

**UNIT – I**

**PART A**

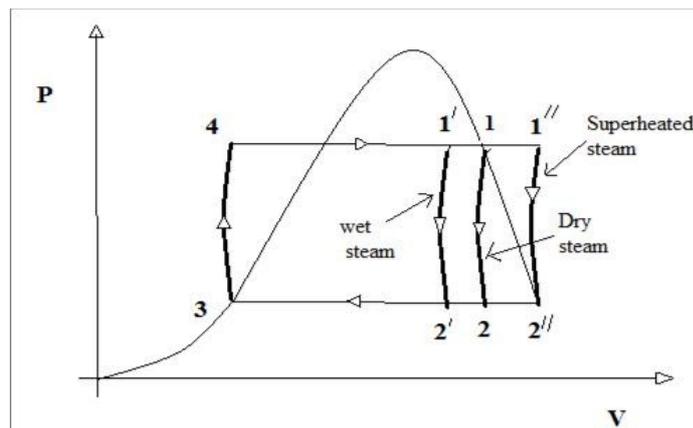
**1. What is a thermodynamic cycle?**

A Thermodynamic cycle is a series of thermodynamic processes transferring heat and work, while varying pressure, temperature, and other state variables, eventually returning a system to its initial state.

**2. What are the processes in a Rankine cycle?**

**(Nov/Dec 2010)**

There are four processes in a Rankine cycle they are



- 1 – 2 Reversible adiabatic expansion in the turbine.
- 2 – 3 constant pressure heat transfer in the condenser
- 3 – 4 Reversible adiabatic pumping process in the feed pump.
- 4 – 1 constant pressure heat transfer in the boiler.

**3. Define – Fluidized Bed Combustion (FBC).**

**(Nov/Dec 2010)**

Fluidized Bed Combustion evolved from efforts to find a combustion process able to control pollutant emissions without external emission controls. The technology

burns fuel a temperature of 1,400 to 1,700 degrees F, well below the threshold where nitrogen oxides form.

FBC systems consist of two major groups

1. Atmospheric systems
2. Pressurized systems

Two minor sub groups

1. Bubbling or Circulating fluidized beds
2. Atmospheric fluidized beds

**4. What is the function of hot primary air? (May/June 2013)**

The functions of hot primary air are

1. It is used to dry the coal in the pulverizer
2. It is used to increase the efficiency of the boiler

**5. What is super – critical boiler? Give any two advantages. (May/June 2013)**

Super – critical boiler is defined as a large number of steam generating plants are designed between working pressure ranges of 125atm to 300atm and temperature range of about 510° C to 660° C. The super – critical boiler requires only preheater and super heater.

The main advantages of super – critical boilers are

1. High thermal efficiency.
2. Heat transfer rate is high.
3. The erosion and corrosion are minimized.

**6. Mention the various modern ash handling systems. (April/May 2010)**

The various modern ash handling systems are

1. Gravitational separator
2. Cyclone separator

3. Packed type scrubber
4. Spray type wet collector
5. Electrostatic precipitator

**7. What are the factors affecting cooling of water in cooling tower?**

**(April/May 2010)**

The factors affecting cooling of water in cooling towers are

1. The explosive time
2. Amount of water surface exposed
3. Relative humidity of air
4. Velocity of air
5. Accessibility of air to various parts of cooling

**8. What is the necessity of feed pump in thermal power plant?**

**(Nov/Dec 2011)**

The feed pump is a pump which is used to deliver feed water to the boiler. It is desirable that the quantity of water supplies should be at least equal to that of evaporated which is supplied to the engine.

**9. Mention the advantages of pulverized fuel firing system.**

**(Nov/Dec 2011)**

The advantages of pulverized fuel firing system are

1. Combustion rate is increased
2. Thermal efficiency is increased
3. Fuel feed rate is increased

**10. List out the major advantages of high pressure boilers in modern thermal power plants.**

**(Dec 2004)**

The major advantages of high pressure boilers in modern thermal power plants are

1. It gives high working pressure
2. It can be easily transposed
3. It can be quickly started

## UNIT – II

### PART A

- 1. What is the function of draft tubes? (May/ June 2013)**

The function of draft tubes is to allow the turbine to be set above the tail race to facilitate inspection and maintenance. It also regains the major portion of the kinetic energy at runner outlet by diffuser action.

- 2. Write any four advantages of hydro-electric power plant. (May/ June 2013)**

The advantages of hydro-electric power plant are

3. Water source is perennially available.
4. Running cost is very low.
5. Power generation can be switched on and off in a very short time.
6. Non-polluting
7. Greater reliability
8. High efficiency
9. Suitable for spinning reserve
10. Man power requirement is low.
11. Simple in design and operation.

- 3. What is a surge tank? (Nov/ Dec 2010), (April/ May 2010)**

A surge tank is a small reservoir in which the water level rises or falls to reduce the pressure swings during opening and closing of inlet valve. The surge tank is not required for run off plants and medium head plants. Surge tanks are used to control the pressure in the penstock.

- 4. What are the advantages of impulse turbine? (April/ May 2010)**

The advantages of impulse turbine are

3. Greater tolerance of sand and other particles in the water
4. Better access to working parts
5. No pressure seals around the shaft
6. Easier to fabricate and maintain
7. Better part-flow efficiency

- 5. What is the purpose of trash rack? (Nov/ Dec 2010)**

The purpose of trash rack is to catch trash and other things such as fish from water before it is being sent into the impeller unit of a hydro station. It is a moving rack with an automatic backwash that allows self clearing and non-killing removal of fish.

- 6. What is the function of surge tank in hydro electric power plant? (Nov/ Dec 2011)**

The function of surge tank in hydro-electric power plant is to control the pressure in the penstock. Surge tanks are required for high head plants where the water is taken to the power house through tunnels and penstocks.

**7. What are the different types of spillways?**

**(Nov/ Dec 2011)**

The different types of spillways are

11. Ogee spillway
12. Chute (Through) spillway
13. Side channel spillway
14. Shaft (Morning glory or Glory hole) spillway
15. Siphon spillway

**8. Write the formula to calculate the hydraulic power produced by a hydro turbine.**

The hydraulic power is given as

$$P = \rho g Q H$$

where

- P – Hydraulic energy in Watt
- g – Acceleration due to gravity ( $9.81 \text{ m/s}^2$ )
- $\rho$  - Water density ( $1000 \text{ kg/m}^3$ )
- Q – Flow or discharge ( $\text{m}^3/\text{s}$ )
- H – Height of fall of water or head in meter.

**9. What are the factors influencing the selection of site for hydro-electric power plant?**

The factors that influencing the selection of site for hydro-electric power plant are

6. Availability of water and water head
7. Accessibility of site
8. Water storage capacity
9. Distance from the load centre
10. Type of land

**10. What are the types of hydro power plants based on quality of water available?**

The types of hydro power plants based on quality of water available are

4. Run-of-river plant without pondage
5. Run-of-river plant with pondage
6. Plant with storage reservoirs
7. Pumped storage plants
8. Mini and micro hydro plants

## UNIT – III

### NUCLEAR POWER PLANTS

#### PART A

- 3. What is LMFBR? Why is a liquid metal preferred for coolant in a fast breeder reactor? (May/June 2013)**

LMFBR is Liquid Metal Fast Breeder Reactor which produces more fissionable fuel than they use. This is possible because the non-fissionable U-238 is 140 times more abundant than the fissionable U-235.

Cooling and heat transfer are done by liquid metals. Liquid metals such as Sodium and Lithium are the preferred coolants in a fast breeder reactor, with sodium being the most abundant and most commonly used.

- 4. Define – Mass Defect (May/June 2013)**

Mass defect is defined as the difference in mass between the mass of an atom and the sum of the masses of the protons, neutrons and electrons of that atom.

- 5. What are the requirements of fission process? (April/ May 2010), (Nov/ Dec 2010)**

The requirements of fission process are

1. The total binding energy of the resulting elements must be greater than that of the starting element.
2. No. of neutrons lost to fission must be kept low.
3. Speed with which chain reaction proceed must be very fast.

- 6. What are the essential components of a nuclear power plant? (April/ May 2010)**

The essential components of a nuclear power plant are

1. Fuel rods
2. Reactor
3. Steam line
4. Generator
5. Containment
6. Radioactive and non-radioactive water loop
7. Control rods
8. Heat exchanger
9. Pump
10. Turbine
11. Cooling water tower

- 7. What is the function of a moderator? (Nov/ Dec 2010)**

The function of moderator is to slow down the neutrons released from fission so that they cause more fission. It is usually water, but may be heavy water or graphite.

**8. What is known as binding energy?**

**(Nov/Dec 2011)**

Binding energy is the energy required to split a nucleus of an atom into its component parts such as neutron and protons which are also collectively called as nucleons.

It is used to determine whether for that particular atom, fission or fusion reaction will be a favorable process.

**9. What is the function of pressurizer in pressurized water reactor? (Nov/Dec 2011)**

The function of pressurizer is to ensure the constant pressure. If pressure falls in the primary circuit, water in the pressurizers is heated up by electric heaters, thus raising the pressure. If pressure increases, colder cooling water is injected to the pressurizer. Since the upper part is steam, pressure will drop.

**10. What is the purpose of reprocessing of nuclear waste?**

The purpose of reprocessing of nuclear waste is to separate the waste from the uranium and plutonium which can they be recycled into new fuel. The reprocessing effectively reduces the volume of waste and limits the need to mine new supplies of uranium, so that extending the life time of the resources.

**11. What are the various types of nuclear reactor?**

The various types of nuclear reactor are

1. Pressurized Water Reactor (PWR)
2. Boiling Water Reactor (BWR)
3. Pressurized Heavy Water Reactor (PHWR)
4. Liquid Metal Fast Breeder Reactor (LMFBR)
5. High Temperature Gas cooled Reactor (HTGR)
6. Advanced Gas cooled Reactor (AGS)
7. Basic Gas-cooled Reactor (Magnox)
8. Advanced Pressurized Water Reactor (AP 600)
9. Advanced Liquid Metal Reactor (ALMR)
10. Integral Fast Reactor (IFR)
11. Modular High Temperature Gas cooled Reactor (MHTGR)
12. Simplified Boiling Water Reactor (SBWR)

**10. What are the various types of radiation associated with nuclear fission?**

The various types of radiation associated with nuclear fission are

1. Alpha radiation
2. Beta radiation
3. Gamma radiation
4. Neutron radiation

## UNIT – IV

### GAS AND DIESEL POWER PLANTS

#### PART A

**12. Write the classification of oil injection system.**

**(May/June 2013)**

The classifications of oil injection system are

1. Common rail injection system
2. Individual pump injection system
3. Distributor system

**13. What is meant by regeneration in gas turbine power plant?**

**(May/June 2013)**

The temperature of exhaust gas leaving the turbine is quite high in the gas turbine power plant. This exhaust gas can be utilized to preheat the air at temperature  $T_2$  before it enters into the chamber. This process is called as regeneration.

**14. Write the advantages and disadvantages of gas turbine power plant.**

**(April/ May 2010), (Nov/Dec 2011)**

The advantages of gas turbine power plant are

1. Less warm up time is required.
2. The floor space required by a gas turbine is less when compared to steam turbines.
3. The gas turbine power plant can be started up as well as shutdown quickly.
4. It has high thermal efficiency of the order of 37%
5. Only less amount of cooling water is required.
6. No ash disposal problem.

The disadvantages of gas turbine power plant are

1. No load and partial load efficiencies are low.
2. High sensitive to component efficiency
3. The efficiency depends on ambient pressure and temperature.
4. High air rate is required to limit the maximum inlet air temperature. Hence exhaust losses are high.
5. Air and gas filter are required to prevent dust into the combustion chambers.

**15. Write the applications of diesel power plant.**

**(April/ May 2010)**

The applications of diesel power plant are

1. Used as peak load plants
2. Suitable for mobile plants
3. Used as standby units
4. Used as emergency plant
5. Used for small and nursery stations
6. Used in small capacity central station

**16. What are the applications of gas turbine power plant?**

**(Nov/ Dec 2010)**

The applications of gas turbine power plant are

1. Surface vehicles – Ships, locomotives, helicopters, etc,
2. Road vehicles – Racing cars, conqueror tanks, trains, etc,
3. Marine applications – Naval, civilian maritime, etc,

**17. What are the various components in a diesel engine power plant?**

**(Nov/Dec 2010)**

The various components in a diesel engine power plant are

1. Diesel engine
2. Exhaust system
3. Cooling system
4. Air intake system
5. Fuel system
6. Lubricating system

**18. What are the functions of lubrication system?**

**(Nov/Dec 2011)**

The functions of lubricating system are

1. Lubricating
2. Cooling
3. Cleaning
4. Sealing
5. Noise absorption

**19. What are the various working fluids in gas**

**turbine?** The various working fluids in gas turbine are

1. Air
2. Helium
3. Argon
4. Carbon-dioxide

**20. Write the various factors that influence the performance of gas turbine.**

The various factors that influence the performance of gas turbine are

1. Part load efficiency
2. Fuel combustion
3. Air mass flow rate
4. Thermal efficiency
5. Regeneration

**10. What are the starting methods of diesel engine?**

The starting methods of diesel engine are

1. By an auxiliary engine
2. By an electric motor
3. By compressed air

**UNIT V**

**NON-CONVENTIONAL POWER GENERATION**

**PART A**

**1. What are the classifications of OTEC based on location and cycle? (May/June 2013)**

The classifications of OTEC based on location

1. Land plant
2. Shelf based plant
3. Floating plant

1. Open cycle
2. Closed cycle
3. Hybrid cycle

**2. What are the classifications of geothermal energy conversion system? (May/June 2013)**

The classifications of geothermal energy conversion system are

1. Single cycle geothermal power plant
2. Binary cycle geothermal power plant

**3. What is a fuel cell? (April/ May 2010)**

A fuel cell is a device that converts the chemical energy of a fuel (hydrogen, natural gas, methanol, gasoline, etc.) and an oxidant (air or oxygen) into electricity. In principle, a fuel cell operates like a battery. Unlike a battery however, a fuel cell does not run down or require recharging. It will produce electricity and heat as long as fuel and an oxidizer are supplied.

**4. What are the advantages and disadvantages of tidal power plant? (April/ May 2010)**

The advantages of tidal power plant are

1. Tidal power is renewable and sustainable energy resource.
2. It produces no solid or liquid pollution.
3. It has little visual impact.
4. Tidal power exists on a worldwide scale from deep ocean waters.

The disadvantages of tidal power plant are

1. It will not help in reducing the overall need for fossil power stations, but only allow them to run at lower rating for a certain amount of time.

2. Tidal power schemes have a high capital cost and a very low running cost.
3. Do not generate electricity at steady state.
4. This method of generating power is not economical on a large scale in comparison with the conventional power sources.

**5. Define – Photo-voltaic Cell**

**(Nov/ Dec 2010)**

Photo-voltaic cell is defined as a specialized semiconductor diode that converts visible light in DC. Some PV cells can also convert infrared (IR) and ultraviolet (UV) radiations into DC. PV cells are integral part solar-electric energy systems, which are becoming important as an alternate source of utility power.

**6. What are the classifications of MHD Power Generation?**

**(Nov/Dec 2010)**

The classifications of MHD power generation are

1. Open cycle systems
2. Closed cycle systems
  - a) Seeded inert gas systems
  - b) Liquid metal systems

**7. What are the factors to be considered for suitable site selection of tidal power plant?**

**(Nov/Dec 2011)**

The factors to be considered for suitable site selection of tidal power plant are

1. Volume of water moving around during the tide or the cubature of the tidal flow
2. Interruption of the flow of normal shipping traffic
3. It should be able to construct a barrage which stores the maximum quantity of water with minimum cost of construction.
4. Speed and volume of water passing through the site

**8. What are the main parts of geothermal power plant?**

The main parts of geothermal power plant are

1. Production well
2. Vaporizer
3. Circulating pump
4. Expansion tube
5. Generator
6. Condenser
7. Transformer

**9. What are the various types of solar energy collectors?**

The various types of solar energy collectors are

1. Stationary or Non-concentrating collectors
  - a) Flat plate collector
  - b) Compound parabolic collector
  - c) Evacuated tube collector

2. Sun tracking concentrating collectors
  - a) Single axis tracking
  - b) Two-axis tracking

**10. Write the advantages and disadvantages of wind power generation.**

The advantages of wind power generation are

1. In exhaustible fuel source
2. No pollution
3. Excellent supplement to other renewable source

The disadvantages of wind power generation are

1. Low energy production
2. Expensive maintenance