

Two Marks

Questions and Answers

UNIT - 1: ILLUMINATION

1. **What is the basic nature of light?**

Light is a form of electromagnetic energy radiated from a body which is capable of being perceived by the human eye. The sensation of light results from a flow of energy into the eye and the light will appear to vary if the rate of this flow of energy varies. Light radiations form only a very small part of the complete range of electromagnetic radiations. Light can be of different colours, which depend on the wavelength of the radiation causing it.

2. **What are the essentials of good lighting system?**

- ◇ Adequate illumination of suitable colour on the working surfaces.
- ◇ Good maintenance
- ◇ Avoidance of hard shadows
- ◇ Avoidance of glare.

3. **Define Luminous Flux.**

The total quantity of light energy emitted per second from a luminous body is called luminous flux. It is represented by the symbol F and measured in lumens. The concept of luminous flux assists us to specify the output and efficiency of a given light source.

4. **Define Solid Angle.**

Solid angle is the angle generated by the surface passing through the point in space and the periphery of the area. It is denoted by ω , expressed in 'steradians' and is given by the ratio of the area of the surface to the square of the distance

between the area and the point, i.e., $\frac{\text{Area}}{(\text{Radius})^2}$.

5. What are the artificial sources of lights?

(May / June 2007)

- ◇ By temperature incandescence.

Example: Incandescent tungsten filament lamps.

- ◇ By establishing an arc between two carbon electrodes.

Example: Carbon arc lamps, flame arc lamps, Magnetic arc lamps.

- ◇ Discharge lamps.

Example: Mercury vapour lamps, sodium vapour lamps, neon-gas lamp and fluorescent lamp.

6. State the laws of illumination.

(April / May 2010)

- ◇ E is directly proportional to the intensity (I) of the source.

$$E \propto I$$

- ◇ *Inverse square law:* The illumination of a surface is inversely proportional to the square of the distance from the source. $E \propto \frac{I}{r^2}$

- ◇ *Lambert's Cosine law:* According to this law, E is directly proportional to the cosine of the angle made by the normal to the illuminated surface with the direction of the incident flux. $E \propto \frac{I \cos \theta}{r^2}$.

7. What are called temperature radiators?

Incandescent tungsten filament lamps are known as temperature radiators because their output depends on the temperature of their filaments.

8. Why carbon is used as filament material in incandescent lamps?

Carbon is used as filament material in Incandescent lamps because it has the following properties,

- ◇ It prevents the blackening of the bulb, the working temperature is 1800°C.
- ◇ The commercial efficiency of filament lamp is about 4.5 lumens per watt app.

9. What are the materials used for Incandescent lamps?

The materials used for making filaments of Incandescent lamps are

- ◇ Carbon
- ◇ Tantalum
- ◇ Tungsten

10. Why Tungsten is used as filament material in Incandescent lamps?

The efficiency, when worked at 2000°C in an evacuated bulb is 18 lumens per watt. This metal is most widely used for this purpose.

11. What are the other forms of arc lamps?

The various forms of arc lamps are:

- ◇ Carbon arc lamp
- ◇ Flame arc lamp
- ◇ Magnetic arc lamp.

12. What are the material properties in Incandescent lamps?

The ideal material for the filaments of the Incandescent lamps is one which has the following properties,

- ◇ High melting point
- ◇ Low vapour pressure
- ◇ High resistivity
- ◇ Low temperature coefficient
- ◇ Ductility
- ◇ Sufficient mechanical strength to withstand vibrations during use.

13. Explain the aging effects in Incandescent lamps?

With the passage of time the light output of an incandescent lamp decreases due to the following two reasons:

- ◇ Evaporation of the filament tends to cause the bulb to blacken.
- ◇ Evaporation makes the filament slowly decrease in diameter, which means that the resistance of the filament increases. Therefore, an old filament draws less current and operates at a lower temperature, which reduces its light output. Consequently the efficiency of the lamp (lumens output/watt input) also decreases with the passage of time.

14. What are the advantages of Incandescent lamps?

Direct operation on standard distribution voltage

- ◇ Operating power factor unity.
- ◇ Good radiation characteristics in the luminous range.
- ◇ No effect of surrounding air temperature.
- ◇ Availability in various shapes and shades.

15. What is the principle of Discharge lamps?

In all Discharge lamps, an electric current is passed through a gas or vapour which renders it luminous. In this process of producing light by gaseous conduction, the most commonly used elements are neon, mercury and sodium vapours.

16. What are the types of Discharge lamps?

- ◇ Type-1: Those lamps in which colour of light is the same as produced by the discharge through the gas or vapour. *Example:* Sodium vapour, mercury vapour and neon gas lamps.
- ◇ Type-2: those lamps which use the phenomenon of fluorescence, these are known as fluorescence lamps. In these lamps, the discharge through the vapour produces ultra-violet waves which cause fluorescence in certain materials called as phosphor. The inside of the fluorescent lamp is coated with a phosphor which absorbs invisible ultra-violet rays and radiate visible rays. *Example:* Fluorescent mercury-vapour tube.

17. List out the demerits of Discharge lamps.

- ◇ High initial cost
- ◇ Poor power factor
- ◇ Starting, being somewhat difficult requires starters/transformers in different cases.
- ◇ Time is needed to attain full brilliancy.
- ◇ Since these lamps have negative resistance characteristic ballasts are necessary to stabilize the arc.
- ◇ The flicker causes stroboscopic effect.
- ◇ They are suitable only for a particular position.

18. Explain mercury Iodide lamps.

These lamps are similar in construction to high pressure mercury vapour lamps but in addition to mercury, a number of iodides are added which fill the gaps in the light spectrum, and thus, improve the colour characteristic of light. A separate ignition device, in addition to the choke is required for such a lamp. Their efficiency is comparatively high (75-90 lumens/watt).

19. Write down the applications of Mercury Iodide lamps.

Mercury Iodide lamps are suitable for application in the fields of,

- ◆ Flood lighting
- ◆ Industrial lighting
- ◆ Public lighting

20. List out the efficiency of Discharge lamps.

- ◆ Sodium vapour lamp: Its efficiency is about 40-50 lumens/watt.
- ◆ Mercury vapour lamp: Its efficiency is 30-40 lumens/watt.
- ◆ Mercuryiodide lamp: Its efficiency is comparatively higher(75-90 lumens/watt).
- ◆ Neon lamp: Its efficiency of neon lamp lies between 15-40 lumens/watt.
- ◆ Fluorescent lamp: The efficiency of fluorescent lamp is about 40 lumens/watt about three times the efficiency of an equivalent tungsten filament lamp.

21. What are the advantages of Startless fluorescent lamp?

- ◆ Almost instantaneous starting.
- ◆ No flickering and i.o false starts.
- ◆ Lamp life is lengthened.
- ◆ Starting and operation can occur at low voltage of 160-180 V.
- ◆ Lower maintenance cost (due to the elimination of any starter-switch).

22. Explain the Stroboscopic effect.

Stroboscopic (or flickering) effect" produced by fluorescent lamps is due to the periodic fluctuations in the light output of a lamp caused by the cyclic variations of the current on AC circuits. This phenomenon creates multiple-image appearance of moving objects and makes the movement appear jerky.

23. In what cases stroboscopic effect is troublesome?

This effect is very troublesome in the following cases,

- ◆ When an operator has to move objects very quickly particularly those having polished finish. These objects would appear to move with jerky motion which over along period would produce visual fatigue.
- ◆ In the case of rotating machines whose frequency of rotation happens to be a multiple of flicker frequency, the machines appear to decrease in speed of rotation or be stationary.

How the Stroboscopic effect can be minimized?

- ◇ By using three lamps on the separate phases of a 3-phase supply.
- ◇ By using a 'twin lamp' circuit on a single-phase supply, one of the chokes having a capacitor in series with it and the lamp.
- ◇ By operating the lamp from a high frequency supply (obviously, stroboscopic effect will entirely disappear on DC supply).

What are the demerits of Fluorescent lamps due to stroboscopic effect?

- ◇ Low efficiency due to power loss in ballast series-resistance.
- ◇ Increased cost of the ballast resistance and reversing switch.
- ◇ Less life of the tube (about 80 percent of that with A.C. operation).

State the properties of Useful fluorescent lamp life.

- ◇ The normal life of a fluorescent lamp is 7500 hours.
- ◇ The active life may vary from 5000 to 10000 hours depending upon the operating conditions.
- ◇ Light output is reduced by 15-20 percent after 4000 hours operation and it is, therefore, advisable to replace the fluorescent lamp after 4000-5000 hours burning on economical grounds.

Write down the merits of Fluorescent lamps.

- ◇ High luminous efficiency
- ◇ Long life
- ◇ Low running cost
- ◇ Low glare level
- ◇ Less heat output

What are the demerits of Fluorescent lamps?

- ◇ Stroboscopic effect.
- ◇ Small wattage requiring large number of fittings.
- ◇ Magnetic hum associated with choke causing disturbance.

Define the term Specular reflection.

When light falls on polished metallic surfaces or silvered surfaces, then most of it is reflected back according to the laws of reflection i.e., the angle of incidence is equal to the angle of reflection. Only a small portion of the incident light is absorbed and there is always the image of the source. Such reflection is known as specular reflection.

30. Define term lux. (Nov / Dec 2008, May / June 2007, 2009)

It is the luminous flux received by a surface per unit area. It is denoted by symbol E and is measured is 'lumens per square meter' or lux or 'metre candle' i.e $E = F/A$ lumens/ m^2 or lux, where A is the area of the surface.

31. Define the term MSCP and lamp efficiency. (May / June 2012)

MSCP: It is defined as the mean of candle powers in all directions and in all planes from the source of light.

Lamp efficiency: It is difined as the ratio of luminous flux to the power input. It is expressed in lumens per unit.

32. Define Luminous efficiency. (Nove / Dec 2012)

It is the ratio of energy radiated as light to the total energy radiated. It is measured in lumens/watt.

33. What is the importance of street lighting system (Nov / Dec 2012)

- ◇ To make the traffic and obstructions on the road clearly visible in order to promote safety and covenience.
- ◇ To enable the community value of the street.
- ◇ To make the street more attractive.

34. What is mean by energy efficient lamp (Nov / Dec 2010)

Energy saving lamps are sources of artificial light that employ adavnced technology to reduce the amount of power used to generate light, relative to traditional filament burning high bulbs. *Example* : CFL and LED.

35. List the type of energy saving fittings suited for industrial and educational institutions (Nov / Dec 2007)

- ◇ Linear fluroscent diffuser.
- ◇ Square wave or rectangular fluroscent diffuser.
- ◇ Direct lighting mainly used for industrial and outdoor lighting, in that 90% of total light flux is made to fall directly on the working plane with the help of deep reflectors.

UNIT - 2: REFRIGERATION AND AIR CONDITIONING

1. What is meant by refrigeration?

It is the process of reducing the temperature of an object from the normal surrounding temperature in a controlled way in order to cool them.

2. What is refrigerator?

Refrigerator is a machine that reduces the temperature of the substances by storing the heat in it. This machine has refrigerant that is nothing but a gas or fluid, which is circulated through different stages to extract the heat from the substances.

3. What is refrigerant?

Refrigerant is nothing but the liquid that can be liquefied and vaporized to reduce the temperature of the substance to be cooled. CO_2 is used as refrigerant in ships, but while handling piping, problems arise with such refrigerant.

4. Give some of the applications of refrigeration.

- i) The making of ice.
- ii) The Air-conditioning of industries.
- iii) The metal manufacturing and their treatment.

5. What is meant by air-conditioning?

The process by which the temperature, humidity, purity, and circulation of air is controlled in an enclosed area is known as air-conditioning.

6. What are the factors that lead to the efficient air-conditioning?

- i) Temperature control.
- ii) Humidity control.
- iii) Air movement and circulation.

7. What are the cooling methods of air?

Normally, the air is cooled in summer by the following methods:

- ◆ By circulating the cold water.
- ◆ By using the ice-activated systems.
- ◆ By using the water-evaporative systems.

8. What are the heating methods of air?

- ◆ By using electric heaters.
- ◆ By using electromechanical heat pumps.
- ◆ By using heat exchangers using waste systems.

7. What do you mean by refrigeration?

Refrigeration is the process of removing heat from the space to be cooled and rejecting it to a colder medium. It is done in a controlled way in order to cool them. It is one of the most important processes in the modern world.

8. Explain the importance of refrigeration.

Refrigeration is used for the preservation of food, medicines, and other perishable goods. It is also used for the production of ice and for the air-conditioning of buildings and industries.

9. What are the applications of refrigeration?

Refrigeration is used in many applications such as the preservation of food, the production of ice, the air-conditioning of buildings and industries, and the cooling of machinery. It is also used for the production of low-temperature environments for scientific and industrial purposes.

10. What is air conditioning?

Air conditioning is the process of controlling the temperature, humidity, and purity of the air in an enclosed space. It is done in a controlled way in order to provide a comfortable and healthy environment for the occupants.

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7. What do you understand by a cold chain for food products?

Proper food preservation requires the maintenance of a cold chain beginning from the place of harvest and ending at the place of consumption. A typical cold chain consists of facilities for pre-treatment at the place of harvest, refrigeration/freezing at food processing plant, refrigeration during transit, storage in refrigerated warehouses (cold storages), refrigerated displays at the market, and finally storage in the domestic freezer/refrigerator. It is very important that suitable conditions be provided for the perishable products through out the chain.

8. Explain the importance of cold storages.

Preservation of perishable products using cold storages equalizes the prices throughout the year and makes these products available round the year. Without them, the prices would be very low at the time of harvest and very high during the off-season. With storage facilities, it would also be possible to make the products available in areas where they are not grown.

9. What are the important issues to be considered in the design of refrigeration systems?

Refrigeration systems are used in a wide variety of applications. Each application has specific requirements of temperature, moisture content, capacity, operating duration, availability of resources etc. Hence, refrigeration system design must be done for each application based on the specific requirements. Since refrigeration systems are cost and energy intensive, it is important to design the systems to achieve low initial and running costs. Reliability of the systems is also very important as the failure of the refrigeration systems to perform may lead huge financial losses. Of late, issues related to environment have attracted great attention, hence the refrigeration systems should be as far as possible environment friendly.

10. What is the relation between refrigeration and air conditioning?

Air conditioning involves control of temperature and moisture content. One of the most common requirement of air conditioning systems is cooling and dehumidification of air.

Refrigeration systems are required for cooling and dehumidification. Refrigeration systems can also used for heating of air by utilizing the heat rejected at the condenser, i.e., by running them as heat pumps.

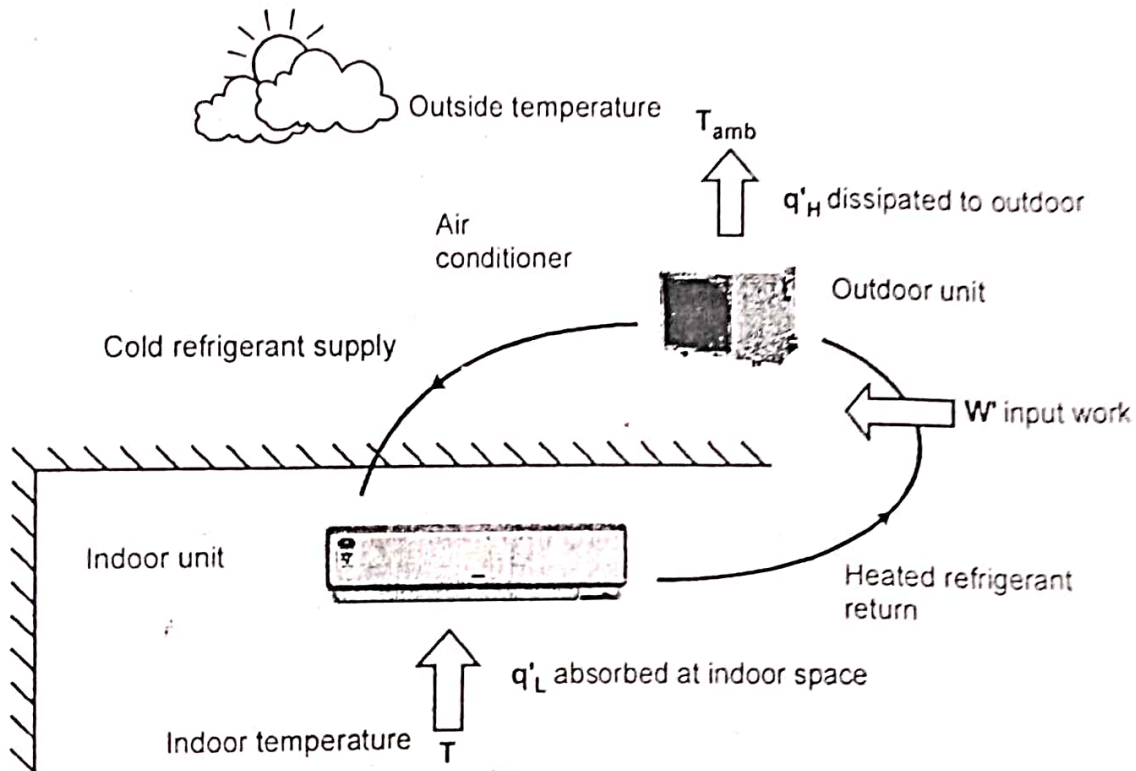
11. What is meant by IAQ and what does it involve?

IAQ stands for Indoor Air Quality and it refers to the ways and means of reducing and maintaining the pollutants inside the occupied space within tolerable levels. IAQ involves specifying suitable levels of fresh air supply (ventilation), suitable air filters, use of proper materials of construction, furniture, carpets, draperies, etc.

12. Define Energy Efficient motor.

Electric motors are of utmost importance in industrial as well as agriculture sector. These motors found their application as constant speed drives with very low rating as well as variable speed drives with very high rating. Energy efficiency and energy conservation are very closely related to each other.

13. Draw the Block diagram of smart air conditioners.



14. Define efficiency motor.

Efficiency = output power/input power

15. Define Motor life cycle.

Three types of motors have been considered: the synchronous reluctance motor, the permanent magnet assisted synchronous reluctance motor and the induction motor. The assessment of lifecycle has been made in terms of its four stages: manufacturing, distribution, use and end of life.

UNIT - 3: HEATING AND WELDING**1. Explain Resistance heating?***(May / June 2007)*

This method of heating is based upon I^2R effect and has wide applications such as heat treatment of metals (e.g. Annealing, normalizing, hardening, tempering etc), drying and braking of potteries, domestic cooking etc. In oven where wire resistances are employed for heating, temperature to the tune of 1000°C can be obtained.

2. What are the methods of heating?

The two methods of heating are,

- ◇ Direct resistance heating
- ◇ Indirect resistance heating.

3. Explain direct resistance heating.*(May / June 2007)*

In this method the material or charge to be heated is treated as a resistance and current is passed through it. The charge may be in the form of powder, small solid pieces or liquid. The electrodes are inserted in the charge and connected to either A.C or D.C supply. In case of D.C or single-phase A.C supply two electrodes will be required, while in case of 3-phase supply three electrodes will be used.

4. Where the direct resistance method is employed?

This heating method is employed in,

- ◇ Salt bath furnaces.
- ◇ Resistance welding.
- ◇ Electrode boiler for heating water.

5. Give the properties of good heating element.*(April/May 2014), (Nov/Dec 2014)*

- ◇ High specific resistance.
- ◇ High melting temperature.
- ◇ Low temperature coefficient of resistance.

- ◇ High oxidizing temperature.
- ◇ High ductility and flexibility.
- ◇ High mechanical strength of its own.

6. What are the factors affecting heating element? (May / June 2010)

Every heating element with passage of time breaks open and becomes unserviceable. Some of the factors responsible for this failure are,

- ◇ Formation of hot spots which shine brighter during operation
- ◇ Oxidation
- ◇ Corrosion
- ◇ Mechanical failure.

7. What are the materials employed for low and medium temperature services?

Alloy of nickel and chromium Ni = 80%, Cr = 20% (or)

Alloy of nickel, chromium and iron Ni = 65%, Cr = 15%, Fe = 20%

Ni-Cr alloy is suitable for temperature at which oxidation takes place and work in severe conditions. Ni-Cr-Fe alloy is recommended for use up to 850°C .

8. What is the basis of resistor material?

“Silicon carbide” is the basis of resistor material for operating in air temperatures upto about 1500°C. The material is formed into rods of diameters and lengths for combination into circuits of the required electrical rating.

9. What is a Resistance furnace?

Resistance furnaces or ovens are suitably-insulated closed chambers with a provision for ventilation. These are used for heat treatment of metals, pottery work, commercial and domestic heating.

10. Define Heating chamber.

An enclosure for charge which is heated by radiation or convection or both is called a heating chamber. The design of the chamber, apart from mechanical consideration, is related primarily to temperature and the major mode of heat transfer to be used.

11. Why the heating chambers are used?

The chambers are used to;

- ◇ Control the distribution of heat within the chamber
- ◇ Control the cooling rate of charge, if required
- ◇ Confine the atmosphere around the charge
- ◇ Store as much of the heat supplied as may be practicable and economical.

12. List out the types of heating chambers.

The heating chambers may be of

- ◇ Batch type
- ◇ Continuous type

13. Give the ways by which the temperature can be controlled.

There are three ways by which the temperature can be controlled

- ◇ Voltage
- ◇ Time
- ◇ Resistance

14. Mention the heat produced in heating elements to overcome the losses.

The heat produced in the heating elements, besides raising the charge to the required value, is also to overcome the losses mentioned below,

- ◇ Heat used in raising the temperature of oven or furnace.
- ◇ Heat used in raising the temperature of the containers or carriers.
- ◇ Heat conducted through walls.
- ◇ Escapement of heat due to opening of door.

Give the principle of Electric arc furnaces.

An arc can also be obtained by using low voltage across two electrodes initially in contact with each other. The low voltage required for this purpose can be obtained by using a step-down transformer. Initially, the low voltage is applied, when the two electrodes are in contact with each other. Further, when the two electrodes are gradually separated from each other, an arc is established between the two.

Give the shapes of the Electric arc furnaces.

The arc furnaces are usually of following two shapes,

- ◇ Cylindrical shape
- ◇ Conical shape.

Mention the advantages of the conical shape electric arc furnace.

The conical shape entails the following advantages

- ◇ Large surface area per unit bath volume
- ◇ Consumes less power
- ◇ Reduced melting time
- ◇ Reduced radiation losses.

What are the types of electrodes used in arc furnaces?

The following three types of electrodes are used in arc furnaces:

- ◇ Carbon Electrode.
- ◇ Graphite Electrode.
- ◇ Self-baking Electrode.

List down the types of arc furnaces.

Arc furnaces are of following three types:

- ◇ Direct arc furnace
- ◇ Indirect arc furnace
- ◇ Submerged arc furnace.

20. What are the advantages of indirect arc furnace?

The advantages are as follows,

- ◆ Lower overall production cost per tonne of molten metal.
- ◆ Sound castings in thin and intricate designs can be produced.
- ◆ Metal losses due to oxidation and volatilization are quite low.
- ◆ Flexible in operation.

21. Explain the process of Induction heating.

The process of Induction heating makes use of the currents induced by the electro-magnetic action in the charge to be heated. Induction heating, in fact, is based on the principle of transformer working. The primary winding is supplied from an A.C source is magnetically coupled to the charge which acts as a short-circuited secondary of a single turns.

22. Mention the types of Induction furnaces.

Basically, the two types of Induction furnaces are,

- ◆ Core type or low frequency induction furnace
 - i) Direct core type
 - ii) Vertical core type
 - iii) Indirect core type
- ◆ Coreless type or high frequency induction furnace.

23. What are the drawbacks in direct core type furnace?

This type of furnace has the following drawbacks,

- ◆ Leakage reactance is high and consequently the power factor is low on account of poor magnetic coupling.
- ◆ Low frequencies have to employ as normal frequency causes turbulence of the charge. This requires a motor-generator set or a frequency converter.
- ◆ It suffers from pinching effect.

24. Enumerate the advantages of vertical core type induction furnace.

- ◆ Consistent performance and simple control.
- ◆ Accurate temperature control, uniform castings, reduced metal losses and reduction of rejects.
- ◆ High efficient heat, low operating costs and improved production.
- ◆ High power factor (0.8-0.85) comparatively.
- ◆ Local working conditions in a cool atmosphere with no dirt, noise or fuel
- ◆ Absence of crucibles.
- ◆ Absence of combustion gases resulting in elimination of the most common source of metal contamination.

25. What are the applications of Coreless type Induction furnace?

These furnaces find applications in the following fields,

- ◆ Steel production (Energy consumption is 600 to 1000 kWh per tonne of steel).
- ◆ Melting non-ferrous metals like brass, bronze, copper and aluminum etc., along with various alloys of these elements.
- ◆ Vacuum melting.
- ◆ Melting in controlled atmosphere.
- ◆ Melting for precision casting.
- ◆ Electronic industry.
- ◆ Industrial activities like soldering, brazing, hardening and annealing and sterilizing instruments etc.

26. Give the advantages of Coreless type Induction furnace.

Some of the advantages of coreless induction furnace are as follows,

- ◆ Fast in operation.
- ◆ Low erection cost.
- ◆ Can be operated intermittently.
- ◆ Operation is free from smoke, dirt, dust and noises.
- ◆ Charging and pouring is simple.

- ◇ Less melting time.
- ◇ Precise control of power.
- ◇ Possibility of employing vacuum heating necessary for precious metal melting.

27. Mention the advantages of eddy current heating.

Some of the advantages are as follows,

- ◇ Temperature control is very easy.
- ◇ The heat can be made to penetrate into metal surface to any desired depth.
- ◇ This heating method is quick, clean and convenient.
- ◇ Very less wastage of heat.
- ◇ The equipment can be operated even by unskilled labour.
- ◇ The surface area over which heat is produced can be accurately controlled.
- ◇ The amount of heat produced can be accurately controlled by suitable timing devices.

28. Give the demerits of eddy current heating.

- ◇ The generation of heat is costly.
- ◇ Efficiency of equipment is quite low.
- ◇ Initial cost of the equipment is high.

29. What are the applications of eddy current heating?

- ◇ Surface hardening
- ◇ Annealing
- ◇ Soldering

30. Define the term Annealing.

In conventional method of annealing the process takes long time resulting in scaling of the metal which is undesirable. But in eddy current heating, time taken is much less so that no scale formation takes place. By this method a temperature of the order 750°C can be attained in one minute upto a depth of 25 mm.

31. Enumerate other applications of eddy current heating.

- ◇ Drying of paints.
- ◇ Welding.
- ◇ Melting of previous metals.
- ◇ Sterilization of surgical instruments.
- ◇ Forgings of bolt heads and rivet heads.

32. Mention the Electrodes of carbon arc welding

Electrodes are made of either carbon or graphite, are usually 300 mm long and 2.5 mm to 12 mm in diameter. Graphite electrodes are harder, more brittle and last longer than carbon electrodes. They can withstand higher current densities but their arc column is harder to control.

33. Define Dielectric heating. (May / June 2007)

Dielectric heating is also known as High frequency capacitive heating. It is employed for heating insulators like wood, plastics and ceramics etc. which cannot be heated easily and uniformly by other methods. The supply frequency required of dielectric heating is between 10-50 MHz and applied voltage is 20 kV. The overall efficiency of dielectric heating is about 50 percent.

34. What are the advantages of dielectric heating?

- ◇ Heating is uniform since heat is generated within the dielectric medium itself.
- ◇ With the increase in frequency the heating becomes faster.
- ◇ Only method for heating bad conductor of heat.
- ◇ Heating is fastest.
- ◇ Heating can be stopped immediately as and when desired.

35. Mention the applications of dielectric heating.

(May/June 2007, 2009, 2012)

- ◇ Drying and gluing of wood.
- ◇ Drying of rayon cakes in textile manufacture.
- ◇ Dehydration of foods.
- ◇ Gluing of laminated glass.
- ◇ Rubber vulcanizing.

36. Give the applications of carbon arc welding.

- ◇ Carbon arc welding is suitable for galvanized sheets using copper-silicon-manganese alloy filler metal.
- ◇ It is adaptable for automation particularly where amount of weld deposit is large and materials to be fabricated are of simple geometrical shapes such as water tanks.
- ◇ Useful for welding thin high-nickel alloys.
- ◇ Can be employed for welding stainless steel of thinner gauges with excellent results.

37. Mention the advantages of carbon arc welding.

- ◇ The temperature of the molten pool can be easily controlled by simply varying the arc length.
- ◇ Can be easily adapted to inert gas shielding of the weld.
- ◇ Can be used as an excellent heat source for brazing, braze welding and soldering etc.
- ◇ Easily adaptable to automation.

38. What is meant by resistance arc welding (May / June 2012)

In resistance welding heavy current is passed through the metal pieces to be welded. Heat will be developed by the resistance of the work piece to the flow of current the heat produced for welding is given by,

$$H = I^2 Rt.$$

H - Heat developed at the contact area

I - Current in amperes

R - Resistance in ohms

t - Time of flow of current

39. Enumerate the quantities of good welding.

- ◇ Uniformly rippled surface of the weld.
- ◇ Even control of the weld.
- ◇ Even width of the weld.
- ◇ Absence of surface defects like overlap, under cut, crack, and surface porosity.

UNIT - 4: TRACTION.

1. What are the electrical characteristics of traction motors?

- ◇ High starting torque.
- ◇ Simple speed control.
- ◇ Better commutation.
- ◇ Capability to operate in parallel.

2. What are the Mechanical characteristics of traction motors?

- ◇ Traction motor must be robust.
- ◇ It should be capable to withstand continuous vibration.
- ◇ Minimum weight.
- ◇ Must be totally enclosed.

3. What are the types of motors find its application in traction?

- ◇ DC series motor.
- ◇ AC series motor.
- ◇ Repulsion motors.
- ◇ Three phase induction motors.

4. What is electric traction?

The locomotion in which the driving or tractive force is obtained from electric motors is called electric traction.

5. Name the application of electric traction.

- ◇ Electric trains
- ◇ Tram cars
- ◇ Trolley buses
- ◇ Diesel-electric vehicles

6. How electric traction is classified?

- ◇ **Non-electric traction systems:** These systems do not use electrical energy at any stage.

Example: Steam engine drive used in railways.

- ◇ **Electric traction systems:** These systems involve the use of electric energy at some stage or the other.

Example: Railway electric locomotive fed from overhead AC supply.

7. State the requirements of an ideal traction system. (Dec 2012)

- ◇ High adhesion coefficient
- ◇ Minimum wear on the track
- ◇ It should be pollution free
- ◇ Speed control should be easy
- ◇ It should be possible to overload the equipment for short periods

8. Name different systems of traction

- ◇ Steam engine drive
- ◇ Internal combustion engine drive
- ◇ I.C engine electric drive
- ◇ Petrol electric traction
- ◇ Battery electric drive
- ◇ Electric drive

9. Give the important features of a good braking system.

- ◇ It should be fast and reliable
- ◇ The braking force must be capable of being controlled
- ◇ Kinetic energy of the rotating parts of the motor and its driven machines must be suitably dissipated and suitable means must be provided.

0. Explain electric braking.

In electric braking or electrodynamic braking system, the kinetic energy of the moving part of the system is converted into electrical energy which in turn is dissipated as heat in a resistance or in certain cases may be returned to the supply.

1. State the advantages of electric braking?

- ◇ Electric braking is quite fast.
- ◇ Electric braking is free from fires and is more smooth than mechanical braking.
- ◇ It is quite cheap as far as maintenance part is concerned due to the fact that no replacement of brake shoes or lining is needed.

2. What are the disadvantages of electric braking?

- ◇ Initial cost is very high.
- ◇ Electric braking cannot be applied to all types of electric motors.
- ◇ Electric braking can stop the motor but it cannot hold it stationary.

3. What are the types of load torque?

Load torques are classified into two types:

- ◇ Active or Potential loads.
- ◇ Passive loads.

4. Classify load torques depending on the speed?

Depending upon the speed the load torque is classified into:

- ◇ Constant load torque
- ◇ Load torque \propto speed
- ◇ Load torque \propto speed²
- ◇ Load torque $\propto \frac{1}{\text{speed}}$

15. Give the expression for back emf, supply voltage and torque developed by the motor?

$$\text{Back emf } E_b = K_e \phi \omega_m$$

$$\text{Supply voltage } V = E_b + I_a R_a$$

$$\text{Torque } T = K_t \phi I_a$$

16. Classify load torques depending on the variation of time?

It is classified into:

- ◇ Continuous and constant load
- ◇ Continuous but variable load
- ◇ Pulsating load
- ◇ Impact load
- ◇ Short time intermittent load

17. Give two methods of speed control in DC motors?

- ◇ Variable resistance in field circuit and armature circuit.
- ◇ By tapping the field.

18. Give two methods of speed control in AC motors?

- ◇ Voltage drop in series impedance
- ◇ Voltage variation and pole changing

19. What are the losses reduced for energy conservation?

- ◇ Electrical transmission losses
- ◇ Electrical motor losses
- ◇ Conversion losses
- ◇ Losses in the load
- ◇ Mechanical transmission losses

20. Merits and Demerits of shunt transition?***Merits***

It operates satisfactorily over a wide range of loads, making it suitable for locomotive applications.

Demerits

During shunt transition, one motor is actually short circuited and then disconnected from supply and afterwards reconnected in parallel. This result in loss of tractive effort during this period till motor is reconnected in parallel.

21. Give the advantage and disadvantage of Steam engine drive?

Advantages

- ◇ Simplicity in design
- ◇ Easy speed control
- ◇ Simplified maintenance

Disadvantages

- ◇ Low thermal efficiency.
- ◇ It has strictly limited overload capacity.
- ◇ Extensive and costly auxiliary equipment.

22. Give the advantage and disadvantage of I.C. engine drive?

Advantages

- ◇ Low initial investment.
- ◇ Very simple braking system.

Disadvantages

- ◇ Limited overload capacity.
- ◇ A gear box is essential for speed control.

23. What is mean by tramways?

It is perhaps the cheapest type of transport available in very dense traffic. It receives power through a bow collector about 600 V DC.

24. What are the Undesirable effects of Harmonics in source current?

- ◇ Malfunction of electronic equipment.
- ◇ Skin effect.
- ◇ Saturation of transformers.

25. What are the Undesirable effects of Harmonics in traction application?

- ◇ Mal operation of signals.
- ◇ Interference with telephone lines which run by the side of the track.

26. What are the steps to solve problems of low power factor and harmonics?

- ◆ Converters are used which have good p.f.
- ◆ Static VAR compensators are used to maintain p.f.

27. What is the purpose of traction control?

- ◆ To provide smooth acceleration
- ◆ To control speed
- ◆ To avoid damage to couplings

28. What is series-parallel control?

It is so named since this method assumes that at least two motors are being used which are connected in series at start for low speed and in parallel for speed running.

29. Give Advantages of regenerative braking?

- ◆ Reduced energy consumption.
- ◆ Less wear and tear of brake blacks, wheels and tracks.

30. What is plugging?

Plugging involves reconnection of motor to supply in such a way that motor develops a torque in opposite direction to the movement of the rotor. The system decelerates till zero speed and then it will accelerate in opposite direction. It is called as reverse current braking .

31. What is dynamic braking?

In dynamic or rheostatic braking, the supply to the motor is disconnected during the braking period. The field continues to get energized in the same direction. Thus the motor starts working as a generator and all the kinetic energy of the moving parts is converted into electrical energy which is further dissipated in external resistance connected across the motor during braking period.

32. What is regenerative braking?

In case of regenerative braking, the machine is made to work in a way that it generates energy and feeds it back to the supply system. This is achieved when E_b is greater than V . Thus the direction of current in the armature gets reversed; the direction of field remaining same, the torque produced is in the opposite direction.

7. Give the features of trolleybus.

- ◇ As the total weight is limited that of the electrical equipment must be cut down to the minimum possible value.
- ◇ The adhesion between a rubber tyred wheel and the roadway is sufficiently high to enable only a single driving axle and therefore a single motor be used.

8. Name the protective devices used in tramways and trolley buses.

- ◇ Circuit breakers.
- ◇ Lightning arrester or surge diverter.
- ◇ Radio interference suppressor.

9. Give the general features of motors in traction service.

- ◇ Motors should have suitable speed torque characteristics.
- ◇ The motors must have high torque during starting and acceleration in order to accelerate heavy mass.
- ◇ Motor should be amenable to easy and simple methods of rheostatic and regenerative braking mechanisms.

10. What are the functions of tractive effort exerted by the traction unit?

- ◇ To give necessary linear and angular acceleration to the train mass.
- ◇ To overcome the gravity component of the weight of the train.
- ◇ To overcome the wind and frictional resistance of the train.
- ◇ To overcome curve resistance.

11. Define tractive effort.

The effective force necessary to propel the train at the wheels of the vehicle is called the tractive effort. It is tangential to the driving wheels and measured in newton. It is a vector quantity.

12. Give expression for tractive effort.

The total tractive required running a train on track = Tractive effort during acceleration + Traction effort to overcome the effect due to gravity + Tractive effort used in overcoming frictional resistance.

$$F_t = F_a \pm F_g \pm F_r$$

39. List two merits of series - parallel starting of traction motors.

(Nov/Dec 2007) (May/June 2009)

- ◇ In bridge transition method, both of the motor circuit are closed during transition. This is employed for sub urban services.
- ◇ There is no jerk in this method.
- ◇ Starting efficiency is increased from 50% to 66.67%. By adapting four motors. Starting efficiency increased upto 72 to 73%.

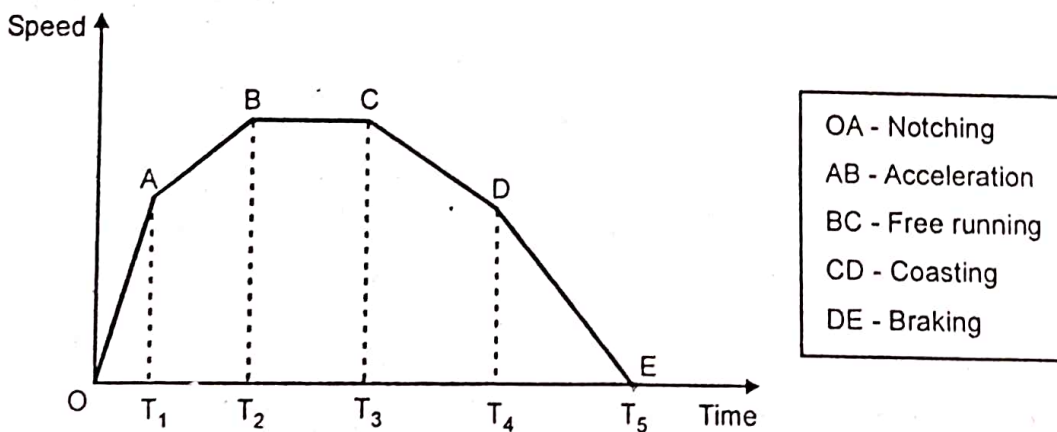
40. What is the voltage level used in traction distribution network?

(Nov/Dec 2009)

- ◇ D.C System - 600 V, 750 V, 1500 V, 3000 V.
- ◇ Single - phase AC system - 15 to 25 Kv, at 16 2/3, 25 and 50 Hz.
- ◇ Three - phase AC system - 3.3 KV to 3.6 KV at 16 2/3 Hz.

41. With respect to traction system, explain, 'free running'.

(Nov / Dec 2009)



During t_2 to t_3 the power supplied to the motor is at full voltage and speed at during that period is constant, and power drawn from the supply is also constant.

42. Name two type of loads, related to electrical drives.

(Nov / Dec 2009, 2010)

◇ Active load

◇ Passive load

i) The load which are due to the force of gravity, tension or compression in a spring or any elastic body are called active loads.

ii) These torque are due to friction, cutting and deformation of inelastic bodies.

43. Write the applications of DC shunt motors

(Nov / Dec 2009)

◇ Supplying excitation of small and medium alternators.

i) Electrolytic processes.

ii) Welding process, lathe machines, centrifugal pumps, fans, blowers, conveyors, lift weaving machine, spinning machine etc.

44. What type of motor is used for electric fraction

(Apr / May 2010)

◇ D.C series motor

◇ A.C series motor

◇ Repulsion motor

◇ 3 - phase inclusion motor

◇ Linear induction motor

45. Give any two advantages of electric traction

(Apr/May 2010)

◇ Due to absence of smoke and dust it is very clean.

◇ This type of drive is most suitable for high traffic density for route.

◇ It can withstand high over / loads.

◇ Electric bracking is superior to mechanical bracking.

46. Define continuous rating of motor

(April/May 2010)

This is the rating or the output of a motor which can be derived continuously for long periods without exceeding the permissible temperature. This rating is applicable to drive like fans, pumps, textile, mills etc. Which operate continuously for long periods.

47. Define tractive effort

(Nov / Dec - 2008, May / June 2012)

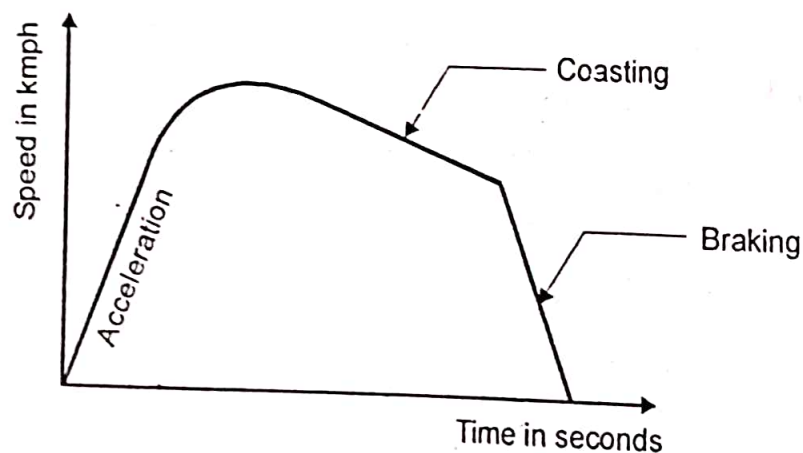
The effective force, necessary to propel the train at the wheels of the vehicle is called the tractive effort. It is tangential to the driving wheels and measured in newtons.

The tractive efforts required to run a train on track are,

- i) Tractive effort needed to provide acceleration (F_a).
- ii) Tractive effort needed to overcome the train resistance (F_t).
- iii) Tractive effort needed to overcome gradients (F_g).

48. Sketch the time curve for a sub urban service

(Nov / Dec 2010)



In this type of service the distance between two successive stations in the range of 1.5 kms to 8 km. Acceleration and braking retardation required are high. Free running period is not possible and coasting period will be comparatively longer than urban services.

UNIT - 5: DOMESTIC UTILIZATION OF ELECTRICAL ENERGY

1. List out the various types of energy.

Energy is the power we use for transportation, for heat and light in our homes and for the manufacture of all kinds of products. There are two sources of energy:

- ◇ Non renewable energy
- ◇ Renewable energy.

2. Define non renewable sources of energy.

Most of the energy we use comes from fossil fuels, such as coal, natural gas and petroleum. Uranium is another non renewable source, but it is not a fossil fuel. Uranium is converted to a fuel and used in nuclear power plants. Once these natural resources are used up, they are gone forever.

3. Define renewable sources of energy.

Renewable sources of energy can be used over and over again. Renewable resources include solar energy, wind, geothermal energy, biomass and hydropower. They generate much less pollution, both in gathering and production, than non renewable sources.

4. What is wind energy?

Wind energy is an indirect form of solar energy.

6. Write down the application of wind power.

- ◇ Wind turbine are used to generate electricity.
- ◇ Wind mills are used for producing mechanical power.
- ◇ Wind pumps are used for water pumping or drainage.
- ◇ Wind power is used in sails to propel ships.

7. Mention characteristics of wind energy.

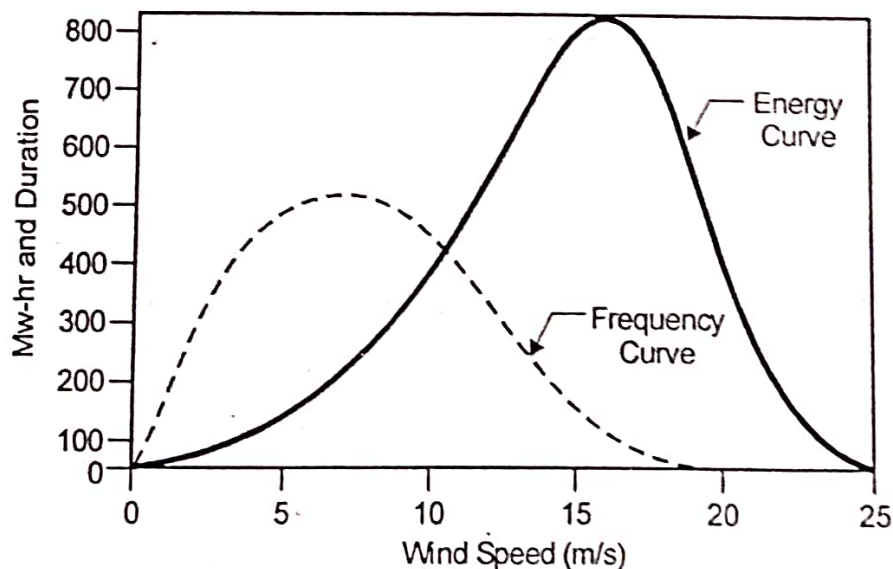
- ◇ Wind power system do not pollute the atmosphere.
- ◇ Fuel provision and transport are not required in wind - power system.
- ◇ Wind energy is a renewable source of energy.
- ◇ Wind energy when produced on small scale is cheaper but competitive with conventional power generating system when produced on a large scale.

8. What is meant by wind turbine?

A wind turbine is a rotating machine which converts the kinetic energy of wind into mechanical energy.

9. Mention the various advantages of wind power.

- ◆ **Clean:** Aside from the manufacturing process, wind power emits absolutely no green house gases.
- ◆ **Fuel:** There are no fuel concerns as long as the wind blows, electricity will be generated. There are no worries about sourcing the fuel from elsewhere to make it work.
- ◆ **Place - ability:** Due to their nature, wind turbine can be placed in a variety of locations rather inhospitable locations.
- ◆ **Decentralised:** One wind power plant cannot generate huge amount of electricity.
- ◆ **Domestic:** Wind power lends itself well to domestic applications as wind turbine can be virtually any size.

10. Obtain the distribution profile of wind speed.**11. Classify vertical axis wind turbine based on blade profile.**

- i) Multiple blade type
- ii) Savonius type
- iii) Darrieus type

12. Mention the sites selected to install wind mills.

- i) Plane sites
- ii) Hill top sites
- iii) Sea - Shore sites
- iv) Off - shore shallow water sides

13. List down the main industrial applications wind energy.

- i) Tele Communications
- ii) Radar
- iii) Pipeline control
- iv) Navigations aids such as ship with sails
- v) Cathodic protections
- vi) Weather stations / seismic monitoring
- vii) Air - traffic control

14. What is meant by house wiring?

House wiring consists of an electrical wiring system that distributes energy to be used in equipment and appliances around the house. It also involves the proper installation and operation of the electrical outlets, switches, breakers, meter base and different electrical circuits.

15. Mention types of domestic wiring.

Following are the different types of domestic wiring :

- i) Cleat wiring
- ii) Wooden casing and capping wiring
- iii) TRS or Batton wiring
- iv) Surface conduit wiring
- v) Concealed conduit wiring

16. What are the advantages and disadvantages of cleat wiring?***Advantages***

- ◇ The installation and dismantling is simple and fast and hence is very useful for temporary wiring.
- ◇ The cable can be inspected easily and if there is any problem with the wiring the same can be rectified without much problem.

Disadvantages

- ◇ The appearance of the wiring is not good.
- ◇ It cannot be used in damp places.
- ◇ As the wiring is exposed to atmosphere, its life span is short.

17. What are the advantages and disadvantages of Wooden/PVC Casing and Capping Wiring?

The following are the advantages and disadvantages of this method of wiring.

Advantages

- ◇ It is relatively cheaper as compared to conduit but costlier as compared to cleat-wiring.
- ◇ Short-circuit of wire i.e. between phase and neutral is avoided as the two are placed in different grooves.
- ◇ Physical inspection of wiring makes it simple to carry out any repair if required (by opening the capping).
- ◇ PVC casing capping gives better look and is economical as compared to wood.

Disadvantages

- ◇ In case of a short-circuit, there is risk of fire (use of wood or PVC).
- ◇ Normally not recommended for damp places.

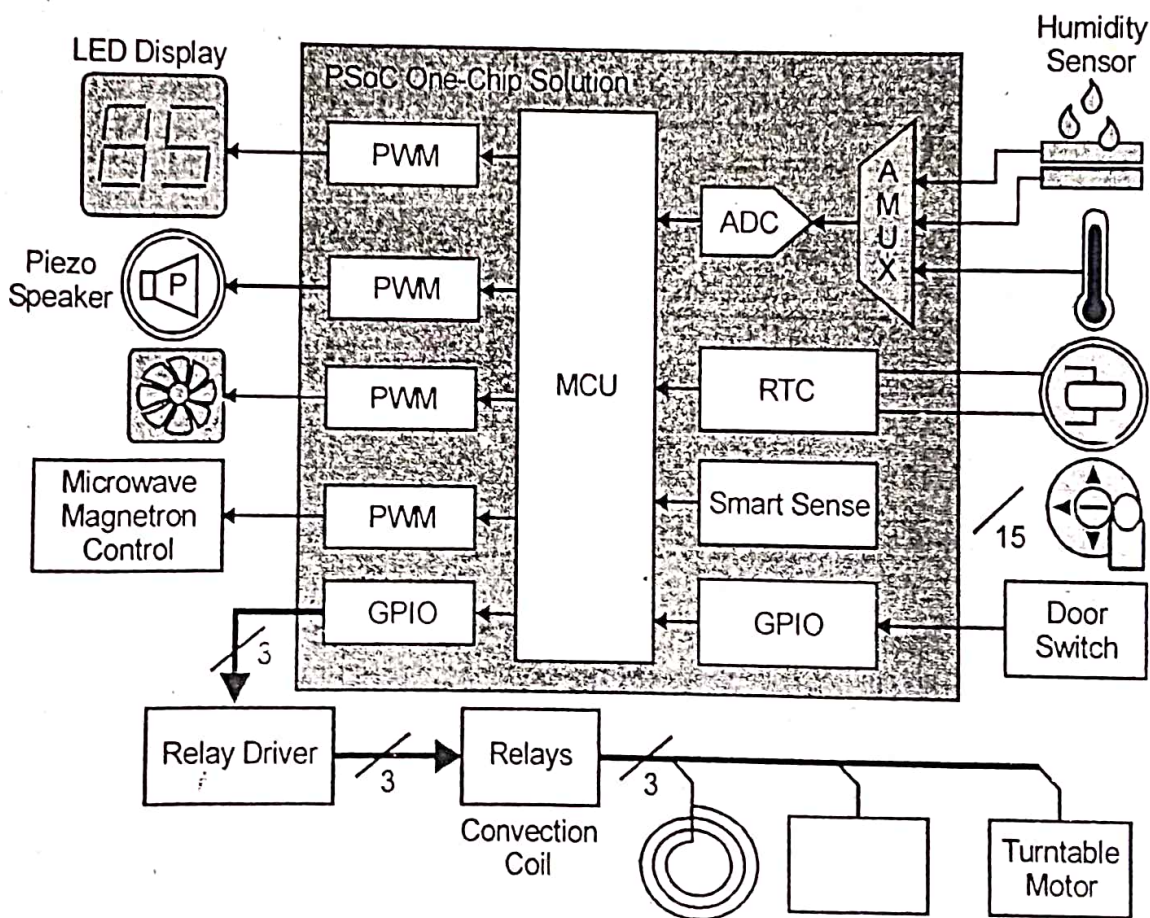
18. Define Distribution Board.

Distribution board located in covered Verandah in a house or in the room where there is no Verandah. Care should be taken to see that privacy should not be disturbed while selecting the location for meter board as the meter reader shall be visiting the house regularly.

9. List out the requirements of the insulating materials used for cable.

- ◇ High insulation resistance.
- ◇ High dielectric strength.
- ◇ Good mechanical properties i.e. tenacity and elasticity.
- ◇ It should not be affected by chemicals around it.
- ◇ It should be non-hygroscopic because the dielectric strength of any material goes very much down with moisture connect.

10. Draw the block diagram of induction stove.



11. What are the advantages of cooking with induction stove.

- ◇ Boil 50% faster
- ◇ Precise temperature control
- ◇ Easy-to-clean surface
- ◇ Auto-sizing burners

22. Define Induction Heater.

An induction heater consists of an electromagnet and an electronic oscillator that passes a high-frequency alternating current (AC) through the electromagnet. The rapidly alternating magnetic field penetrates the object, generating electric currents inside the conductor, called eddy currents.

23. List out the applications of inductive heating.

- ◆ Targeted heating for surface heating, melting, soldering is possible with the inductive heating process.
- ◆ Besides metals, heating of liquid conductors and gaseous conductors is possible by inductive heating.
- ◆ For heating of silicon in semiconductor industries, the inductive heating principle is used.
- ◆ This process is used in inductive furnaces for to heat metal to its melting point.
- ◆ As this is a contactless heating process, vacuum furnaces make use of this process for making specialized steel and alloys that would get oxidized when heated in the presence of oxygen.
- ◆ Induction heating process is used for welding of metals and sometimes plastics when they are doped with ferromagnetic ceramics.
- ◆ Induction stoves used in the kitchen works on the inductive heating principle.
- ◆ For brazing carbide to shaft induction heating process is used.
- ◆ For tamper resistant cap sealing on bottles and pharmaceuticals, the induction heating process is used.

24. What is meant by rice cooker?

A rice cooker or rice steamer is an automated kitchen appliance designed to boil or steam rice. It consists of a heat source, a cooking bowl, and a thermostat. The thermostat measures the temperature of the cooking bowl and controls the heat. Complex rice cookers may have sensors and other components, and may be multipurpose.