PART I (40 Marks)

Question 1
With reference to vacuum tube diode:

(a) Draw a graph of plate current (I_p) versus plate voltage (V_P) for any two given cathode temperatures.

(b) Define the following terms:
   (i) Space charge region
   (ii) Plate resistance

Question 2
Explain how an n-type semiconductor can be formed. Also, state the majority and minority charge carriers in n-type semiconductors.

Question 3
With the help of a neat circuit diagram, explain the working of a semiconductor diode as a half-wave rectifier.

Question 4
Draw a neat diagram showing the construction of a crystal microphone and briefly explain its working.
Question 5
Fill in the blanks choosing the appropriate word(s) from those given in brackets. Write the correct answer in your answer booklet. [4]
(a) In the forward region of its characteristics, a diode appears as an _______ switch. (On, Off)
(b) Semiconductor materials have _______ bonds. (ionic, covalent)
(c) The collector characteristics of a Common Emitter (CE) mode transistor may be used to find its _______. (output resistance, voltage gain)
(d) The voltage gain efficiency of a half-wave rectifier is approximately _______. (40%, 80%)

Question 6
(a) Name one element for each of the following: [2]
   (i) Active circuit element
   (ii) Passive circuit element
(b) State any two applications of a capacitor. [2]

Question 7
A D.C. shunt motor connected to a 230V D.C. supply takes a line current of 12A at some load. If the field resistance and armature resistance are 230Ω and 1Ω respectively, calculate the back emf ($E_b$). [4]

Question 8
Briefly explain how a Cathode Ray Oscilloscope can be used to measure an unknown frequency. [4]

Question 9
Write short notes on the following: [4]
(a) Ceiling rose
(b) Flexes

Question 10
With reference to Common Base (CB) connection, the current amplification factor is 0·9. If the emitter current ($\Delta I_E$) is 1 mA, determine the value of base current ($\Delta I_B$). [4]
PART II (60 Marks)

Answer any five questions.

Question 11

(a) Give any one reason to explain why there is a drop in the terminal voltage of a shunt generator when it is loaded. [2]

(b) Giving any two reasons, explain why a shunt generator fails to build up its voltage. [2]

(c) With the help of a schematic diagram, explain the working of a 3phase 4wire system used in the distribution of A.C. power. [4]

(d) State any two advantages of overhead cables over underground cables. [2]

(e) Name any two types of mechanical protection used for manufacturing cables. [2]

Question 12

(a) Explain how an electron beam is produced, focussed, deflected and detected in a CRT (Cathode Ray Tube). [6]

(b) Draw a neat labelled circuit diagram of a power amplifier circuit. [4]

(c) State any two precautions that must be taken while wiring is done for bathrooms. [2]

Question 13

(a) Draw the circuit diagram of a Choke-Input filter. Explain its filtering action. [4]

(b) If the size of a wire is expressed as \( \frac{3}{29} \), what do the numbers 3 and 29 indicate? [2]

(c) Fill in the blanks choosing the appropriate word(s) from those given in brackets. Write the correct answer choosing your answer booklet. [4]

(i) Series motor develops a high torque at a _______ speed. (low, high)

(ii) Speed (N) of a motor is _______ proportional to the back emf (E_b). (inversely, directly)

(iii) The slope emf (E) verses field current (I_f) graph will give the value of _______ resistance. (field, armature)

(iv) In a shunt generator, the field coil is connected _______ to the armature coil. (parallel, in series)

(d) With reference to semiconductors, what is meant by the term doping? Also, name any one dopant. [2]
Question 14
(a) Fill in the blanks choosing the appropriate word from those given in brackets. Write the correct answer in your answer booklet. [4]
   (i) A device which blocks A.C. and bypasses D.C. is known as _____. (capacitor, inductor)
   (ii) Reverse current of a p-n junction consists of _____. (minority, majority)
   (iii) Barrier potential _____. with increase in junction temperature. (decreases, increases)
   (iv) The maximum voltage that can be applied to a diode without destroying it is called its peak _____ voltage. (forward, inverse)
(b) With reference to shunt motor, explain briefly the functions of overload release coil and no-volt release coil. [6]
(c) State any two differences between wires and cables. [2]

Question 15
(a) With the help of a neat diagram, explain the working of a moving coil loud speaker. [4]
(b) With reference to the triode valve, obtain the relationship between amplification factor ($\mu$), mutual conductance ($g_m$) and a.c. plate resistance ($r_p$). [4]
(c) A 24V, 600 mW zener diode is to be used for providing a 24V stabilized supply to a variable load, as shown in Figure 1 below. The input (I/P) voltage is 32V. [4]

![Figure 1](image)

Calculate the following:
(i) Series resistance $R$ required.
(ii) Diode current when $R$ is 1200Ω.

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Question 16
(a) With reference to PNP or NPN types of transistor, explain why the three sections are of:
   (i) Different sizes
   (ii) Different doping levels
(b) With reference to practical generator, explain briefly the use of its following parts:
   (i) Field system
   (ii) Armature windings
   (iii) Brushes

Question 17
(a) With the help of a neat diagram, explain how a capacitor can help to self-start a single phase A.C. motor.
(b) Prove that $I_{rms}$ (root mean squared) value of current is equal to $\frac{I_o}{\sqrt{2}}$, where $I_o$ is the peak value of current for a full wave rectifier.
(c) With reference to power supplies, state any two functions of bleeder resistance.

Question 18
(a) Name any two materials used for making a fuse wire and state two important properties of this fuse wire.
(b) With reference to transistors, obtain the relationship between current amplification factor in Common-Base (CB) mode ($\alpha$) and current amplification factor in Common-Emitter (CE) mode ($\beta$).
(c) State any two differences between transistor and triode tube.
(d) Name any two methods used to minimise eddy current losses in a transformer.