

STEAM TECHNOLOGY [90]

Attempt all Questions. Tables & charts are allowed. Assume any missing data.

QUESTION NO. One: JM30]

Objective Type Questions

Choose the correct statement;

1. A Boiler is said to be fire – tube boiler if ?

- (a) water passes through tubes and hot products of combustion from furnace are around the tubes
- (b) the hot products of combustion passes through the tubes and water around it
- (c) forced circulation takes place
- (d) none of the above

2. A Boiler is said to be water tube boiler if

- (a) Water passes through tubes and hot products of combustion are around the tubes
- (b) the hot products of combustion passes through the tubes and water around it
- (c) forced circulation takes place
- (d) none of the above

3. Which of the following is a fire tube boiler

- (a) Lancashire boiler
- (b) locomotive boiler
- (c) Cochran boiler
- (d) all of the above

4. Which of the following is a water tube boiler

- (a) Babcock and Wilcox boiler
- (b) stirling boiler
- (c) yarrow boiler
- (d) all of the above

5. A Device, which is used to generate and supply steam at a high pressure and temperature, is called

- (a) steam turbine
- (b) steam boiler
- (c) steam engine
- (d) none of the above

6. The rate of flow of steam in case of water tube boilers as compared to fire tube boiler is:

- (a) Less
- (b) more
- (c) same
- (d) none of the above

7. A Benson boiler requires

- (a) Two drums
- (b) One drum
- (c) no drum
- (d) three drums

8. Maximum heat loss in a boiler occurs due to

- (a) flue gases
- (b) uncomplete combustion
- (c) un burnt carbon
- (d) moisture in fuel

9. Locomotive type boiler is

- (a) vertical tubular fire-tube type
- (b) horizontal tubular water-tube boiler
- (c) horizontal multi-tubular fire-tube boiler
- (d) none of the above

10. Draught produced by a chimney is known as

- (a) induced draught
- (b) forced draught
- (c) natural draught
- (d) none of the above

11. Stack refers to a chimney which is made of
 (a) masonry structure (b) concrete structure (c) metal (d) none of the above
12. Nozzle is designed for
 (a) maximum pressure at outlet (b) maximum discharge
 (c) maximum pressure and maximum discharge (d) none of the above
13. The fitting mounted on the boiler, whose function is to prevent the steam pressure in a boiler exceeding a fixed maximum pressure, is called
 a) Safety valve b) Stop valve c) Fusible valve d) Blow off cock
14. The fitting mounted on the boiler, whose function is to control the flow of steam from boiler to the main steam boiler pipe and to shut off steam completely when required, is called
 a) Safety valve b) Stop valve c) Fusible valve d) Blow off cock
15. The fitting mounted on the boiler, whose function is to empty the boiler when required and discharge mud and scale which are accumulated at the bottom of boiler is called
 a) Safety valve b) Stop valve c) Fusible valve d) Blow off cock
16. The fitting mounted on the boiler, whose function is to regulate the supply of water pumped into the boiler by the feed pump is called
 a) Water level indicator b) Feed check valve c) Blow off Water d) Stop valve
17. The device, which indicates the exact level of water in the boiler at any instant, is called :
 a) water level indicator b) Feed check valve c) Blow off Water d) Stop valve
18. A device, whose function is to heat feed water by utilizing the heat in the exhaust flue gases before leaving through the chimney, is called
 a) super heater b) economizer c) air preheater d) none of the above
19. A device in which the heat of the combustion products is utilized first dry wet steam and then to rise its temperature without raising its pressure, is called
 a) super heater b) economizer c) air preheater d) feed pump
20. A device in which some portion of waste heat of flue gases is recovered to heat the air before it passes into the furnace for combustion purposes, is called
 a) super heater b) economizer c) air preheater d) feed pump
21. A device, which is used for pumping water into the boiler and also for heating the feed water, is called
 a) Economizer b) feed pump c) injector d) air preheater
22. A device used for raising the pressure of feed water, is called
 a) economizer b) feed pump c) injector d) air preheater
23. Which of the following are boiler mountings?
 a) economizer b) fusible plug c) superheating d) injector
24. Which of the following are boiler accessories?
 a) Safety valve b) stop valve c) economiser d) blow of clock
25. Choose the wrong statement
 a) Safety valve is a boiler mounting b) Economizer is a boiler accessories
 c) The supply of water pumped into the boiler is regulated by feed check valve
 d) Super heater heats the feed water by utilizing the heat in the exhaust the gases before having through the chimney
26. The function of high steam ... and low water safety valve is
 a) to blow out if the steam pressure is higher than the working pressure
 b) to blow out steam when the water level in the boiler is low
 c) both (a) and (b) d) none of the above

27. which safety valve of the following should be used for portable boilers?

- a) dead weight safety valve b) spring loaded safety valve
c) lever safety valve d) high steam and low water safety valve

28. The cost of reheat equipment consisting of boiler, piping and controls may be more than of the conventional boilers by:

- a) 5% to 10% b) 10% to 12%
c) both (a) and (b) d) none of the above

29. There is an optimum pressure at which the steam should be removed for reheating, the whole steam is removed from the high pressure exhaust, where the pressure is about:

- a) 5% of boiler pressure, b) 10% of boiler pressure,
c) 15% of boiler pressure, d) 20% of boiler pressure,

30. There is an optimum pressure at which the steam should be removed for reheating, the whole steam is removed from the high pressure exhaust, where the pressure is known and after undergoing a pressure drop should be

- a) 5% of reheat pressure, b) 10% of reheat pressure,
c) 15% of reheat pressure, d) 20% of reheat pressure,

31.- Economizer are located relative to after or before feed pump, comment?.

- a) after feed pump b) before feed pump
c) without feed pump d) non of the above

QUESTION NO. Two: [M20]

(a) A Steam power plant operates on Reheat cycle, the pressure limits of 50 bar and 5Kpa with steam mass flow rate of 1500 kg/min. Steam enters both stages of the turbine at 500 °C. If the moisture content of the steam at the exit of turbine not to exceed 5%, and the efficiency of high pressure turbine is 0.85% while the pressure losses in the reheat is 0.5 bar, the efficiency of low pressure turbine is causes entropy generation of 0.3 kJ/kg .K. Determine:

- 1- the efficiency of low pressure turbine;
- 2- the net power output and the thermal efficiency of the cycle,
- 3- optimum pressure at which the steam should be removed for reheating, Show the cycle on (T-s) and (h-s) diagrams

(b) What are the different methods used for reheating the steam? Discuss the merits and demerits of different systems? Explain the Main Advantages and Disadvantages of Reheat cycle.

(c) Show with the help of drawing What are the different arrangements used for the disposal of bled steam condensate? List out merits and demerits of each over others.

NO. THREE: [M20]

(a) As a mechanical Engineer in charge of a Power plant:

- 1- Explain in a table a complete comparison between Fire-tube and Water-tube Boilers?
- 2- Explain in detail the steps of Hydrostatics test?

(b) For determining the dryness fraction of steam, it is passed through a separating throttling calorimeter. The absolute pressure of steam before throttling is 8 bars, the pressure and temperature of steam after throttling are 4 mm of Hg above atmosphere and 120°C respectively. At the separator, 0.5 kg of water is trapped and 3.2 kg of condensed water is collected from the condenser. Determine the dryness fraction of steam in the main line.

(c) A steam turbine develops 200 kW. with a consumption of 15.12kg/h.kw. The pressure and temperature of the steam entering the nozzle are 12 bar and 220°C. The steam leaves the nozzles at 1.2 bar. If the diameter of the nozzle at throat is 7 mm, find the number of nozzles required. If 8% of the total enthalpy drop is lost in friction in the diverging part of the nozzle, determine the diameter at the exit of nozzle and the quality of steam leaving the nozzle.

QUESTION NO. FOUR: [M20]

(a) As a mechanical Engineer What are the different factors necessary for ideal boiler includes?. Give an outline sketch showing the arrangement of Water tubes boiler. Indicate on it the positions of water indicator level, fusible plug, blow off cock, and superheater .Mention the function of each.

(b) What are the common types of chimneys, and the advantages and disadvantages of each?

(c) Find the mass of flue gases flowing through the chimney when the draught produced is equal to 20 mm of water. Temperature of the flue gases is 297°C and ambient temperature is 27°C. The flue gases formed per kg of fuel burned are 20 kg. Diameter of the chimney is 2 meters. Neglect the losses.

مع أطيب التمنيات بالتوفيق
Dr ALY ELBOUZ