UTILISATION OF ELECTRICAL ENERGY AND TRACTION

ELECTRICAL ENGINEERING

4TH SEMESTER

Utilisation of Electrical Energy & Traction.

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Ch 4/ Electrolytic process 05/04/2017

Definition - The substance which decompose when a electric current is passed through them are called Electrolyte.

* The process of decompositn of electrolyte by the passage of electric current through them is called electrolytic process or electrolysis.

* Electrolytes may be solid, liquid (molten/aqueous) Caustic soda but they are generally liquid.

* ~~pure liquid~~ water is ~~not an electrolyte~~ liquid
* pure liquid like water don't suffer appreciable decomposition

Basic Principle of electro-deposition

Electrodeposition is the process of depositing a metal over another metal or non metal by electrolysis. Electroplating is a very common example (Water H_2O)

* It is used for.
  i) To protect the metals against corrosion.
  ii) To give shiny appearance to the article

Important terms regarding Electrolysis 06-01-2017

Electrotyping :- In this process wood cuts are reproduced in copper by the process of electroplating

Electro-forming :- The production or reproduction of an article by electro deposition is called as electroforming. In the product^n of coins, etc mould is first made by having an impression of point in wax surface which has exact impression of the object is coated with powered graphite in order to make it conducting.

(Le

Electro-deposition / - plating

Electrodeposition is the process of depositing a metal over another metal or non metal by electrolysis.

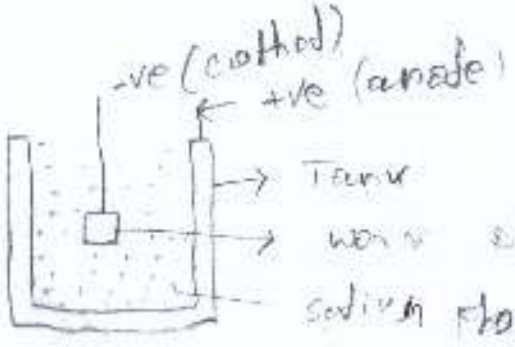
* An electroplating is a very common example of such a process.

Electro cleaning :-

The article before electroplating should have a surface free from grease, oil etc. And they are cleaned by electro cliving method. A solut^n of Sodium phosphate is used as an electrolyte.

The tank is connected to +ve terminal of DC supply and one peice to clean is made the cathod and is suspended in the sol^n of Sodium phosphate.

Heavy current is passed through the solut^n & Caustic soda is produced on the cathod which has a cleaning action



Faraday's laws of Electrolysis:-

1st Law

The weight of a substance liberated from an electrolyte in a given time is proportional to the total quantity of electricity past in that time

Explanatn.

If W is the weight of substance liberated

Then $W \propto Q$

where, Q is the quantity of electricity passed

$W \propto I \cdot T$ or $Q = I \cdot T$

I = current & T = time.

$W = I \cdot T$ or $W = ZIT$

Z is the constant called electrochemical equivalent E.C.E

$$Z = \frac{W}{IT}$$

2nd Law

If the same current flows for a given time through several electrolytes the weight of substance liberated are proportional to their chemical ~~equipment~~ equivalents.

Explanatn

The chemical equivalent is the weight of the substance which can displace or combine with unit weight of hydrogen or 8 grams of oxygen.

Chemical equivalent = $\frac{\text{Atomic weight of substance}}{\text{valency}}$

Chemical equivalent of hydrogen is one by definition

According to this law if we take the two electrolyte of copper sulphate & nickel sulphet in which same current flows for the same time then.

$$\frac{\text{weight of copper deposited by given quantity of electricity}}{\text{" " nickel " " same " "}} = \frac{\text{chemical equivalent of copper}}{\text{" " " nickel}}$$

16-01-2017

Current Efficiency:

Due to impurities which cause secondary reactions the quantity of a substance liberated is less than that calculated from faradays law

$$\text{current efficiency} = \frac{\text{Actual quantity of substance liberated}}{\text{Theoritical quantity}}$$

It should be noted that its value lies between 80 to 95%.

Energy efficiency:

on account of secondary reactions, the actual voltage required for the deposition or liberation of metal is higher than the theoritical value, which increases the actual energy required

$$\text{Energy efficiency} = \frac{\text{Theoritical energy}}{\text{Actual energy required}}$$

Principle of electro deposition:-

18/01/2017

Import

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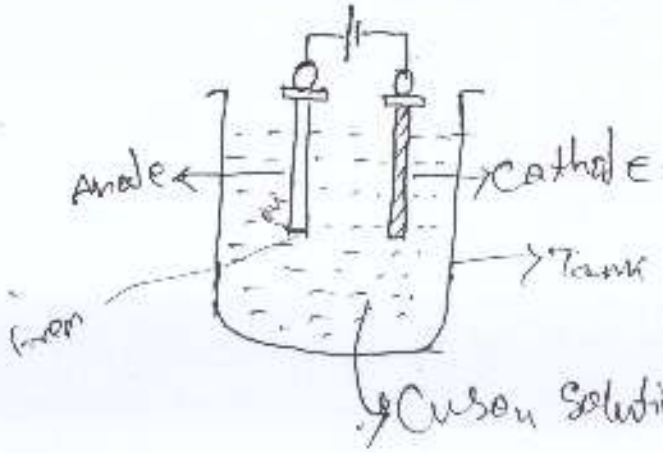


potential applied across them, the electrodes are named as +ve or anode and -ve or cathode

* Consider the case of copper sulphate ($CuSO_4$) dissolved in water. It dissolves in to +vely charge copper ion's and -vely charged sulphate ions.

* If two electrodes are placed in the soln and one of them is connected to the +ve terminal DC and the other to the -ve terminal as shown in the fig. then +vely charged ions travels towards the cathode and the -vely charged ions towards anode.

* Copper is deposited at the cathod as metal. The sulphate ions are collected at the anode and react with water giving out oxygen as shown in the following reaction

$$2SO_4 + 2H_2O = 2H_2SO_4 + O_2$$

* oxygen is liberated as gas at the anode & H_2SO_4 is formed in the electrolyte.

* The whole process describe above is called electrolysis but its effect is that Copper is also deposited on the Cathode.

19/01/2017

factor affecting the amount of electro deposition :-

1. Time :- Time is $\propto$ to the quantity of electro deposition. So we can say that more mass will be deposition in more time.

2. Efficiency :- Greater is the efficiency, greater is the quantity of metal deposited for a given time.

3. Current - The value of current is also directly proportional to the mass of metal deposited. Greater is the current, Greater is the quantity of metal deposited.

4. Strength of soln :- In this strength of soln is more than the means of metal deposited will be more.

factor governing the better Electro deposit^{n} 20.7.17

If the current density is more the quantity of metal deposit become more uniform. At low value of current density the ions are released at slow rate

* Current density is defined as the ratio of current to the area. Its unit is, A/m^2

Electrolytic Concentration.

Electrolytic Concentration is directly proportional to the current density. If the electrolytic concentration is more then the current density is also more

Temperature.

The temp^{r} of the electrolyte is different for different metal to have best deposit^{n},

for example:-

In chromium plating, the temp^{r} is 35°C and in nickel plating, the temp^{r} is 60° C

98.4° F (farenite)
Normal temp^{r} of human body

Addition of Agents

The quality of metal deposition is improve by the presence of an additional agent which may be organic compound such as rubber, sugar.

Nature of electrolyte:-

The smoothness of the metal deposition depends upon the nature of electrolyte. for example, copper plating for the solution of copper sulphate

Extract of Metal. 20-1-17

The extracting of metal is done by two ways

(i) The ore is treated with a strong acid to obtain salt at the solution of such salt is electrolysed to liberate the metal.

(ii) When ore is ~~soft~~ molten state it is electrolysed in a furnace.

EXTRACTION OF ZINC :——

The ore except of zinc is treated with concentrated sulphuric acid roasted and passed through other process to get ready of impurities the zinc sulphate solution is then electrolyte 21/01/17

Extraction of aluminium.

The ores of aluminium are bauxide, cryolite. Bauxide is treated chemically & reduced to aluminium oxide and electrolysed. Alumium deposite at cathode

seperating metals from there compounds

Many metals are seperated from there compound by electro-lysis for example:-

An ore of aluminium Contain about 40% aluminium oxide. 24-01-17

Applicatn of Electrolysic

The following are the applicatn of electrolysic

i. Extractn of metal from there ore.
ii. " " Zinc
iii. " " Aluminium
iv. Refining of metal

v- Production of chemical.
vi- Separating metal from there compounds
vii- Electrodeposition
viii- Electro cleaning.

Refining of metal

The metal extracted from there core is not that is much pure which would be use for electricity application. The purity of copper obtained from its core is about 98 %. But Copper to be used in electrical application must have a purity of 99.95 % . purity of copper is obtained by electrolysis. The electrolyte solution used is copper sulphate.

Production of chemical

Many chemicals such as Caustic soda, chlorine gas are produced by electrolysis on a large scale

Short Q:

1) state faradays 2nd law of electrolysis.?

Ans- Faradays 2nd law state that if the same current flows for a given time through several electrolytes, the weight of the substance liberated are proportional to there chemical equivalent.

2) what is electro-plating ? The process of depositing a metal on the surface of some other metal by electrolysis is called electroplating.

3) write the name of the solution used for silver plating?

Ans- For silver plating we use the soln. sodium argento cyanide

$Na[Ag(CN)_2]$

4) Electro chemical equivalent of a substance is the amount of that substance by weight liberated in a unit time by the passage of unit current. Its unit is gm/Coulomb.

5) what is current efficiency?

It is the ratio of actual quantity of substance liberated to theoretical quantity of substance liberated

6) Mention the need of electroplating. The electroplating is used for (i) To protect the metal from the corrosion.
(ii) To give shining appearance to the articles.

Explain factors affecting the amount of electrodeposition

2) State and explain faradays laws of electrolysis

3) write Basic principle of electrodeposition.

CH-7

Electrical heating :-

Introduction :-

Electric heat is preferred over other types of heating methods thus is by Coal, Wood, gas

$$P = I^2 R \text{ watt}$$

$$H = I^2 R t$$

Advantage of electrical heating :-

Neat and clean atmosphere :-

* There is Coal dust or smoke and operator hand don't go black.

No pollution :-

* Absence of flue gases doesn't result in pollution at atmosphere.

Control temperature :-

* A temp can be controlled with in ± 5°c with is not possible in non-elatrical heating process

Low surrounding temp :-

The temp around an electrical furnace is much lower as compair to that of non-electric furnace

Heating bed conductor of heating electricity.

* Wood, plastic & baccary a/c can be uniformly suitable heated with direct heating process

Cheap furnace :-

In electrical furnace don't required big space for in-stallation no storage of coal & fire wood in necessary.

mode of heat transforing :-

There are three modes of transmission of heat those are

(i) Conduction, Solid
(ii) Conversion Liquid
(iii) Radiation. Object

liquids are heated by Convertion solid by Conduction method & distance, objects are heated from this source of heat by radiath

stefan's law :-

According to stefan's law energy radiated per second per unit area by a perfect body is directly ~~prop~~ propertional to the 4th power of its absolute temper

$$E \propto T^4$$

$$\Rightarrow \sigma T^4$$

where E = energy radiation

σ = stefan's constant.

T = Absolute temper

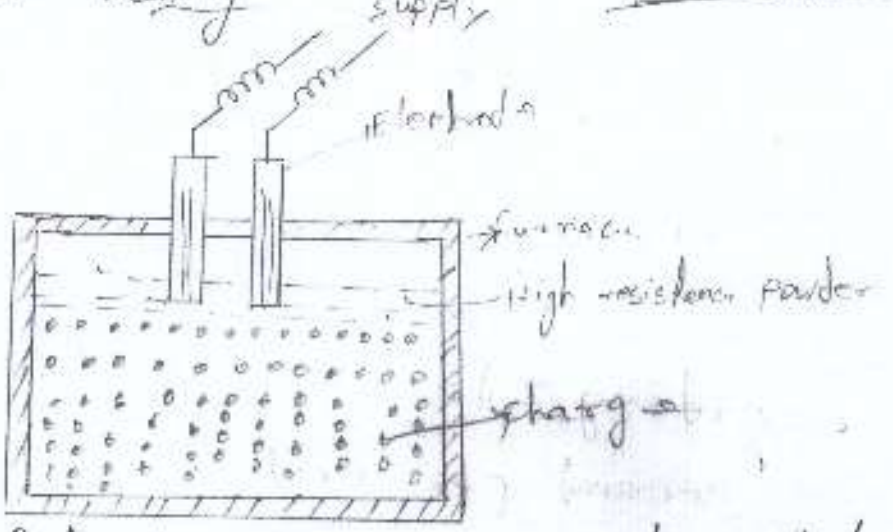
Principle of resistance Heating

This method is base upon the I^2R loss whey ever the current is passed through a register material, heat is developed due to I^2R loss there are two types of resistance heating

(i) Direct resistance heating
(ii) Indirect resistance heating.

Direct resistance heating

31/01/2011

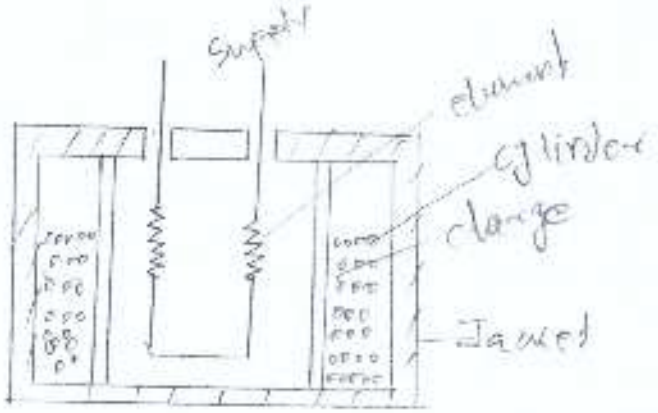


In this method of heating the material or charge to be heated is taken to be a resistance and a current is passed through it. The 2 electrodes are immersed in the charged and connected to the supply. A powder of high resistivity material is sprinkled over the surface of the charge to avoide direct short ckt

The current flows through the charge and heat is developed. This method has high efficience since heat is developed in the charged it self.

- Arc Heater

Indirect resistance heating



In this method of heating the current is passed through a high resistance element which is placed below or above the oven depending up on the nature of the Job to be perform

The heat proportional to I^2R Losses developed in heating element passes to the charged by radiation

* Room heaters, Various ovens, & water heater etc.

Difference bet^n direct & indirect resistance heating

Direct resistance heating	Indirect resistance heating
*It mainly Consist of two electrode and charge	* It consist of two resistive element, Jacket, cylinder & charge.
* High resistive powder is sprinkled to avoid this short cut	* NO high resistive Powder is used

02/02/2017

Arc furnace

The furnace used for extraction or melting of ferrous & non ferrous metal need a high temper for operation.

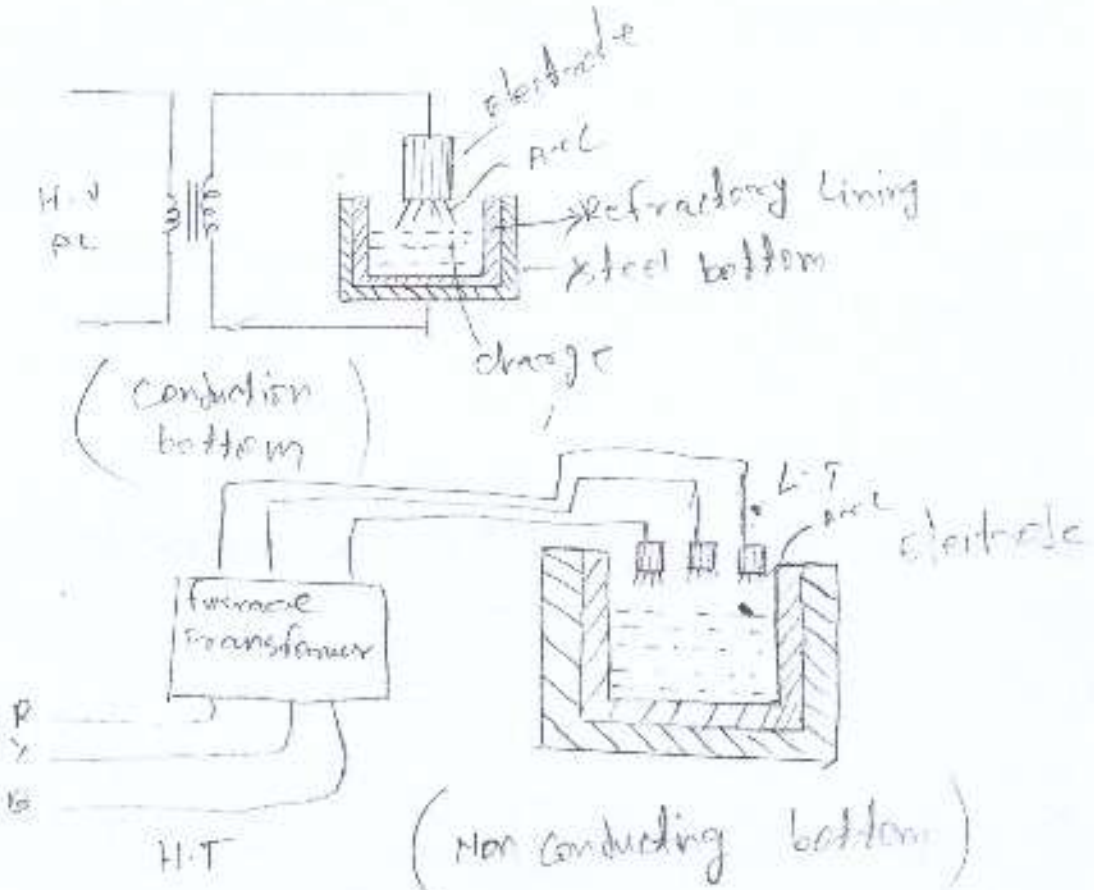
Electric arc which gives an arc temper bet^n 3000°c to 3500°c on low tension operat^n. Arc is the flow of current through an air gap bet^n two Conducting bodies

Arc furnace is divided in to two types

a. Direct arc furnace

b. Indirect arc furnace

a. Direct arc furnace



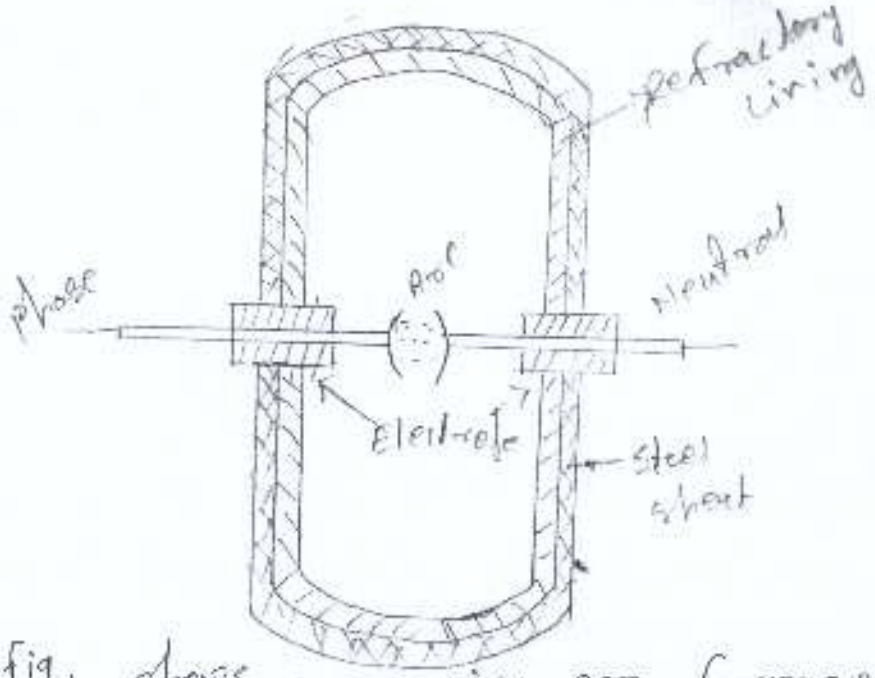
when the arc is struck bet^n electrode and the charge to be heated, so that the arc current flows through the charge and there is a direct contact bet^n the arc & charge.

Electrically this furnaces can be further divided in to two catagories

(a) Conducting bottom
(b) Non Conducting bottom

The former has bottom of the furnace as a part of the electrical ckt where as no current flows through the body of the furnace in the second case.

b. Indirect arc furnace



The bove fig. shows a rocking arc furnace working on the principle of indirect arc. In this arc furnace, low voltage 1-ϕ AC supply is applied across the electrodes by steel circuiting the electrodes for a moment and with drawing this appart. The heat from the arc is transfer to the charge top layer through radiation.

03/02/2017

Induction Heating :-

Eddy current

Whenever the flux is linking to any Conduction body changes, the induced emf is created which is a funct^n of rate of change of flux / rate of change of current.

Consider a coil of 'N' ~~terms~~ turns wound on one ~~time~~ limb of a magnetic core. Let the coil be supplied with alternating current from a source. The flux created by the current will be changing in mgnitude as well as direct^n This changing flux links with the coil as well as the magnetic core which results an induced emf.

Due to this induced emf which cause circulat^{n} of current through the core. This current is called eddy current

Hysteresis loss

If a piece of magnetic material is magnetised or demagnetised, some energy is lossed in this process. This loses occuring in any electromagnetic device is known as hysteresis loss.

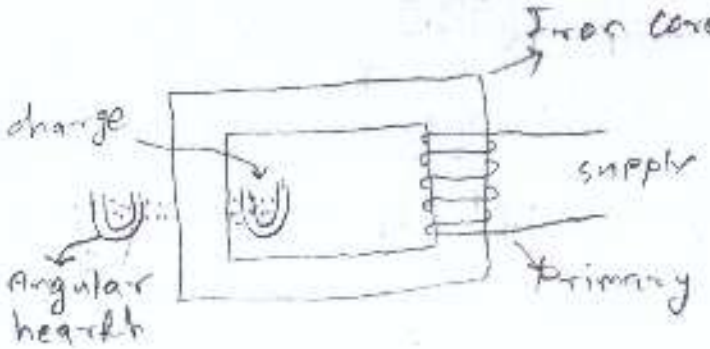
Classificat^{n} of Induct^{n} heating of furnace

* Induct^{n} heating of furnace is divided in to two types
  a) Core type
  b) Coreless type.

Core type induction heating is divided in to 3 types such as -

i - Direct core type.
ii - Vertical core type.
iii - Indirect core type.

i- Direct Core type Induction furnace 03/02/2017



* The above fig. shows the direct core type induct^{n} furnace
* It is shown just like a T/f. charges formes

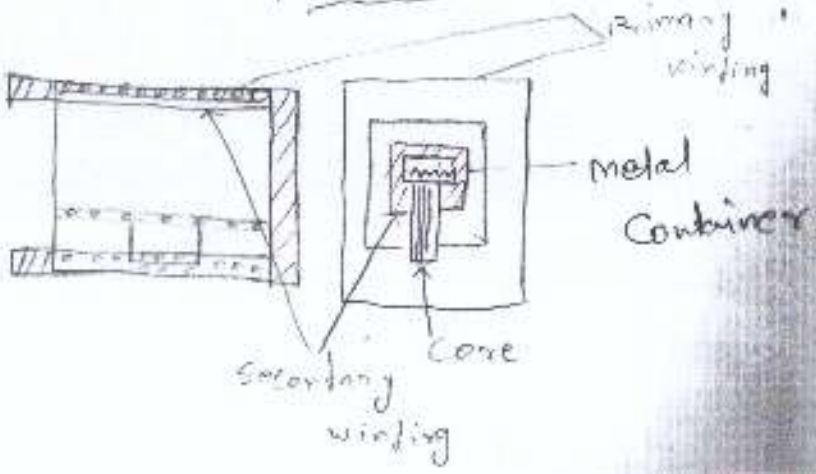
the secondary winding and consist of one turn only
* The current in the charge is very high. The charge is magnetically coupled to the primary winding
* when there is no metal then no current flow to the secondary side

Vertical core type

Induct^{n} furnace

The furnace improve over core type furnace. It has vertical channel for the charge. The magnetic coupling in this furnace is good as compare to core type induct^{n} furnace. It can operate from normal frequency supply. It is used in industries for melting and refining the feros & non-ferros metal

Indirect Core type induction furnace;-



The fig. shows the constructional dig. of indirect core type induction furnace. The secondary winding forms the wall of a metal container and the iron core links the primary as well as secondary winding.

The advantage obtained is simple good and temp control can be achieve.

Skin effect

04/02/2017

The steady direct current when flowing through a conductor distributed uniformly over the cross-section of the conductor. In case of AC, the distribut^n is not uniform. The AC current tends to concentrate near the surface of the conductor & no current flows through the core of the conductor. This concept is know as skin effect.

Coreless induction furnace

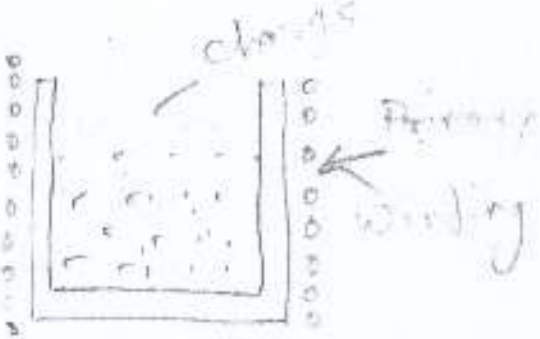


Fig (a)

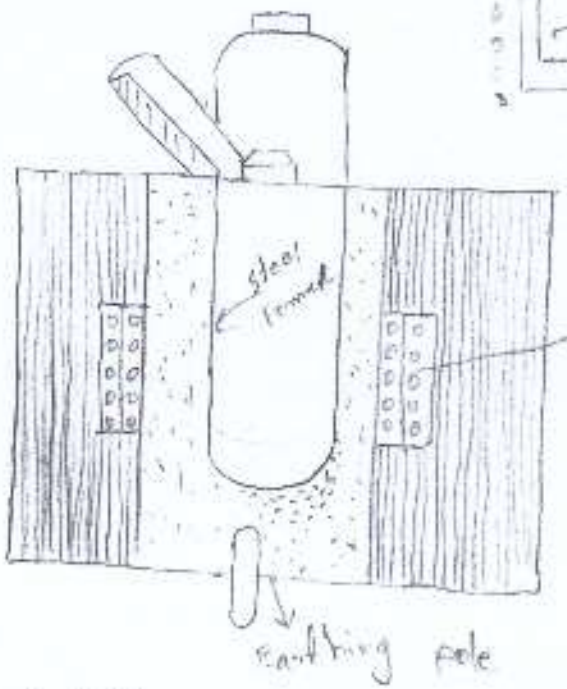
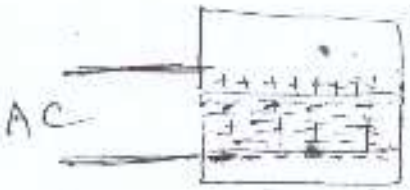


Fig (b)

Dielectric Heating

* In ~~direct~~ dielectric heating allows the uniform heat ~~rabite~~ on non conducting material while there not able to conduct the electricity.

* Dielectric heating is also known as high frequency heating or Capacitive heating.



* As we know in whole of the universe's metal made by combination of molecules which element particle is atom.

* when dielectrical material not present in electrical field then metal molecules present in random position

Operation

when we give the high voltage AC supply then electric supply flow across the electrode. Due to electrostatic force +ves -ve charge store in that plate(electrode) which is reverse according to frequency

Since the dielectric material behave like a capacitor and the dielectric molecules polarized due to ~~reformise~~ formation of diapoles or polar molecules

* ~~when~~ IF molecules polarized then the +ve charge of molecule attracts by -ve plate.

* The atomic weight and atomic number of copper are 64 & 29 respectively, Therefor, a Copper atom has 29 protons, 29 electrons and 35 neutrons

* The charge on an electron is so small that it is not Convenient/~~Convenient~~ Convenient to select it as the unit of charge. In practice, Coulomb is used as the unit of charge. one Coulomb of Charge is equalto the charge on 625×10^{16} electrons i.e.

1 Coulomb = charge on 625×10^{16} electrons

Charge on one electron, $e = \frac{1 \text{ coulomb}}{625 \times 10^{16} \text{ electrons}} = 1.6 \times 10^{-19}$ C

Electric Current :- (I)

* The flow of free electron is called current

* The rate of flow of ~~current~~ electrons i.e., charge flow per second, $I = \frac{Q}{t}$ — Coulomb (Q) / — Second (t)

when 1 Coulomb flow in 1 second then $I = \frac{1}{1} = 1$ A

Electric Potential :- (V)

The Capacity of Charged body to do work is called Electric Potential

Electric Potential $V = \frac{\text{Work done}}{\text{Charge}} = \frac{W}{Q}$ $\frac{\text{Joule}}{\text{Coulomb}}$

$W = \frac{1 \text{ Joule}}{1 \text{ Coulomb}} = 1$ V

Potential Difference :- (V)

The difference in the potentials of two charged bodies is called potential difference (A +5V ←←← B +3V)

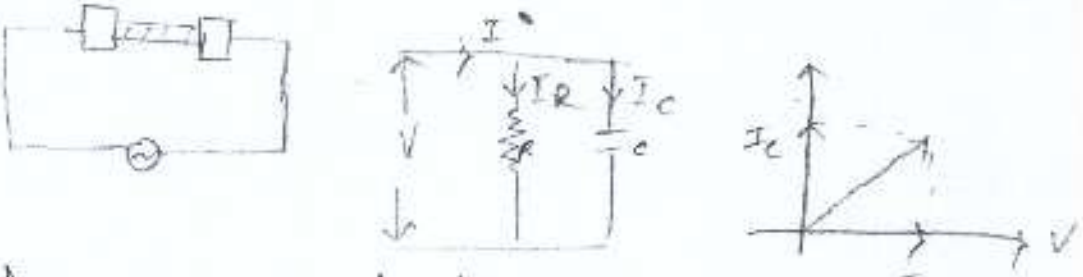
When two bodies attain the same potential then current flow stop.

The fig. shows the construction [illegible] furnace. The flux developed by the primary winding setup eddy current in the charge.

These eddy current are sufficient to heat the meta to melting point. It mainly consist of steel former and water Cooled induction coil. The artificial cooling of primary windi is necessary due to high amount of heat. The coil is Constructed in the form of tube through which Cooled wate is circulated

06/02/2017

Principle of Dielectric Heating



The principle of dielectric heating states that the material to be heated is placed betⁿ two Conducting electrode across which alternating voltage of high frequency is applied. Two electrodes seperated by an dielectric medium and across which some potential differ is applied from a capacitor. A resistor is Connected in parallel. The resistor 'R' is very high so the current flowing through it is very small. So that the Capacitor Current Can be Considerd same as total ant current

The power Consume by the ckt is given by

$$P = 2\pi f C V^2 \cos\phi$$

Capacitance of the capacitor is Calculated by

$$C = \frac{K_0 K A}{t}$$

where,

ε_0 = Absolute permitivity of air = 8.854×10^{-12} F/m

ε = Relative permitivity of material to be heated

A = Surface area of the plate in m^2

t = Thickness of the material to be heated in meter

Applicat^n of Dielectric Heating

Following are the applicat^n of dielectric heating. These are

a) ply wood industry

b) plastic industry

07/02/2017

) A piece of plywood is to be heated by dielectric heating. The area of cross-sectn of the piece is 0.5 m^2 & the thickness is 2.5 cm. If the frequency is 2.5 Hz & the power developed is 1000 w. Find the voltage which is necessary for heating. The relative permitivity of wood is 3.6 & Powerfactor is 0.046.

Ans

Gn.D

A = 0.5 m^2

t = 2.5 cm = 0.025 m

f = 2.5 Hz

P = 1000 W

ε = 3.6

Cosϕ = 0.046

R.D.

V = ?

Soln

$$C = \frac{\varepsilon_0 \varepsilon A}{t} = \frac{8.854 \times 10^{-12} \times 3.6 \times 0.5}{0.025} = 6.37 \times 10^{-10}$$

$$P = 2\pi f C V^2 \cos\phi$$

$$V^2 = \frac{P}{2\pi f C \cos\phi} = \frac{1000}{2\pi \times 2.5 \times 6.37 \times 10^{-10} \times 0.046} = 2.17 \times 10^{12}$$

$$V = \sqrt{2.17 \times 10^{12}} = 1473891.986 \text{ V}$$

Micro wave Heating

In this system electricity is converted in to electro magnetic wave which generate energy and this energy is used to cook the food.

The wavelength of these waves is very short at high frequency is called micro wave.

* when microwave energy comes in to contact with some substance it is reflected
* This wave are reflected metals and absorved by moisture present in the food.
* when this energy is absorve, heat is developed and cooking take place.
* The applicatn of wave heating are -
  (i) processing of cement
  (ii) food processing and kitchen work

09/02/2017.

Short questions:-

① what is stiffence law?

Ans According to stiffence law, energy radiate per second per unit area by a perfect bodies varies directly as the fourth power of it's absolute temper.

$$E \propto T^4 \Rightarrow \sigma T^4$$

② state mode of heat transfer?

Ans Heat transfer can be possible with conductn, convectn, radiation

③ Define electrical heating?

Ans Electrical heating is defined as that electric current passes through a medium, (solid, liquid or gas), heat is produced

④ Defined resistance heating ?

Ans Whenever a current passed through a resistive material, heat is produced. This process is called resistance heating

⑤ Define skin effect

Ans The tendency of an AC to concentrate near the surface of the conductor is called as skin effect.

⑥ What is dielectric heating?

Ans Dielectric heating is defined as that process of heating in which the material to be heated is placed bet" two conducting electrodes, across which alternating voltage of higher frequency is applied

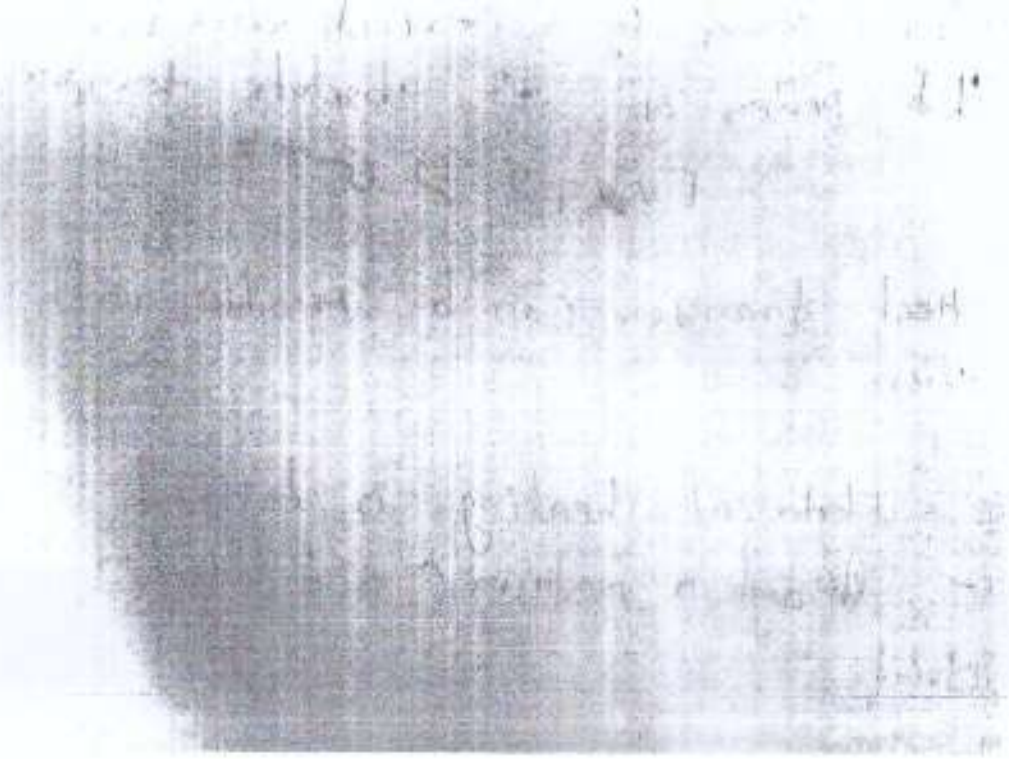
Unit 4

① Explain Coreless type Induction furnace

② 07/02/17 problems

③ state advantage electrical heating

④ with neat dig. explain the working of a indirect core type Induct" furnace



Principle of Arc welding

Welding:-

It is a process in which two metal parts are joint by heating

Electric welding

* Electric welding is defined as the branch of welding in which electric current is used to developed a large heat required for joining to pieces of metals It is up two types they are -

a) Resistance welding

b) Arc welding.

Principle of Arc welding.

* An electric arc is produced by bringing two conductors connected to a suitable source of electric current momentarily in contact and then spepearated by small distance. The current continues to flow across the small gap and give intense heat. The gap is provided bet" the electrode and the surface of the work piece by keeping the electrode at a distance of about 3mm to 6mm from the surface of the work piece.

The heat developed is utilized to melt the part of work-piece and thus formed the joint. Current from a source (Ac or Dc) is used

Properties of arc welding:-

* The external pressure is not required in case of arc welding.

* The temperature of the arc welding must be high

DC Arc phenomenon:- 10/02/2017

* DC arc phenomenon, supply is dc. Here the striking voltage is high. Dc welding plant has both generators motor. Arc is most stable. Energy Consumption is more because M-G (motor generator) set is required to run continuously. Heat produced is uniform

AC arc phenomenon:-

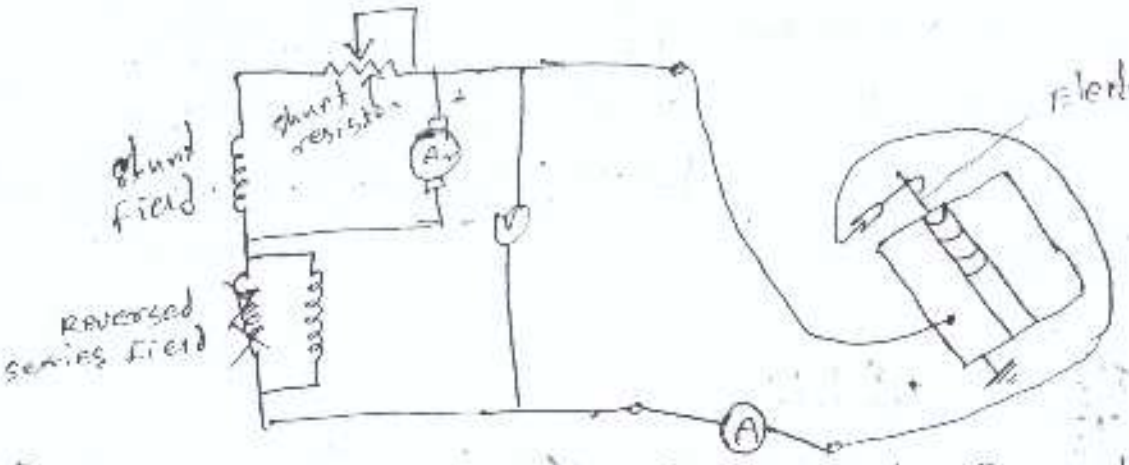
There is no rotating parts in case of AC welding
* AC welding T/F has high efficiency.
* Ac is not at all stable.
* Energy Consuption is low in Case of Ac welding
There is always danger of electric shock to operator due to low operating voltage. 11/02/2017

DC Arc welding plant single line

It Consist of mainly motor generator set. The motor is squirrel cag induction motor and generated is differential Compound generator to give the characteristic and the terminal voltage decreases as the load current increases

* It supply from existing system is used for welding then a resistance is connected is series with the equipment and control is obtained by variation of external resistance.

DC Arc welding plant of multiple type

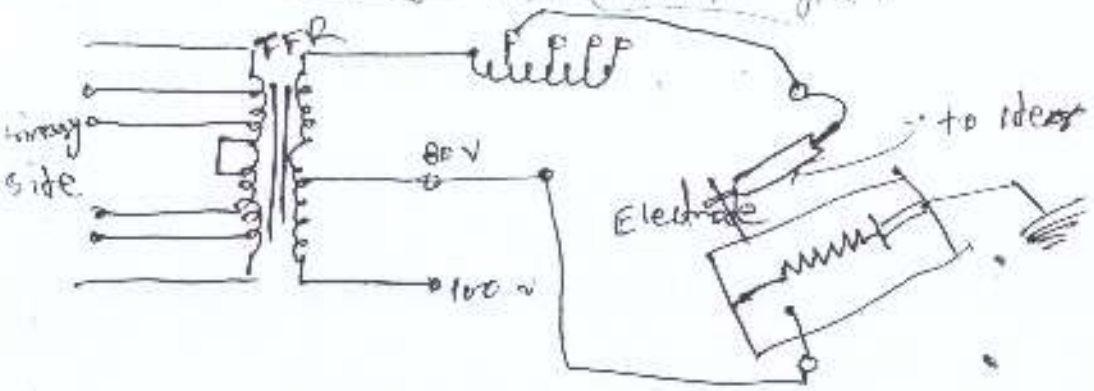


* Fig. shows the standard method for obtaining the characteristic of a DC generator is based on reversed series winding
* In this method the series coil are wound in a reverse direction to the shunt coils and thus the field created by the series field in opposition to the created by shunt field.
* on open ckt, the shunt field is only operating and the max voltage is available to strike the arc
* when the arc is struck, then current flows through the series field winding as well as the shunt field winding.
* series field thus opposes shunt field
* The resultant field strength is less than that of open ckt field strength and the voltage drops.
* The main funct^{n} of electrode is when current passes through it the atom split and heat is created which is very helpfull for welding purpose.

AC Arc welding plant of single line 12-02-19

A T/F Decreased the voltage from the supply to near about 100V & to regulate the current the characteristic of resistance & reactance may be used for the AC welding equipments.

AC Arc welding for multiple type.



* Fig. shows the Connectn diagram for ac welding
* Voltage at the secondary side of the T/F remains Constant & available for striking the earth.
As I shown as the current flowds ; the voltage drop across the reactance Coil, Reduces the voltage at the arc to the required value.
Reactance coil also controls the Flow of Current
* The reactor in series with the arc Controlling the Current. Be adjusting the amount of reactn in a cct. which is achived by tapping the Coil.

Types of arc welding.

The mejority of arc welding is done by hand process the operatn holding & electrode holders. In to which the electrode is fatked in his hand & uniting the arc as required. when the elctroded has been Consume it is replace & the process is Continue.

In the metalic arc system. A metal rod is used as an electrode & the arc is strive between this electrodes & work, which respectively from the two terminal .. AC supply from the secondary of the welding transformer or DC supply from the DC welding generator depending open-witer. AC or DC, used

* When the work piece is suddenly struck by the electrod and then separated from a little bit. This results in an arc between -n the job & the electrodes due to the heat generated by the arc, A little portion of the work melts. and erec the tip of the electrodes.

* The two pieces to be welded fused together.

CARBON ARC Welding.

* This method is normally used for welding copper & its alloys. The carbon electrods which is kept (-ve) with respect to the work. IF DC is used.

* If carbon electrode is made (+ve), the carbon particles have a tendency go in to the welded joint.

ATomic Hydrogen Arc welding:-

The essential of the atomic hydrogen arc welding process are.

① Electrode energy is supply to an arc betn two tongsten electrodes. where it is transform in to heat.

② The source of power would be eighter DC or AC.

③ Molecular hydrogen is blown through this arc.

④ * To strick & maintain the arc an open circuit voltage of 300 V is necessary.

Hellium or Argon Arc welding:-

This method is used for welding aluminium alloys magnesium & magnesium alloys & arc is struck bet' electrodes of tungstens & the arc & hellium or argon is used to give an inert Atomosphere

16-02-2017

Principle of Resistance welding

The principle of resistance welding is the generatn of heat in the joint by passing a heavy current through the parts This being followed by the applicatn of mechanical pressure. It will thus be in that a resistance m/c must be capble of supplying an electric current of the value required to produce the necessary heat

The heat generated, (H) by passeg of an electric current, (I) through a resistance (R) is given by $H = I^2Rt$

where,
R = resistance
t = time
I = current
H = heat

* The resistance welding may be defined as the method in which a sufficiently strong electric current is send through the two metals in contact to be welded bringing the two pieces to the molten (liquid) state and thus applying mechanical pressure at this time to complet the joint

Different Resistance welding methods

17/02/2014

The following electric resistance welding processes are commonly used.

a) Butt welding
b) Flash " "
c) spot " "
d) seam " "
e) projection welding

a) Butt welding

* The two parts or components are brought together and pressure is applied along the axial direct^n.
* A heavy current is passed from the welding TF which creates the necessary heat at the joint due to the comparatively high resistance of the contact area
* The main applicat^n of it in welding pipes, wires & rods

b) Flash welding

Current is applied to the parts before they are brought together so that when they meet flashing takes place.

* The two parts to be welded are clamped strongly.
* The parts are brought together and the resistance to the current flow heats the contacting surface
* It's applicat^n is in product^n work particularly in welding rods & pipe together

Spot welding.

In its simplest form the spot welding m/c consists of a T/F to produce high current at low voltage. Electrodes are connected to the end's on the secondary winding for leading the current to the work and to apply the necessary mechanical pressure.

* It's applicatn is in fabricating all types of sheet's metal structure

Seam Welding.

It similar to stop welding except that series of spots are placed by roller electrodes instate of tipped electrodes.

* most seam welding produces a continious seam weld near the edge of two over lapped metals by using two roller electrodes

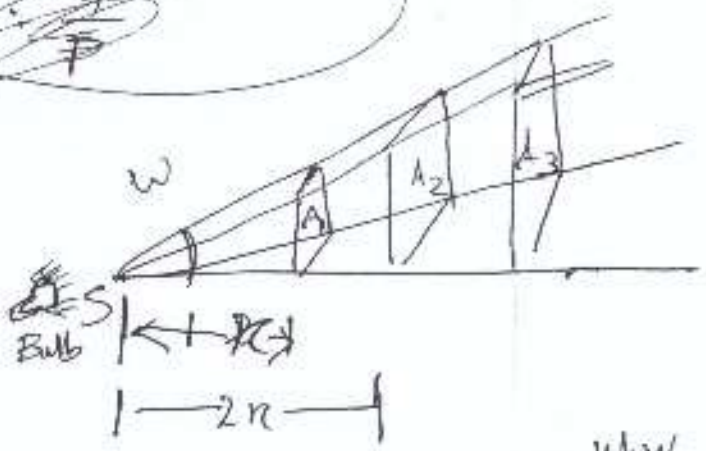
It's applicatn is in many types of pressure tight for leak proof tanks

Projectn welding.

It is modified form of spot welding. projectn welding consists of forming slide projectn's on the sheet of metal The projectn are accurately form in precise locatn on the metal by a special set of dies

It is advantageous in assembling parts made by punching or stamping and for welding studes, nuts to plates

Mean horizontal Candle Power



Where

E = Illumination

I = Intensity

ϕ = flux

W = solid angle

A = Area

for surface S_1 & having area A_1

$$E_1 = \frac{\phi}{A_1}$$

$$I = \frac{\phi}{W}$$

$$\Rightarrow \phi = I \cdot W \qquad \left\{ W = \frac{A}{r^2} \right.$$

$$= I \cdot \frac{A_1}{r^2}$$

$$E_1 = \frac{\phi}{A_1} = \frac{I \cdot \frac{A_1}{r^2}}{A_1} = \frac{I}{r^2}$$

$$\uparrow \boxed{E_1 = \frac{I}{r^2}} \quad \text{lux/m}^2$$

for surface S_2 & area having A_2

$$E_2 = \frac{\phi}{A_2}$$

$$I = \frac{\phi}{W}$$

$$\Rightarrow \phi = I \cdot W$$

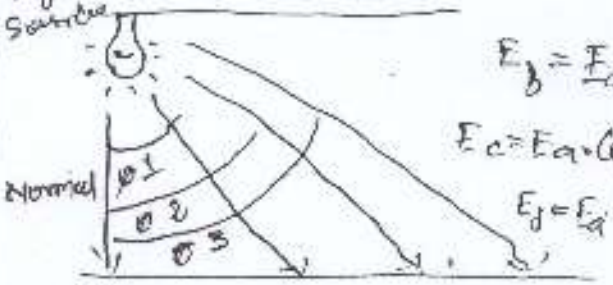
$$= I \cdot \frac{A_2}{2r^2}$$

$$= I \cdot \frac{A_2}{2r^2}$$

$$E_2 = \frac{\phi}{A_2} = I \cdot \frac{A_2}{2r^2} = \boxed{\frac{I}{2r^2}}$$

$$\uparrow \boxed{E_2 = \frac{I}{2r^2}} \quad \text{lux/m}^2$$

Lambert's Cosine law $\cos\theta$



Q) 1. Mention the type of arc welding?

Ans Arc welding are of 4 types. They are

i) Metalic arc welding.
ii) Carbon " "
iii) Atomic hydrogen arc welding
iv) Helium or argon " "

2. Mention the types of resistance welding?

Ans Resistance welding are of 5 types.

(i) Bult welding
ii) flash "
iii) spot "
iv) Seam "
v) Projectn "

3. Write the applicatn of Bull welding?

Ans For welding pipes, wires rods

4. Define Arc welding.

Ans Arc welding is that process of electrical welding in which metalic pieces are joint to gether throug Larg amount of heat produced by striking and arc betn an electrode & metalic pieces

5. why Ac welding is better suited for structural work

Ans In Ac welding the amount of head developed is more th that of Dc welding which is very keptw for jointing the metal pieces in structural work.

Long question

1. Explain principle of Arc welding V.Imp
2. Name different types of arc welding & explain one of the
3. Briefly explain about metalic arc welding?

CH-4

ILLUMINATION

Nature of Radiation & it's spectrum

* Human eye is produce some sensation known as light.
* Energy is emited and absorbe only in discrete quantum of magnitude is hf

where,

H = plank's Constant = 6.54×10^{-27} erg-sec

f = frequency

* Radiation is developed when ever an electro falls from an outer orbit to one nearer the nucleares
* when such a transition occurs, radiation is emitted.
* The velocity 'v' : Wave length λ & frequency 'f' are related to $v = \lambda f$
* Visible light is usually defined as having a wave length in the region of 400 nano meter between the infrared with longer wave length and the ultra voulate with certain wave length
* V-rays, X-rays, micro weves & radio wave are also light
* This property is refer to as wave particle duality.
* Higher frequencies have shorter wave length &

Low frequencies have longer wave length.
* Radio waves have very long wave length whereas
X-ray & Cosmic ray have very small length

20th Feb 14

Luminous Intensity :-

Intensity of Illuminations is defined as ratio of flux in lumen to the solid angle ~~spherical~~ steradian

$$I = \frac{\phi}{\omega}$$ — flux, — solid angle.

Unit is Candela

Lumen :-

It is the unit of luminous flux

Luminous flux :-

It is defined as total quantity light energy radiated or emitted per second from a luminous body in the form of light wave.

* It is denoted by 'ϕ'
* It's unit is lumen.

Mean spherical Candle power :- M.S.C.P

Mean spherical Candle power is defined as the average of Candle power in all directions and all planes from the source of light.

$$M.S.C.P = \frac{\text{Total flux in lumen}}{4\pi}$$

Problem

A 250 V lamp has a total flux of 3000 lumens & draws a current of 0.8 A. Calculate

(i) lumen/watt = ? (ii) MSCP/watt = ?

Sol^n

GIVEN

$V = 250\ V$
$I = 0.8\ A$
$\phi = 3000$ lumen

REQUIRED

(i) lumen/watt = ?
(ii) MSCP/watt = ?

(i) $\frac{\text{lumen}}{\text{watt}} = \frac{3000}{250 \times 0.8} = 15$ ($P = V \times I$, wattage of lamp = 250 × 0.8 = 200)

(ii) $MSCP = \frac{3000}{4\pi} = 238.9$ ~~$\frac{3000}{4\pi} = 250 \times 0.8$~~ $P =$

5) Calculate the total flux from the lamp having mean spherical candle power is 35

Soln C.P.

MSCP = 35

R.D.

$\phi = 2$.

$MSCP = \frac{\phi}{4\pi}$

$\phi = MSCP \times 4\pi = 439.82$ lumens

(MHCP) Mean horizontal candle power

It is defined as the average of all the candle power in all direct^n in horizontal plane containing the source of light

Mean hemispherical candle power (MHSCP)

It is defined as the average of the candle power in all direct^n above or below the horizontal plane passing through the source of light

Brightness.

It is defined as luminous intensity per unit area of either a source of light or illuminated surface

Luminous efficiency.

It is defined as the output in lumen/watt

* It is measured in lumen/watt.

* Luminous effi, $\eta_L = \frac{\phi}{P}$

Solid angle.

Solid angle is defined as the ratio of area (A) of the line to the square of the radius of that light line

* It is denoted as ω

* It is unit is "steradian.
* Solide angle sphere, $\omega = \frac{\text{Area of the sphere}}{(\text{Radious})^2} = \frac{4\pi r^2}{r^2}$

$= 4\pi$ steradian

Illumination

22th feb-17

* when the light falls up on any surface, th phenomenon is called illumination.
* It is defined as the no. of lumens, falling on the surface/~~unit area~~ per unit area
* It is denoted by symbon 'E'
* And is measured in lument per m2 (lumen/m²)

~~Mathmatically~~

$$E = \frac{\phi}{A}$$

Laws of Illuminatn

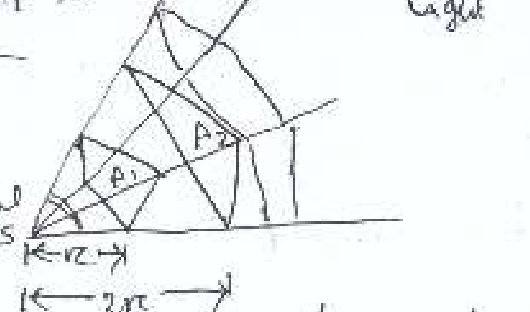
Illuminatn has two law. These are

i> Inverse square law
ii> Lambert's Cosine law

i> Inverse square law

* According to this law the illumination (E) of a surface in inversly proportional to the square of distance betn ~~the source~~ & the ~~surface~~, provided that the distance betn the surface and the source is sufficiently large, so that the source can be regarded as a point source.

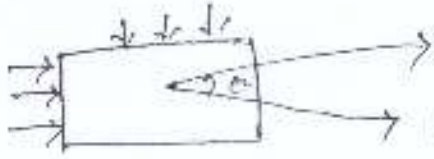
Parallel surface & the point source of light



Explanatn

Consider a point source 'S' having an intensity I.

* Let two surface having area A_1 & A_2 be place at distances r & 2r meter away from the source. The two surface are enclosed in the same solid angle (ω)



$E = \frac{\phi}{A} \cos\theta$

$E = \frac{\phi}{A}$

27th feb-17

Polar Curve

The illumination flux emitted by a source can be determine from the intensity distribution curve. The luminous intensity or candle power of any practical lamp is not uniform in all directions due to its unsymmetrical shape. The distribution of light is given by polar curve

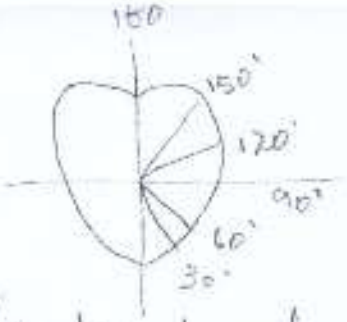
* A radial ordinate pointing in any particular direction on a polar curve represents the luminous intensity of the source when view from that direction

* If the luminous intensity is measured in a horizontal plane about a vertical axis and a curve is plotted bet^n candle power and the angular position, a horizontal polar curve is obtained.

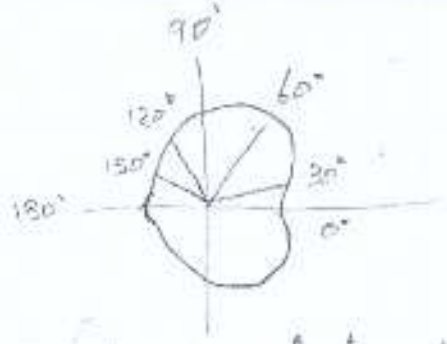
* Similarly vertical polar curve gives the relation of candle power in vertical plane passing through the lamp at various angle

* The luminous intensity of the lamp at differed angles is called Polar curve

* It is the representation of luminous intensity variation at various in the horizontal



(Vertical polar curve)



(Horizontal polar curve)

The flux emited by a source can be obtained by a polar solid which is related to the vertical Polar curve. The polar solid is assumed to be Concentric with a sphere.

* slight depression at 180° is case of vertical polar curve is due to the position of lamp holder whereas at zero (0°) in the horizontal polar curve

Types of lighting scheme

28th Feb-17

The lighting scheme can be classified as

i → Direct Lighting
ii → In direct lighting
iii → Semidirect lighting
iv → semi indirect lighting
v → local lighting

i. Direct Lighting

* The light from the source is throughin directly over the surface to be illuminated. Reflections gives addition! help
* But should not be too dip otherwise ceiling & wall willn't be illuminated properly
* The mounting height should not be too low otherwise chances of direct glare exist

ii. Indirect lighting

* In this case no light reaches directly from the source on the surface to be illuminated.
* on the other, the reflected light is used for illumination.
* In case of indirect lighting, a reflector is mounted on a bulb and the entair light emited by the bulb is thrown on the ceiling.
* And after reflectn from the ceiling light falls on the working plane.

Ex - club, restaurant

iii. Semidirect light

In this case 60% or more of the light reaching the surface to be illuminated comes directly from the source.

* The rest of it comes after reflection

iv. Semiindirect light

More than 60% of light is thrown on the surface reflecting the light

* The rest comes on the surface to be illuminated directly from the source.
* This will happen if the mounting height of ~~mounting~~ lighting is low. This scheme is used as for interior lighting

v. Local lighting

If the light is confined to illuminate a particular object it is called local lighting.

* An ordinary table lamp in a study room gives local lighting

Light distribut^n & Control :— 2nd Nov - 17

Coefficient of Utilizat^n

* All the lights emited by the source doesn't reach the surface to be illuminated. Some portion of light directly fails upon open surface & sun light fails upon surface after reflection from wall or ceiling. All the light failling upon the wall & ceilling don't reach to surface because some light is absorbed.
* Coefficient of utilisat^n is the ratio of lumen's reaching on working plane to the total lumens emitted by source of light. It is < unity

$$C.F = \frac{\text{Lumens reach working plane}}{\text{Total lumens of ligh}}$$

Depreciat^n factor :—

Due to accumulat^n of dirt, dust & smoke on lamp the emit less light as compare to that emit when they are new once.

* Depreciat^n factor is the ration illumination when every thing is clean to the illuminat^n under normal working condition
* It is more than unity. $D.F = \frac{\text{Total lumes of light}}{\text{lumen reach working plac}}$

Maintenance factor.

It is reverse of depreciat^n factor.

* It is always less than unity

Absorbtion factor

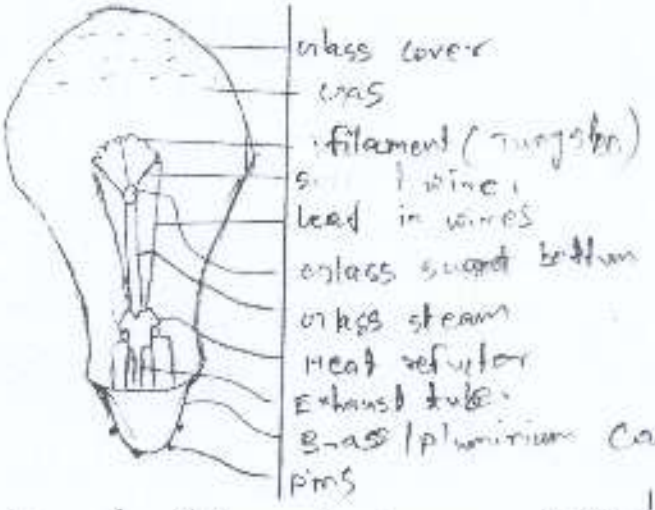
In case of factories or places where atmosphere is full of fume fumes There possibility of absorbtn of light energy.

Absorbtn factor is the ratio of net lumens available after absorbtn to the total lumens emitted by source of light

$$A.F = \frac{\text{Net lumen available after absorbtn}}{\text{Total lumens emitted by source of light.}}$$

3rd mar-17

Filament lamp or Incandescent



100 Hz

The shows the dig. of filament lamper incandenscent

* The principle of filament lamp/ incandenscent lamp is when the current is passed throughe wire both heat and light are enofuced.

* The material used for the lamp must have following properties

i. It should have high melting point

ii. " " " resistivity

* the material used for filament is tungsten

* now a days tungsten is used for filament becaus it fulfills above all properties

It Consist of tungsten filament placed in a glass Cover. The glass bulb is filled with a chemical inert gass (nitrogen or argon)

The white glass Cover gives diffused light effect, The blue glass Cover gives the moon light appearance

Effect of Variatn of voltage on working of filament lamp :—

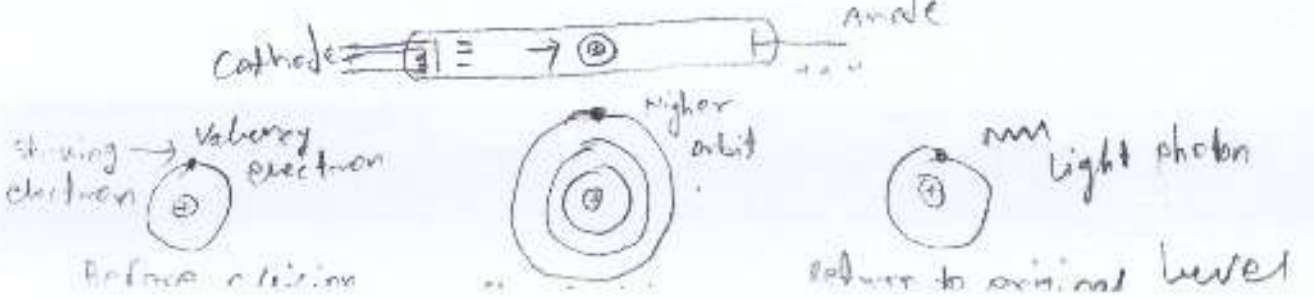
The rating of the bulb is specified in Volt & Wattage

Ex — 60W, 230V or 100W, 250V, 40W, 230V etc

* If the bulb of a given voltage rating, are not operated at the rated voltage, there is direct influence on the
  i) lumens output
  ii) life
  iii) efficiency.

* A small increase of the order of 5% in the operating voltage reduces the life by 50%.
* Similarly we can't ignore the fact that operatn at lesser voltage than the rated value results in increased life period.
* The dit put on the other hand is drastically reduced so that in order the have same flux output, we have to use more no. of bulbs

Excitatn of gas discharge Lamps :—



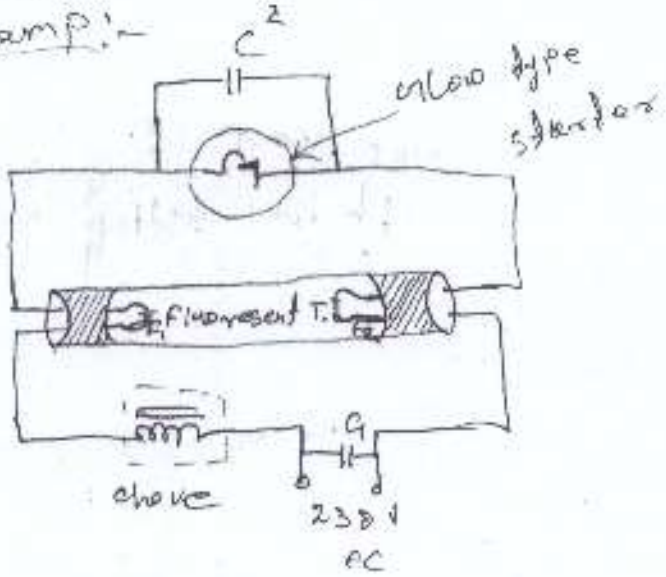
According to quantum theory, any excited atom is capable of emitting light.

* Consider a gas filled discharge tube filled with light neon, argon, at low pressure.
* when cathode is heated with the help of hot filament thermionic emission starts from the cathod.
* The electron emitted are attracted towards anode and starts accelerating towards anode. But there is collision betn accelerating electrons and gas atoms due to obstacal created by gas molicle present in the tube
* In this type of collision quantom of energy given by striking electron is large enough to change energy level or gas atom.

4th mrs - 17

~~Fluorescent lamp~~

Fluorescent lamp:-



when the ckt shown in fig. is energised, nearly full voltage appeares across the starter terminal. The starter is fidld with argon gas. This gas ionisase and a glow appeares inside the starter.

* This warms of the bimetalic strip and soon after the strip bend & short out the starter terminal.

* This given a circulatⁿ of stronger current through the filament and choke ckt.

* In the mean while the bimetalic strip of starter pulls down and breakes open this starter ckt

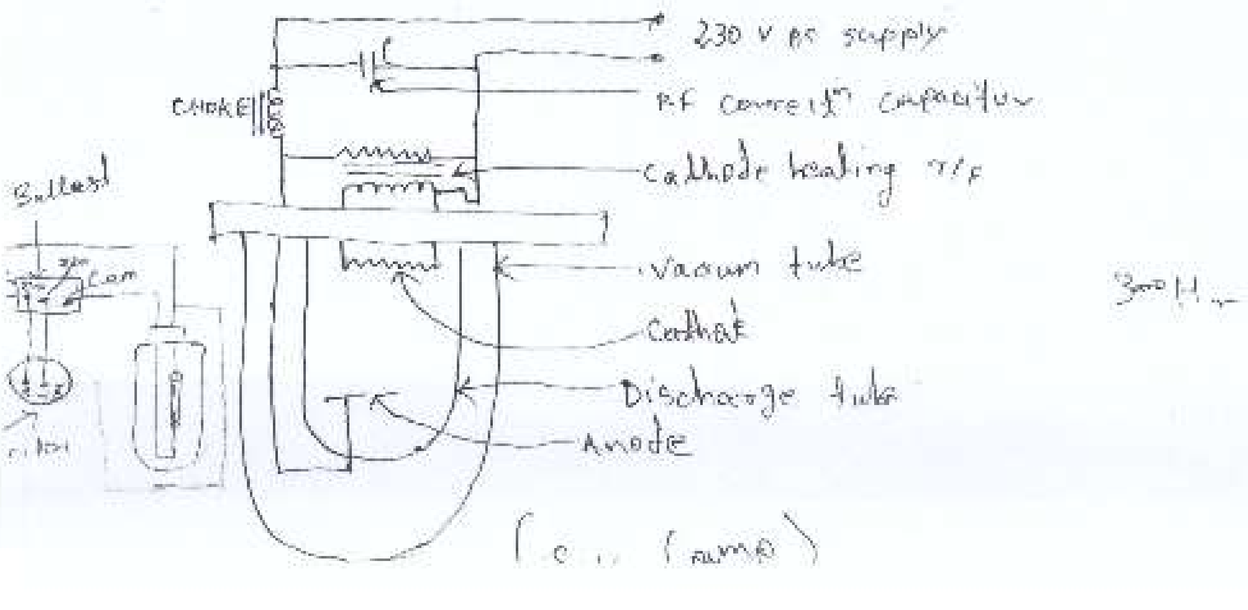
* A high voltage surge is induced in the choke which makes one the filament at a very high potential with respect to another filament

* This momentary high potential difference is enough to ionised the gas medium i.e (mercury & argon present inside the tube.)

* The current doesn't flow afterwards through the starter ckt due to the low potential difference across the tube

* The choke also help's keeping the current through the ionised medium ith in self limit

Sodium Vapour Lamp :-

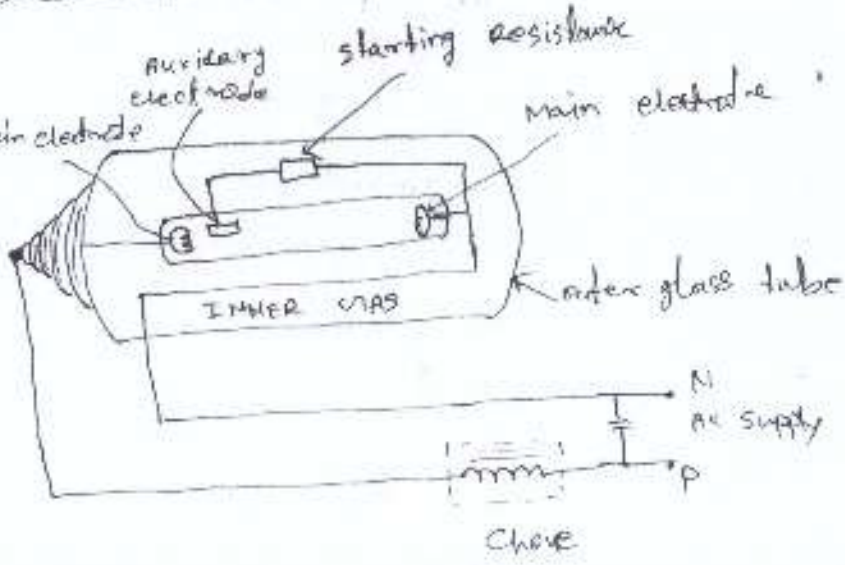


(... Lamp)

Sodium vapour lamp consist of an inner u shape glass tube made up high resistance glass and small amount of metallic sodium, neon gas and two electrodes.

* The inner tube is enclosed with an outer glass tube of u shape.
* When AC supply is given to the lamp, the discharge takes place in the neon gas at first. The metallic sodium gradualy vapourise and the ionisation producing a light of yellow colour.
* The cathod heating T/F is use to send a high voltage of 4000 V at the time of starting the lamp.
* The function of choke is to limit the current
* The function of power factor Correction capacitor is to improve the power factor.
* These lamps are suitable only for AC supply operation. These lamps are used for out door lighting and highways.

Mercury Vapour Lamp



A mercury vapour lamp is a gas discharge lamp that uses an electric arc through vaporise mercury to produce light. 6th mar-19

* The operat^n of mercury vapour lamp and the flourescent lamp is based on the excitat^n of atoms of some argon gas

Construct^n:-

A mercury vapour lamp mainly consist of following parts -

1. main electrode
2. Auxiliary electrode
3. choke
4. Capacitor
5. starting resistor.

* A tube containing mercury vapour is made up hard glass.
* there two main electrodes made up of tungsten wire and starting electrode which is spaced quit closed to one of the main electrodes
* Inside the inner tube, the mercury & argon gas is present

Working:-

when the ckt is energised from the supply, voltage appears bet^n the main electrode I and the auxiliary electrode. The argon gas comming bet^n these two electrodes are immediately ionised because distance bet^n these two electrodes are very small. A small current starts flowing through the starting register in series with the auxiliary electrode.

* The electrode keeps the [illegible]
* Funct^n of the capacitor across the tube is to improve the power factor
* Ultimately the medium betⁿ main electrodes is ionised and the current starts flowing betⁿ the two

Neon lamp

Neon lamp consist of a glass bulb filled with neon gas with small percentage helium. The two electrodes in the glass bumb are of pure iron spaced few mm apart

* These lamps are operated on 110 V or 150 V DC supply

Neon gas gives orange pink colour light.

These lamps are used as an indicator lamp & night lamps

Neon Sign:-

Neon signs are made using electrified, luminous tube lights that contain neon & other gases.

* They are mostly used for neon lighting.

7th mar - 17

* High lumen output and low consumption

Flourescent Lamp

* A Compact fluorescent lamp (CFL) is also known as energy saving lamp
* The lamp uses a tube which is curvered or folded
* Compare to general service Incandancent lamp giving the same amount of visible light and a CFL has a higher purchase price than that of incandencen lamp but can save of 5 time of its purchase price in the electricity cost over the lamp.
* CFL has following advantages over conventional lamp

i. More Compact
ii. Light weight
iii. Higher luminous efficiency
iv. Flicker free operat^{n}
v. Longer Lamp life.

Short questions:-

1. Define solid angle?

Ans A solid angle is subtended at a point in space by an area and is the angle enclosed in the volume formed by an ifinite no. of lines lying on the surface of the volume meeting at a point

2. Define MSCP?

Ans It is the mean of candle Power in all directions and in all planes from the source of light.

3. Define luminous Intensity?

Ans It is defined as the flux emitted by the source Per unit solid angle.

4. Define luminous efficiency

Ans * It is the ratio of energy radiated the form of light to the total energy radiated by the body

5. Define brightness?

It is defined as the flux emitted per unit area or luminous intensity per unit projected area of the source in a direct^{n} perpendicular to the surface.

6. Define utilizat^{n} factor?

Ans It is the ratio of lumens reaching plane to the total lumens given out by the lamp.

* It is also < unity.

Ques
1. Describe & explain with correct" dig. the operat" of fluorescent lamp with glow type starter.
2. Explain the working of a sodium vapour lamp with the necessary dig.
3. state & explain inverse square law.
4. Explain the different types of lighting scheme.
5. Explain the filament lamp is used for illumination purpose & state the advantages of the lamp over the other ~~lamp~~ other time.

CH-5

Industrial Drives

9th mar-17

Introduct" :-
For obtaining electric drives, both Ac & Dc motors are used. How ever Ac system is preferred
* Inspite of advantages of Ac system some times it becomes essential to used dc energy as industrial drive

Electric drive :-
An electric drive is defined as a form of m/c equipment designed to convert electric energy in to mechanical energy and provide electrical controll of thes process

Types of electric drives.
Electric drives used in industries may be ~~defined~~ divided in to -
a) Group drive
b) Individual drive

2) Individual drive:

* In this type of electric drive an single electric motor is used to drive one individual m/c.
* Though it cost more than group drive but each operator has complet control on his m/c.

3) Group drive:

In this, one motor is used as a drive for two or more than two m/c.
* The motor is connected to a long shaft, on which belt & pulleys are connected to run others m/c
* This type of electrical drive is economical

Choice of electrical Drives

* Some of the important factors to choose an electrical drive are:
i- requiredment related to the source

• Requiredment related to the source

* Type of source, and it's capacity, magnitude of voltage, voltage fluctuation, power factor

(ii) steady state operatn requiredment

* Nature of speed torque characteristic, speed regulatn, speed range, efficiency

(iii) Transient requirement.

starting breaking.

(iv) capital & running cost mentancence.

(v) Environmental & location.

(vi) Reliability

10th may - 17

starting & running characteristic of Dc motor:-

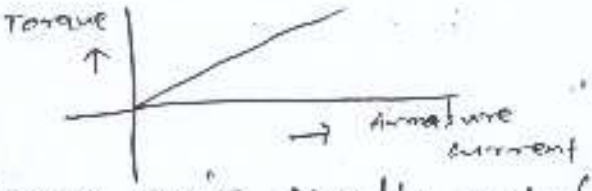
1- Dc shunt motor.

In shunt motor the field is Connected in paralled with armature.

a) speed current characterishics.

* The motor can be used as compare to a constant speed motor.

b) Torque current characteristic



* It is observe that torque varies directly as the load current, hence the curve follows a linier law i.e

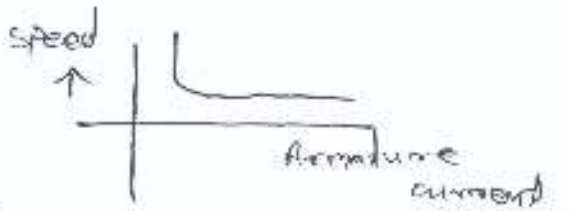
$$T \propto \phi I_a$$

But ϕ is constant so $T \propto I_a$

ii- DC series motor :-

In this motor, the field winding is connected in series with the armature winding. It means as the load on the motor increases the current through the series winding also increases

a) speed current characteristic



$N \propto \frac{E_b}{\phi}$

we know $\phi \propto I_a$ in d.c series motor.

$$N \propto \frac{1}{I_a}$$

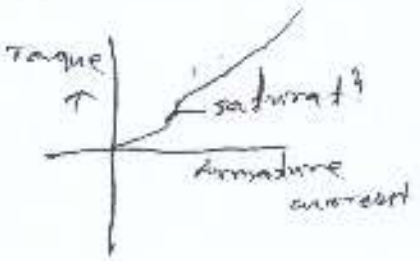
* Speed in a series motor is inversily proportional to flux per pole and directly proportional to the applied voltage.

b) Torque current characteristic

$T \propto \phi I_a$

But $\phi \propto I_a$ in series motor

$$T \propto I_a^2$$ it occur ∴ in saturat^n



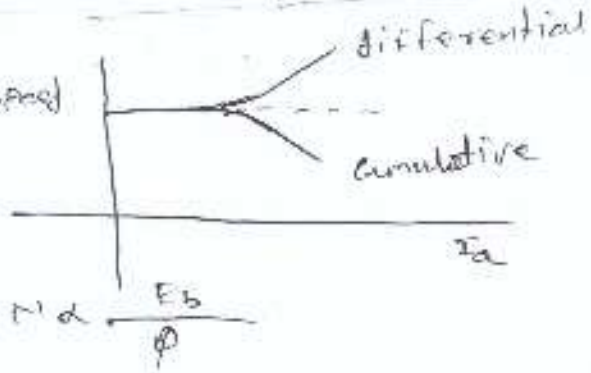
* In series motor, torque $T \propto I_a^2$ up to saturat^n. hence the curve drawn bet^n armature current and torque is parabolla up to saturat^n point. therefore the starting torque of the dc series motor is very high

(iii) Compound motor

There are two types of compound motor's

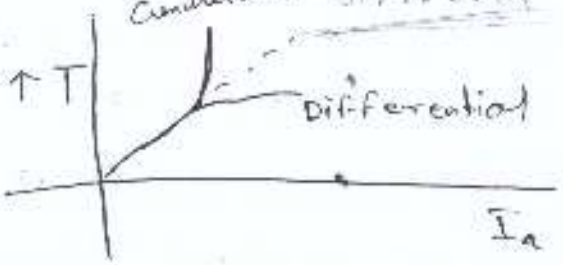
1. Cumulative Compound motor
2. Differentially Compound motor

a) speed current characteristics of cumulative compound motor & differentially compound motor



b) Torque current char. of cumulative C.M & differentially C.M

$T \propto \phi I_a$



Starting char. of AC motor

3ϕ I.M can be started with the help of following factors -

1. Direct online starter
2. rotor resistance starter
3. Auto T/F starter
4. star-delta starter

* The relat^n bet^n starting torque with respect to full load torque in case of DOL starter is

$$\frac{T_{st}}{T_F} = \left(\frac{I_{st}}{I_F}\right)^2 \times S_f$$

where, T_{st} = starting torque
T_F = full load torque
I_{st} = starting current
I_F = full load current
S_F = full load slip

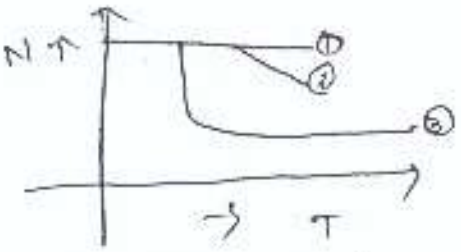
* The relatⁿ betⁿ starting torque w.r.t full load torque in case of rotor resistance starter is

$$\frac{T_{st}}{T_f} = K^2 \left(\frac{I_{sc}}{I_f}\right)^2 \times S_f$$

* The relatⁿ betⁿ starting torque w.r.t full load torque in Cas of start delta starter is given by

$$\frac{T_{st}}{T_f} = \frac{1}{3} \left(\frac{I_{sc}}{I_f}\right)^2 \times S_f$$

Characteristic of AC motors



The running char. of an ac motor is the speed torque chara. as shown in the fig.

* Curve '1' shows the running char. of synchronous I.M. It is a constand speed motor.
* Curve '2' shows the running cha. of 3-φ I.M
* Curve '3' shows the running cha. of repulsion motor.

Applicatⁿ of DC shunt motor:

This motor has nearly constand speed and torque varies proportional to the current.

* It's starting torque & maintenance cost is medium.

It can be used for driving constant speed eg Line shaft, lath, Vacuumcleaner, washing m/c, blower

Applicat^n of dc series motor

This has a very high starting torque. As it varies as the square of the current.

* The speed is varying and is dangerously high at light or no load.

* These motors are used for heavy duty applicat^{n}s such as electric tract^n, cranes.

Appl's for Cumulative Compound motor

* This motor has high starting torque of the order of 2 to 3 times of the full load torque
* It requires medium maintainance

These are used for driving compressers, passenger elevator

Applicat^n of differential Compound motor.

* It's starting torque is low & has unstable operat^n

It is seldom used in practice

Applicat^n of 3-ϕ squirrel cage I.M.

This motor is a nearly constant speed motor with a fore starting torque

* It has high over load capacity
* It is used in lathe, drilling m/c, blowers

Applicat" of slip ring I.M

The speed of slip ring I.M is also constant.
* It's starting torque is about twice the fun load torque.
* It has high overload capacity.
* It is used for high power at high starting torque & adjustable speed.
* It is also used in Lift & Compressers.

Applicat" 3-ø series motor.

* It has high starting torque up about 2.5 times the fun load torque.
* It is used in drives, where load increase with speed such as centrifugal pump.

Applicat" of synchronous I.M. 17th mar 17

This is also a constant speed motor and it's starting torque is about twice the final load torque. This can also work on varying PF both lagging and leading. Control of speed is not possible.

This is used for driving large fans, Compressers

Applicat" of 1-ø synchronous motor.

It operate state constant speed and speed Control is not possible
* It's initial cost is quite more
* It is used in teleprinter, clock

Applicatn of Capacitor start I.M.

* It has high starting torque of 1.5 times the full load torque. speed Control is not possible & p.f is 0.7 to 0.9 lagging

* It is mainly used in ~~oper~~ Compressor, refrigerator

Applicatn of Cap. start Cap. run type motor.

* It's efficiency is high and P.F varies from 0.9 to 1 (lagging)

* It is used in water Cooler and large airconditioner

Applicatn of Repultion motor.

Repultion motor also has high starting torque like a series motor. speed Control over a wide rang is possible by shifting of brushes

* It is used for services requiring large starting torque and adjstable but Constant speed just as in Coil winding m/c

Applicatn of series motor.

* It is used in drives where load increases with speed such as fan's, pumps and where high starting torque is required.

Applicatn of electric drive.

* Industrial applications are far too numerous. we will now suggest possible choice of motor for Particular service keeping in view all external forces

> Domestic appl.

Small universal motors usually series type is used for various domestic applicatn

2) crane

DC series motor or DC Compound motor are preferred onaccount of there high starting torque

3) Lift

. DC Compound wound or AC slipring I.M are used

19th mar 17

sheet 2 with answers :-

1. Define electric Drive?

Ans An electric drive is defined as a form a m/c design to Convert electric energy in to mechanical energy and provide electrical Control of the process

2. what do u mean by group drive?

Ans In this type of electric drive one motor is used as a drive afor two or more than two m/c's

3. state individual drive?

Ans In this type of electric drive, a single electric motor is used to drive one individual m/c

4. which type of drive has Low P.F?

Ans group drive has Low p.f

5. Write the advantage of electric drive?

Ans Cost is too low.

* Control is very easy

* It is maintenance cost is very less
* The system is very easy & clean

6. write down the advantage of individual electric

Ans The advantage of individual electric drive are
* Individual motor works at good P.F
* Efficiency of this system is high
* Individual drive is more reliable
* More useful where constant speed is require

7. which type of drive required long running shaft

Ans Group drive required long running shaft

8. write down the app. of DC series motor ?

Ans The applicatn of DC series motor is mainly used for tractn

9. write down the app. of 3-ϕ squirrel I.M ?

Ans This type of I.M is used in tubewells, drilling m/c crusinder & blower

10. write down the app. of repultion motor ?

Ans A repultion motor is used in ~~for~~ constant speed app as in Coil winding m/c

long questions

1) write down the difference betn group drives individual drive.

2) write down the app. of I.M

Ch 6 — 58 — Electric Traction — 13th May 14

Introduction :-

Electric tract^n means a locomotion in which the driving force is obtained from electric motor. one of the practical operat^n of electricity which enters in to the everyday life.

System of tract^n

* max^m tractive effort should be exceeded in order that a rapid acceleration may be obtained.
* The locomotive or train unit should be self contained and able to run in any route

Advantage of Electric Tract^n

Following are the advantage of electric tract^n system

(i) cheapness

It is the cheapest of all other system traction

(ii) acceleration or breaking.

These are smooth and rapid

(iii) clean

It is free from smoke & gas

(iv) Maintenance.

Maintenance & repairing cost is about 50% that of steam tract^n

(v) starting time

It can be started without any loss of time.

Disadvantage of electric tract"

Following are the disadvantage of electric traction?

* Higher initial expenditure is involve in electric tract"
* failure of supply is a problem to be faced in electric tract"
* The electrical operated vheicle have to move only on electrified trac
* for the achivement of elektric breaking & control, additional equipment is required.

Running characteristic of ac & DC tract" motor:- with neat

DC tract" system:-

In india electrificat" of the trac has bein confined to the urban and suburban lines in the large citie i.e mumbai, kolkata, chenai. Tue types of ~~vehicles~~ vahicles are used for electric tractin

In DC tract" system the electric motors used are DC series motor. The operating voltage is from 1500 to 3000 volt for main line railways.

The motors receive power from an over head line with help of a pantograph an the railways still trac is the return Conductor. The overhead wire is fed from the various Scubstat". These substations receive power from 3-ϕ, 11 kV or 3-ϕ, 33 kV or 3-ϕ, 66k transmission line.

* Then this Ac power is Coverted in to DC power by using rectifier

Ac tract^n system -

Ac system in india is being employed

*) 3-ϕ Ac system -

The system employees 3-ϕ slip ring I.M, Speed Control being being obtained by Combinat^n of pole changing and rotor resistance method. ~~the main~~

* The main advantage of the system is that regenerating breaking is obtained immideatly

b*) 1-ϕ standard frequency system:

This system has a single overhead wire supplied at 25 kV 50 Hz which is the standard industrial frequency.

* A T/f is mounted on the locomotive and stepsdown the voltage which is further rectifier and supply to the tract^n motor.

* The substat^n are supply at a high voltage of 110 to 132 kVA which is step down to 25 kV by T/f is installed at each substat^n

c*) 1-ϕ low frequency system:-

1-ϕ, 15 kV ~~25~~ is ~~50~~ cycle/sec is used in sweden & ~~england~~ australia.

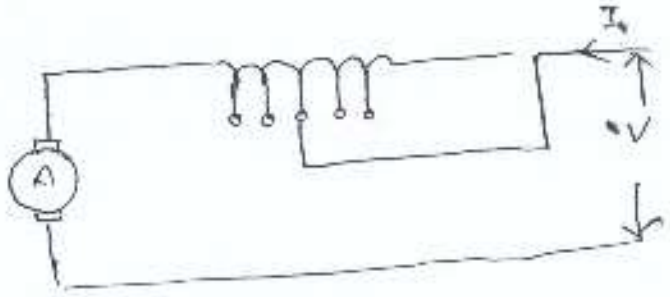
* A stepdown T/f is carried in the tract^n unit which takes down the voltage to about 400 V for use of traction motors

1 Φ series motors

* The motors have the disadvantages of low PF and Commutation difficulties.
* speed control in 1-Φ series motor is done by variation of applied voltage.
* usually supply is obtained through a TPF

21th mar 17

Tapped field Control



This is another method of increasing the speed by reducing the flux ($N \propto \frac{1}{\Phi}$) and it is accomplished by reducing the number of terms of the field winding through which current flows.

* In this method of speed control of DC series motor, a number of tappings from the field winding are brought out side when the all the field terms are in the cut, the motor runs at lowes speed and speed increases with cutting out sum of the series field terms