Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.

2) The model answer and the answer written by candidate may vary but the examiner may should assess the understanding level of the candidate.

3) The language errors such as grammatical, spelling errors should not be given more importance (Not applicable for subject English and Communication Skills).

4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.

5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.

6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.

7) For programming language papers, credit may be given to any other program based on equivalent concept.

1 Attempt any ten. 20 marks

a) Define potential difference and give its unit.
Ans:
Potential difference between two points is defined as difference between the electric potentials at those points; OR it is also the work done in moving a unit positive charge (of 1 coulomb) between the two points of the electric path. 1 mark
Its unit is Volt. 1 mark

1 b) State Ohm's law.
Ohm's law:
As long as physical conditions are constant (dimensions, pressure and temperature), the potential difference between any two points in the conductor is directly proportional to current between them. 1 mark
PD "V" α current "I". or V = I R. (R = constant of proportionality called as the resistance of the conductor) 1 mark

1 c) Define temperature coefficient of resistance. State its unit.
Ans:
Temperature coefficient of resistance: It is defined for a particular initial condition (defined by the resistance and temperature) as the fractional change in resistance for unit change in the temperature. (OR ratio of change in resistance of the material per degree Celsius to its resistance at the initial temperature). ½ mark
α_1 (TCOR at initial temp.) = $(R_2 - R_1)/[R_1 (t_2 - t_1)]$ 1 mark

Its unit is per degree Celsius($/^0C$) ½ mark

1 d) Define i) linear network and ii) Non-linear network.
Ans:
i) Linear network: If the characteristics, parameters such as resistance, capacitance, inductance etc remain constant irrespective of changes in temperature, time, voltage etc then the network is called as linear network. 1 mark
ii) Non-linear network: If the parameters of network change their values with change in voltage, temperature, time etc then the network is called as non-linear network. 1 mark

1 e) State any four types of capacitors.
Ans:
Types of capacitors:

i) Air capacitor
ii) Paper capacitor
iii) Mica capacitor
iv) Ceramic capacitor
v) Electrolytic capacitor
vi) Poly-carbon capacitor

Any four types ½ mark Each type

1 f) Compare series & parallel circuit in terms of voltage and current.
Ans:

parameter	Series circuit	Parallel circuit	
Voltage	Total voltage gets divided between individual elements. $V_T = V_1+V_2+V_3+\ldots V_n$	Voltage across each element is same. $V_T=V_1=V_2=V_3=\ldots=V_n$	1 mark
Current	Current through all the elements is same. $I_T=I_1=I_2=I_3=\ldots=I_n$	The total current gets divided between individual elements. $I_T= I_1+I_2+I_3+\ldots I_n$	1 mark

1 g) Define the term magnetic hysteresis.
Ans:
Magnetic hysteresis: when a magnetic material is subjected to cycle of magnetization, it is found that flux density (B) in the material lags behind applied magnetization force (H). This phenomenon is known as magnetic hysteresis. 2 marks

1 h) State two Faraday's laws of Electromagnetic of induction.
Ans:
i) Faradays first law: The first law states that whenever the magnetic lines of force linking with a coil or conductor changes, an emf gets induced in the coil or conductor. 1 mark
ii) Faradays second law: Whenever a conductor cuts or is cut by the magnetic flux, an emf is induced in the conductor the magnitude of which is proportional to the rate at which the conductor cuts or is cut by the magnetic field. 1 mark

1 i) Enlist two electrical properties of insulating materials.
Ans:
Electrical properties of insulating materials: Any two properties 1 mark each
i) Resistivity should be very high
ii) Volume resistance, surface resistance should be large.
iii) Dielectric should be large.

1 j) Define self inductance and give its unit.
Ans:
Self inductance: The property of the coil to oppose any change in current flowing through itself is known as self inductance. 1mark
Its unit is Henry. 1 mark

1 k) Give the classification of magnetic materials.
Ans:
Magnetic materials can be broadly classified into following types: 2 pts 1 mark 3 pts 2 marks
i) Paramagnetic materials
ii) Diamagnetic materials
iii) Ferromagnetic materials

1 l) List any four applications of lead acid battery.

Ans: Any four points ½ mark each = 2 marks

Applications of lead acid battery:

i) As standby units in the distribution network
ii) In the uninterrupted power supplies
iii) In the telephone system
iv) In the railway signaling
v) In the battery operated vehicles
vi) In the automobiles for starting and lighting

1 m) State Fleming's right hand rule:

Ans:

Fleming's right hand rule:

Stretch the thumb, first finger & second finger of the right hand mutually at right angles with each other. Orient the hand such that first finger points in the direction of lines of magnetic flux and the outstretched thumb in the direction of relative motion of conductor then the second finger indicates the direction of induced emf. 2 Marks

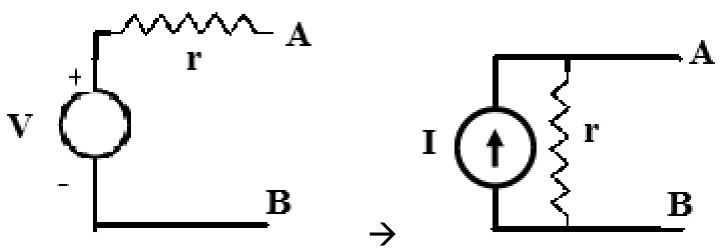
2 Attempt any four. 16

2 a) How to convert practical voltage source to practical current source. Draw equivalent current source for given circuit.

Ans:

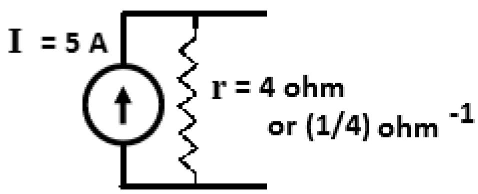
Steps to transform Voltage source to Current source:

1) Calculate equivalent current source as the short circuit current through the voltage source terminals: ($I = V / r$)
2) The Shunt Resistance of current source: ($R_{sh} = r$) 1 Mark
3) Draw the equivalent source.



1 Mark

For given figure



2 Marks

2 b) Given: $R_1 = 80\ \Omega$, $t_1 = 10^0$ C, $R_2 = 98.8\ \Omega$ and $t_2 = 62^0$ C.

Sol^n :

$R_2 = R_1 (1 + \alpha_1 \Delta t)$ — 1 mark

$98.8 = 80 [1 + \alpha_1 (62-10)]$

$98.8 = 80 + (\alpha_1 \text{ x } 4160)$

$18.8 = 4160\ \alpha_1$

$\alpha_1 = 0.0045\ /^0 C$ — 1 mark

Now,

$\alpha_1 = \alpha_0 / [1 + (\alpha_0 \text{ x } 10)]$ — 1 mark

$\therefore\ 0.0045 = \alpha_0 / [1 + 10\ \alpha_0]$

$\therefore\ \alpha_0 = 0.0047\ /^0C = 4.7 \text{ x } 10^{-3}\ /^0C$

$\therefore$ RTC at 0^0 C $= 4.7 \text{ x } 10^{-3}\ /^0C$ — 1 mark

2 c) Show duality between series and parallel DC circuit (any four points)

Ans:

Duality between Series and parallel D.C. circuits:

Sr. No	Series circuit	Parallel Circuit
1	Total $V = V_1 + V_2 + V_3$	Total current $I = I_1 + I_2 + I_3$.
2	Common current $I = I_1 = I_2 = I_3$	Common voltage $V = V_1 = V_2 = V_3$
3	Resultant resistance $R_T = R_1+R_2+R_3$	Resultant conductance $G_T = G_1+G_2+G_3$
4	$I = (V_1 / R_1) = (V_2 / R_2) = (V_3 / R_3)$	$V = (I_1/G_1) = (I_2/G_2) = (I_3/G_3)$

1 mark Each point

2 d) i) How to convert delta to star? ii) convert the circuit in fig to equivalent star.

i) We can convert delta into equivalent star by using following formulae:

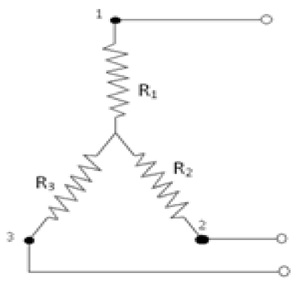


Fig : Star network

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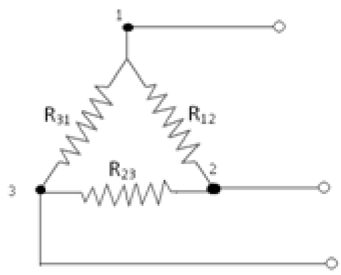


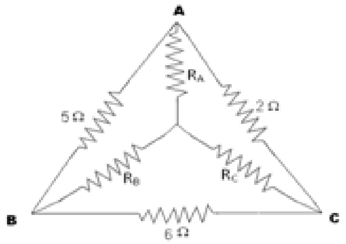
Fig : Equevalent Delta network

$R_1 = (R_{12} * R_{31}) / (R_{12} + R_{23} + R_{31})$

$R_2 = (R_{12} * R_{23}) / (R_{12} + R_{23} + R_{31})$ — 2 Marks

$R_3 = (R_{23} * R_{31}) / (R_{12} + R_{23} + R_{31})$

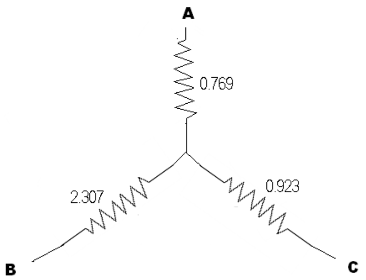
ii) Conversion of given circuit into equivalent star:



$R_A = (R_{AB} * R_{AC}) / (R_{AB} + R_{BC} + R_{CA})$
$= (5*2) / (5+6+2)$
$= 10/13$
$= 0.7690$ ohm ½ mark

$R_B = (R_{AB} * R_{BC}) / (R_{AB} + R_{BC} + R_{CA})$
$= (5*6) / (5+6+2)$
$= 30/13$
$= 2.307$ ohm. ½ mark

$R_C = (R_{BC} * R_{AC}) / (R_{AB} + R_{BC} + R_{CA})$
$= (2*6) / (5+6+2)$
$= 12/13$
$= 0.923$ ohm ½ mark

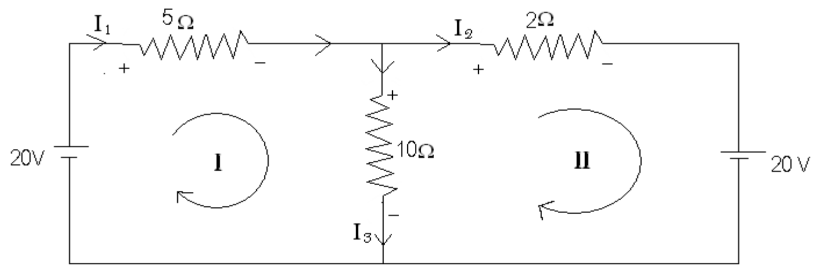


½ mark

2 e) Determine current through 10 ohm resistance using mesh analysis.

Ans:

Given circuit is ,



In loop I by KVL,

$20 - 5I_1 - 10I_3 = 0$

$\therefore 5I_1 + 10I_3 = 20$ ---------------------- (1) 1 Mark

In loop II, by KVL,
$-2I_2 - 20 + 10I_3 = 0$
$\therefore 2I_2 - 10I_3 = -20$ -------------------------(2) 1 Mark
But, By KVL,
$I_1 = I_2 + I_3$ -------------------------(3)
Putting value of I_1 in equation (1)
$5(I_2 + I_3) + 10I_3 = 20$
$5I_2 + 15I_3 = 20$ ------------------------(4)
Solving equations (2) and (4), we get
$\therefore I_2 = -1.25A$ 1 Mark
Putting value of I_2 in equation (2),
$(2 \times -1.25) - 10I_3 = -20$
$\therefore I_3 = 1.75$ A
Therefore, current through 10Ω resistance is 1.75 A. 1 Mark
(students may also solve by assuming loop currents to get same answer)

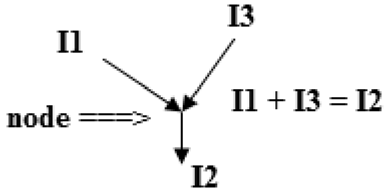
2 f) Compare magnetic circuit with electric on any four points.
Ans:

	Electric Circuit	Magnetic Circuit
1	Current: flow of electrons through conductor is current, it is measured in Amp.	Flux: lines of force through medium from N pole to S pole form flux.It is measured in Weber.
2	EMF: It is driving force for current, measured in Volts.	MMF: It is driving force for flux, measured in amp-turn.
3	Resistance: It is opposition of conductor to current measured in ohms.	Reluctance: It is opposition offered by magnetic path to flux measured in AT/Wb.
4	Resistance is directly proportional to length of conductor.	Reluctance is directly proportional to length of magnetic path.
5	For electric circuit we define the conductance.	For magnetic circuit we define permeability.
6	Electric circuit is closed path for current.	Magnetic circuit is closed path for magnetic flux.
7	For electric circuit I = EMF/resistance	For magnetic circuit Φ= MMF/reluctance
8	Current is actual flow of elctrons	Flux is direction of force- Nothing flows between N pole and S pole.
9	Current does not pass through air.	Flux can pass through air also.

Any four points 1 mark each

3 a) State Kirchoff's laws for electric circuit.
Ans:
i) Kirchoff's current Law:
It states that the algebraic sum of currents meeting at a node in electric circuit is zero. 2 marks
Or
It states that, at any node algebraic sum of incoming currents is always equal to sum

of outgoing currents.



ii) Kirchoff's voltage law:

It states that, in any closed path in a network, the algebraic sum of products of currents and resistances in each of the branches, plus the algebraic sum of emf's in the same path is zero. 2 marks

In other words, Σ emf - Σ IR = 0

3 b) Define following:

Ans:

i) MMF: The force which sets up magnetic flux through in a magnetic path/circuit, is called as magneto motive force. 1 mark

ii) Reluctance: The property of magnetic material which opposes the setting up of magnetic flux in it, is Reluctance. 1 Mark

iii) Fringing: In a magnetic circuit, the useful flux passing through air gap tends to bulge outwards (as parallel lines of flux repel each other) due to which effective area of air gap increases. This effect is known as fringing. 1 mark

iv) Leakage flux: Some flux while passing through the magnetic circuit, leaks through the air surrounding the core.This flux is called as leakage flux. 1 mark

3 c) Given : L_{iron} = 100 cm = 1 m, Air gap $L_{air\ gap}$= 0.2 cm = 2 x 10^{-3}m, N = 800, μ_r = 1200, I = 1 A, B = ?

Ans:

Total MMF = MMF for iron + MMF for air gap 1 Mark

$NI = \text{Ø} S_{iron} + \text{Ø} S_{air\ gap} = \text{Ø}[L_{iron}/(\mu_0 \mu_r A) + L_{airgap}/(\mu_0 A)]$

$NI = B[L_{iron}/(\mu_0 \mu_r) + L_{airgap}/(\mu_0)]$ -------------(1) 1 Mark

Substituting in (1)

$800 X 1 = B [1/(4\pi \times 10^{-7} \times 1200) + (2 \times 10^{-3})/(4\pi \times 10^{-7})]$ 1 Mark

From which B = 0.3546 tesla or wb/m^2. 1 Mark

3 d) Given : P= 40W per lamp, ON for 5 hrs per day, tariff = Rs 5 per kWh,

Ans:

Assuming 30 day month.

Four lamps consume 40 x 4 = 160W for t= 5 hrs a day

$\therefore$ total hours in a month= 30 x 5 =150 hrs

Energy consumed in one month,

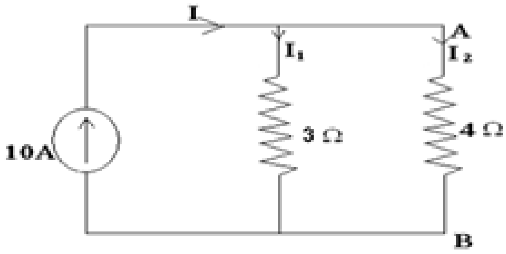
E= P x t 1 Mark

= 160 x 150

= 24000 Wh

= 24 kWh. 1 Mark
∴ monthly electricity bill = (No. of units) x (rate per unit) 1 Mark
= 24 x 5
= Rs 120. 1 Mark

3 e) Calculate current through branch AB using current division formula.
Ans:
Given circuit is :



According to current division formula,
$I_2 = [\ R_1 / (R_1 + R_2)\ ] \times I$ 1 Mark
= [3 / (3+4)] x 10 1 Mark
= 4.285 A 1 Mark
Therefore, current through branch AB is 4.285 A. 1 Mark

3 f) What are the thermal properties of good insulating materials?
Ans:
Thermal properties of insulating material:
1. Heat resistance- insulating material shall have the ability to withstand higher temperature to avoid deterioration.
2. Thermal conductivity- material should conduct the heat quickly to surrounding so that machine temperature remains in specified working range.
3. Thermo-plasticity – materials classified according temperature at which plastic yield occurs are used for producing hard composite dielectrics such as vulcanized rubber, bitumen etc. In such process thermo-plasticity of material is essential.
4. Softening and melting point shall be high.
5. Materials should be non-ignitable when exposed to arcing situations.
6. Expansion and contraction due to changes in temperature shall be very less.

Any four points 1 Mark each

4 a) What is the equation of energy stored in a capacitor? State meaning of terms used.
Ans:
Expression for electrical energy stored in a capacitor.
$E = 1/2\ (Q^2/C)$ 1 Mark
$= 1/2\ QV$ 1 Mark
$= 1/2\ CV^2$ 1 Mark
Where, Q is the amount of charge stored.
C is the capacitance in farads.
V is the potential difference in volts. 1 Mark

4 b) Three capacitors have capacitances 3μF, 5 μF and 7 μF. Find total capacitance when they are connected in i) series ii) parallel.

Ans:

Given: C_1= 3μF, C_2= 5 μF, C_3= 7 μF

i) For Series combination:

$1/C_s = (1/C_1)+(1/C_2)+(1/C_3)$ 1 Mark

$1/C_s = (1/3)+(1/5)+(1/7)$

$1/C_s = 0.33+0.2+0.142$

$1/C_s = 0.672$

$\therefore C_s = 1.48$ μF 1 Mark

ii) For parallel combination:

$C_p = C_1 + C_2 + C_3$ 1 Mark

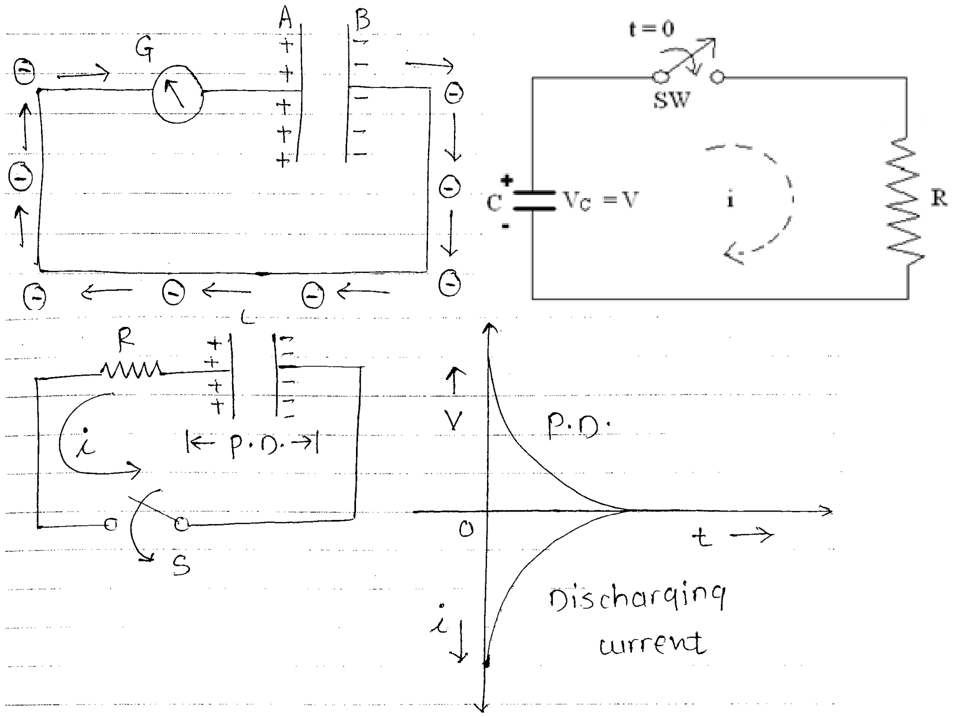
$C_p = 3 + 5 + 7$

$C_p = 15$ μF 1 Mark

4 c) Explain the phenomena of discharging of capacitor.

Ans:

Phenomenon of discharging of Capacitor :



1 mark

The discharging circuit for a charged capacitor is shown in figure. Note that there is no voltage source involved in the RC discharging circuit.

The switch SW is closed at t = 0 to connect the charged capacitor across resistor R and the discharging current i starts flowing through the circuit. The discharging current flows in the opposite direction to that of the charging currents. 1 mark

Operation:

We assume that the switch SW is initially open and that the capacitor is charged to V volts i.e. V_C = V at t = 0. The capacitor voltage will start decreasing exponentially as shown in figure. 1 mark

Some of the important expressions for the RC discharging circuit are as follows,

1. Initial discharging current : $I_0 = V/R$
2. Instantaneous capacitor voltage : $V_c = V_e^{-t/RC}$
3. Instantaneous discharging current : $i = -I_0\, e^{-t/RC}$. 1 mark

4 d) Explain electrolytic capacitor with neat diagram.

Ans:

Electrolytic capacitor :

In an electrolytic capacitor, two sheets of aluminum foil, separated by a fine gauges soaked in an electrolyte rolled up and encased in an aluminum or ceramic or plastic tube. The aluminum oxide is dielectric. The electrolytic capacitors can be used only for DC and should be connected with correct polarity. The electrolytic capacitors have the advantages of small size and low cost. The range of capacitor is from around 1 μF to 200 μF and working voltage up to 400 volt DC. Their main field of applications is in electronic circuit and filters circuits. Explanation 2 Marks

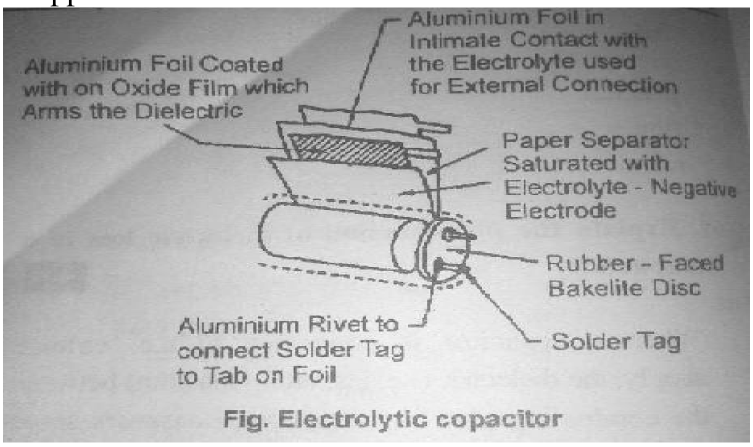


Fig. Electrolytic copacitor

Diagram labeled 2 Marks
Unlabeled 1 Mark

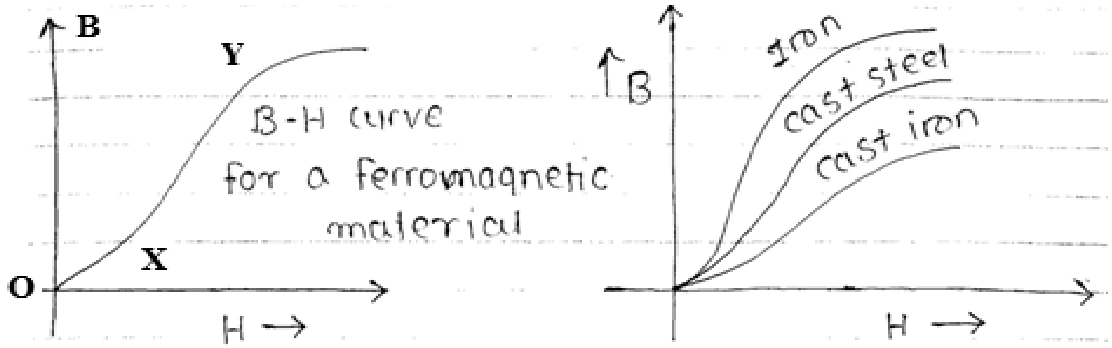
4 e) Explain B-H curve for magnetic material.

Ans:

B-H Curve of Mgnetic material:

The B-H curve is the graphical representation of relation between B and H , with H plotted on the X-axis and B plotted on the Y-axis.

Typical B-H curve is as shown in fig. below:



Valid diagram 1 Mark

Description of the B-H curve:

The B-H curve can be described by dividing it into 3 regions.

- **Region OX**: For zero current, H = 0 and B is also zero. The flux density B then increases gradually as the value of H is increased. However B changes slowly in this region. — 1 Mark
- **Region XY**: In this region, for small change in H, there is large change in B. The B-H curve is almost linear in this region. — 1 Mark
- **Region beyond Y**: After point Y, the change in B is small even for a large change in H. Finally, the B-H curve will tend to be parallel to X axis. This region is called as saturation region. — 1 Mark

4 f) What are different methods of charging batteries? Explain any one of them.

Ans:

There are two methods of charging of batteries:

1) Constant current method — 1 mark
2) Constant voltage method — 1 mark

1) Constant current method:-

i) In this method, the charging current is kept constant by varying the supply voltage to overcome the increased back emf.

ii) If a charging booster is used the current supplied by it can be kept constant by adjusting its excitation.

iii) It charged on a d.c supply, the current is controlled by varying the rheostat connected in the circuit.

iv) The value of charging current should be so chosen that there is no excessive gassing during final stages of Charging the cell temperature should not exceed 45^0C.

v) This method takes a comparatively longer time.

Explanation of any one type 2 Marks

2) Constant voltage charging method:

i) In this method the charging voltage is held constant throughout the charging process.

ii) The charging current is high in the beginning when the battery is in discharged condition and it gradually drops off as the battery picks up charge resulting in increased back e.m.f.

iii) This is the common method of charging used in battery shops and in automotive equipment.

iv) In this method time of charging is almost reduced to half.

5 Attempt any four of following. — 16 marks

5 a) Prove that $L = N^2/S$, where N=number of turns, S = reluctance.

Ans:

We define the co-efficient of self inductance (L) as,

$$L = (N \times \Phi) / I$$ — 1 Mark

But, Φ = (m.m.f.) / Reluctance

$$\therefore \Phi = (N \times I) / S$$ — 1 Mark

$$\therefore L = (N / I)\,[(N \times I) / S]$$ — 1 Mark

$$\therefore L = N^2 / S \text{ Henry} \ldots\ldots \text{ Hence proved}$$ — 1 Mark

5 b) State and explain Lenz's law.

Ans:

Lenz's Law :

Statement :

The direction of induced emf produced due to the process of electromagnetic induction is always such that, it will set up a current to oppose the basic cause responsible for inducing the emf. — Statement 2 Marks

The mathematical representation is, $\mathbf{e = -N\,(d\Phi/dt)}$

Explanation :

If a bar magnet with its N pole facing the coil is brought close to the coil, due to the relative motion between the coil and the magnet, there is a change in flux linkage with the coil. An emf is induced in the coil and current I starts flowing. This current produces its own magnetic field.

The direction of this current is such that it produces and N-pole on the side of the coil it faces. — Explanation 2 Marks

As N-pole produced by the coil is close to the N pole of magnet, there is force of repulsion between the two and this will oppose the magnet coming closer to the coil. Thus the induced emf produces current in such way that it opposes the cause behind its own production.

5 c) What is coefficient of coupling? Explain in brief.

Ans:

Co-efficient of coupling :

It is a measure of the portion of flux produced by a coil linking another coil. It is defined as (K) the ratio of actual mutual inductance (M) present between the coils C_1 and C_2 to the maximum possible value of M. OR it is the fraction of the total flux produced by current in a coil that links the other coil. — 1 Mark

Mathematical expression for co-efficient of coupling is :

$K = M / M_{max}$

But, $M_{max} = \sqrt{(L_1L_2)}$

$\therefore K = M / (\sqrt{L_1L_2})$ — 1 Mark

The maximum value of K is 1 which represents the coupling of all flux produced by one coil with the other coil.

Corresponding to K = 1 the value of mutual inductance will be maximum and it is given by, $M_{max} = \sqrt{(L_1L_2)}$ Corresponding to K = 1 — 1 Mark

The coupling betwwen the two coils is said to be a tight coupling if K = 1 and the coupling is called as loose coupling if K is less than one. — 1 Mark

The coefficient of coupling is also called as Magnetic coupling Coefficient.

5 d) A coil of 100 turns is linked by a flux of 20 mWb. If the flux is reversed in time of 2 msec. Calculate average emf induced in the coil.

Ans:

Given : N = 100, initial flux Φ_1 = 20 mWb = 20 x 10^{-3} Wb,

final flux Φ_2 = -20 x 10^{-3} Wb, time of reversal t = 2 msec = 0.002 sec

We know that

$e = N$ (average rate of change of flux w.r.t time) 1 Mark
$e = |N(\Phi_2 - \Phi_1)|/t$, 1 mark

$\therefore e = 100 \times |[(-20 \times 10^{-3} - 20 \times 10^{-3})| / (2 \times 10^{-3})]$ 1 Mark
$= 2000$ volt
$\therefore$ Average induced emf in the coil = 2000 volt 1 Mark

5 e) State the laws of resistance and derive unit of resistivity.
Ans:
Laws of resistance:
i) It varies directly as length 'l' of the conductor. ½ mark
ii) It varies inversly as the cross sectional area 'a' of the conductor. ½ mark
iii) It depends on the nature of material of the conductor. ½ mark
iv) It depends on the temperature of the conductor. ½ mark

Derivation of unit of resistivity:
The resistivity is given by,
$\rho = R \times (a / l)$ 1 Mark
$\therefore$ Its unit can be derived as, $= \Omega \times (m^2 / m)$
$= \Omega m$
$\therefore$ Unit of restivity is Ωm. 1 Mark

5 f) List out various types of resistors used in electric circuit and also state one application of each.
Ans:
Types of resistors and their applications:

Any four types 1 Mark each

1. Carbon composition resistor; Aplication : Potential divider
2. Wire wound resistor; Application : Power aplifiers
3. Film type resistor, Appplication : medical instruments
4. Carbon film resistor, Application : Amplifier
5. Metal film resistor, Application : Oscillator

6 Attempt any four. 16 marks

6 a) State at least four indicators of fully charged lead acid battery.
Ans:
Indications of a fully charged lead acid battery :
- Gassing :
  When the lead acid cell is fully charged, it freely gives off hydrogen at the cathode and oxygen at the anode. This process is known as gassing. Another important observation is that when the cell is fully charged, the electrolyte appears to be milky. The charging should be stopped immediately as soon as gassing observed. 1 Mark
- Voltage :
  The terminal voltage of a fully charged lead-acid cell with stop increasing further. It approximately remains constant at around. 1 Mark
- Specific gravity of electrolyte :

During the discharging, the specific gravity of the electrolyte decreases due to production of water and the specific gravity increases during the charging process due to absorption of water. The value of specific gravity is 121 for a fully charged cell. It can be measured with a hydrometer and specific gravity can be used as the third indication for full charging. 1 Mark

- Colour of the plates :

The colors of positive and negative plates of the cell when fully charged are as follows: 1 Mark

Positive plate – Deep chocolate brown.
Negative plate – Clear slate gray.

6 b) Explain ampere-hour efficiency.

Ans:

Ampere Hour efficiency:

- The ampere-hour efficiency is defined as the ratio of ampere hours drawn from the battery while discharging to the ampere hours supplied to it while charging. 1 Mark

$\therefore$ AH efficiency =(A-H during discharge)/ (A-H input while charging) 1 Mark

- The typical value of AH efficiency is 90 to 95%. 5 to 10% reduction is due to the losses taking place in battery. 1 Mark

- The ampere hour efficiency takes into account only the current and time but it does not consider the battery terminal voltage at all. 1 Mark

6 c) Define i) amplitude, ii) frequency, iii) time period & iv) angular velocity related to AC.

Ans:

(i) Amplitude:
The maximum value attained by an alternating quantity during its positive or negative half cycle, is called as its amplitude. 1 Mark

(ii) Frequency:
The number of cycles completed per second by an alternating quantity, is called as its frequency. 1 Mark

(iii) Time period:
The time (in seconds) required by an alternating quantity to complete its one cycle, is known as time period. 1 Mark

(iv) Angular velocity:
The frequency of an alternating quantity expressed in electrical radians per second, is known as angular velocity. 1 Mark

Or

In ac cycle, rate of change of angle ωt with respect to time, is known as angular velocity.

6 d) Give general properties of insulating materials.

Ans:

General properties of the insulating materials:

i) Resistivity should be very high.
ii) It should be water resistant.
iii) It should not contain impurities.
iv) It should not be affected chemically nor be corroded easily.
v) Its resistance should not drop under high voltage and high temperature.
vi) It should be heat resistant(not affected by heat) and fire proof.
vii) It should be mechanically strong.
viii) It should not be porous.

Any four points 1 Mark each

6 e) Give properties and application of following materials i) mica & ii) rubber.

Ans:

(i) Mica:

Properties:

It has very high resistance.
It is heat resistant, moisture resistant, it has good elasticity and is fire proof.
It retains its electrical and mechanical properties even at very high temperature.

Any two 1 Mark

Applications:

It is used in commutator, insulators in electric heating units.
It is used for binding armature winding .
Mica papers are used in rotor winding, turbo generators.

Any two 1 Mark

(ii) Rubber:.

Properties:

Rubber is moisture repellent and possesses good insulating properties.
Its specific resistance around is 10^{17} Ω/cm.
Vulcanized rubber is more resistant, mechanically strong and tough, elastic and can withstand high temperature.
It can be affected chemically.
It has low heat resistance.

Any two 1 Mark

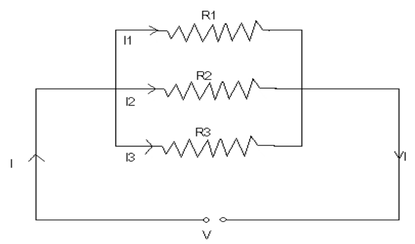
Applications:

It is extensively used as insulation on wires, cables etc.

1 Mark

6 f) Derive relation for equivalent resistance in parallel connection.

Ans:



1 Mark

P.D. across all the resistances is identical and current in each resistor is different and is given by Ohm's law.

The total current $I_T = I_1 + I_2 + I_3$ 1 Mark

$\therefore (V/R_P) = (V/R_1) + (V/R_2) + (V/R_3)$ 1 Mark

If R_P = equivalent resistance of the parallel combination.

$\therefore (1/R_P) = (1/R_1) + (1/R_2) + (1/R_3)$ 1 Mark