

POWER PLANT ENGINEERING.**UNIT III- POWER FROM RENEWABLE ENERGY****1. What are the components of solar energy?**

1. Collector
2. Storage unit

2. What is concentration ratio?

Concentration ratio is defined as the ratio between the aperture area and the receiver absorber area of the collector.

3. List the various types of solar energy collectors.

1. Stationary collectors (or) Non- concentrating
 - (a) Flat plate collectors
 - (b) Compound parabolic collectors
 - (c) Evacuated tube collectors
2. Sun tracking concentrating collector
 - (a) single axis tracking
 - (b) Two-axis tracking

4. List any four applications of solar collectors.

1. Solar water heating
2. Solar space heating systems
3. Solar refrigeration
4. Industrial process heat systems

5. List the four important solar systems.

1. Low temperature cycles using flat plate collector or solar pond
2. Power tower or central receiver system
3. Distributed collector system
4. Concentrating collectors for medium and high temperature cycle

6. List the advantages of solar Energy.

1. Solar energy is free from pollution
2. They collect solar energy optically and transfer it to a single receiver, thus minimizing thermal-energy transport requirements
3. They typically achieve concentration ratios of 300 to 1500 and so are highly efficient both in collecting energy and converting it to electricity.
4. The plant requires little maintenance or help after setup
5. It is economical

7. List any four disadvantages of solar energy.

1. Available in day time only
2. Need storage facilities
3. It needs a backup power plant
4. Keeping back up plants hot includes an energy cost which includes coal burning

8. List the classification of OTEC based on location.

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

9. List the classification of OTEC based on cycle.

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

10. List any four benefits of OTEC.

1. Airconditioning
2. Chilled soil agriculture
3. Aquaculture
4. Desalination

11. List any four disadvantages of OTEC.

1. Degradation of heat exchanger performance as dissolved gases.
2. Degradation of heat exchanger performance by microbial fouling
3. Improper sealing
4. Parasitic power consumption by exhaust compressor

12. List the various components of wind energy system.

1. Rotor
2. Gearbox
3. Enclosure
4. Tailvane

13. What are the two basic design of turbines?

1. Vertical axis (or) Egg beater style
2. Horizontal axis (propeller style) machines

14. Write down the various types of wind power plants.

1. Remote
2. Hybrid
3. Grid connected

15. List any four advantages of wind turbine.

1. Inexhaustible fuel source
2. No pollution
3. Excellent supplement to other renewable source
4. Its free

16. List the disadvantages of wind power generation.

1. Low energy production
2. Expensive maintenance

17. What are the various ways of creating tidal energy?

1. Tidal Barrager
2. Tidal fences
3. Tidal turbines

18. List the various types of turbines used in tidal power station.

1. Buld turbine
2. Rim turbine
3. Tubular turbines

19. What are the components of tidal power station?

1. Barrage
2. Turbines
3. Sluices
4. Embankments

20. List any four advantages of tidal power generation.

- b1. Renewable and sustainable energy
2. No liquid or Solid pollution
3. Little visual impact
4. Reduces dependence upon fossil fuels

21. List the limitations of tidal energy.

1. Orientation problem
2. Requires storage devices
3. Available at a lower rating and time
4. High capital cost

22. What are the main parts of geothermal power plant?

1. Production well
2. Vaporizer
3. Circulating pump
4. Expansion turbi

5. Generator

6. Condenser

7. Transformer

23. What are the classifications of geothermal energy conversion system?

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

24. What are the applications of geothermal energy?

1. Generation of electric power
2. Space heating for building
3. Industrial process heat

25. What are the advantages of geothermal energy?

1. Cheaper
2. Versatile in its use
3. Delivers greater amount of energy

26. What are the disadvantages of geothermal energy?

1. Drilling operation is noisy
2. It needs large areas of exploitation of geothermal energy
3. Low overall power production efficiency.

27. What are the classification of MHD system?

1. Open cycle systems
2. Closed cycle syste

6

UNIT - III

1. Give the lay out of diesel Power plant & Schematic.

The air & Fuel mixture are working in diesel engine power plants the atmospheric air is coming inside the combustion chamber during the suction stroke & Fuel is inject through the injection pump

Schematic diagram of diesel Power plant.

Application of diesel Power Plant:-

- Quite suitable for Mobile Power generation
- used as Peak load plants in combine with thermal or hydro plants

→ used as stand by plant.

Advantages:-

- Diesel Power plants cheaper
- occupy less space
- lay out simple
- Design & installation simple
- respond vary load
- no stand by losses.

Disadvantages:-

- Repair & Maintenance cost are high
- Plant capacity is limit
- Life of diesel plant low.

2) with aid of block diagram, explain working of closed cycle gas turbine power plant. Maximum steam temperature in a power cycle exceed 600°C but pulverize coal furnace temp is 1200°C .

Combined plants are of following types:-

1. Gas turbine - steam turbine plant
2. MHD - Gas turbine P.P.
3. Gas turbine & combined cycle.

Gas turbine - steam turbine plant

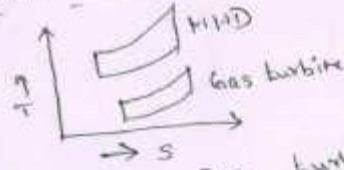


In combination of simple gas turbine power plant & steam boiler & steam produced by using this heat from exhaust gas turbine is recover by a heat recovery boiler.

$$\eta = \eta_1 + \eta_2 - \eta_1 \eta_2$$

overall $\eta\%$ may be 40 - 45%

MHD - Gas turbine - Power plant:



one MHD & one gas turbine P.P are connect in series heat reject

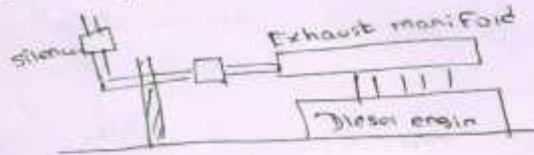
Gas turbine & combined cycle cogeneration plant:-

The power plant produces both thermal & electrical energy called cogeneration plant.

7
 3. Draw & explain Air intake system & Exhaust System.
 The purpose of exhaust is to discharge engine exhaust to atmosphere outside building. It has silencers & connecting ducts.

Diagram of Exhaust System.

waste heat boilers may be provide with exhaust to utilize heat energy. IF air heating is required the exhaust pipe from engine is surrounded



Air intake system



→ Dry or oil bath Filter
 - oil impingment type of filter.
 Following precaution should be taken.

- i Air intake should not be locate inside engine room.
- ii Air should not taken from confined space.

4. with neat sketch explain various types of lubricating system:-
 Include oil pump, oil tank, Filter, cooler & pipes

The various lubricating system in IC engines may be

- (i) wet sump lubrication
- (ii) Dry sump lubrication
- (iii) mist lubrication

Wet sump lubrication systems:-

1. splash system
2. Semi pressure system
3. Full pressure

splash system:-

* Diagram

Oil reach lower portion of cylinder walls, crank shaft & other parts due to splash of oil

(ii) semi pressure system:-

→ Partial pressure lubricating system.

The system is used if bearing loads are heavy & splash lubrication not sufficient

(iii) Full pressure system:-

oil pump, oil gallery, pressure release valve, oil filter, oil pressure gauge.

Dry sump lubrication system:-

lubricating oil stored in oil sump

Called wet sump system.

Mist Lubricating Systems:- Most of 2 strokes crank

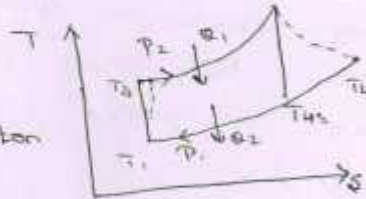
charged. They employ crank case compression

adding 2 to 3% lubricating oil in fuel,

The mixture of oil & fuel is induced

5) with neat sketch briefly explain to derive the brayton cycle:

Brayton cycle is use to analyse the gas turbine plant with reference to brayton cycle shown above



Heat supplied $Q_1 = m_a c_p (T_3 - T_2)$

m_a = mass of air

Heat rejected $Q_2 = m_a c_p (T_4 - T_1)$

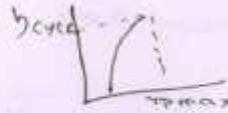
$$\frac{T_{2s}}{T_1} = \frac{T_3}{T_{4s}}$$

$$= \left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}}$$

$$= r_p^{\frac{\gamma-1}{\gamma}}$$

$$\eta_c = \frac{T_{2s} - T_1}{T_2 - T_1}$$

$$\eta_T = \frac{T_3 - T_4}{T_3 - T_{4s}}$$



$$T_1 - T_{2s} = T_3 - T_{4s} - T_1$$

$$\eta_{cycle} = 1 - \frac{1}{r_p^{\frac{\gamma-1}{\gamma}}}$$

$$W_{net} = Q_1 - Q_2 = w_T - w_C$$

$$= m_a c_p (T_3 - T_{2s} - T_{4s} + T_1) w_{net}$$

Substitute $T_{2s} = T_{4s}$ $T_3 = T_{max}$

$$w_{net} = m_a c_p (T_{max} - T_{min})^2$$

6) Explain in brief about Effects of Regeneration:

The temp of exhaust gas leaving turbine is quite high this exhaust gas can be utilize to preheat air at temp T_4 .

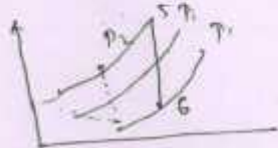
$$\Sigma = \frac{\text{Actual temp rise}}{\text{Max temp rise possible}}$$

$$= \frac{T_5 - T_2}{T_4 - T_2}$$



Effect of inter cooling:-

By staging compression process 1-2, 3-4 with perfect inter cooling the cycle h% decreases.
 where small cycle 1-2-3-4-1



Effect of Reheat:-

By staged heat supply process with combustor & reheater cycle h% decreases

$$P_r = P_1 P_2$$

7) List out the advantages, disadvantages & application of Diesel Power plants:-

Advantages:-

- Easy to design & install.
- Easily avail in standard quantity.
- Can respond to load change
- Less stand by loss
- less space
- Start & stop quickly.
- capital cost low
- High efficiency.

Disadvantages:-

- High operating cost
- Noise Pollution
- Capacity restricted

Application:-

- used as peak load
- emergency power

