

**Instructions to candidates**

Duration: 01 hour

Number of questions: 04

Answer **only 02** questions.

Mark allocation: 100 marks.

1.

- a. State Kirchhoff's current law and Kirchhoff's voltage law.

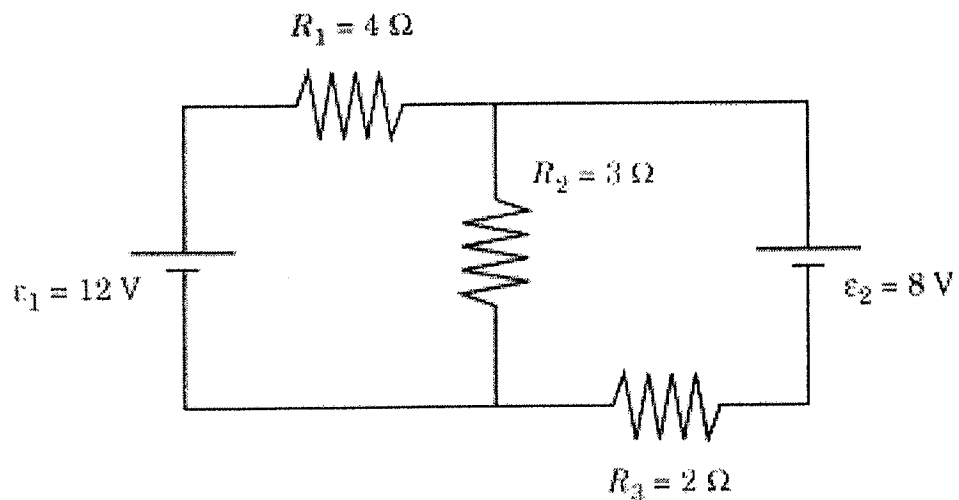
(10 marks)

- b. State the superposition theorem.

(10 marks)

- c. Calculate the current through the resistors  $R_1$ ,  $R_2$ , and  $R_3$  in the following circuit using Kirchhoff's laws. Clearly illustrate the steps.

(30 marks)



2.

- a. Explain the term "Commutation" in a DC generator.

(5 marks)

- b. What is the armature of a DC generator? What are the main types of windings of an armature?

(10 marks)

- c. Write down the e.m.f. equation of a DC generator. Explain the terms of your equation.

(15 marks)

d. A 4-pole generator has a lap-wound armature with 50 slots with 16 conductors per slot. The useful flux per pole is 30 mWb.

i. Determine the speed at which the machine must be driven to generate an e.m.f. of 240 V. (10 marks)

ii. What would be the speed if the generator were wave-wound? (10 marks)

3.

a. Write a relationship among turns ratio, voltage ratio, and current ratio of an ideal transformer. (10 marks)

b. Define the terms "step-up transformer" and "step-down transformer". (10 marks)

c. An ideal transformer, connected to a 240 V main power supply, supplies a 12 V to a lamp of 150 W. Calculate the transformer turns ratio and the current taken from the supply. (15 marks)

d. A  $12 \Omega$  resistor is connected across the secondary winding of an ideal transformer whose secondary voltage is 120 V. Determine the primary voltage if the supply current is 4 A. (15 marks)

4.

a. An *npn* transistor is biased in the forward-active mode. The base current is  $I_B = 8.50 \mu\text{A}$  and the emitter current is  $I_E = 1.20 \text{ mA}$ . Determine  $\beta$ ,  $\alpha$ , and  $I_C$ . (20 marks)

b. Calculate  $I_B$ ,  $I_C$ ,  $I_E$  and  $V_{CE}$  for the following circuit, given that  $\beta = 150$  and  $V_{BE} = 0.7 \text{ V}$ . (30 marks)

