Time allowed: 2.35 hours Total Marks: 68

Note: Answer all parts from Section-B and all questions from Section-C on the E-sheet. Write your answers on the allotted/given spaces.

SECTION – B (Marks 42) [14×3=42]

Q-2: Attempt all parts from the following. All parts carry equal marks.

i. How electric field is related to potential gradient? Derive a relation for it?

OR

How can you identify that which plate of a capacitor is positively charged? Discuss briefly.

ii. Briefly describe the use of potential divider to get variable potential?

OR

What do you mean by the terms permittivity and permeability?

iii. We are given three capacitors each of the capacity C. How can we arrange them to obtain resultant capacity (2/3)C?

OR

Find the value of the electric field between the plates of the parallel plate capacitor if the voltage is 120V and the distance between the plates is 1mm.

iv. The current flowing through a conductor is 2mA at 50V and 3mA at 60V. Is it a ohmic or non-ohmic conductor? How?

OR

What will happen if a voltmeter is connected in series with the load and ammeter in parallel with the supply?

v. A proton moving at 4.00×10^{6}m/s through a magnetic field of magnitude 1.70T experiences a magnetic force of magnitude 8.20×10^{-13}N. What is the angle between the protons velocity and the field?

OR

How much money you will spend per day for having a bulb working in the house circuit with the voltage of 110V and the current of 1 A. (Assume that1kWh costs 100Rs)

vi. If two household light bulbs rated 60 W and 100 W are connected in series to household power, which will be brighter? Explain.

OR

Since the equation for torque on a current-carrying loop is: $T = NIAB\ Sin\ \theta$, the units of Nm must equal to Am^2T. Verify this relation.

vii. In a step-up transformer, a high voltage AC is obtained by supplying a low voltage AC. Does it contradict the principle of conservation of energy?

OR

A cylindrical bar magnet is kept along the axis of a circular coil. Will there be a current induced in the coil if the magnet is rotated about its axis? Give reason.

viii. An automobile with a radio antenna 1.0m long travels at 100.0km/h in a location where the Earth's horizontal magnetic field is 5.5×10^{-5}T. What is the maximum possible emf induced in the antenna due to this motion?

OR

A pair of adjacent coils has a mutual inductance of 1.5H. If the current in one coil changes from 0 to 30A in 1.5 sec, what is the change of flux linkage with the other coil?

ix. On which principle seismometer works? Explain briefly.

OR

What is a choke coil? Briefly explain its function?

x. Calculate the impedance of the circuit containing R= 60Ω, L=0.4H and C=10μF in series connected to an AC source of frequency 50Hz.

OR

What force is required to stretch a wire of $1cm^2$ in cross-section to double its length ($Y=2\times10^{11}N/m^2$)?

xi. Suppose that you are given two materials A and B respectively. A has large hysteresis loop area while B has small hysteresis loop area. Which material A or B is suitable to use in relays and solenoids?

OR

Can an AC source be connected to a circuit and yet deliver no power to it? If so, under what circumstances?

xii. Illustrate the IV characteristics of PN junction?

OR

Mention the properties of ferromagnetic materials?

xiii. What enables a floating bullet train to achieve a speed of 600km/h? How?

OR

When semiconductor junction diode is formed electrons should flow from N to P region but all the electrons do not do so? Explain why?

xiv. In a certain circuit, the transistor has a collector current of 10mA and a base current of 40μA. What is the current gain of the transistor?

OR

A pure inductive coil allows a current of 20A to flow from a 220V, 50Hz supply. Find the inductive reactance and inductance of the coil.

SECTION – C [Marks: 26]

Note: Attempt all questions. Marks of each question are given within brackets.

Q-3: State and explain Gauss's law. Derive an expression for electric field intensity between two oppositely charged parallel plates. [1+2+4=7]

OR

What is an energy band theory? Explain using diagram how insulators, conductors and semiconductors are classified on the basis of this theory. [1+2+2+2=7]

Q-4: Prove maximum power transfer theorem using diagram. [5+1=6]

OR

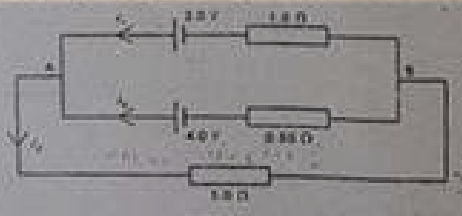
Draw and explain the circuit arrangement for a transistor in a common emitter configuration. Also mention why it is the most widely used configuration of transistor? [2+4=6]

Q-5: Define an AC generator. Derive the relation for induced e.m.f and explain how it is used to produce an alternating current by using graph and different orientations of coil rotating in a magnetic field. [1+2+4=7]

OR

Derive the relation for the equivalent impedance and power factor for R-L-C series A.C circuit using diagram. Also discuss the conditions for this circuit as: inductive, capacitive and resistive. [2+2+3=7]

Q-6: Calculate the current passing through 2V cell in term of I_1 in the figure. [3+3=6]



OR

An electron beam enters a crossed-field velocity selector with magnetic and electric fields of 2.0mT and 6.0×10^{3}N/C respectively. (i) What must the velocity of the electron beam be to traverse the crossed fields undeflected?
If the electric field is turned off, (i) What is the acceleration of the electron beam? (ii) What is the radius of the circular motion that results? [2+2+2=6]

FORMULAE:

E=V/d	F =qvBSinθ	$X_C=\frac{1}{\omega C}$	P = IxV	E = Pxt	$X_L=\omega L$
ε=Blv	ε = dϕ/ dt	ε = MdI/ dt	$Z=\sqrt{R^2+(X_L-X_C)^2}$		Y=FL/AΔL
β= I_c/ I_B	X_L=V/I	ε=IR	$I_3=I_1+I_2$		v=E/B
q/m = v/Br	$C_{eq}=C_1+C_2+C_3$		$\frac{1}{C_{eq}}=\frac{1}{C_1}+\frac{1}{C_2}+\frac{1}{C_3}$		