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 should assess the understanding level of the candidate.

3) The language errors such as grammatical, spelling errors should not be given 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 should give credit for any equivalent figure/figures drawn.

5) Credits to 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 (as long as the assumptions are not incorrect).

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 of the following **20**

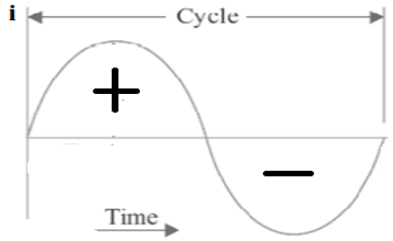
1 a) Define AC and DC current.

Ans:

1] AC current (Alternating current) :-

It is defined as the current which changes its 'magnitude (value)' and 'direction' with respect to time. (waveform/ graph optional)

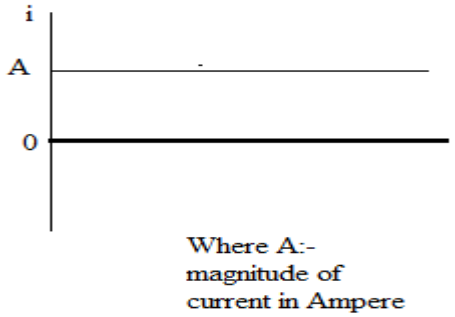
In the positive half cycle current flows in forward direction while in the negative half cycle current flows in the reverse direction.



1 mark

2] DC current:- (Direct current)

It is defined as the current whose magnitude and direction remains constant with respect to time.



1 mark

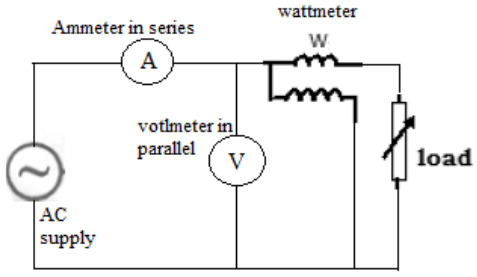
1 b) Name the three types of torques required for indicating meters. 1 mark for 1st and 2nd point.1 mark for 3rd point

Ans:-

1. Deflecting torque
2. Controlling torque
3. Damping torque

1 c) Draw the connection diagram for ammeter, voltmeter and wattmeter with AC supply

Ans:-



1 mark for connection and 1 mark for symbols and names.

1 d) List 2 Applications of DC series motor

Ans:

1.Cranes
2.Hoists
3.Trolley and cars
4.Conveyors
5.For traction work i.e. electric locomotives
6.Elevator
7.Air compressor

1 mars for each of any 2 appl^{n}

1 e) Define regulation and Efficiency of transformer

Ans:-

1. **Efficiency:-**
   It is defined as the ratio of the output power to the input power of transformer.
   % Efficiency = (output power/input power) x 100
   OR
   % Efficiency = (output power/(output power+ losses)) x 100

1 mark for efficiency and 1 mark for regulation

2. **Regulation:-**
   The change in secondary voltage of transformer from no load to full load expressed as a fraction or percentage of no load (or Full load voltage), keeping primary voltage constant, is called as regulation.

Regulation= $(V_{NL}-V_{FL})/ V_{NL}$

OR Regulation= $(V_{NL}-V_{FL})/ V_{FL}$

(Most of the times it is expressed as %)

1 f) State the losses in single phase transformer

Ans:

There are two types of losses occurred in transformer
1) Core loss / Iron loss (Hysteresis and eddy current loss)
2) Copper loss.(Primary copper loss and Secondary Copper Loss)

1mark for each loss

1 g) State necessity of starter for 3 Phase induction motor

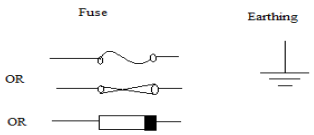
Ans:

i) The starters are required for 3-phase I.M. **to limit the heavy or large starting current** drawn by the induction motor when directly switched on.
ii) The high starting current produces **large copper losses** in motor that generates **heat** which can damage insulation of motor.
iii) The high starting current produces heavy drop (or dip) in supply voltage that can affect other equipment operating on it.

1 mark for each of any 2 points

1 h) Draw symbol of earthing and fuse

Ans:-



1 mark for each symbol

1 i) Write the full form of MCCB and ELCB. — 1 mark for each full form
Ans:-
MCCB: Moulded Case Circuit Breaker
ELCB: Earth Leakage Circuit Breaker.

1 j) Write the formula to determine synchronous speed and % slip of induction motor
Ans:-

1. Synchronous speed (N_s):- — 1 mark for each formula

$$N_s = \frac{120f}{P}$$

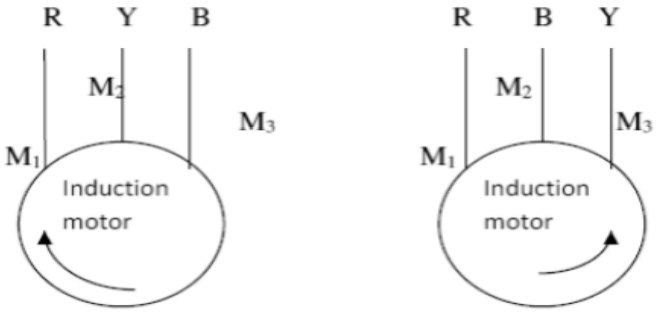
where 'f' is frequency and 'P' be Number of poles

2. %slip:-

$$\%\, slip = \frac{(N_s - N)}{N_s}\, x100$$

where Ns is synchronous speed and N is rotor speed.

1 k) How the direction of 3 phase induction motor is reversed
Ans:
The direction of rotation of 3-phase induction motor is reversed by changing the phase sequence of supply. — 2 marks for statement (diagram just for reference)



1 l) Name the electrical machines used for electro-agro system.
Ans:- — 2 marks for any 2 points
Electrical machines used in electro-agro system:
1. Induction motor in mono block and centrifugal pumps
2. Electrical dryers (harvesting and for partial drying of grains) use single phase induction motor and shaded pole motor
3. Small portable battery operated DC motor are used in sprayers.
4. Cutting machines for crops uses high speed electric motors.

2 Attempt any FOUR of the following: 16

2 a) Write four advantages of polyphase supply systems over single phase system.
Ans:
Advantages of polyphase supply systems over single phase system:

1) Polyphase transmission line requires less conductor material for same power transfer at same voltage.
2) For same frame size, polyphase machine gives more output.
3) For same rating, polyphase machines have small size.

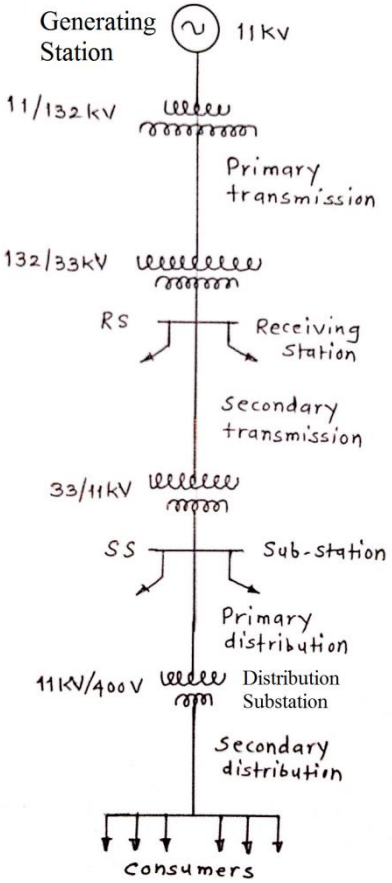
— 1 mark for each of any four advantages

4) Polyphase motors produce uniform torque.
5) Polyphase induction motors are self-starting.
6) For same rating, polyphase motors have better power factor.
7) Polyphase transformers are more economical. Power capacity to weight ratio is more.
8) Polyphase machines have higher efficiencies.
9) Polyphase system is more economical with regards to generation, transmission and distribution of power.
10) Polyphase system requires less maintenance and it increases the life of the system.
11) In polyphase system, stationary three-phase armature winding produces rotating magnetic field, which is not possible by single-phase winding.

2 b) Draw single line diagram showing electrical power supply scheme.

Ans:

Electrical power supply scheme:



Labeled diagram 4 marks

Partially labeled diagram 3 marks

Unlabeled diagram 1 mark

2 c) An alternating current is represented by $i = 50.5 \sin\left(314t + \frac{\pi}{2}\right)$. Calculate

i) Amplitude, ii) Frequency, iii) I_{rms}, iv) Phase difference.

Ans:

Standard form of sinusoidal quantity: $i = I_m \sin(\omega t + \emptyset)$

i) Amplitude:

I_m = 50.5 A

1 mark for each bit

ii) Frequency:
Angular frequency ω = 2πf = 314

$$\therefore f = \frac{314}{2\pi} = 50\ Hz$$

iii) RMS value of current (I_{rms}):

$$I_{rms} = \frac{I_m}{\sqrt{2}} = \frac{50.5}{\sqrt{2}} = 35.49A$$

iv) Phase Difference:
Phase difference $\phi = \frac{\pi}{2}$ rad. = 90°

2 d) A resistance of 10 Ω and capacitance of 50μF are connected in series across 200V, 50Hz AC supply. Calculate i) Capacitive reactance, ii) impedance, iii) current, iv) phase angle.
Ans:
Given: Resistance R = 10Ω, Capacitance C = 50μF, Voltage V = 200V
Frequency f = 50Hz — 1 mark for each bit

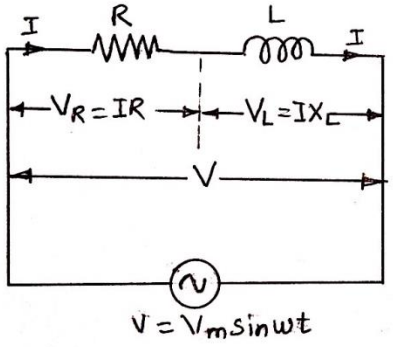
i) Capacitive Reactance $X_c = \frac{1}{2\pi fC} = \frac{1}{2\pi(50)(50\times10^{-6})} = 63.66\ \Omega$

ii) Impedance $Z = \sqrt{R^2 + X_c^2} = \sqrt{(10)^2 + (63.66)^2} = 64.44\ \Omega$

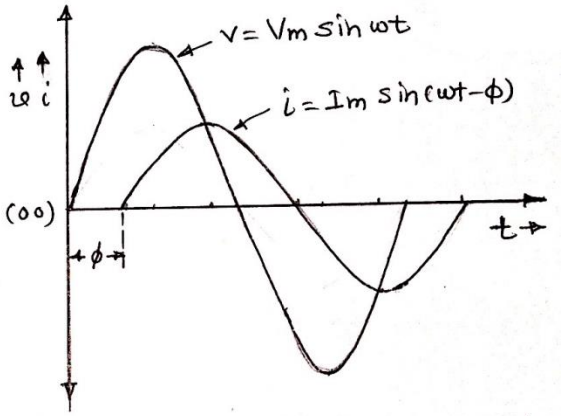
iii) Current $I = \frac{V}{Z} = \frac{200}{64.44} = 3.1A$

iv) Phase Angle $\emptyset = tan^{-1}\left(\frac{X_c}{R}\right) = tan^{-1}\left(\frac{63.66}{10}\right) = 81°$.

2 e) Draw the circuit diagram and waveforms of voltage and current in R-L series circuit.
Ans:



circuit Diagram

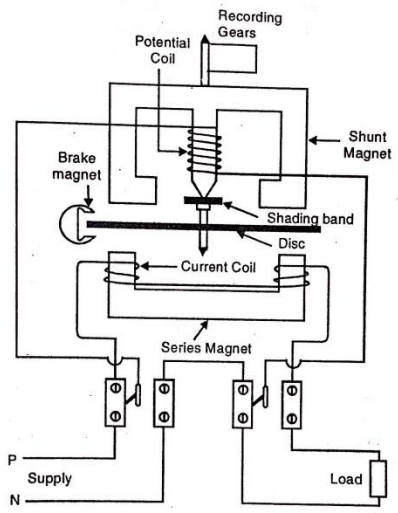


Waveforms of Voltage and Current

2 marks for circuit diagram

2 marks for waveforms

2 f) Draw a neat labeled diagram of single-phase energy meter showing all its important parts.
Ans:
Single-phase Energy meter:
(Examiner is requested to consider following diagram or any other equivalent diagram of single-phase energymeter)



Labeled diagram 4 marks

Partially labeled diagram 3 marks

Unlabeled diagram 1 mark

3 Attempt any FOUR of the following: **16**

3 a) List the main parts of DC machine. Write the function of any two.

Ans:

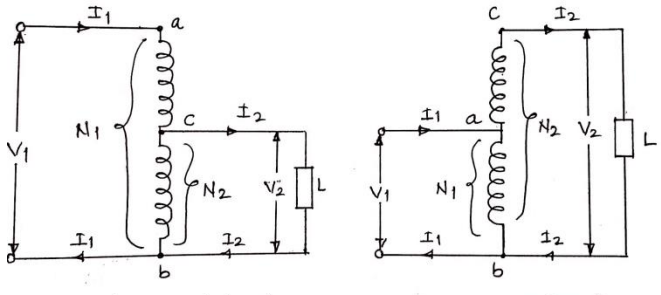
Part	Functions
Yoke	(i) Provides mechanical support for poles. (ii) Acts as protecting cover for machine. (iii) Carries magnetic flux.
Pole Core & Pole Shoes	(i) Provides support for the field winding, which is placed around it. (ii) Allows the field winding to produce magnetic flux in it. (iii) Pole shoes spread out the magnetic flus over the armature periphery more uniformly.
Field Winding	Produces mmf and consequently magnetic flux when carries current.
Armature	(i) It houses the armature conductors. (ii) It rotates the armature conductors in the magnetic field.
Armature Winding	Provides conductors to - induce emf in it (in generator) - produce force on it (in motor)
Commutator	(i) Works as media to collect from or to send current to the armature winding. (ii) Helps to maintain unidirectional current in armature winding.
Brush	(i) To inject or collect current from rotating armature winding. (ii) To facilitate electrical connection of rotating armature winding to external stationary circuit.
Bearings	(i) To support the rotor and reduce friction for smooth rotation of rotor. (ii) Maintains rotor in a fixed physical position relative to the stator.
Shaft	Used to transfer mechanical power

½ mark for each of any four parts = 2 marks

1 mark for function of any two parts = 2 marks

3 b) Explain auto-transformer with step-down and step-up diagrams.

Ans:



2 marks for labeled circuit diagram

An autotransformer has a single winding on an iron core and part of winding is common to both the primary and secondary circuits. Fig.3b(i) shows the connections of a step-down autotransformer. Here N_2 are less than N_1 and V_2 is less than V_1. Fig. 3b(ii) shows the connections of a step-up autotransformer. Here N_2 are greater than N_1 and V_2 is greater than V_1. In either case, the winding 'ab' having N_1 turns is primary winding and winding 'bc' having N_2 turns is secondary winding. The primary and secondary windings are connected electrically as well as magnetically. Therefore, the power from the primary is transferred to secondary conductively as well as inductively.

2 marks for explanation

3 c) Derive emf equation of single phase transformer.

Ans:

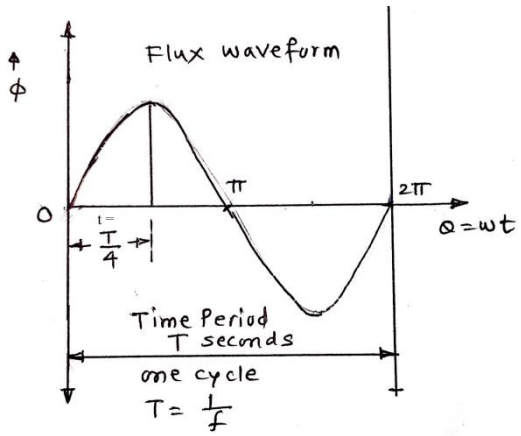
Emf equation of single phase transformer:

Let N_1 be the no. of turns of the primary winding.

N_2 be the no. of turns of the secondary winding.

$\emptyset_m$ be the maximum value of the flux in wb.

f be the frequency of supply in Hz.



1 mark for diagram

First Method:

Maximum value of flux is reached in time $t = \frac{1}{4f}$

Average rate of change of flux

$= \frac{\emptyset_m}{t} = \frac{\emptyset_m}{(1/4f)} = 4\emptyset_m f$ wb/sec.

1 mark

According to Faraday's law of electromagnetic induction,

Average emf/turn induced =Average Rate of change of flux

$= 4\emptyset_m f$

Form factor $= \frac{RMS\ Value}{Average\ Value} = 1.11$ for sinusoidal quantity.

$\therefore$ RMS value of emf/turn $= 1.11 \times Average\ value = 4.44\emptyset_m f$ volt

1 mark

$\therefore$ RMS value of emf in primary winding = RMS value of emf/turn $\times N_1$

$$E_1 = 4.44\ \emptyset_m f N_1 \quad \text{volt}$$

Similarly, 1 mark

RMS value of emf in secondary winding $E_2 = 4.44\ \emptyset_m f N_2$ volt

OR

Second Method:

The alternating magnetic flux in the core is given by, 1 mark

$$\emptyset = \emptyset_m sin(\omega t)$$

According to Faraday's law of electromagnetic induction,

Instantaneous value of emf/turn $= e = -\frac{d\emptyset}{dt}$

$$= -\frac{d}{dt}[\emptyset_m sin(\omega t)]$$
$$= -\omega \emptyset_m cos(\omega t)$$
$$= \omega \emptyset_m sin\left(\omega t - \frac{\pi}{2}\right) \quad \text{volt}$$

1 mark

Maximum value of emf/turn $= \omega \emptyset_m = 2\pi f \emptyset_m$

RMS value of emf/turn $= 0.707 \times 2\pi f \emptyset_m = 4.44\ \emptyset_m f$ volt 1 mark

$\therefore$ RMS value of emf in primary winding = RMS value of emf/turn $\times N_1$

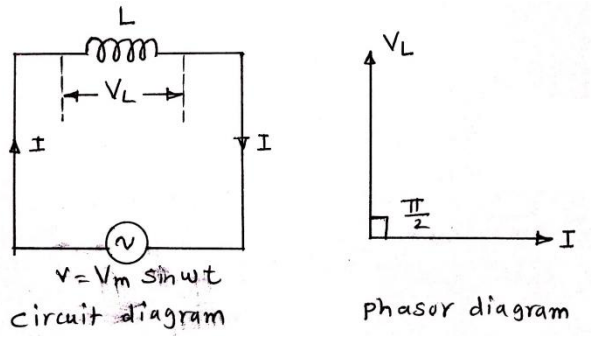
$$E_1 = 4.44\ \emptyset_m f N_1 \quad \text{volt}$$

Similarly, 1 mark

RMS value of emf in secondary winding $E_2 = 4.44\ \emptyset_m f N_2$ volt

3d) Draw a circuit diagram of pure inductive circuit and phasor diagram.

Ans:



2 marks for circuit diagram

2 marks for phasor diagram

3e) An RL series circuit consists of 100Ω resistance and 0.22 H inductance connected across 220V, 50Hz AC supply. Calculate:

(i) Impedance, (ii) Current, (iii) Voltage across resistor, (iv) Voltage across inductor

Ans:

Given: Resistance R = 100Ω, Inductance L = 0.22 H,
Voltage V = 220V, frequency f = 50 Hz.

(i) Impedance:

Inductive reactance $X_L = 2\pi f L = 2\pi \times 50 \times 0.22 = 69.16\ \Omega$

Impedance $Z = \sqrt{R^2 + X_L^2} = \sqrt{(100)^2 + (69.16)^2} = 121.56\ \Omega$

1 mark for each bit

(ii) Current:

Current $I = \frac{V}{Z} = \frac{220}{121.56} = 1.8\ A$

(iii) Voltage across resistor:

$V_R = I.R = 1.8 \times 100 = 180$ volt

(iv) Voltage across inductor:

$V_L = I.X_L = 1.8 \times 69.16 = 125$ volt

3 f) A single phase 230V/150V, 1 kVA, 50Hz transformer is supplied by 230V AC supply. Find full load primary and secondary currents.

Ans:

Given: V_1= 230V, V_2 = 150V, VA = 1000 volt-amp, frequency f = 50Hz

(i) Full load Primary current:

$$I_{1FL} = \frac{VA}{V_1} = \frac{1000}{230} = 4.347\ A$$ 2 marks

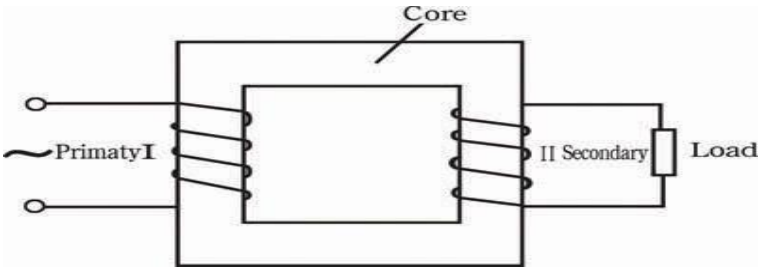
(ii) Full load Secondary current:

$$I_{2FL} = \frac{VA}{V_2} = \frac{1000}{150} = 6.66\ A$$ 2 marks

4 Attempt any FOUR of the following: 16

4 a) Explain working principle of transformer and draw neat labeled diagram

Ans:-



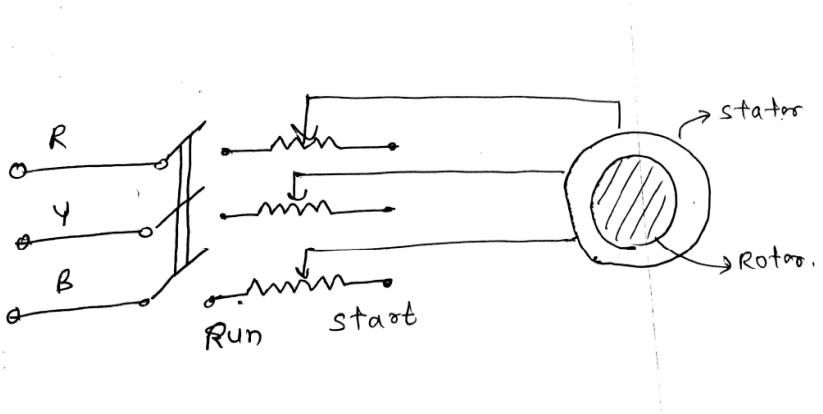
2 marks diagram

- Transformer works on the principle of **Mutual induction**. Mutual induction between two or more winding is responsible for transformer action in an electrical transformer. 2 marks

- When AC voltage is applied to the primary winding, it produces alternating flux in the core. This flux links with the secondary winding and according to Faraday's law of electromagnetic induction, an emf is induced in the secondary winding. This emf is called 'Mutually Induced EMF'. explanation

4 b) Draw and explain neat labeled diagram of the stator resistance starter for starting of 3 Phase induction motor

Ans:-

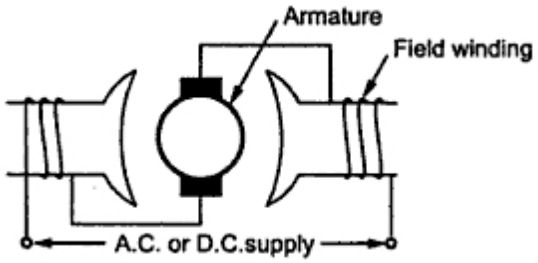


2 marks for diagram

-A resistance is connected in each phase of stator winding.
-Initially starter is kept at maximum (starting mode) to keep high resistance with lower voltage to the stator.
-Due to reduced voltage, starting current also gets reduced.
-As motor accelerates, we don't need to control the current externally. So the resistance is reduced in steps and finally kept on RUN position.
-At RUN position, the stator resistance is totally removed from the circuit.

2 marks for explanation

4c) Explain the working principle of universal motor and state its two applications
Ans:-



1 mark for diagram

-It is modified **DC series** motor which can work on AC as well as DC supply.
-When current flows through both field and main armature winding, there is generation of force (or torque in circular point of view).
- The force is directly proportional to the product of main flux and armature Current.

F (or torque) α (flux)(Armature current)

-They have nearly same operating characteristic for both AC and DC supply.

1 mark for explanation

Applications of universal motor:
1) Vacuum cleaners,
2) Mixers,
3) Dryers,
4) Sewing machines

2 marks for any 2 application

4d) Write factors for selection of motor for electric drives.
Ans:-
Factors for selection of motor for electric drives:
1)Type of drive:- individual or group
2)Electrical supply:-whether it is AC or DC,1phase or 3 Phase
3) Nature of the load : The load on the motor may be constant or variable, and according to the nature of load the motor is selected.
4) Speed Requirement: The application may require constant speed or variable speed operation.
5) Environmental condition: The environmental condition means the condition of surroundings in plant. For chemical or explosive conditions, the totally enclosed type motor is selected
6) Efficiency: In some application precise output required, in that case high efficient motors are used.
7) Price : cost is one of the factor which is considered in motor selection.
8) Motor Duty Cycle: Applications require continuous or intermittent operation and

1 mark for each(any 4 points)

hence duty cycle of motor is also taken in to account in selection.

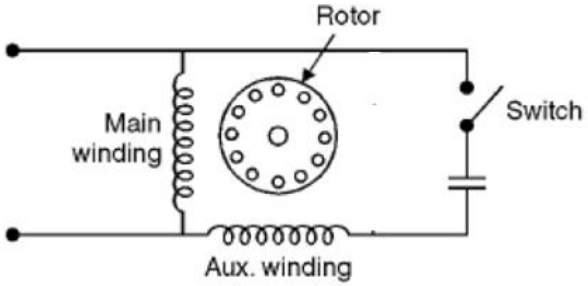
4 e) Compare squirrel cage and slip ring induction motor on any four points
Ans:-

S.No.	Squirrel Cage Induction Motor	Slip Ring Induction Motor
1	Rotor is in the form of bars	Rotor is in the form of 3-ph winding
2	No slip-ring and brushes	Slip-ring and brushes are present
3	External resistance cannot be connected	External resistance can be connected
4	Small or moderate starting torque	High Starting torque
5	Starting torque is fixed	Starting torque can be adjust
6	Simple construction	Complicated construction
7	High efficiency	Low efficiency
8	Less cost	More cost
9	Less maintenance	Frequent maintenance due to slip-ring and brushes.
10	Starting power factor is poor and power factor on running is better	Starting power factor is adjustable & large but low power factor on full load
11	Size is compact for same HP	Relatively size is larger
12	Speed control by stator control method only	Speed can be control by stator & rotor control method

1 mark for each of any four points

4 f) Explain the working of a single phase capacitor start induction motor.
Ans:-

Single phase capacitor start induction motor:



2 marks for dia.

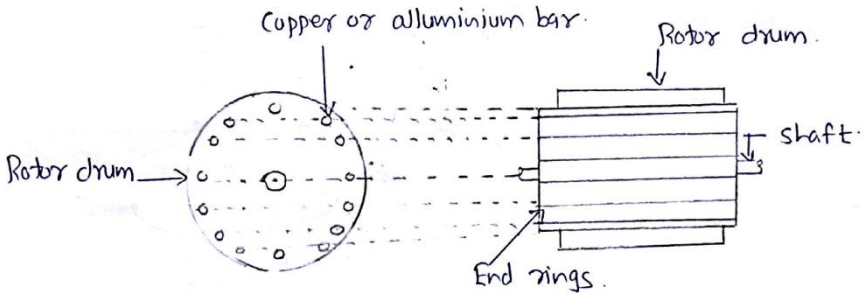
-In this motor, auxiliary winding is in the series with a capacitor and in circuit only during starting
-Due to capacitor, we can get approximate 90 degree of phase difference in main and auxiliary winding current.
-This 90 degree of phase difference provides the rotating magnetic field.
-After attaining 75-80% of synchronous speed, centrifugal switch in series with auxiliary winding get opened and auxiliary winding gets disconnected and motor runs without capacitor.

2 marks for explanation

5 Attempt any FOUR of the following: 16

5 a) Explain the construction and working of squirrel cage rotor 3 phase induction motor.
Ans:

Construction and working of squirrel cage rotor 3 phase induction motor:



Construction of squirrel cage rotor

2 marks for diagram

2 marks for explanation

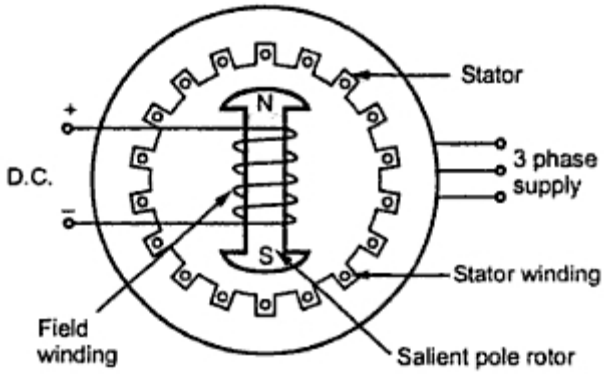
In squirrel cage rotor, rotor drum is provided with a no. of circular holes parallel to the shaft. In these holes copper or aluminium bars are placed and these bars are short circuited at both the ends by end rings. Due to short circuited rotor bars, the rotor part is not accessible to the user. Therefore, insertion of external resistance in the rotor circuit is not possible. Due to this reason, these motors produce moderate starting torque, which is fixed. The bars and end rings are look like a cage, used to arrest squirrels in old days, hence it is called as squirrel cage rotor.

5 b) Explain the construction of alternator with neat diagram.

Ans:

Alternator:

An alternator consists of stator and rotor. The stator is in the form of hollow cylinder, slotted on the inner periphery. The stator core is made up of steel laminations to reduce the iron losses. In the stator slots, three-phase winding is uniformly distributed.



2 marks for diagram

2 marks for explanation

The rotor carries magnetic poles and field winding. Two types of rotor constructions are available:

i) Salient pole construction

ii) Cylindrical rotor construction

The figure shows salient pole construction. In salient pole construction, the field poles appear projected on the rotor. Therefore, there is uneven air gap between stator and rotor. At projected poles, the gap is minimum and at the space between the poles, the air gap is maximum. The field winding is place round the poles as shown in the figure. In case of cylindrical rotor construction, the rotor surface appear smooth with uniform air gap between stator and rotor, as the field winding is placed in rotor slots. The field winding is connected to an external DC supply using slip ring – brush arrangement.

5 c) List any four types of electric motor enclosures and state one advantage of each.

Ans:

Type of enclosure	Advantages

1. Open type	Allows free ventilation
2. Protected type	Provides complete protection with ventilation
3. Drip-proof type	Provides protection from liquid or moisture
4. Splash-proof type	Provides complete protection from dust, dirt etc.
5. Totally-enclosed type	Provides complete protection without ventilation
6. Pipe ventilated type	Provides cool air to motor
7. Flame-proof type	Provides protection to the motor from sparking, explosive environment etc.

½ mark for each of any four types = 2 marks

½ mark for each of any four advantages = 2 marks

5 d) A 4 pole, 50 Hz squirrel cage induction motor runs on load at a speed of 1000 rpm. Calculate:
(i) Percentage slip, (ii) The frequency of induced current in the rotor.

Ans:

Given: Poles P = 4, Frequency f = 50 Hz, Speed N = 1000 rpm

i) Percentage Slip:

Synchronous speed $N_s = \frac{120f}{P} = \frac{120\times50}{4} = 1500\ rpm$ — 1 mark

$$\% s = \frac{N_s - N}{N_s} \times 100 = \frac{1500 - 1000}{1500} \times 100 = 33.33\%$$ — 2 marks

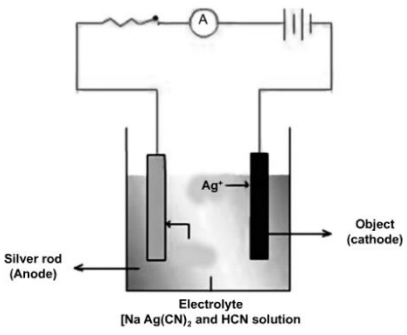
ii) Frequency of Rotor current: — 1 mark

$$f_r = sf = 0.3333 \times 50 = 16.66\ Hz$$

5 e) Explain the process of electroplating used in electrometallurgical system.

Ans:

Process of electroplating:



2 marks for diagram

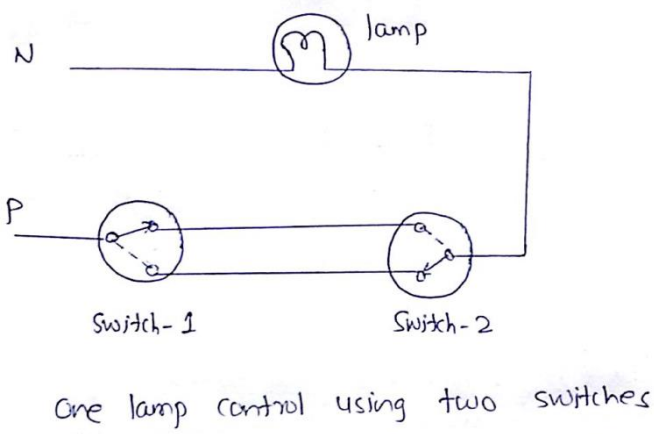
Electroplating is a process of depositing a layer of one material for protective or decorative purpose on the other material. The electroplating tank is made up of wood, RCC, fibre or stainless steel to avoid corrosion. The electroplating tank is filled with electrolyte solution. The anode is connected to positive terminal while cathode is connected to the negative terminal of DC supply. The article to be plated forms the cathode and the metal rod whose coating is to be given, acts as the anode. As soon as the DC supply is switched on, the process of electrolysis takes place and article gets coated with the anode material.

2 marks for explanation

5 f) Draw the wiring diagram for control of one lamp using two switches.

Ans:

4 marks for labelled diagram



One lamp control using two switches

6 Attempt any FOUR of the following: 16

6 a) State any four advantages of electric heating.

Ans:

Advantages of Electric Heating:

1) Clean operation: In electric heating, there is no formation of ash or smoke etc., hence operation is clean.
2) No pollution: No production of flue gases, smoke, ash. Dust etc. hence no pollution.
3) Temperature control is easy: No. of heating elements can be turned on and off manually or automatically, hence temperature control is easy.
4) Uniform heating:
5) Less attention: It requires less attention as compared to other heating methods.
6) Economical: It does not require large space and storage accessories, therefore capital and running cost of electrical heating is less.
7) High utilization efficiency: The losses are less, hence utilization efficiency is high.
8) High temperature: Very high temperature can be attained.
9) Quick heating: Time required for electric heating is comparatively less.
10) Large scale production: It is used for large scale production.
11) Bad conductor of heat and electricity can be heated.

1 mark for each of any four

6 b) Explain working of MCCB.

Ans:

Moulded Case Circuit Breaker (MCCB):

The MCCB are designed to provide protection for low voltage distribution system. It protects the devices from overload and short-circuit. The MCCB has following components:

i) Moulded case or frame
ii) Operating mechanism
iii) Arc extinguishers
iv) Contacts
v) Trip unit

2 marks for constructio n

The moulded case or frame provides an insulated housing to mount all the components of MCCB.

The operating mechanism, consisting of lever, spring, contacts etc. is used to open or close the MCCB electrically.
The arc extinguisher facilitates for the quenching of arc produced when MCCB gets opened and current is interrupted.
The trip unit is the brain of the circuit breaker. It senses the overload or short-circuit condition and trip mechanism is operated to trip the MCCB. When overload occurs, the thermal relay mechanism permits overload for short duration, then bimetal strip actuates the tripping mechanism to open the MCCB contacts. When short-circuit occurs, large magnetic force produced by short-circuit current operates the lever to trip the MCCB and open the contacts.

2 marks for working

6 c) State the necessity of earthing. State types of earthing.

Ans:

Necessity of Earthing:

The earthing is used to provide protection and safety to the operator and the equipment. Also it facilitates the balanced supply conditions.

2 marks

Types of Earthing:

i) Pipe earthing
ii) Plate earthing

1 mark each

6 d) Explain the various safety precautions to be taken while handling electric equipment.

Ans:

Various safety precautions to be taken while handling an electric equipment:

1) Only qualified person should be allowed to handle the equipment, untrained person should not be allowed.
2) Place yourself at safe distance from working equipment.
3) Wear appropriate clothing.
4) Use shoes with rubber sole to avoid electric shock.
5) Use proper instrument to test the circuit.
6) Always obey the safety instructions given by the person in charge.
7) Use approved discharge earth rod for earthing before working.
8) Do not touch or operate switches when your hands are wet.
9) The earth connection should be perfectly sound ar proper.
10) Avoid overloading of circuits or circuits.
11) Do not expose your eyes, face to an electric arc.
12) Never speak to any person while working on live installation.
13) Don't make safety devices inoperative.
14) Follow strictly the maintenance schedule.
15) Avoid working on live parts.
16) Switch off the supply before starting of work.
17) Never touch the wire till you are sure that it is not live.
18) Make habit to observe for danger notices, cautions boards, flags and tags.

½ mark for each of any 8 precautions

6 e) Explain with neat diagram process of any one type of electric welding.

Ans:

Types of Electric Welding:

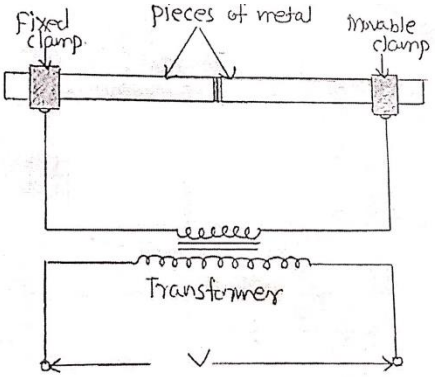
Resistance welding:	Arc Welding

- Butt welding - Spot welding - Seam welding - Projection welding	- Carbon arc welding - Metal arc welding

2 marks for diagram of any one welding method

1) Resistance Welding

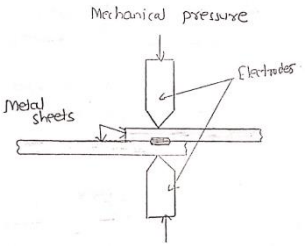
a) Butt Welding:



The two metal pieces to be welded are connected across secondary of welding transformer using clamps, as shown in the figure. When supply is given to the primary winding, the voltage is stepped down to secondary but current is stepped up. The high current passes through the pieces of metal and the area of contact. The sufficient heat is developed at the contact, melting the metal and further causing welding at contact.

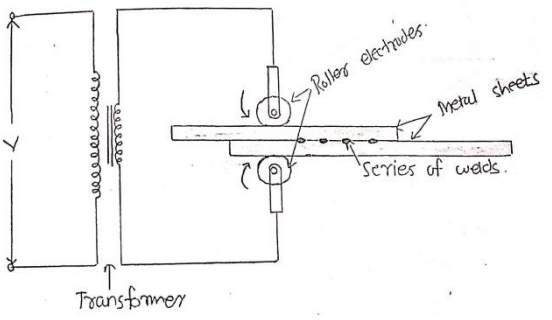
2 marks for explanation of that method

b) Spot Welding:



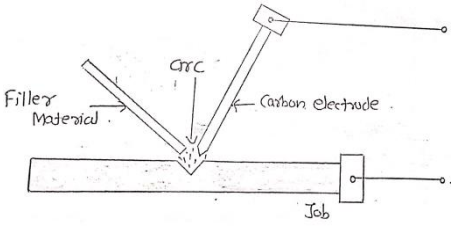
In spot welding, the welding is done at certain points on metallic sheets. The pieces to be welded are held between the two tipped electrodes. When current passes through the electrodes, high current density at the point of contact causes melting of metal and a spot weld is produced.

c) Seam Welding:



Seam welding is similar to the spot welding except that series of spots are produced by roller electrodes instead of tipped electrodes. Two sheets are passed in between the two roller electrodes. Depending upon the number of welding current pulses per second and peripheral speed of the electrode wheels, we get series of weld spots

2) Arc Welding:



The electrodes used for this welding are made up of carbon or graphite. An electric arc is struck when the short-ciruited electrodes are separated a little bit. In the process of withdrawing the electrodes apart, the area of contact of

electrodes first reduces which increases the resistance producing large localized heat and then on actual separation of electrodes, arc is struck. Due to high temperature of arc, electrode melts and weld is produced.

6 f) State different types of lamps. Explain any one lamp used for domestic purpose.

Ans:

Types of lamps:

1) Incandescent Lamp
2) Fluorescent Lamp
3) Compact Fluorescent Lamp (CFL)
4) Mercury Vapour Lamp
5) Sodium Vapour Lamp
6) Metal Halide Lamp
7) Arc Lamp
8) LED Lamp

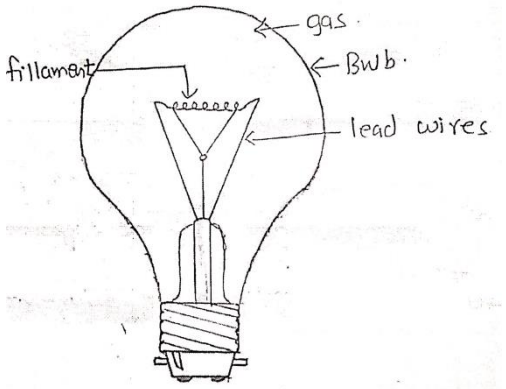
1 mark for types of lamps

Lamps Used for Domestic Purposes:

1) Incandescent Lamp:

1 mark for diagram of any one lamp

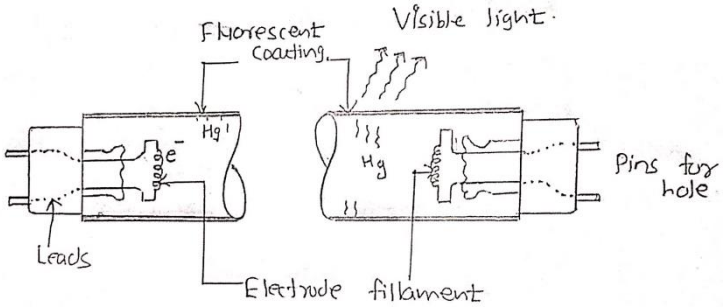
The incandescent lamp consists of glass bulb, filament, lead wires etc. When the voltage is applied to the lamp, the current flows through it. Due to i^2R power loss, the filament gets heated. The temperature of filament increases to very high value and it starts emitting the light.



The filament is made up of tungsten material. The operating temperature of the lamp is 2000°C. The luminous efficiency is 10 lumens per watt. The working life is 1000 working hours.

2 marks for description of that lamp

2) Fluorescent Lamp:



The fluorescent lamp consists of electrodes, glass tube coated inside surface with fluorescent material, inert gas such as argon or krypton and small amount of mercury in the glass tube. When sufficiently high voltage appears across the electrodes, the discharge takes place through the gas inside the tube. Thus current flows, the electrons while moving strikes with mercury atoms and carrier multiplication takes place. The current carriers when strike with the fluorescent material coated on the inner surface of tube, the material absorb their energy and

convert it into light. Thus visible light is emitted outside the tube.

3) CFL(Compact Fluorescent Lamp): **OR**

CFL is a type of fluorescent lamp which uses less power and have longer life but generally have higher purchase price. 3 marks for description of CFL

There are two main parts in a CFL, namely (i) The gas filled tube and (ii) The electronic ballast. The electronic ballast contains a small circuit board with rectifier, a filter capacitor and usually two switching transistors connected as high frequency resonant series DC to AC inverter. The high frequency about 40 kHz is applied to the lamp. Since the resonant converter tends to stabilize lamp current over a range of input voltages, standard CFLs do not respond well in dimming applications.

Working:

Electrical energy in the form of an electrical current from the ballast flows through the gas, causing it emits ultraviolet light. The ultraviolet light then excites a white phosphor coating on the inner surface of tube. This coating emits visible light.