ELECTRICITY AND ELECTRONICS

(Three hours)

Maximum Marks: 100

*(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 from **Part I** (Compulsory) and five questions from **Part II**.*

All working including rough work, should be done on the same sheet as, and adjacent to,

the rest of the answer.

Mathematical tables and squared paper are provided.

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

PART I
Answer all questions.

Question 1

(a) With reference to vacuum tubes define the following terms: **[2]**

  (i)   Grid cut off voltage;

  (ii) A.C plate resistance.

(b) Calculate the mutual conductance (g_m) of a triode if amplification factor (μ)=20 and plate resistance (r_p) =8000Ω. **[2]**

Question 2

(a) Draw a neat diagram to show that diode works as a half wave rectifier. **[2]**

(b) State *any two* causes for failure of vaccum tube. **[2]**

Question 3

(a) What is the value of the ripple factor for the following: **[2]**

  (i)   Half wave rectifier;

  (ii) Full wave rectifier.

(b) State *two* main functions of bleeder resistor used in the regulated power supply. **[2]**

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Question 4

Draw a neat diagram of a crystal microphone. Mention one important quality this crystal should possess. **[4]**

Question 5

(a) Obtain the relationship between the root mean square (rms) of current (I_{rms}) and its peak value (I_m). **[3]**

(b) Write *any one* difference between electrolytic and non-electrolytic capacitor. **[1]**

Question 6

Write short notes on the following: **[4]**

(a) Pendant holder;

(b) Distribution board.

Question 7

A full wave rectifier uses two diodes *(Figure - 1)*. The internal resistance of each diode may be assumed constant at 20Ω. The transformer (rms) secondary voltage is 50V and the load resistance is $980\ \Omega$. **[4]**
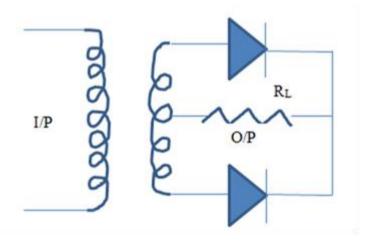

Figure - 1

Calculate:

(a) The mean load current;

(b) The rms value of load current.

Question 8

   (a)   What is meant by short circuiting in electrical wiring?   **[2]**

   (b)   What arrangement could be made to prevent an electrical wiring from short circuiting?   **[2]**

Question 9

Explain in brief the importance of series resistor in the voltage stabilization circuit.   **[4]**

Question 10

(a)   Given below are three figures drawn for energy per band against edge of the nucleus.   **[3]**
    Which of the following figures refer to

    (i)   Conductors;
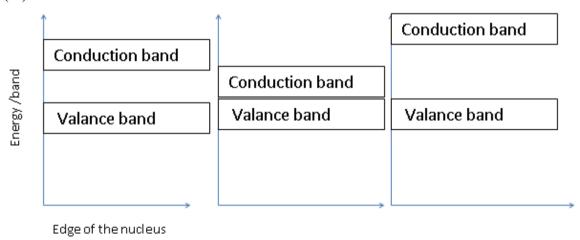
    (ii)   Semiconductors;

    (iii)   Insulators?

| **Fig-2** | **Fig-3** | **Fig-4** |

(b)   State *any one* method to prevent leakage of current.   **[1]**

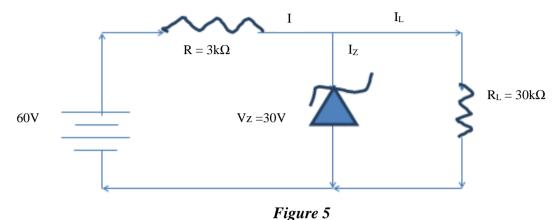
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SECTION B

Answer *any five* questions.

Question 11

(a) Calculate the current through Zener diode if the load resistance $R_L = 30$ kΩ for the circuit **[4]** given below (Figure 5):

Figure 5

(b) What is the function of a fuse? Explain the structure of a cartridge fuse. **[4]**

(c) State *any four* IEE rules and regulations used while installing an electrical appliance. **[4]**

Question 12

(a) Compare AC and DC distribution of power. **[2]**

(b) With the help of a neat diagram explain how a three wire system is used in the distribution of electrical power. **[4]**

(c) With the help of a neat diagram explain how a transistorised voltmeter works. **[6]**

Question 13

(a) Fill in the blanks: **[4]**

    (i) In p-type semiconductor, the current conduction is by _____.

    (ii) If a p-n junction is forward biased, its resistance is _____.

    (iii) The emitter of a transistor is _____ doped.

    (iv) The function of a transistor is to _____.

(b) Write short note on the following: **[4]**

    (i) Vulcanised Indian Rubber (VIR)

    (ii) Flexes.

(c) Show the electrical connection of a heater for domestic use. **[4]**

Question 14

(a) Explain how a gramophone record can be prepared.   **[4]**

(b) State one condition each for using the following: **[4]**
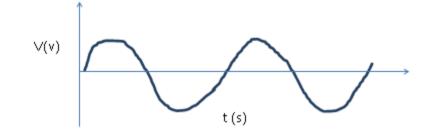
    (i)   Underground cables;

    (ii) Overhead cables.

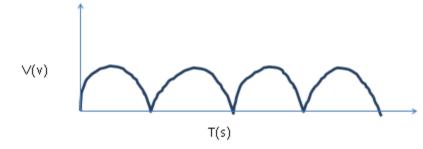(c) With the help of a diagram explain how an ear phone works.   **[4]**

Question 15

(a) State the names of the devices give the following output (O/P) voltage when connected in   **[3]**
an appropriate circuit:

(i)

(ii)

(iii)

Figure 6

(b) Explain how a single loop generator can be used to produce an electrical O/P.   **[4]**

(c) Explain how a dc motor behaves as a self -regulated machine.   **[5]**

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Question 16

(a)   Mention *any two* passive circuit elements. Why are they so called?   **[3]**

(b)   State the main functions of the following devices: **[4]**

    (i)   Impedance matching transformer.

    (ii)   Inductor in a filter circuit.

    (iii)   Cathode by pass capacitor in a vacuum tube circuit.

    (iv)   Inter poles in a generator.

(c)   Why is a single phase a.c motor unable to self-start? Explain the necessity of auxiliary winding in the working of such motors. Also state *any one* application of such a motor.   **[5]**

Question 17

(a)   A d.c. shunt generator has an induced voltage on 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]**

(b)   Explain how a p-n junction is formed.   **[4]**

(c)   What is a microphone? Explain the working of a ribbon microphone.   **[4]**

Question 18

(a)   Explain with the help of a neat diagram the working of a d.c shunt motor starter.   **[6]**

(b)   Briefly explain how is a shunt motor protected against   **[6]**

    (i)   Low Voltage

    (ii)   Overload

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