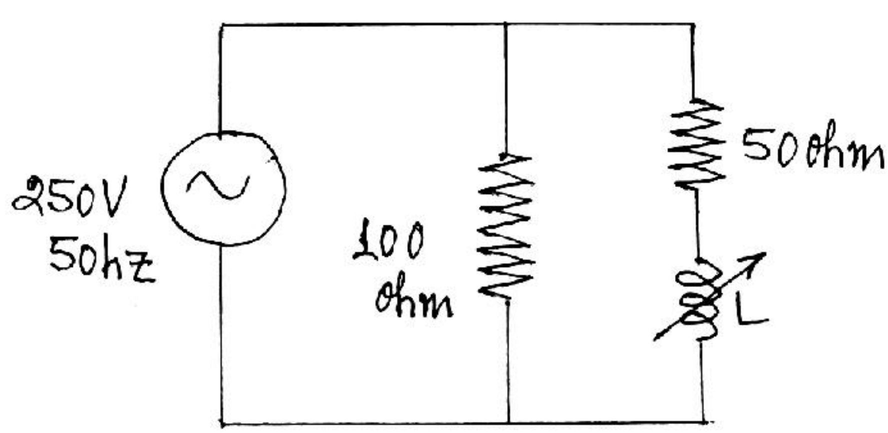

Fig. 4

BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING EXAMINATION, 2017

(1st Year, 2nd Semester)

PRINCIPLES OF ELECTRICAL ENGINEERING - II

Time: Three Hours Full Marks: 100

(50 marks for each part)

Use a separate Answer-script for each Part

PART-II

Answer Any three questions

(2 marks for neat and well-organized answers)

1. a) Determine the Fourier series for the non-sinusoidal wave shown in Fig.1 8

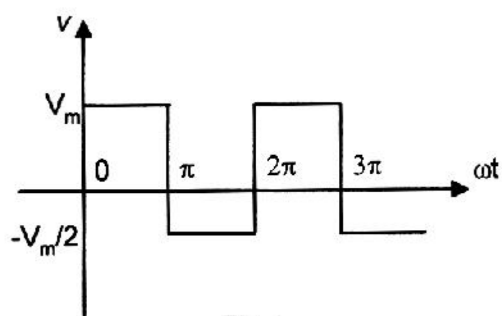

Fig.1

b) A non-sinusoidal voltage $v = 230\sin\omega t + 50\cos\omega t - 40\sin5\omega t - 10\cos5\omega t$ V is applied across the series combination of a resistor of 10Ω and an capacitor of 5μF. Calculate the reading of the ammeter connected in series with the circuit. Take fundamental frequency as 50Hz. 8

2. a) Explain how reactive power can be measured by one wattmeter in the case of balanced three phase load. Draw the necessary circuit and phasor diagrams. 4+2+2

b) Three impedances are connected in star across a balanced 3-wire, three–phase 440V supply. Phase sequence is ABC. Calculate the reading on the watt-meter connected as shown in Fig.2. 8

3. a) Three impedances as given below are connected in delta across a balanced three-phase 400V supply of phase sequence ABC. Calculate the vector power-factor.
$Z_A=10\angle45^0\ \Omega$, $Z_B=10\angle-35^0\ \Omega$ and $Z_C=10\angle60^0\ \Omega$. 8

b) The positive, negative and zero sequence components of the phase voltage of a three-phase generator are given by $200\angle45^0$ V, $80\angle-90^0$ V and $25\angle110^0$ V, respectively. Calculate the line voltage when the generator is i) star and ii) delta. 4+4

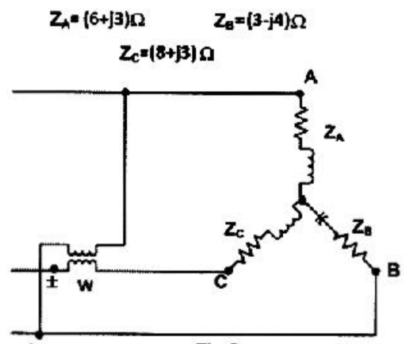

Fig.2

4. a) What is neutral shift? Explain how neutral shift can be determined with the help of Millman's theorem. 2+6

b) A balanced star connected load of (7+j5)Ω/phase is in parallel with a balanced delta connected load of (5-j7)Ω/phase across a 415V, 50Hz balanced three-phase supply of phase sequence ACB. Calculate the line current, active, reactive and apparent power drawn by the combined load. 8

5. a) Prove that the zero sequence component will not be present in the line voltage of a star connected system. 5

b) The generated phase emf of a three-phase alternator contains fundamental, third, fifth, seventh and ninth harmonics of peak magnitudes 220V, 99V, 66V, 33V and 22V, respectively. Calculate the ratio of the voltmeter readings connected to measure the phase voltage for star and delta connections. 5

c) Calculate the active power and volt-ampere due to the following waves. 6

$$v = 100\sin(\omega t + 50^\circ) + 40\sin(3\omega t - 60^\circ) \text{ V}$$
$$i = 10\sin(\omega t - 40^\circ) - 12\cos(3\omega t + 20^\circ) \text{ A}$$

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