

ELECTRICITY AND ELECTRONICS

21070038

Maximum Marks: 80

Time Allotted: Three Hours

Reading Time: Additional Fifteen Minutes

Instructions to Candidates

1. You are allowed an **additional fifteen minutes** for **only** reading the question paper.
2. You must **NOT** start writing during the reading time.
3. This question paper has **7 printed pages and one blank page**.
4. It is divided into **three sections** and has **thirteen questions** in all.
5. All questions are compulsory.
6. **Section A** has **twelve subparts** which are very short answer questions. Each subpart carries 1 mark.
7. While attempting **Multiple Choice Questions** in **Section A**, you are required to **write only ONE option as the answer**.
8. **Section B** has **eight questions** which are short answer questions. Each question carries 4 marks.
9. **Section C** has **four questions** which are long answer questions. Each question carries 8 marks.
10. **Internal choices** have been provided in **two questions in Section B** and in **one question in Section C**.
11. The intended marks for questions are given in brackets [].

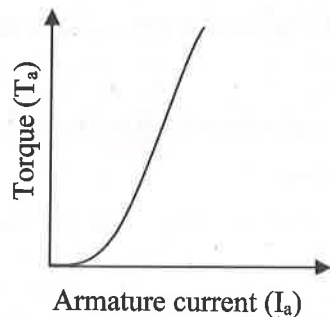
Instruction to Supervising Examiner

1. Kindly read **aloud** the Instructions given above to all the candidates present in the examination hall.

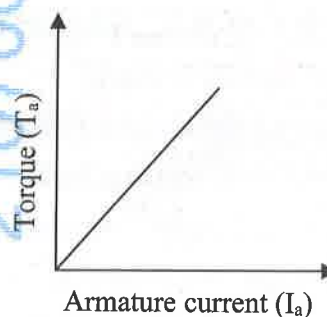
SECTION A – 16 MARKS

Question 1

- (i) In a Cathode Ray Oscilloscope (CRO), the **saw tooth** voltage is applied at the: [1]
- (a) cathode.
 - (b) accelerating anode.
 - (c) vertical deflecting plates.
 - (d) horizontal deflecting plates.
- (ii) In a series generator, which of the following is / are connected with the armature in **series**? [1]
- (a) Load
 - (b) Brushes
 - (c) Commutator
 - (d) Field windings
- (iii) The characteristics shown in **Graph 1** and **Graph 2** below are respectively of: [1]



Graph 1



Graph 2

- (a) shunt motor, series motor.
 - (b) series motor, shunt motor.
 - (c) series generator, shunt generator.
 - (d) shunt generator, series generator
- (iv) With an **increase** in speed of a d.c. motor: [1]
- (a) both back emf and line current fall.
 - (b) both back emf and line current increase.
 - (c) back emf increases and line current falls.
 - (d) back emf falls and line current increases.

- (v) In a Common-Emitter (CE) amplifier, the input signal is applied across: [1]
 (a) reverse bias base emitter junction.
 (b) forward bias base emitter junction.
 (c) reverse bias collector base junction.
 (d) forward bias collector base junction.
- (vi) Earthing is necessary to give protection against _____. (danger of electric shock, over loading) [1]
- (vii) The Peak Inverse Voltage (PIV) for a centre tapped full wave rectifier is _____. (V_m , $2V_m$) [1]
- (viii) In a split phase motor, _____ is connected to the centrifugal switch. (starting winding, main winding) [1]
- (ix) A moving coil loudspeaker converts _____. (sound energy to electrical energy, electrical energy to sound energy) [1]
- (x) Why are auxiliary winding used in a single phase induction motor? [1]
- (xi) Match the following: [4]

	Column I		Column II
1.		A.	Lamp holder
2.		B.	Transistor
3.		C.	Capacitor
4.		D.	Resistor

(xii) State whether the following are True or False.

- (a) A gramophone pickup translates the information stored mechanically in the groove of a gramophone record into an exactly corresponding electrical signal. [1]
- (b) Power amplifier circuit amplifies both voltage and current. [1]

SECTION B - 32 MARKS

Question 2

[4]

With the help of a labelled circuit diagram, explain how a **capacitor** is used to 'self-start' a single phase a.c. motor.

Question 3

[4]

Draw a labelled circuit diagram of a bridge rectifier using semiconductor diodes.

Question 4

[4]

Explain the working of a moving coil microphone.

Question 5

[4]

Define the following vacuum tube constants and write the relationship among them:

- (i) amplification factor (μ)
- (ii) a.c. plate resistance (r_p)
- (iii) mutual conductance (g_m)

Question 6

[4]

- (i) What is the use of a **filter** circuit? Explain the working of a **choke input filter** circuit.

OR

- (ii) Explain the formation of a p-n junction diode.

Question 7

[4]

With reference to **Zener** diode, answer the following questions.

- (i) What is the use of a Zener diode in a regulated power supply?
- (ii) Sketch a voltage (V) versus current (I) graph for a Zener diode.
- (iii) Zener diode is heavily doped as compared to an ordinary diode. Explain.
- (iv) Draw its circuit symbol.

Question 8**[4]**

State the function of each of the following in a Cathode Ray Oscilloscope (CRO):

- (i) Screen
- (ii) Focus control
- (iii) Intensity control
- (iv) Volt per division (amplitude per division)

Question 9**[4]**

- (i) Draw a labelled circuit diagram to show **2 wire distribution** of d.c. power to load like lamps.

OR

- (ii) Draw a labelled circuit diagram to show **3 phase 3 wire distribution** of d.c. power to load like lamps.

SECTION C - 32 MARKS

Question 10

- (i) Study the circuit diagram shown in **Figure 1** carefully and answer the following questions.

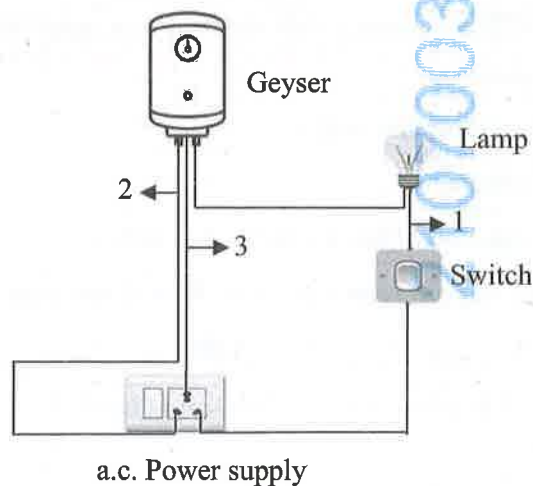


Figure 1

- (a) The parts labelled 1, 2 and 3 represent connecting wires. Identify the earth wire and phase (live) wire. **[2]**
- (b) What are the energy conversions in the two loads? **[2]**
- (c) Which load draws more current from the a.c. supply? **[1]**
- (d) Which type of connection, series or parallel, is preferred in home appliances? Justify your answer. **[2]**
- (ii) Mention *any one* type of lamp holders. **[1]**

Question 11

- (i) Draw a labelled circuit diagram of an RC coupled amplifier. [5]
- (ii) Calculate α and I_c for the transistor shown in **Figure 2**. (where symbols have their usual meaning) [3]

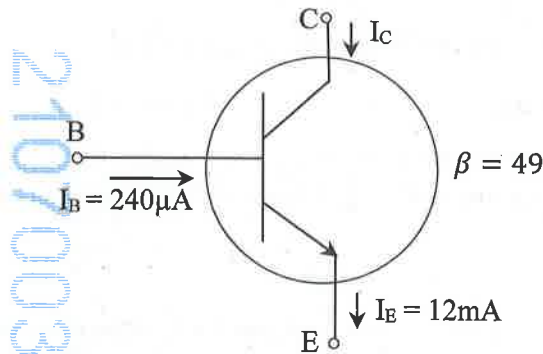


Figure 2

Question 12

Answer either subparts (i) – (iii) or (iv) – (vi).

- (i) State the function of each of the following in a d.c. motor with a starter resistor and protective devices: [3]
- (a) Starter resistor
 - (b) Low (No) volt release coil
 - (c) Overload release coil
- (ii) Explain the significance of **back emf** in d.c. motors. [3]
- (iii) Write the **voltage** and **current** equations for a shunt motor. [2]

OR

- (iv) In the working of a generator as shown in **Figure 3**, state the use of the parts labelled 1, 2 and 3. [3]

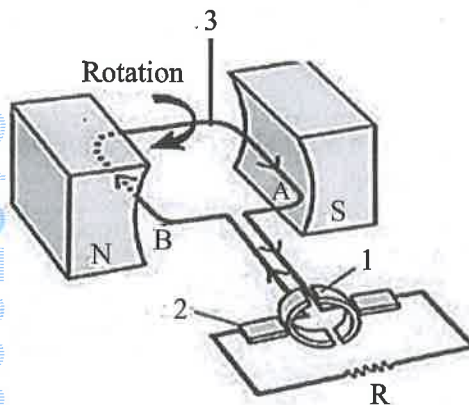


Figure 3

- (v) Identify the lap – winding type armature from the given circuits.

[1]

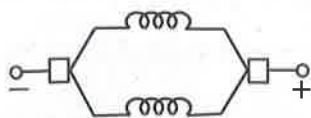


Figure 4A

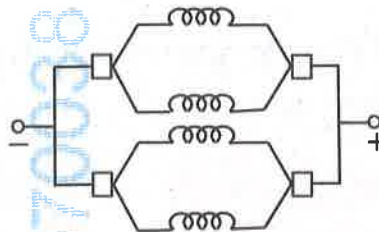


Figure 4B

- (vi) Discuss *two* effects of armature reactions. Suggest remedies to minimise these *two* effects in the working of a generator.

[4]

Question 13

- (i) Using a transistor (npn or pnp), draw a labelled circuit diagram to show Common-Base (CB) and Common-Collector (CC) modes of connection.
- (ii) Explain the following terms with reference to a p-n junction diode.
- (a) Depletion region
- (b) Potential barrier
- (iii) Compare **ripple factor** and **efficiency** for both full wave and half wave rectifier.

[4]

[2]

[2]