**[5868]-105**

**F.E. (All Branches)**

**103004 : BASIC ELECTRICAL ENGINEERING**

**(2019 Pattern) (Semester - I/II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Assume suitable additional data, if necessary.*
5) *Use of non-programmable calculator is allowed.*

**Q1)** a) Define and state the unit of admittance, conductance & susceptance. Also draw the admittance triangle for inductive circuit. **[4]**

b) Obtain the expression for current and power, when voltage $v = V_m \sin \omega t$ is applied across purely resistive circuit. Also draw the waveform for voltage, current & power on common X-axis. **[6]**

c) The series circuit having resistance 5 Ω, inductance 0.1 H and capacitance 150 μF is connected to 1-phase, 200 V, 50 Hz AC supply. Calculate- **[8]**

    i) Inductive reactance XL     ii) Capacitive reactance Xc

    iii) Net reactance X     iv) Impedance Z

    v) Current drawn by the circuit   vi) Power factor

    vii) Active power P     viii) Reactive power Q

**OR**

**Q2)** a) Define and state the unit of active, reactive and apparent power in case of single phase circuit. Draw the power triangle. **[4]**

b) Derive the expression for resonant frequency and comment on impedance, current and power factor in case of series resonance circuit.**[6]**

c) Derive the expression for power, when voltage $v = V_m \sin \omega t$ is applied across R-L series circuit. Also draw the waveform for voltage, current & power on common X-axis. **[8]**

*P.T.O.*

*Q3)* a) What is phase sequence? State it's any two applications. **[3]**

b) State the relation between : **[6]**

   i) Phase voltage and line voltage

   ii) Phase current and line current in case of balanced delta connected 3-ph load. Using above relations, obtain the expressions for 3-ph active power and 3-ph reactive power.

c) A 80 kVA, 1000/250 V, 1-ph 50 Hz transformer has iron loss of 1000 W and copper loss 400 W, when its primary draws current of 50A. Calculate **[8]**

   i) Efficiency at full load and power factor = 0.8 lag.

   ii) Efficiency at half load and power factor = 1 lag.

### OR

*Q4)* a) What are the losses in the transformer? State the parts in which they take place. **[3]**

b) Derive the EMF equation of single phase transformer. **[6]**

c) Three identical impedances each of 6+j8 Ω are connected in star across 3-ph, 415 V, 50 Hz ac supply. Determine **[8]**

   i) Line voltage

   ii) Phase voltage

   iii) Phase current and line current

   iv) 3-ph active, reactive and apparent power

*Q5)* a) Define the practical voltage source & explain it by means of **[4]**

   i) Symbol of representation

   ii) Value of internal resistance

   iii) Graphs between V and I

b) Derive the equations to convert Delta connected resistive circuit into equivalent Star circuit. **[6]**

c) For the circuit given in fig 5c, write down the steps to find current through PQ using Superposition Theorem. **[8]**
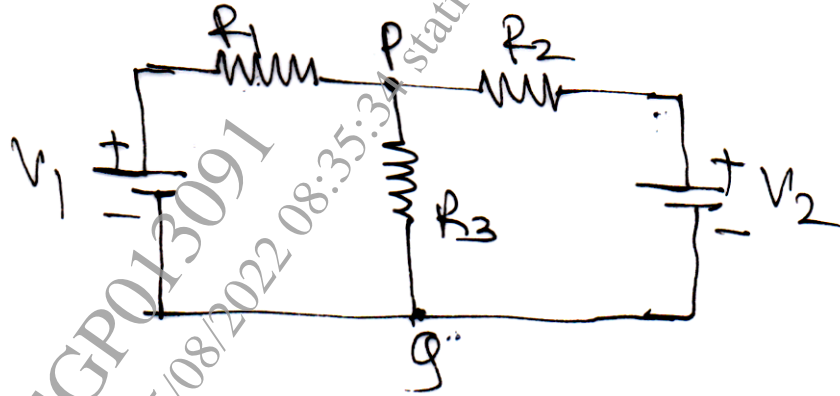


Figure 5c

OR

**Q6)** a) State and explain KCL & KVL **[4]**

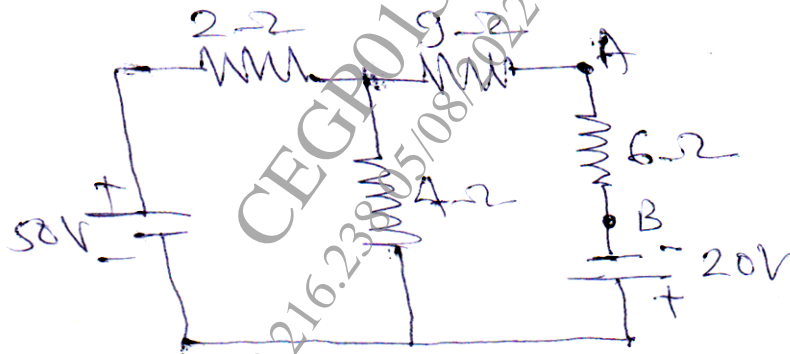b) Calculate the current flowing through 6 Ω (AB) for the circuit shown in fig 6b, using Kirchhoff's Laws. **[6]**



Figure 6b

c) Calculate the current flowing through 6 Ω (AB) for the circuit shown in question 6b, using Thevenin's Theorem. **[8]**

**Q7)** a) Define resistivity of the material & state the factors on which it depends. **[3]**

b) Explain construction and working principle of Lithium Ion battery and state it's any two applications. **[6]**

c) Derive an expression for insulation resistance of a single core cable. Draw the necessary diagram. Also comment on insulation resistance when **[8]**

i)   Two cables are connected in series and

ii)  In parallel

OR

**Q8)** a) Write the name of materials used for anode, cathode and electrolyte in case of Lead Acid Battery. State it's any three applications. **[3]**

b) If $\alpha_1$ and $\alpha_2$ are the RTC of a conducting material at $t_1^0C$ and $t_2^0C$ respectively prove that $\alpha_2 = \dfrac{\alpha_1}{1 + \alpha_1(t_2 - t_1)}$ **[6]**

c) A water pump lifts 12000 litre of water to a height of 15 m per minute. The efficiency of motor and pump is 75% & 80% respectively. Calculate **[8]**

i)   Input power to motor in kW

ii)  Daily energy consumption if pump is used 04 hrs a day

iii) Monthly electricity bill as per above daily uses for the month of 30 days at the rate of 10 Rs/unit.

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