BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING EXAMINATION, 2019

(1st Year, 2nd Semester, Supplementary)

PRINCIPLES OF ELECTRICAL ENGINEERING

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

(2 marks for neat and well-organized answers)

1. a) Explain how three-phase power can be measured by two-wattmeter method. Draw the relevant circuit and phasor diagrams. 8

   b) Find out the Fourier series for the non-sinusoidal wave as shown in Fig.1. 8

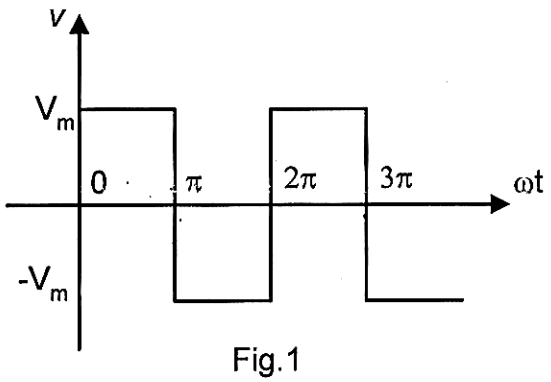

Fig.1

2. a) Prove that the line voltage V_{AB} of a balanced star-connected system leads the phase voltage V_{An} by 30^0. Draw the relevant phasor diagram. 6

   b) A set of balanced impedances of $Z_{ph}=10\angle 30^0\ \Omega$ are connected in star across a balanced supply of 400V. If the phase sequence is ABC, then calculate the line current, power-factor, total active, reactive and apparent power of the combined load. 10

3. a) Explain how neutral shift can be determined with the help of Millman's theorem. 8

   b) A three-phase, 400V, 4-wire system has the following load impedances $Z_A = 10\angle -60^\circ\ \Omega$, $Z_B = 5\angle 0^\circ\ \Omega$ and $Z_C = 10\angle 60^\circ\ \Omega$. Calculate the line currents and the neutral current and the power drawn by each load when phase sequence is ABC. 8

4. a) A 3-phase, 3-wire delta connected system has the following phase emfs: V_{AB}=(200+j40)V, V_{BC}=(-60-j220)V and V_{CA}=(-40+j232)V. Calculate the symmetrical components of the phase emfs. 8

b) For a three-phase, 4-wire, star-connected system, prove that the neutral current contains only the zero sequence components. 8

5. a) Discuss about average and vector power-factors in the case of an unbalanced three-phase load. 8

b) Determine the active power drawn by the non-sinusoidal waves given below:

$$v = 100\sin(\omega t+30^0) - 50\sin(3\omega t-60^0)\ V$$

$$i = 10\sin(\omega t-40^0) + 5\sin(3\omega t+150^0)\ A$$ 8

Ref. No.: Ex/EE/T/121/2019(Old)

B.E. ELECTRICAL ENGINEERING FIRST YEAR SECOND SEMESTER EXAMINATION 2019 (Old)

Principles of Electrical Engineering

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. Two marks for neatness

Q.1a) State and explain Compensation theorem. **8**

b) 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**

Q.2a) In an equivalent circuit of a transformer the magnetizing current component (I_m) isrepresented to flow through a reactor whereas the active component of current (I_{h+e}) isshown to pass through a resistor. State whether the statement is true or false. Justify your answer citing suitable reasons. **6**

b) The high and low voltage windings of a 2200/220Volt single phase 50 Hz transformer has resistance of 4.8Ω and 0.04Ω, and reactance of 2Ω and 0.018Ω respectively. The low voltage winding is connected to a load having an impedance of (6+j4)Ω. Determine (i) the current in the low voltage winding, (ii) load voltage and (iii) power consumed by load. **10**

Q.3a) What is Q-point? **4**

b) A non-linear resistor R_b having V-I characteristics as given in the table is

connected in parallel with a 10Ω resistor and 1.5V source with an internal resistance of 20Ω. Determine the operating voltage and current and the current through the non-linear resistor graphically. **12**

I	10mA	50mA	175mA	300mA
V	0,5V	0.75V	1.0V	1.125V

Q. 4.a) A coil of inductance 200microhenry is magnetically coupled to another coil of inductance 800microhenry. The co-efficient of coupling between the coils is 0.05. Calculate the inductance if the two coils are connected in (i) series aiding, (ii) series opposing, (iii) parallel aiding and (iv) parallel opposing. **8**

b) A series RLC circuit consisting of 10 ohm resistance and 200μF capacitor and variable inductance is supplied from 200V, 50 Hz ac. Draw the locus of the current in the circuit as inductance is varied from 0 to 0.3H. **8**

Q. 5a) In the coupled network of Fig. 1, find the current flowing through the resistances. The co-efficient of coupling between the coils is 0.6. **8**

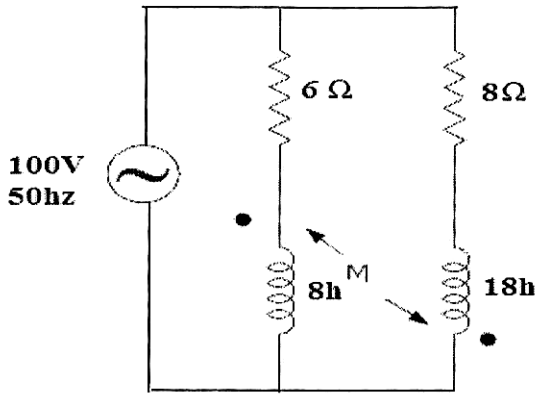

Fig. 1

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-circle below G-axis in Y (admittance) plane. Draw the necessary diagrams. **8**