

6. (a) An iron-cored choking coil takes 4 Amperes at a power factor of 0.5 when connected to a 200 volt, 50 Hz supply. Find:
- (i) The coil power loss (5 marks)
  - (ii) The inductance of the coil (5 marks)
- (b) When the applied voltage is reduced to 80 Volts, 50 Hz the current is 8 Amperes and the power factor 0.8. Find:
- (i) The coil power loss (5 marks)
  - (ii) The inductance of the coil. (5 marks)

**END OF PAPER**

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EXAMINATION: AUTHORISATION B  
JULY 2017

Paper I (Theory)

Time Allowed: 3 Hrs

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WRITE ALL YOUR WORK IN THE ANSWER BOOK PROVIDED.  
 EVERY ANSWER SHOULD INCLUDE ALL WORKINGS, NECESSARY  
 DIAGRAMS AND FORMULAE.

START EACH ANSWER ON A FRESH PAGE.

Answer any FIVE Questions

1. (a) State the losses that occurs in a D.C. generator. (3 marks)
- (b) A D.C. shunt generator supplies 195 amps at 230 volts. The armature resistance is 0.02 ohms and the field resistance is 44 ohms. If the iron and friction losses amount to 1600 watts, draw a well labelled figure for the above D.C. shunt generator and calculate the following: (2 marks)
  - (i) The e.m.f. generated (4 marks)
  - (ii) Copper losses (3 marks)
  - (iii) Mechanical power input (4 marks)
  - (iv) Overall efficiency and electrical efficiency (4 marks)
2. (a) What is meant by Regulation of a Transformer? (4 marks)
- (b) Mention and briefly explain the losses which occur in a Transformer. (6 marks)
- (c) A 500 kVA transformer has full-load copper losses of 4 kW and an iron loss of 2.5 kW. If the power factor of the load is 0.75, determine:
  - (i) The output kVA at which the efficiency of the transformer is a maximum (5 marks)
  - (ii) The maximum efficiency assuming the power factor of the load remains 0.75 (5 marks)
3. (a) Describe with the aid of a diagram how a rotating magnetic field is developed in a 3-phase induction motor. (4 marks)
- (b) Explain what is meant by the term Slip when related to an induction motor. (3 marks)
- (c) The power supplied to a 3-phase, 50 Hz induction motor is 32 kW and the stator losses are 1200 W. If the slip is 5%, determine:
  - (i) The rotor copper loss (3 marks)
  - (ii) The total mechanical power developed by the rotor (3 marks)
  - (iii) The output power of the motor if the friction and windage losses amount to 750 W (3 marks)
  - (iv) The efficiency of the motor, neglecting the rotor iron loss (2 marks)
- (d) Explain how the power factor (pf) of a 3-phase motor may be improved. (2 marks)

4. A 3-phase 500 Volt, star connected a.c generator supplies a 3-phase, 74600 Watts mesh connected induction motor. The efficiency of the motor is 90% and the pf is 0.85. Draw a neat labelled diagram of the arrangement showing all the currents and emf in the circuit. (4 marks)

Calculate:

- (a) the current in each motor phase. (4 marks)
  - (b) the current in each generator phase. (4 marks)
  - (c) the active and reactive components in each motor phase. (4 marks)
  - (d) the active and reactive components in each generator phase. (4 marks)
5. Refer to Figure 1:
    - (a) Redraw Figure 1 and assume that the current flows from the positive terminals of the batteries. Label ALL branch currents flowing. (5 marks)
    - (b) Use Kirchoff's Laws to determine the currents flowing in each branch of the network shown in Figure 1 below and comment on results. (15 marks)

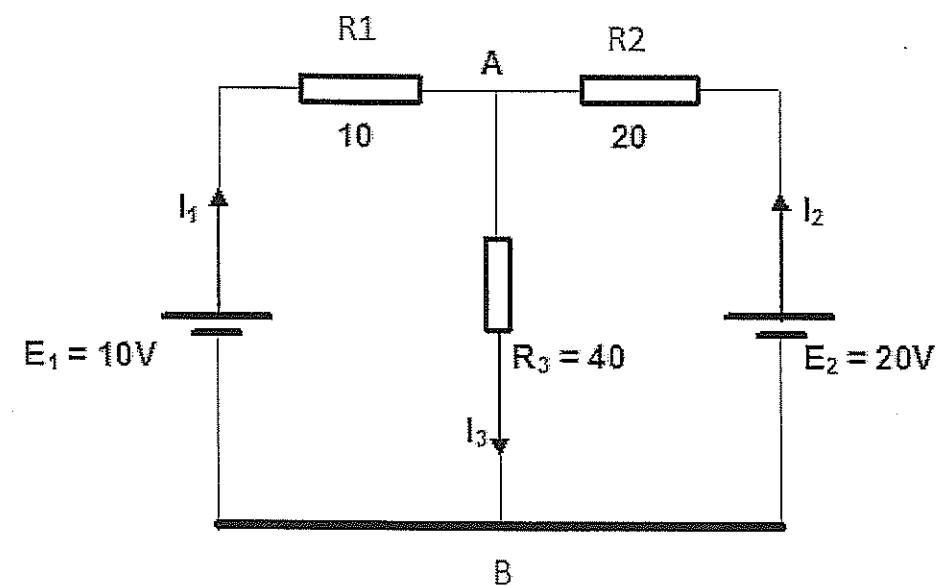


FIGURE 1