

This paper consists of **SEVEN (7)** pages including the front page.  
Structured (6 questions – answer 4)

**CONFIDENTIAL**

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INVIGILATOR**

(The CLO stated is for reference only)

ESSAY (100 marks)

**INSTRUCTION :**

This section consists of **SIX (6)** questions. Answer **FOUR (4)** questions only.

**QUESTION 1**

- a) Define the following electrical terms : [CLO1:C1]
- i. Potential Difference
  - ii. Current
  - iii. Resistance
- (3 marks)
- b) State **FOUR (4)** factors that affect the resistance of a conductor. [CLO1:C1]
- (4 marks)
- c) A resistor that dissipates power of 500W is connected to a 50V battery. Determine the value of the resistance. [CLO1:C3]
- (4 marks)
- d) By referring to **Figure 1(d)** below, calculate : [CLO1:C3]
- i. the total resistance,  $R_T$  (6 marks)
  - ii. the voltage drop,  $V_x$  (4 marks)
  - iii. the current,  $I_1$  (4 marks)

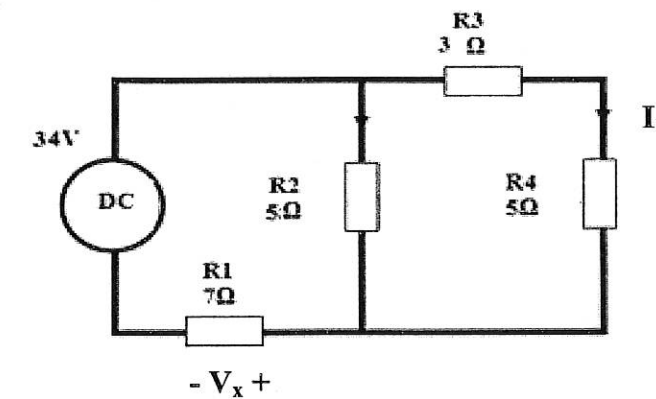


Figure 1(d)

QUESTION 2

- a) Define the following terms: [CLO1:C1]
  - i. Inductive reactance (2 marks)
  - ii. Capacitive reactance (2 marks)
- b) Calculate the total capacitance,  $C_{AB}$  in Figure 2 (b). [CLO2:C3] (5 marks)

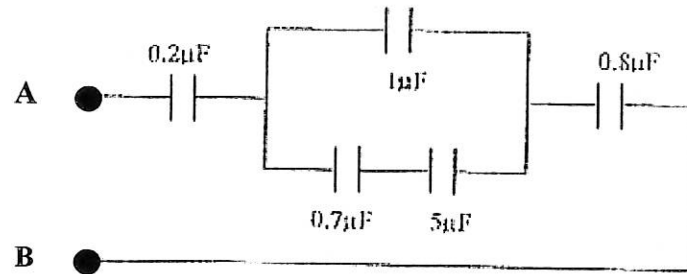


Figure 2 (b)

- c) Calculate the total inductance,  $L_{AB}$  in Figure 2 (c). [CLO2:C3] (5 marks)

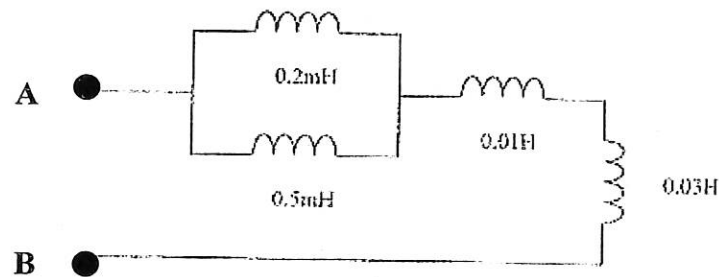


Figure 2 (c)

- d) An  $8\Omega$  resistor,  $0.05H$  inductor and  $100\mu F$  is connected in series with a  $150V$ ,  $50Hz$  supply.
  - i. Draw and label the circuit [CLO2:C1] (3 marks)
  - i. Calculate the impedance,  $Z$  [CLO2:C3] (6 marks)
  - ii. Calculate the total current,  $I_T$  [CLO2:C3] (2 marks)

QUESTION 3

- a) Define the three phase system. [CLO1:C1] (3 marks)
- b) State **FOUR (4)** terms that can be defined as differences between the single phase system and 3- phase system. [CLO1:C1] (4 marks)
- c) Draw the three phase waveform and state the voltage equation for each phase. [CLO1:C2] (6 marks)
- d) Explain the differences between 3-phase system and the single phase system in terms of their applications and give examples for each system. [CLO1:C2] (12 marks)

## QUESTION 4

- a) State **THREE (3)** factors that influence the magnetic field strength of a solenoid.  
[CLO1: C2] (6 marks)
- b) State the definitions and units for the terms below: [CLO1:C1]
- i. Magnetic flux density
  - ii. Magnetomotive force
  - iii. Reluctance
- (9 marks)
- c) One soft iron solenoid with a cross sectional area of 600mm<sup>2</sup> has an average length of 300mm and is wound with 300 turns of wire with 2A current running through it. Given the relative permeability,  $\mu_r$  is 900. Calculate : [CLO1: C3]  
(10 marks)
- i. the magnetomotive force,  $F_m$
  - ii. the magnetic field strength, H
  - iii. the magnetic flux density, B
  - iv. the magnetic flux,  $\Phi$
  - v. the reluctance, S

## QUESTION 5

- a) Define transformer with the aid of diagram. [CLO1:C1]  
(4 marks)
- b) Explain the uses of stepped-up and stepped-down transformer with the aid of diagrams.[CLO1:C2]  
(10 marks)
- c) An ideal transformer is connected to a supply of 10kVA, 60 Hz. A 1000 turn has been wound to a coil at a 230V primary winding and a 1500 turns at a secondary winding. Calculate: [CLO1: C3]  
(11 marks)
- i. the ratio of a transformer, k
  - ii. the secondary voltage,  $V_s$
  - iii. the primary current,  $I_p$
  - iv. the secondary current,  $I_s$
- Identify the type of transformer being used

## QUESTION 6

- a) The commutator and slip ring are the main characteristics that differentiate between DC and AC generators. Explain. [CLO1:C2] (4 marks)
- b) Define the term slip speed and state its the formula. [CLO1:C1] (4 marks)
- c) 3-phase, 50Hz induction motor has 8 poles. If the full load slip is 2.5%, determine: [CLO1:C3] (9 marks)
- the synchronous speed,  $n_s$
  - the rotor speed,  $n_r$
  - the frequency of the rotor,  $f_r$
- d) A 3-phase AC generator, 50 Hz with STAR connection has 200 phase winding. If the flux produced is 40mWb at each pole, calculate : (Assume  $K_p = 1$  and  $K_d = 0.93$ ) [CLO1:C3] (8 marks)
- the phase generated voltage,  $E_{ph}$
  - the line voltage,  $E_L$