Instructions – (1) All Questions are *Compulsory*.

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

1. **Attempt any TEN of the following:** 20

   a) Define active circuit and passive circuit.

   b) Define resistance. Also write down its formula.

   c) A capacitor of 12\(\mu\)F is connected across a battery of 6 volt. Determine energy stored in this capacitor.

   d) Draw simple magnetic circuit.

   e) State Fleming’s right hand rule with diagram.

   f) Define:

      (i) Self induced emf.

      (ii) Mutually induced emf.

   g) State any two properties of insulating materials.
h) State Ohm’s law for electric circuit.

i) Two resistance of 6Ω each are connected in parallel. Find equivalent resistance.

j) Define:
   (i) Dielectric strength
   (ii) Breakdown voltage

k) State the relation for energy stored in a capacitor.

l) Define ampere hour efficiency and watt hour efficiency.

m) State the relationship between permeability of free space and relative permeability of air.

n) Compare dry cell and liquid cell (any two points).

2. **Attempt any FOUR of the following:**

   a) In a circuit containing resistance of 60Ω connected across a voltage sources of 20V and current is allowed to pass for 50 sec. Calculate :
      (i) workdone in Joules
      (ii) heat energy produced in kcal.

   b) Derive the expression for equivalent resistance when three resistances are connected in series.

   c) Find equivalent resistance between terminal A and B shown in Figure No. 1

![Fig. No. 1](image-url)
d) Derive an expression for the capacitance of parallel plate capacitor with medium partly air.

e) A coil has resistance of $3.146\,\Omega$ at a temperature of $40^\circ C$ and $3.767\,\Omega$ at $100^\circ C$. Find resistance of coil at $0^\circ C$ and temperature coefficient of resistance at $40^\circ C$.

f) Compare electric circuit and magnetic circuit on any four points.

3. Attempt any FOUR of the following: 16

a) Find equivalent capacitance of series parallel combination of capacitance shown in Figure No.2.

b) Convert given voltage source of Figure No. 3 into equivalent current source and given current source of Figure No. 4 into equivalent voltage source.
c) Define following terms related to circuit
   (i) Bilateral Network
   (ii) Node
   (iii) Loop
   (iv) Branch

d) Find current flowing through 10Ω resistance shown in Figure No. 5 Using Kirchhoff's law.

![Fig. No. 5]

e) Explain B-H curve for magnetic material. With the help of diagram. Explain the concept of leakage flux, useful flux and fringing.

4. Attempt any FOUR of the following: 16
   
a) Convert delta connected network shown in Figure No. 6 into equivalent star.

![Fig. No. 6]
b) Compare alternating current and direct current.

c) Define the following terms:
   (i) Magnetic flux density
   (ii) Reluctance
   (iii) Magneto motive force
   (iv) Permeance

d) State Kirchhoff’s current law and explain with neat diagram.

e) The capacitance of capacitor formed by two parallel plates each of 200 cm² area separated by dielectric of thickness 4 mm is 0.0004 μF. Voltage of 20,000 volt is applied to the capacitor. Calculate:
   (i) Total charge on plates
   (ii) Electric flux density

f) A mild steel ring of 30 cm circumference has cross sectional area of 6 cm² and winding of 500 turns. Air gap is cut of 1 mm in magnetic circuit. A current of 4A produces a flux density of 1 Tesla in air gap. Find
   (i) total ampere turns
   (ii) relative permeability of steel

5. Attempt any FOUR of the following: 16

   a) Derive expression for energy stored in magnetic field of a coil.

   b) Calculate the inductance and energy stored in magnetic field of air cored coil of 250 cm long 50 cm. diameter and bound with 4000 turns and carrying current of 10A.

   c) Air core coil has 500 turns and diameter of 30 cm and cross sectional area 3 cm² Calculate:
      (i) inductance of coil
      (ii) emf induced in coil if current of 2A is reversed in 0.04 sec.
d) What is amorphous metal material? Give any three properties of amorphous metal.

e) State and explain Faraday's law of electromagnetic induction.

f) Define following terms:

(i) Cycle
(ii) Frequency
(iii) Amplitude
(iv) Time period

6. Attempt any FOUR of the following: 16

a) Describe the laws for finding direction of induced emf.

b) List the number of steps to be carried out for maintenance of lead acid batteries.

c) Distinguish between HRGO and CRGO on any four points.

d) State necessity of series connection and parallel connection of batteries.

e) List four examples of insulating material and explain any two.

f) Based on temperature withstand ability. Classify insulating material.