

ANNAI MATHAMMAL SHEELA ENGINEERING COLLEGE

VII Semester Mechanical Engineering

ME2403 Power Plant Engineering

SHORT QUESTIONS AND ANSWERS

UNIT I INTRODUCTION TO POWER PLANTS

1. Name the four major circuits in steam power plant.

Coal and ash circuit
Air and flue gas circuit
Feed water and steam circuit
Cooling water circuit

2. What consists of air and flue gas circuit?

Air and flue gas circuit consists of forced draught fan, air-pre-heater, boiler, furnace, super heater, economiser, dust collector, induced draught fan and chimney.

3. What consists of feed water and steam flow circuit in steam power?

The feed water and steam flow circuit consists of feed pump, economizer boiler drum super heater, turbine and condenser.

4. What consists of cooling water circuit and coal & ash circuit in steam power plant?

The cooling water circuit consists of a pump, condenser and cooling tower. The coal and ash circuit consists of coal delivery, preparation of coal, handling of coal to the boiler furnace, ash handling and ash storage.

5. What is the main purpose of the reservoir?

The main purpose of reservoir is to store water received from catchments areas during the rainy seasons and supply the same during the dry season.

6. What is the main purpose of the dam?

The main purpose of the dam is to increase the height of water level and also to increase the working head of the hydraulic power plant.

7. Why trash rack is used?

The trash rack is used to prevent the entry of debris, which might damage the turbine runners and chock up the nozzle of impulse turbine.

8. What is the use of surge tank?

The surge tank is used to provide better regulation of water pressure in the system. The surge tank controls the water when the load on the turbine decreases and supplies water when the load on the turbine increases. Thus, surge tank controls the pressure variations resulting from the rapid changes in water flow in penstock and hence prevents water hammer.

9. What is the function of Fore bay?

Fore bay is considered as naturally provided surge tank. It is temporary water storage when the load on the plant is reduced and provides water for initial increment on increasing load.

10. Write about penstock

The pipe between surge tank and prime mover is known as penstock. It is designed to withstand high pressure. It is made up of reinforced concrete. In very cold areas, the penstock is buried to prevent ice formation and to reduce the expansion joints.

11. What is the use of spill Ways?

Spillway is like a safety valve of the dam. It discharges major flood without damaging the dam. It keeps the reservoir level below the maximum level allowed.

12. Write about prime movers?

Prime mover converts the kinetic energy of water into mechanical energy to produce electrical energy. Pelton wheel, turbine, Francis turbine, Kaplan turbine and Propeller turbine are prime movers used in hydraulic power plants.

13. What are the uses of air filter and superchargers in diesel engine power plant?

The purpose of air filter is to filter the air from dust and other suspended particles. The purpose of super charger is to increase the pressure of the engine to increase power of the engine.

14. What is the use of draft tube?

The draft tube is used to regain the kinetic energy of water coming out of reaction turbine. It enables the reaction turbine to be placed over tailrace level.

15. What is the function-of cooling system in Diesel power plant?

The function of cooling system is to remove heat from the engine cylinder to keep the temperature of the cylinder in low range and extend engine life.

16. What consists of lubrication system in diesel engine power plant?

The lubrication system consists of oil pumps, oil tanks, filters, coolers and connecting pipes. The purpose of the lubrication is to reduce the friction of moving parts and also pipes to reduce the wear and tear of moving parts.

17. What is the purpose of intercooler in gas turbine power plant?

Since the power required to compress the air is less in isothermal process it is required to maintain the, temperature of air constant as far as possible. Hence the air leaving the L.P. compressor is cooled by intercooler and then passed to the H.P compressor.

18. Name two combined power cycles

- Combined cycle of gas turbine and steam power plant.
- Combined cycle of gas turbine and diesel power plant.

19. Define turbo charging in combined gas turbine and diesel cycles

In the combined cycle, the exhaust gas from the diesel engine is expanded in the turbine, which is coupled with compressor which supplies pressurized air to the diesel engine. This increases diesel engine output. This arrangement is known as turbo charging.

20. What is the main purpose of high-pressure boilers?

The high-pressure boilers are used to increase the efficiency of the plant and to reduce the cost of electricity production.

21. State important advantages of high-pressure boilers

The amount of scale formation is less, since the velocity of water through pipes are more. All parts of the system are heated uniformly, so there is no danger of overheating.

22. Name important high pressure boilers

La Mont boiler
Benson boiler
Loeffler boiler
Velox boiler.

23. Write about La Mont boiler? What is the major disadvantage of La Mont boiler

La Mont boiler is a forced circulation high pressure water tube boiler. The major disadvantage is the formation of bubbles, salt and sediment on the inner surfaces of the heating surfaces. This reduces the heat flow and steam generation.

24. Write about Benson boiler? State some important advantages of Benson boiler?

Benson boiler is the high pressure, vertical fire tube boiler. This boiler has no drum and is ~designed to operate at critical pressure of 225 bar. Benson boiler has no drum. So the total weight of the Benson boiler is reduced by-20%, when compared to other boilers.

- The erection of Benson boiler is easier and quicker.

25. Write about Loeffler boiler

The major disadvantage in La Mont boiler is the deposition of salt and sediment on the inner surface of the water tubes. It reduces the heat transfer and ultimately the steam generating capacity.

In Loeffler boiler, this problem is solved by preventing water from flowing through the boiler tubes. The steam is generated outside the tubes.

26. Define the term Reheat cycle

If the dryness fraction of steam leaving the turbine is less than 0.88, then, corrosion and erosion of turbine blades occur. To avoid this situation, reheat is used.

In the reheat cycle, the expansion of steam takes place in one (or) more-turbines. Steam is expanded in the HP turbine first, and then it is reheated. The reheated steam is again expanded in. the LP turbine.

27. What are the important advantages of Re-heating?

Due to reheating, network done
increases Heat supply increases
Thermal efficiency increases
Due to reheating, the turbine exit dryness fraction increases so moisture decreases - so
blade erosion becomes minimum - so life of the turbine will be increased.

28. Name different methods of reheating

- (a) Gas Reheating
- (b) Live - steam reheating
- (c) Combined gas live steam reheater.

29. Define bleeding in steam power plant

Assume I kg of steam is expanded in the turbine. Before complete amount of steam -is expanded, some amount of steam (m kg) is -extracted ' Extracting the steam in the turbine before exhaust is called bleeding. This bled steam is used to heat the feed water.

30. Define the term Regeneration

Regeneration means heating the feed water by steam taken from the turbine. The steam is exhausted (bled) from the turbine at several locations before exhaust and is supplied to regenerator (feed water heater) to heat the feed water.

31. State some advantages of Regeneration cycle

Heat supplied to boiler becomes reduced
Thermal efficiency is increased since the average temperature of heat addition to the cycle is increased.
Due to bleeding in the turbine, erosion of turbine due to moisture is reduced.

32. Name different methods used to extract steam for heating the feed water

- Direct contact heater
- Drain pump method
- All drains to hot well Cascade system

33. Define the term waste heat recovery

Waste heat is the heat which is not at all used and exhausted out as a waste product. Waste heat is normally available from the industry in the form of process steam and water at high temperature. Also, the waste heat is discharged with the exhaust gases in so many industries. This heat can be recovered for useful purpose. This process is known-as waste heat recovery.

34. What are the waste materials, which can be used for fuel for power generation?

- Municipal waste
- Industrial waste
- Paper waste
- Rubber waste.

35 Write about waste heat boilers

The waste heat boilers use the waste heat in gases coming out of diesel engines and gas turbines at high temperature (or) use the waste as a fuel in the incineration.

Some boilers use the industrial dirty gases for power generation.

36. Write about fluidised bed boilers

When the high velocity gas is passed through a packed bed of finely divided solid particles, the particles become suspended in the gas stream and the packed bed becomes a fluidised bed. When the gas velocity is very high, the fluidised bed become turbulent and rapid mixing of particles occurs. Ultimately, the, behaviour of mixture solid particles and -gas become a fluid. Burning of a fuel in such a state is known as Fluidised Bed Combustion. The boiler plant using this fluidised bed combustion is known as fluidised bed boilers.

37. State some advantages of fluidised bed boilers

Any type of fuel - solid, liquid (or) gaseous fuel (or) domestic and industrial waste can be used in FBC system. Any type- of combustible matter can be burned by adjusting the factors as size, air velocity and rate of feed.

High heat transfer rate is possible to the surfaces immersed in the bed, because solid mixing is extremely possible.

High combustion efficiency.

The solid fuel need not be pulverised in fluidised bed boilers.

UNIT II STEAM POWER PLANT

1. Name the two types of coal handling

Out plant handling
In-plant handling.

2. Write about out-plant handling

Out plant handling includes the handling of coalmine to the thermal power plant. These handlings are outside the plant in the following ways.

Transportation by sea (or)

river Transportation by rail

Transportation by road

Transportation of coal by pipeline.

3. Write about inplant handling of-coal

In order to handle large quantity of coal inside the plant, some mechanical handling systems are provided f6r smooth, easy and better controlled operation. The inplant coal handling is divided, into following categories.

Coal unloading

Coal preparation

Coal transfer

Coal storage

4. Why the preparation of coal is necessary?

The coal from coal mines cannot be directly fed into the furnace. Proper preparation of coal should be done before feeding the coal to the furnace. In the coal preparation, the coal passes through the different equipments like 1. Crushers 2. Sizers 3. Driers and Magnetic Separators.

5. Name the different types of coal transforming equipments

1. Belt conveyors 2. Screw conveyors 3. Bucket elevators 4. Grab bucket elevators 5. Skip hoists 6. Flight conveyors.

The coal transfer starts by carrying of coal from-unloading point to the storage site.

6. What is the use of belt conveyors?

Belt conveyors are mostly used for transporting coal over long distance with large quantity. An endless belt is made to run over a pair of end drums and pulleys and supported by series of roller at regular intervals.

7. Write about screw conveyor and bucket conveyors?

In screw conveyor, an endless helicoid screw is fitted to the shaft. On one end of the shaft, the driving mechanism is fitted and the other end of the shaft is supported on a ball bearing. While the screw is rotating, the coal is transferred from one end to the other end.

Bucket conveyors are used as vertical lifts. The coal is loaded at the bottom and unloaded at the top in the bucket conveyors.

8. Define draught, what is the use of draught in thermal power plants

Draught is defined as a small pressure difference required between the fuel bed (furnace) and outside air to maintain constant flow of air and to discharge the gases through chimney to the atmosphere. Draught can be obtained by chimney, fan, steam jet (or) air jet (or) combination of these.

The uses are

To supply required quantity of air to the furnace for combustion of fuel. To draw the combustion products through the system.

To remove burnt products from the system

9. Write about classification of draught

Draught is classified as

1. Natural draught
2. Artificial draught

The artificial draught is further classified as

- (a) Steam jet draught
- (b) Mechanical draught
- (c) Induced draught
- (d) Forced draught

10. Define the term Natural draught and what are the advantages of natural draught system

The tall chimney creates the natural draught by the temperature difference between hot gases in the chimney and cold atmospheric air outside the chimney.

The advantages are

No external power is required

Air pollution is less since gases are discharged at high level. No maintenance cost

Capital cost is less than artificial draught.

11. Write about artificial draught.

In modern power plants, the draught should be flexible to meet the fluctuating loads and it should be independent of atmospheric conditions. To achieve this, the aid of draft fans becomes a must and by employing the draft fans, the height of the chimney would be reduced.

12. Write about forced draught system.

In this system, the blower (forced draft fan) is located at the base of the boiler near the grate. Air is forced to the furnace by forced fan and the flue gases are forced to chimney through economiser and air preheater.

13. What are the advantages of forced draught system?

Since the fan handles cold air, the fan size and the power required are less.
No need of water cooled bearings because the air being handled is cold air,
Pressure throughout the system is above atmospheric pressure so the air leakage into the furnace is reduced.

14. How the induced draught is working?

In an induced draught system, a blower (induced draft fan) is placed near (or) at the base of the chimney. The fan sucks the flue gas from the furnace creating a partial vacuum inside the furnace. Thus atmospheric air is induced to flow through the furnace to aid the combustion of fuel. The flue gases drawn by the fan pass through chimney, to the atmosphere.

15. Why the balanced draught system is preferred than other system?

In the induced draught system, when the furnace is opened for firing, the cold air enters the furnace and dilutes the combustion. In the forced draught system, when the furnace is opened for firing, the high pressure air will try to blow out suddenly and furnace may stop. Hence the furnace cannot be opened for firing (q) inspection in both systems. Balanced draught, which is a combination of induced and forced draught, is used to overcome the above stated difficulties.

16. What is the difference between stocker firing and pulverized fuel firing?

The stocker firing method is used for firing solid coal whereas the pulverised firing method is used for firing pulverised coal.

17. What are the different types of stockers?

1. Over feed stockers Travelling grate stockers Spread stockers
2. Under feed stockers Single retort stocker Multi retort stocker

18. What is the use of pulveriser and name different types of pulverising mills?

The pulveriser is used to pulverise the coal in order to increase the surface exposure. Pulverised coal enables rapid combustion. The different types of pulverising mills are

1. Ball mill
2. Hammer mill
3. Ball and race mill.

19. Name the two methods of pulverized fuel firing system?

1. Unit (or) direct system
2. Bin (or) central system.

20. What are advantages of unit (or) direct system of pulverised fuel firing?

1. The layout is simple and economical
2. It gives direct control of combustion
3. Coal transportation system is simple
4. Maintenance cost is less

21. How the ash handling system is classified?

1. Mechanical handling system
2. Hydraulic system
3. Pneumatic system
4. Steam jet system

22. Why ash handling system is' needed?

To remove the ashes from the furnace ash hopper

To transport the ashes from furnace ash - hopper to a storage
To dispose the ashes from the storage

23. Name different types of dust collectors?

1. Mechanical Dust collector
Gravitational separators
Bag house dust collector

There are three types of bag house dust collector

- Open pressure type
- Closed pressure type
- Closed suction type

2. Cyclone. Separators
3. Elector Static Precipitator (ESP)

24. What is the main purpose of chimney?

The main purpose of chimney is to emit the flue gases at a considerable height to avoid nuisance to the surrounding people.

25. What are the different types of load act on the chimney?

There are two types of loads acting on the chimney namely.

Its own weight which is considered to as a single vertical force acting through the centroid, and

The Wind pressure, which is considered as the horizontal force acting on the centroid of vertical projected area.

26. Name different types of chimney

1. Steel chimney
2. Site constructed chimney
3. Plastic chimney

27. Define forced draft and induced draft cooling towers

If the fan is located at the bottom of the tower and air is blown by the fan up through the descending water it is called as forced draft cooling towers

If the fan is located at the top of the tower and air enters through the louvers located on the tower's side and drawn up and discharge through the fan casing, it is called as induced draft.

28. What are the advantages of induced draft cooling tower over forced draft cooling tower?

- i. The outlet water comes in contact with the driest air and warmest water comes in contact with most humid air.
- ii. The re-circulation is seldom a problem.
- iii. The first cost is low due to the reduction in pump power consumption.

29. What are the advantages of hyperbolic natural-draft cooling towers?

Since no fans are used power cost and auxiliary equipments cost is reduced. Hyperbolic tower chimney creates its own draft even when there is no wind. Ground fogging and warm air re-circulation are avoided in hyperbolic towers. The structure is more or less self-supported.

30. What are the factors that affect the rate of evaporation of water in cooling towers?

Amount of water surface area exposed
The time of exposure
The relative velocity of air passing over the droplets
The RH of air
The direction of airflow relative to water.

31. What is the working principle of Cooling Towers?

The hot water is sprayed from the top of the tower, while the air is made to flow from the bottom of the tower to the top. This air cools the hot water in the cooling tower. Air vaporises a small percentage of water, thereby cooling the remaining water. The air absorbs the heat and leaves at the top of the tower and cooled water leaves at the bottom and recirculated to the condenser.

32. Name different types of cooling towers

The cooling towers are classified as follows.

(a) According to the construction of material

1. Timber - for small tower
2. Ferro concrete - for large capacity stations.
3. Multi deck concrete towers - for large steam stations
4. Metallic

(b) According to the nature of air draught-

1. Atmospheric (or) Natural draught cooling system
2. Mechanical draught cooling tower.

33. How the atmospheric (or) natural draught cooling towers- are classified?

In atmospheric (or) natural cooling towers, the natural air provides the required cooling without the use of fans. This is classified into three types.

1. Natural draft spray filled towers
2. Natural draft packed type towers.'
3. Hyperbolic cooling towers

34. How mechanical draft cooling towers are classified?

Mechanical draft cooling tower is classified into three types

1. Forced draft tower.
2. Induced draft counter flow tower
3. Induced draft cross flow tower.

35. How the dry type cooling towers are classified?

The dry type cooling towers are classified into two types 'as follows.

1. Indirect dry type (or) Heller cooling system
2. Direct dry type-cooling system

36. What are the methods to reduce the effects of particulates?

The effects of particulates can be reduced by the following methods.

Coal cleaning

Using improved electrostatic precipitator design

Controlling the dust within allowable limit. This can be done by increasing the height of chimney thereby reducing the concentration

37. What are the equipments used for ash collection?

Electrostatic precipitator

Fly ash scrubbers

Cinder catcher

Cyclone dust collector

38. What is meant by 'Desulphurization' and name the methods adopted for desulphurization?

Desulphurization of fuel is the process of reducing the sulphur content in the fuel. The following methods are adopted for desulphurization.

1. Chemical treatment
2. Forth flotation
3. Magnetic separation

39. What are the methods adopted to remove' S02 flue gases?

1. Wet scrubbing
2. Solid absorbent
3. Catalytic oxidation

40. Write about CO₂ recorders?

In thermal power plants, it is necessary to keep the concentration of CO₂ as low as possible. To achieve this, a constant recording of concentration of CO₂ is necessary. These recorders are based on the three different principles, as given below.

1. Thermal conductivity cell
2. Chemical absorption cell
3. Density balance

92. What is the necessity of Automatic controls for feed water?
The electrical load on power plant varies in an irregular manner. The automatic control provided at a steam power plant successfully meets over the variable load. The automatic control for feed water is necessary since the supply of feed water depends upon plant load.

41. Name some of the automatic controlling methods for feed water?

1. Single element pilot operated system
2. Single element self operated system
3. Two element pilot operated system
4. Three element pilot operated system

42. What is the purpose of automatic combustion control?

The main purpose of 'automatic combustion' control system is to maintain load against demand, to prevent smoke, to increase boiler house efficiency, to carry out routine adjustments and to provide interlocking safe guards.

43. What are the appliances known as boiler accessories?

The appliances used to increase the efficiency of the boiler are known as boiler accessories.

The important boiler accessories are

1. Economiser
2. Superheater
3. Air preheater
4. Feed pump
5. Injector

44. What are the methods adopted to remove SO₂ from due gases?

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49. What is the use of air preheater?

Air pre heater is used to transfer heat from the flue gases to the air before it passes into the furnace for combustion. It is placed between the economizer and chimney. The overall efficiency of the plant may be increased by 10 per cent by the use of air preheater.

50. Write about boiler mountings?

The devices used for the efficient operation, proper maintenance, and safe operation boiler mountings.

The different boiler mountings are

1. Water gauge (or) water level indicator
2. Pressure gauge (or) steam gauge
3. Safety valves
4. Fusible plug
5. Stop valve
6. Blow off cock
7. Feed check valve.

51. What is meant by boiler trial?

Steam is generated in boilers under certain conditions of feed water and exists as steam while a certain amount of fuel is burnt. To study the performance of boiler, some experiments are conducted by operating, the boiler for a certain length of time and recording the data. This procedure is known as boiler trial.

UNIT III NUCLEAR AND HYDEL POWER PLANTS

1. What are the advantages of nuclear power plant?

- a) No pollution by combustion products
- b) Increased reliability of operation
- c) Space requirement is less.

2. What is nuclear fission?

Nuclear fission is the process of splitting of nucleus into two equal fragments accompanied by the release of heat.

3. Define chain reaction.

The chain reaction is the process in which the number of neutrons keeps on multiplying rapidly during the fission till whole of the fissionable material is disintegrated.

4. What do you understand by moderation?

The process of slow down the neutrons from velocity without capturing them is known as moderation.

5. What factors control the selection of a particular type of reactor?

1. Neutrons energy
2. Types of energy
3. Type of coolant
4. Type of moderators
5. Construction of core

6. What are the components of pressurized water reactor nuclear power plant?

1. Reactor
2. pressuriser
3. heat exchanger
4. Coolant pump

7. Give an example for a low head turbine, a medium head turbine and high head turbine.

- a. High head turbine (above 250m) e.g Pelton wheel
- b. Medium head turbine (60m to 250m) e.g Modern Francis turbine
- c. Low head turbine (less than 60m) e.g Kaplan turbine

8. What are reaction turbine? Give example.

In reaction turbine, the runner utilizes both potential and kinetic energies.
Example: Francis turbine and Kaplan turbine

9. Define unit speed of turbine.

Unit speed is defined as the speed of turbine when the working under a unit head.

10. What is draft tube?

The tube which increases the outlet velocity of turbines is called as draft tube.

11. Write the function of draft tube in turbine outlet?

1. It allows the turbine to be set above tail water level without loss of head for doing inspection and maintenance.
2. It regains the major of the kinetic energy delivered from the runner by diffuse action.

12. What are the different types of surge tanks?

1. Simple surge tank
2. inclined surge tank
3. differential surge tank

UNIT IV - DIESEL AND GAS TURBINE POWER PLANT

1. What are the applications of diesel power plant?

1. Peak load plant
2. Mobile Plants
3. Stand By Units
4. Emergency plants
5. Starting station

2. What are the commonly used fuel injection system in a diesel power station?

1. common rail injection system
2. Individual pump injection system
3. Distribution system

3. What are the methods of cooling in a diesel engine power plant?

1. Thermo system cooling
2. forced cooling
3. pressurized cooling
4. Evaporator cooling
5. cooling with thermostatic regulator

4. What are the methods of lubrication system in I.C Engines?

1. Wet Sump lubrication
2. Dry Sump lubrication
3. Mist lubrication system

5. What is meant by auto-ignition?

In C.I engine combustion occurs due to high temperature produced by the compression of the air

6. What is diesel knock?

If the delay period in C.I engines is long a large amount of fuel will be injected and accumulated in the chamber. The auto ignition of this large amount of fuel many cause high rate of pressure rise and high maximum pressure which may cause knocking in diesel engines.

7. What are the measurement used to find frictional power?

1. Willan s line method
2. Morse test
3. Motoring test
4. Difference between I.P and B.P.

8. Mention the various processes of the brayton cycle.

1. Isentropic compression
2. Constant pressure Heat supplied
3. Isentropic expansion and
4. Constant pressure Heat rejection

9. What are the effects of provided the intercooler in the gas turbine cycle?

1. Heat supply is increased
2. It decreases the thermal efficiency
3. Work ratio will be increased
4. Specific volume of air is reduced

10. What is the principle of operation of simple jet propulsion system?

When the works output of the gas turbine plant is used to produce high velocity jet of hot gases and this jet is used to propel the vehicles in which the systems are mounted such systems are kept as jet propulsion system.

UNIT V OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS

1. Define demand factor

Demand factor is defined as the ratio of maximum demand to connected load.

Connected load is the sum of ratings in kW of equipment installed in the consumer's premises.

Maximum demand is the maximum load, which a consumer uses at any time.

2. Define load curve

Load curve is a graphical representation between load in kW and time in hours. It shows variation of load at the power station. The area under the load curve represents the energy generated in a particular period.

3. Define load factor?

Load factor is defined as the ratio of average load to the peak load (or) maximum demand.

4. What includes fixed cost?

Fixed cost includes the following cost.

- | | |
|----------------------|-------------------------|
| 1. Cost of land | 2. Cost of building |
| 3. Cost of equipment | 4. Cost of installation |
| 5. Interest | 6. Depreciation cost |
| 7. Insurance | 8. Management cost |

5. What includes operating cost?

Operating cost includes the following cost.

- | | |
|---|------------------------------|
| 1. Cost of fuel | 2. Cost of operating labour, |
| 3. Cost of maintenance labours and materials. | |
| 4. Cost of supplies like | |
| Water for feeding boilers, for condenser and for general use. | |
| Lubrication oil and, grease. | |
| Water treatment chemicals. | |

6. What is the need of depreciation cost?

Depreciation cost is the amount to be set aside per year from the income of the plant to meet the depreciation caused by the age of service, wear and tear of the machinery and equipments. Depreciation amount collected every year helps in replacing and repairing the

equipment.

7. Write about atomic number?

The nucleus contains protons and neutrons. The number of protons in a given atom is an atomic number (Z). The atomic number for H is 1 and He is 2.

8. Write about isotopes of an element?

Some elements have the same number of protons in the nucleus but different number of neutrons. As a result, these elements have the same atomic number but different mass number. Such type of elements which have the same atomic number same number of protons - the same chemical properties but different mass numbers due to different number of neutrons, are known as the isotopes of an element.

9. What are the requirements to sustain fission process?

The bombarded neutrons must have sufficient energy to cause fission

The number of neutrons produced must be able to create the rate of fission The fission process must generate energy

The fission process must be controlled

10. Define multiplication factor of a fission process.

$$k = \frac{\text{number of neutrons of any one generation}}{\text{number of neutrons of immediately preceding generation.}}$$

11. Define fertile materials and breeding in reactors

There are materials like U^{235} and Th^{232} which are not fissile but can be converted into fissile materials by the bombardment of neutrons. Such materials are known as fertile materials.

The process of converting more fertile material into fissile material in a reaction is known as breeding

12. What are the desirable properties of a good moderator?

It must be as light as possible It must slow down the neutron as quick as possible It must have resistance to corrosion

It must have good machinability

It must have good conductivity and high melting point

13. What are the desirable properties of a coolant?

It should not absorb neutron

Have high chemical and radiation stability Non-corrosive

Have high boiling point Non-toxic

14. Name few types of reactors.

Fast reactors, Thermal reactors, natural fuel reactors, Enriched Uranium reactors, water moderated reactors, heavy water moderated reactor, graphite moderated reactor, gas cooled reactors and Sodium cooled reactors.

15. What are the advantages using CO₂ as coolant?

Gases do not react chemically with the structural materials

Gas can attain any temperature for a particular pressure

They do not absorb neutron

The leakage of gas will not affect the reactivity

The gas coolant provides best neutron economy

16. What are the advantages of breeder reactors?

It gives high power density than any other reactor
High breeding is possible

High burn-up of fuel is achievable

The operation of the reactor is not limited by Xe poisoning

17. What are the demerits of breeder reactor?

Highly enriched fuel is required

Control is difficult and expensive

Safety must be provided against melt down

Handling of sodium is a major problem

18. What are the advantages of Sodium in fast-breeder reactors?

Sodium has very low absorption cross-sectional area

It possesses good heat transfer properties at high temperature and low pressure It

does not react with any of the structural materials used in primary circuits

AMSEC

19. Name the different types of MHD generators

- Open cycle MHD
- Closed cycle MHD
- Closed cycle MHD with liquid metal

20. What is the working principle of magneto hydrodynamic power plant?

The working principle of MHD is as like that of dynamo. Instead of solid conductor high temperature plasma is passed through the magnetic field at sonic speed. When the gas is passed through magnetic field, current is induced. Electrodes collect this induced current.

21. What is the purpose of control rods?

The control rods are used to start the chain reaction, maintain the chain reaction at required level and to shut down the reactor during emergency.

22. What are the different types of load acting on the chimney?

- Its own weight which is considered to act on a single vertical force acting through the centroid
- The wind pressure, which is considered to act on the horizontal force acting on the centroid of vertical projected area.

23. What is meant by Nuclear fission?

Uranium exists in different isotopes of U238, U234 and U235. Out of these, U235 is most unstable. When unstable heavy nucleus is bombarded with high-energy neutrons, it splits up roughly into two equal fragments and about 2.5 neutrons are released and a large amount of energy is produced. This process is called nuclear fission.

24. Name the different components of nuclear reactor?

- 1. Nuclear fuel
- 2. Moderator
- 3. Control rods
- 4. Reflectors
- 5. Reactor vessel
- 6. Biological shielding
- 7. Coolant

25. State some advantages of Pressurized Water reactor?

- The pressurized water reactor is compact
- In this type, water is used as coolant, moderator and reflector water is cheap and available in plenty)
- It requires less number of control rods.

26. What are the advantages of gas cooled reactor nuclear power plant?

- 1. Fuel processing is simple
- 2. The use of CO₂ as coolant completely eliminates the possibility of explosion in reactor.
- 3. No corrosion problem

27. What is breeding in nuclear reactor?

The process of producing fissionable material from a fertile material such as uranium 238 (U238) and thorium 232 (Th 232) by neutron absorption is known as breeding.

28. Name the coolants commonly used for fast breeder reactors?

- Liquid metal (Na (or) Na K)
- Helium (He)
- Carbon dioxide.