

2013

STEAM GENERATOR & ITS AUXILIARIES

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following :

10x1 = 10

i) The function of scanner air fan in any coal fired
Thermal Power Plant is

- a) to mix scanning air with primary air for supplying
excess air
- b) to prevent ingress of coal dust in flame scanners
- c) to prevent overheating of flame scanners from
radiation heat
- d) to increase the turbulence in the pulveriser
discharge pipe.

ii) The arrangement provided to arrest furnace distortion
is

- a) Buckstay girders
- b) Expansion joints
- c) Anchors
- d) all of these.

iii) Steam separation inside the drum takes place under
which principle ?

- a) Centrifugal Action
- b) Gravity Separation

- c) Heating of Steam
- d) Centrifugal Action and Gravity Separation.
- iv) In the boiler economizer tubes allowable type of heat addition is
 - a) sensible
 - b) nucleate Boiling
 - c) no boiling is desirable in boiler economizer tubes
 - d) departure from nucleate boiling.
- v) In Electrostatic Precipitator
 - a) collecting electrodes are negatively charged
 - b) collecting electrodes are positively charged
 - c) emitting electrodes are positively charged
 - d) emitting electrodes are not charged.
- vi) In a boiler the function of desuperheater is to
 - a) keep the superheated steam at rated condition
 - b) recirculate steam from boiler drum
 - c) increase the sensible heat gain from the flue gases
 - d) maintain the rated steam parameters of reheater during normal operation.
- vii) The medium used to atomize the heavy furnace oil (HDO) for ignitors and warm up guns is
 - a) superheated steam
 - b) saturated steam
 - c) compressed service air
 - d) compressed instrument air.
- viii) Water flow in the boiler is
 - a) Feed regulating →drum →economiser →water wall tubes→ top header →drum
 - b) Economiser →drum→ downcomers →feed regulating station→ bottom ring header →water

wall tubes → top header → drum

c) Feed regulating station → economizer → drum →

downcomers → bottom ring header → water wall

tube → top header → drum

d) none of these.

ix) Orifice nozzles are provided in the coal carrier pipelines

leading to different coal burners of boiler at

various elevations and locations from each coal

pulverizer to facilitate

a) measurement of coal air velocity to burners

b) equal amount of coal air flow to all the corners

c) increase in the velocity of coal air mixture

d) increase in internal pressure of mill.

x) Dissolved oxygen must be removed from boiler water to

avoid

a) Corrosion

b) Foaming

c) Caustic embrittlement

d) Blow down.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What are the various types of bio-fuels that can be used for steam generation ? Mention the advantages of pulverized coal firing. $2 + 3$

3. Define boiling. What are the different types of boiling and how do they affect the steam generation ? $1 + 4$

4. Why superheated steam pressure in sub-critical boiling of modified Rankine cycle is kept at about 160 bar ? Define critical point of boiling. $3 + 2$

5. Why is there a need for demineralization of water ? Why are

ID fans preferred with backward aerofoil blading and FD fans with forward curved blading ? 1 + 2 + 2

6. What is a soot blower ? Why are downcomers provided ?

Sketch the trough seal arrangement and label. 1 + 2 + 2

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 15 = 45

7. Describe with a neat sketch, the T-S diagram of modified Rankine steam cycle of a modern power station. How does the heat addition take place in boiler in different heat traps ?

What are the various steam temperature control devices used in a power station ? 4 + 8 + 3

8. What are the main equipment used in coal handling plant for a coal fired power plant ? Calculate the heat and work transfers, cycle efficiency, work ratio and specific steam consumption of Rankine cycle operating between 25 bar and 0.04 bar with a superheat temperature 450 deg. C.

Compare the parameters when cycle changes to Carnot cycle (saturated steam). Use steam table and neglect pump work. 4 + 8 + 3

9. Draw a schematic layout of air-flue gas circuit of a coal fired power station. Explain the draft arrangement at the various locations with respect to layout of heat traps. Why is flue gas recirculation done ? What types of arrangements are provided at present to minimize NO_x and SO_x generation from boiler ? 5 + 6 + 2 + 2

10. A boiler is producing 0.95 dry steam at the rate of 25 tons per hour at 800 kN/m² pressure at steam drum outlet.

After passing through superheater the final steam temperature is 300 deg. C.

(a) Determine the amount of heat added per kg of steam

per second.

(b) Determine the change in specific volume and internal energy of steam after passing through superheater.

Assume C_p (for superheated steam) = 2.093 and neglect frictional pressure drop in superheater steam flow. 7 + 8

11. What is the various coal feeding arrangements used in coal fired power station ? Coal is fed to a boiler of steam generation capacity 700 MT per hours operating at 150 kg/cm² pressure and supplying steam to turbine at 540 deg C. The boiler is running at 90% thermal efficiency and gross heating value of coal is 4500 kcal/kg, having 15% moisture and 10% overall unburnt carbon loss. Find the specific coal consumption per unit of steam generation. (Use steam table for specific values). 4 + 11

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