

**2012**

**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 purpose of raw coal feeder in a pulveriser is

- a) to control the flow of coal to the mill
- b) to control the flow of air to the mill
- c) to control the speed of mill
- d) to cut off coal supply to boiler furnace.

ii) Capacity of I.D. Fan should be

- a) more than F.D. Fan
- b) less than F.D. Fan
- c) equal to F.D. Fan
- d) I.D. fan capacity is not linked to FD fan capacity.

iii) Main purpose of drum internals is the boiler drum is

- a) to provide easy path for steam and water
- b) to separate water particles from steam
- c) to increase the strength of the drum
- d) to separate suspended solids attached to steam particles.

iv) In the boiler tubes only desirable type of boiling is

- a) film boiling
- b) nucleate boiling
- c) no boiling is desirable in boiler tubes

- d) departure from nucleate boiling.
- v) Principle function of installing electrostatic precipitators is
  - a) to reduce load on ID fan
  - b) to minimize atmospheric pollution
  - c) both (a) and (b)
  - d) for easy operation of ash handling plant.
- vi) To prevent air ingress into the combustion chamber and absorb the downward expansion of the furnace all modern boilers are provided with
  - a) bellows
  - b) trough seal
  - c) labyrinth seal.
- vii) The medium used to atomize the Heavy Furnace Oil ( HFO ) for igniters 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 as follows
  - 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 — economiser — drum — downcomers — bottom ring header — water wall tube — top header — drum
  - d) none of these.
- ix) In the direct firing system the required pulverized coal flow to the furnace is controlled by

- a) controlling amount of primary air flow to mills
  - b) raw coal feeder speed
  - c) adjusting mill classifiers
  - d) all of these.
- x) The presence of carbon monoxide in the gases shows inefficient combustion. This is because
- a) the carbon monoxide ( CO ) carries away more heat as compared to equal amount of carbondioxide.
  - b) the combustion of coal to CO releases less heat as compared to that released during combustion to carbon-dioxide.
  - c) the CO is slow to liberate heat through the heat exchange surfaces.
  - d) the combustion of coal to CO releases more heat as compared to that released during combustion of carbon-dioxide.

### **GROUP – B**

#### **( Short Answer Type Questions )**

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

2. How coal is analyzed for characterization ? What are the problems associated with pulverized coal firing ?  $3 + 2$
3. What are the benefits of modified Rankine cycle ? What are the problems of film boiling ?  $3 + 2$
4. What are the effects of back pressure in subcritical boiling of modified Rankine cycle ? Define critical point of boiling. Mention advantages of supercritical boilers.  $2 + 1 + 2$
5. What economizer recalculation is provided in subcritical boilers ? What is the function of steam attemperator in a subcritical steam generator ?  $2 + 3$
6. What is a balance draft ? What are the various safety valves

used in a modern boiler functionally and location specific in  
a modern day boiler ? 2 + 3

### **GROUP – C**

#### **( Long Answer Type Questions )**

Answer any *three* of the following. 3x15 = 45

7. Describe with a neat sketch the water-steam circuit in a modern power station boiler and explain how the steam flow is maintained at variable steam turbine load condition. What are the various pollution control devices used in a power station ? 9 + 3 + 3
8. What are the factors that affect the performance of a coal mill ? Calculate the specific steam consumption and cycle efficiency of a regenerative Rankine cycle operating between 30 bar and 0.04 bar with one feed heater where boiler is generating dry saturated steam. The bled steam pressure is 2.8 bar. Use steam table neglect pump work. 5 + 10
9. Define boiling. Explain the boiling phenomena in a water tube boiler operating under subcritical regime with a neat sketch and specifying the various stages of boiling. Why reheating is adopted in Rankine cycle improvement and how the reheat stages are determined ? 2 + 7 + 4 + 2
10. A boiler is having a steam generating capacity of 630 tons per hour at 540 deg. C main steam temperature and 142 kg/cm<sup>2</sup> pressure. It is provided with 6 pulverizers *A, B, C, D, E* and *F* and each having 40 tons per hour pulverized coal throughput capacity at maximum loading. The boiler is running at full capacity and fed with the available coal having average gross moisture of 20% and ash of 36%. If the mills are running with the maximum RPM of coal feeders, then determine the amount of hot primary air flow required per mill where hot PA entering the mill at

370°C ( assume 1.01 bar pressure ) and mill leaving coal-air mixture temperature is 70°C with a residual moisture of 2%. Consider that, there is no leakage through mill and no seal air is supplied to the system. Choose the hot air density 0.571 kg/m<sup>3</sup> and  $C_p = 1.067$  kJ/kg.K and  $C_p = 4.19$  kJ/kg.C for moisture.

11. Why excess air is required and how is it monitored ? What are the methods of steam temperature control and what are the problems associated with them ? Explain the functions of drains and vents in boiler. 5 + 6 + 4

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