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).*

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*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 _____ (copper, silicon steel). **[1]**

(vii) A multimeter cannot measure _____. (Capacitance, resistance) **[1]**

(viii) Inductors are _____ devices. (active, passive). **[1]**

(ix) An earphone converts _____. (sound energy to electrical energy, electrical energy to sound energy) **[1]**

(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.

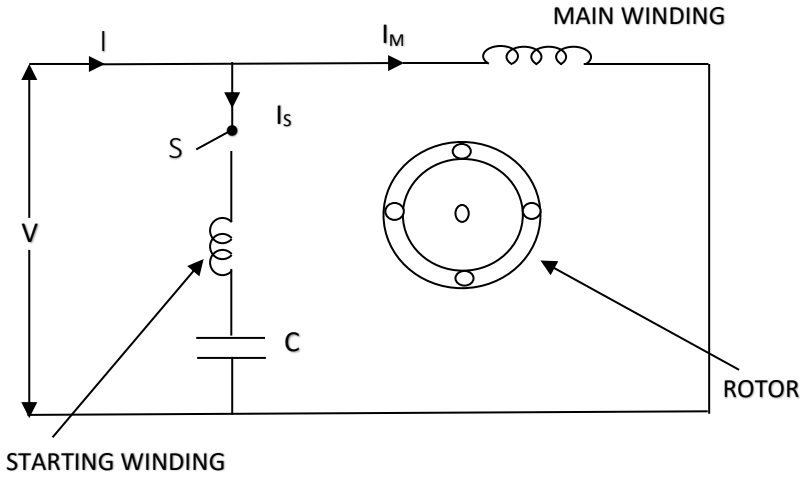


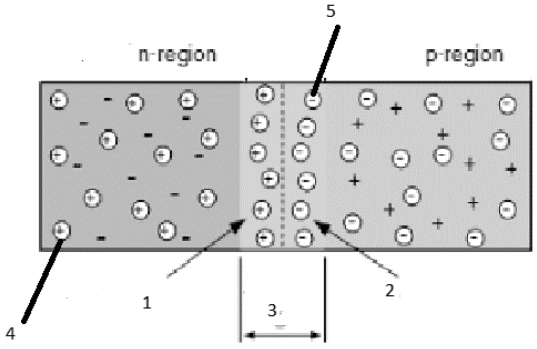
Figure 1

(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 **[4]**

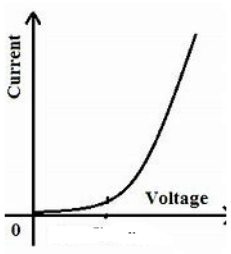
A diagram of a semiconductor diode is shown below. Label the parts from 1 to 4 by using technical terms/names.



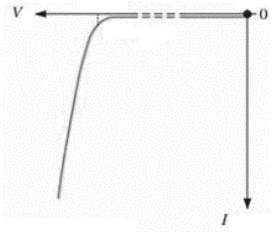
Question 4 **[4]**

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

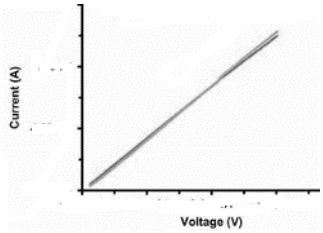
(a)



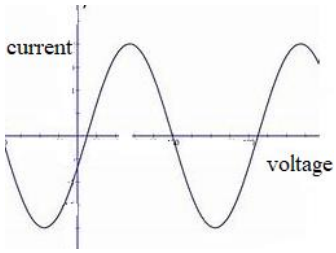
(b)



(c)



(d)



(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.