

ELECTRICITY AND ELECTRONICS

Maximum Marks: 80

Time Allowed: Three hours

*(Candidates are allowed **additional 15 minutes** for **only** reading the paper.*

*They must **NOT** start writing during this time).*

*Answer all questions in **Section A**, **Section B** and **Section C**.*

The intended marks for questions or parts of questions are given in brackets [].

SECTION A – 16 MARKS

Question 1

- (i) The purpose of synchronising control in a CRO is to: [1]
- (a) focus the spot on the screen.
 - (b) lock the display of the screen.
 - (c) adjust the amplitude of the display.
 - (d) control the intensity of the spot.
- (ii) For starting a D.C. motor, a starter resistor is required because: [1]
- (a) it limits the speed of the motor.
 - (b) it limits the starting current to a safe value.
 - (c) it starts the motor.
 - (d) this motor is not self-starting.
- (iii) A single phase induction motor is: [1]
- (a) self-starting.
 - (b) not self-starting.
 - (c) self-starting with the help of an auxiliary winding.
 - (d) None of the above.

- (iv) In an NPN transistor _____ are the minority charge carriers. [1]
- (a) free electrons
 - (b) donor ions
 - (c) acceptor ions
 - (d) holes
- (v) A semiconductor diode has _____. [1]
- (a) one p-n junction
 - (b) two p-n junctions
 - (c) three p-n junctions
 - (d) four p-n junctions
- (vi) The material used for making the stator of an induction motor is _____ [1]
(copper, silicon steel).
- (vii) A multimeter cannot measure _____. (Capacitance, resistance) [1]
- (viii) Inductors are _____ devices. (active, passive). [1]
- (ix) An earphone converts _____. (sound energy to electrical energy, [1]
electrical energy to sound energy)
- (x) What happens to the speed of a D.C shunt motor if the load is increased? [1]
(reduces slightly, increases slightly)
- (xi) Match the following: [4]
- | | |
|---------------------|------------------------|
| (a) DC generator | (1) Voltage regulator |
| (b) Zener diode | (2) Centrifugal switch |
| (c) Induction motor | (3) Transducers |
| (d) Microphone | (4) Split rings |
- (xii) State whether the following statements are True or False: [2]
- (a) The insulation colour used for 'Live' wire is yellow.
 - (b) Minority charge carriers in a p type semiconductor are electrons.

SECTION B - 32 MARKS

Question 2

- (i) Explain why a single phase induction motor is not a 'self starting' machine. [2]
- (ii) Answer the following questions with reference to the circuit diagram shown in *Figure 1* below.

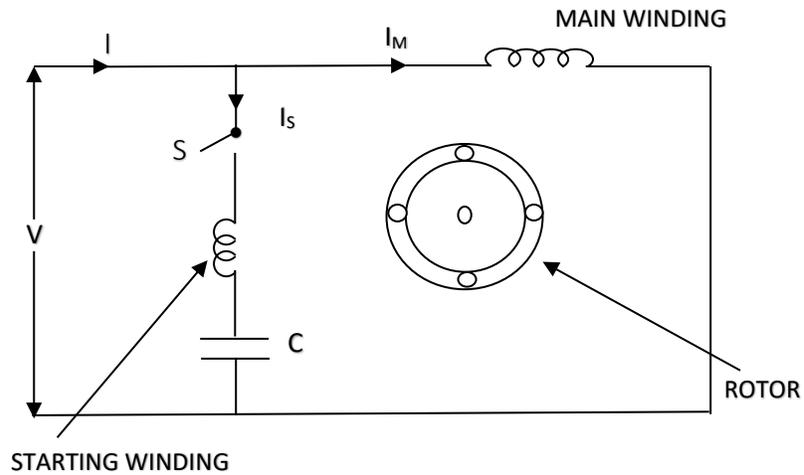
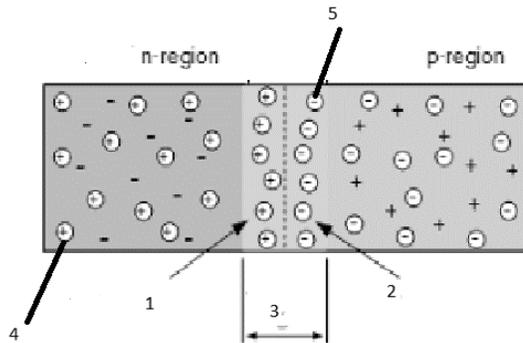


Figure 1

- (a) What is the use of the centrifugal switch 'S'? [1]
- (b) State the function of the capacitor 'C' in this circuit. [1]

Question 3

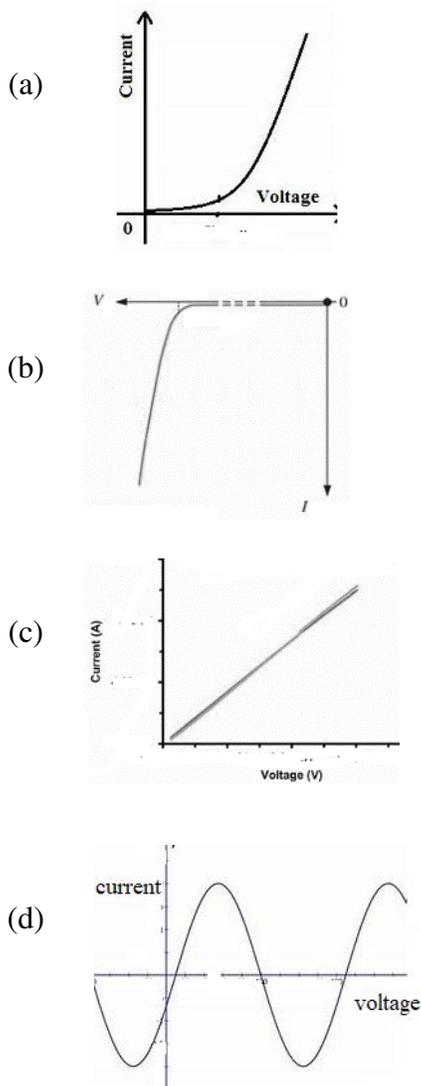
A diagram of a semiconductor diode is shown below. Label the parts from 1 to 4 by using technical terms/names. [4]



Question 4

[4]

- (i) Which one of the graphs given below, shows that the semiconductor diode is a forward biased?



- (ii) Name the three terminals of vacuum triode.

Question 5**[4]**

Name the triode parameter which can be obtained from the ratio of each of the following:

- (i) Change in plate current (ΔI_p) against change in grid voltage (ΔV_g) at constant plate voltage.
- (ii) Change in plate voltage (ΔV_p) against change in plate current (ΔI_p) at constant grid voltage.
- (iii) Change in plate voltage (ΔV_p) against change in grid voltage (ΔV_g) at constant plate current.
- (iv) write the relationship between all the three triode parameters

Question 6**[4]**

- (i) Draw a neat circuit diagram of a full wave rectifier. Also, sketch the input and output graphs.
- (ii) Draw a neat, labelled diagram of a crystal microphone.

Question 7**[4]**

Name the material used in the making of the following:

- (i) Filament of an electric bulb.
- (ii) Brushes for generators and motors.
- (iii) Core of a transformer.
- (iv) connecting wires

Question 8**[4]**

- (i) (a) What is the use of a lamp holder? Mention *any two* types of lamp holders.
- (b) Write a short note on junction box.

OR

- (ii) (a) Briefly explain why 'earth pin' is made thicker and longer in a three-pin plug.
- (b) Write a short note on ceiling rose.

Question 9

[4]

- (i) Draw a neat circuit diagram of a transistorised voltmeter.

OR

- (ii) Draw a neat diagram of a cathode ray tube.

SECTION C - 32 MARKS

Question 10

- (i) With the help of a neat diagram, explain how A.C. electrical power is distributed in a 3 phase 4 wire system. [4]
- (ii) Write a short note on *any one* type of insulation used for copper wires. [2]
- (iii) Draw two separate diagrams to show how a dual switch can be used to turn 'on' and 'off' a lamp from two different places. [2]

Question 11

- (i) Draw a neat, labelled circuit diagram of a transistor (NPN or PNP) as an amplifier. [4]
- (ii) Obtain the relationship between α and β (symbols have their usual meaning). [2]
- (iii) What is the difference between *active* and *passive* circuits elements? Name *any one* active circuit elements. [2]

Question 12

- (i) Explain how 'self excitation' is achieved in a shunt generator. [4]
- (ii) A 441V shunt wound D.C. motor has armature current (I_a) = 60A. If armature resistance (R_a) = 0.8Ω , calculate: [4]
- (a) back emf.
- (b) power supplied to the armature.

OR

- (i) State *two* effects of armature reaction. [2]
- (ii) What is meant by *commutation* in a D.C. motor? [2]
- (iii) Name the *two* types of generators based on 'excitations.' [2]
- (iv) State the function of the following parts of a generator: [2]
- (a) Poles
- (b) Brushes

Question 13 [8]

- (i) With the help of a neat circuit diagram, explain the filtering action of a π –section filter.
- (ii) Draw a neat circuit diagram of a power amplifier.