B.E. ELECTRICAL ENGINEERING EXAMINATION, 2018

(1st Year, 2nd Semester)

PRINCIPLES OF ELECTRICAL ENGINEERING

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

(50 marks for each part)

Use separate answer – script for each part.

PART I

Answer ***any three*** questions.
Two marks are reserved for neat and well organized answers.

1.a) Show that requirement of copper in a three phase three wire system is 0.75 times than that in a single phase system for same voltage between lines and when a fixed amount of power is transmitted over a fixed distance with same amount of power loss. 5

b) Deduce the relationship between the phase and line voltages and currents in a three phase star connected circuit. Draw necessary phasor diagram. 5

c) Show that power consumption, when three identical impedances are connected in delta across a balanced three phase supply, is three times that when the same impedances are connected in star across the same three phase supply. 6

2.a) Deduce an expression for the current flowing through neutral wire in the case of a three phase four wire unbalanced system with line impedances. 6

b) A three phase supply, giving sinusoidal voltage of 400 V at 50 Hz is connected to three terminals marked R, Y and B. Between R and Y is connected a resistance of 100 Ω, between Y and B an inductance of 318 mH with negligible resistance and between B and R a capacitor of 31.8 μF. Determine (i) the current flowing in each line, (ii) the total power supplied and (iii) the resistance of each phase of a balanced star-connected, non-reactive load, which will take the same total power when connected across the same supply. 3+3+4

3.a) State and explain how active and reactive power can be measured in the case of balanced three phase load using one wattmeter. State when three phase power measurement requires the use of three wattmeters. 7

b) Three unequal non-reactive resistors are delta connected to a 440 V, symmetrical, three phase system. If the line currents are 50, 80 and 100 A, what is the total power dissipated in the resistors? If two wattmeters are connected in the circuit to measure the input power, determine the reading on each wattmeter. The current coils are connected in the lines carrying 50 and 100 A. 9

4.a) The voltages across a three phase unbalanced load are $V_a = 300V$, $V_b = 300\angle -90^0 V$, $V_c = 800\angle 143.1^0 V$ respectively. Determine the sequence components of voltages. Phase sequence is abc. Derive the formulae you have used. 8

b) A current $i = 200\sin \omega t + 70\sin 3\omega t + 30\sin 5\omega t$ flows through a resistance of 5Ω in series with a capacitance of 20 μF. Find the amplitude of the voltage of (a) the fundamental; (b) each harmonic. Given ω = 314. 8

5.a) Write the general expression for the following non-sinusoidal wave: 4
$V = 4\sin \omega t - 3\cos \omega t - 7.66\sin 2\omega t + 6.43\cos 2\omega t - 2\sin 3\omega t - 1.5\cos 3\omega t$

5.b) Justify the statement, "the ratio of the line to phase voltage in star connection can be $\sqrt{3}$ only when there is no triplen frequency harmonics in the phase voltage". 4

5.c) The e.m.f. of one phase of a 50-Hz, 3-phase, delta-connected alternator is $565\sin\theta + 50\sin 3\theta - 30\sin 5\theta\ V$. If the resistance and inductance per phase are 0.25Ω and 5 mH, find the r.m.s. value of (a) the current circulating in the windings, and (b) the current in a 50-μF capacitor connected across a pair of lines. 8

B.E. Electrical Engineering First Year Second SemesterExamination, 2018

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. Question No.2 is of 18 Marks.

Q.1a) State and explain Tellegen's Theorem for the ac network? Why the theorem is not concerned with the type of elements used in the network? **6+2**

b)Determine the change in current supplied by the source when the 5Ωresistor is replaced by an 8Ω resistor as shown in Fig.1. Verify by theCompensation theorem. **4+4**

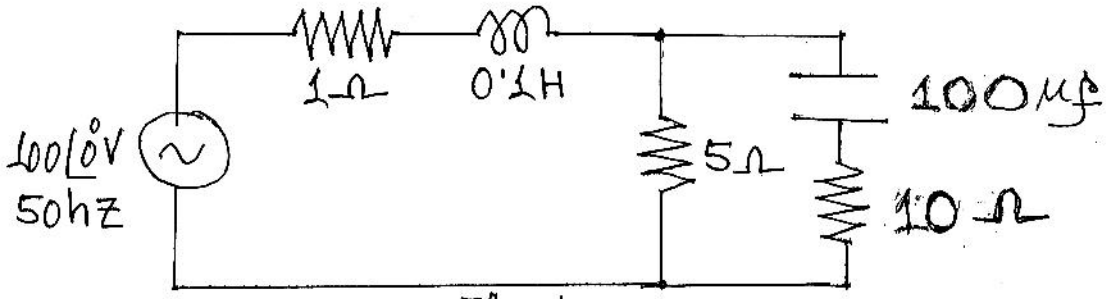

Fig. 1

Q.2a) Two air core inductance coils possess, individually, 60 and 30 millihenry self –inductance, respectively. Measurements show that, if the two coils are connected in additive series the equivalent self-inductance of the combination is 120 millihenrys. If the coils are connected in subtractiveseries, find the equivalent self-inductance of the combination. Find the co-efficient of coupling between the coils. **6**

b) Define mutual impedance. Find out the voltage developed across the condenser C_1 per unit current flowing in the circuit 2 of Fig.2. **6**

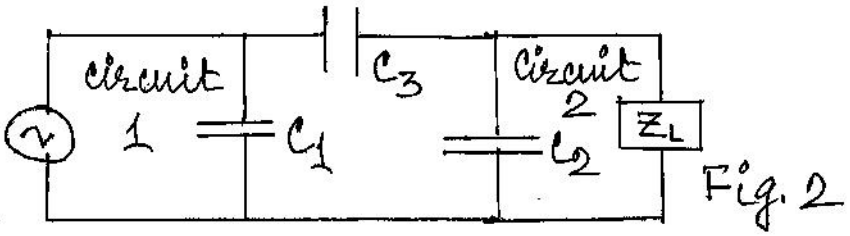

Fig. 2

c)A mutual inductor is used to couple a 20Ω resistive load to a 50Vgenerator as shown in the Fig. 3. The generator has an internal resistanceof 5Ω. The supply frequency is 25Hz.

Determine (i) the generator current and (b) the load current. **6**

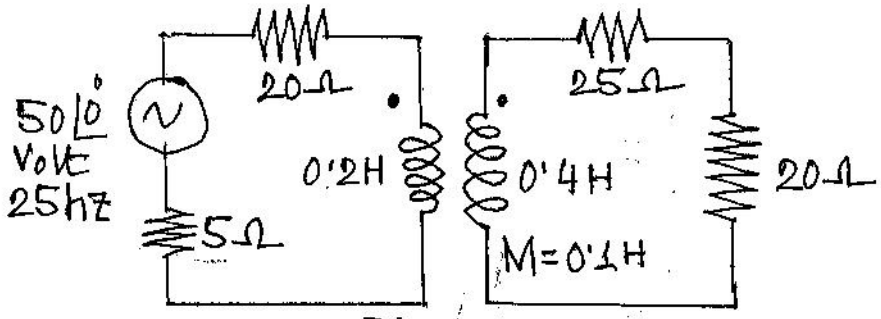

Fig. 3

Q.3. Calculate the current flowing through the diode as shown in Fig.4, voltage across the diode and the power dissipated in the diode using load-line analysis (graphical) technique. The volt-ampere characteristic of the diode is given in tabular form. **16**

Table: V_d = voltage across the diode in volt, I = current in diode in mA

V_d	0 v	0.1 v	0.2 v	0.25 v	0.3 v	0.32 v	0.35 v
I	0 mA	0.046mA	2.19mA	15mA	102.6mA	268mA	702mA

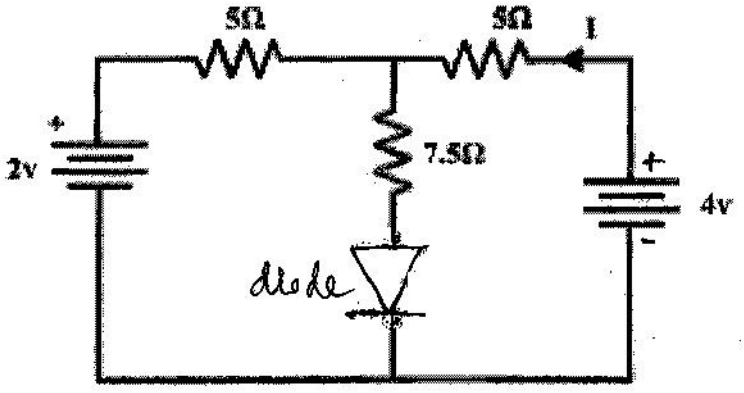

Fig. 4

Q.4 a) Draw and explain the phasor diagram of the equivalent circuit of transformer for the resistive load. Write down the expression for the applied and terminal voltage from the diagram. **6**

b) A 230V/115V single phase transformer takes no load current of 2A at a power factor of 0.2 lagging with low voltage winding kept open. If the low voltage winding is now loaded to take a current of 15A at 0.8 power factor lagging, find the current taken by high voltage winding. **7**

c) How an ideal transformer can be used in impedance matching. **3**

Q.5a) In R-L-C series circuit, the supply frequency of the impressed voltage isvarying from 0 to infinity. Find out the locus of the total current I for the variation in frequency. Also prove from the locus diagram that themaximum voltage across L occurs after the resonance. **5**

b)In R-L series circuit with variable L, prove that each point on Z (impedance) locus above R-axis, corresponds to a point on the semi-circlebelow G-axis in Y-plane. Draw the necessary diagrams. **5**

c) Find out the locus of the current of the circuit shown in Fig.5 and find out the value of R which results in a phase angle of 45° between the supplyvoltage and current. R varies between 0 and ∞. **6**

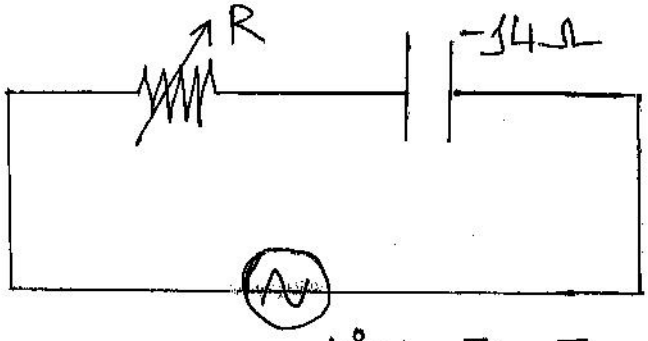

Fig. 5