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 signal that is observed on the screen of an oscilloscope is applied: **[1]**

(a) across its x- plates (horizontal deflecting plate).

(b) across its y- plates (vertical deflecting plate).

(c) to the terminals of the horizontal amplifiers.

(d) to the trigger circuit.

(ii) If a 4 – pole D.C. shunt motor has a ***lap wounded*** armature, the number of parallel paths in this motor will be: **[1]**

(a) 2

(b) 4

(c) 8

(d) 16

(iii) A single phase A.C. motor can be made a ***self-starting*** machine by connecting: **[1]**

(a) an inductor in the circuit.

(b) a resistor in the circuit.

(c) a microphone in the circuit.

(d) a loudspeaker in the circuit.

(iv) In a PNP transistor, the majority charge carriers are: [1]

(a) acceptor ions.

(b) donor ions.

(c) free electrons.

(d) holes.

(v) A P-type semiconductor is formed by doping silicon with: [1]

(a) arsenic.

(b) carbon.

(c) antimony.

(d) indium.

(vi) A machine that runs at a constant speed irrespective of the variation of load on it is a _____ motor. (series, shunt) [1]

(vii) VTVM is used to measure _____. (current, voltage) [1]

(viii) The SI unit of a capacitor is _____. (farad, henry) [1]

(ix) A loudspeaker converts _____. (sound energy to electrical energy, electrical energy to sound energy) [1]

(x) Name the principle on which the D.C. generators work. [1]

(xi) Match the following: [4]

(a)	Fuse	(1)	Staircase lighting
(b)	Insulation	(2)	Electrical connection to a lamp or a fan
(c)	Dual switch	(3)	VIR
(d)	Ceiling rose	(4)	Lead and tin alloy

(xii) State whether the following are True or False: [2]

(a) Fuse is connected to the neutral wire.

(b) An N-type semiconductor is electrically neutral.

SECTION B - 32 MARKS

Question 2

(i) Draw a neat diagram to show a ***'capacitor -start'*** in an A.C motor. **[2]**

(ii) With reference to the Circuit diagram given below in ***Figure 1,*** answer the following questions:

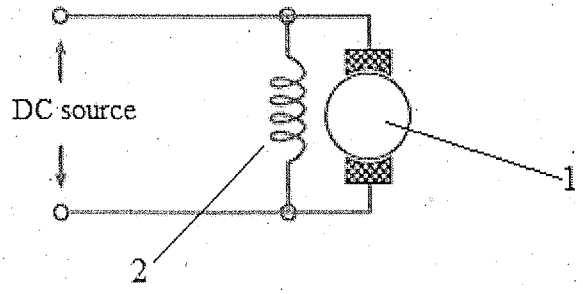


Figure-1

(a) Name the part labelled '1'. **[1]**

(b) What is the use of the part labelled '2'? **[1]**

Question 3 **[4]**

(i) The out-put graph of a full wave rectifier is shown below in ***Figure 2.***

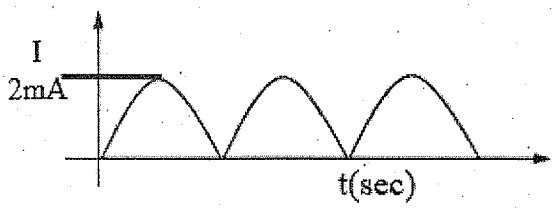


Figure 2

Using the data from the graph, calculate the following:

(a) I_{rms}

(b) I_{dc}

(ii) Draw the energy band diagram for each of the following:

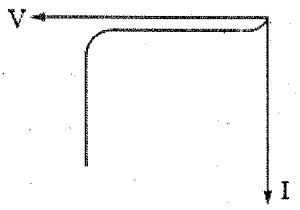
(a) Conductor

(b) Semiconductor

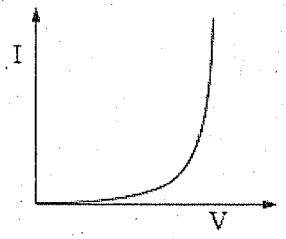
Question 4 **[4]**

(i) Which one of the following graphs shows that the semiconductor diode is reverse biased?

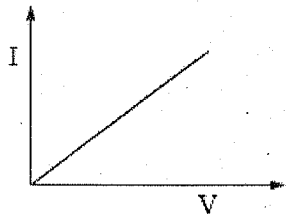
(a)



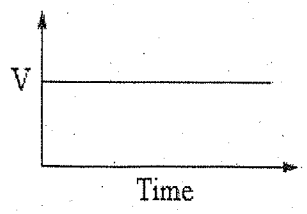
(b)



(c)



(d)



(ii) What are the functions of ***anode, cathode*** and the ***grid*** in a vacuum triode?

Question 5 [4]

(i) Define the following:

(a) Amplification factor 'μ'

(b) Mutual conductance 'g_m'

(c) Plate resistance 'r_p'

(ii) If $\mu = 20$ and $r_p = 8000\Omega$, find g_m.

Question 6 [4]

(i) Draw a neat diagram of a Bridge Rectifier. Also, sketch the input and output graphs.

(ii) What is meant by grid ***cut off*** voltage for a vacuum triode?

Question 7 [4]

Write the function of the following:

(i) Commutator in a D.C generator

(ii) Zener diode

(iii) Capacitor in a filter circuit

(iv) Fuse in an electric circuit

Question 8 [4]

(i) (a) What is the use of a switch in an electric circuit? Is the switch connected to a live wire or a neutral wire?

(b) Write a short note on Electrical Socket.

OR

(ii) (a) Identify the pin labelled 1 in ***Figure 3*** given below. State the use of this pin in an electrical circuit.

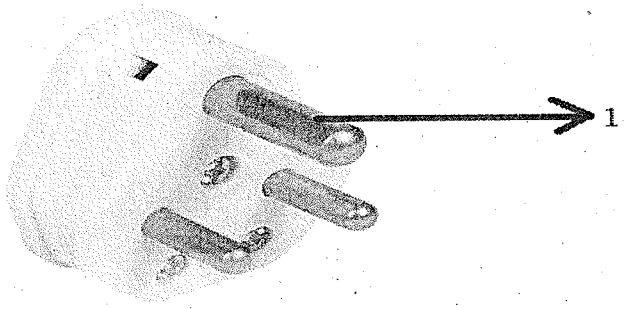


Figure 3

(b) State *any two* differences between a *solid cable* and a *stranded cable*. [4]

Question 9

(i) Draw a neat diagram of a Vacuum Tube Voltmeter.

OR

(ii) Draw a neat diagram of Multi-meter as a Voltmeter.

SECTION C - 32 MARKS

Question 10

(i) (a) State *any one* advantage each of Overhead cable and Underground cable. [2]

(b) Draw a neat diagram of a 3 phase 3 wire system of distribution of power. [2]

(ii) If the size of the wire is expressed as 37/16, what do numbers 37 and 16 represent? [2]

(iii) Draw a neat circuit diagram of a diode in forward biased condition. [2]

Question 11

(i) Draw a neat diagram of a Common Base (CB) amplifier. [4]

(ii) With reference to transistors, define current amplification factors 'α' and 'β' [2]

(iii) Name any two ***passive*** circuit elements. [2]

Question 12

(i) Draw a neat circuit diagram of a Shunt Motor. Write its current and voltage equations. [4]

(ii) A D.C. shunt generator has an induced voltage on an open circuit of 127V. When the machine is on load, the voltage is 120V.Calculate the load current if the field circuit resistance is 15Ω and the armature resistance is 0·02Ω. Neglect armature reactions. [4]

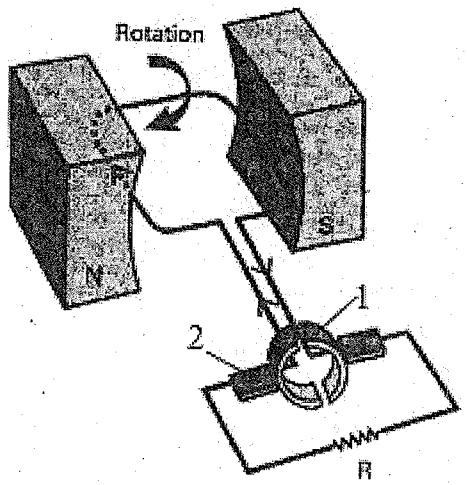
OR

(i) With reference to generators, explain the term ***critical resistance***. [2]

(ii) Give *any two* reasons to explain why voltage does not build up in generators. [2]

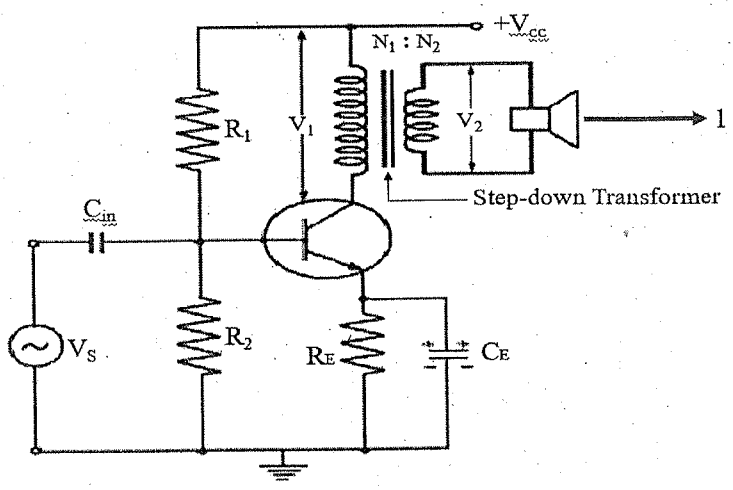
(iii) Name the *two* types of armature windings. [2]

(iv) Study the diagram of the generator given below and label the parts marked '1' and '2'. [2]



Question 13

(i) Study the circuit of the Power Amplifier given below and answer the questions that follow: [3]



(a) State the use of the Step-down Transformer in the circuit shown above.

(b) Name the device labelled '1'.

(c) Is the transistor used an NPN or a PNP type?

(ii) With the help of a neat diagram, explain the working of the ***choke input*** filter. [5]