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Internal Assesment Test –1

Sub: ENERGY ENGINEERING				Code: 18ME81
Date: 11/03/2023	Duration: 90 mins	Max Marks: 50	Sem: 8	Branch (sections): ME (A,B)

Answer any **FIVE** questions.

		Marks	OBE	
			CO	RBT
1	Mention the various types of draught systems used in Chimneys and explain them with neat sketch.	[10]	CO1	L2
2	What are the different types of cooling ponds and cooling towers?	[10]	CO1	L2
3	Enumerate and explain the steps involved in handling of the coal.	[10]	CO1	L2
4	Explain a typical hydraulic ash handling system, with neat sketch.	[10]	CO1	L2
5	Explain with sketch overfeed and underfeed principle of firing coal.	[10]	CO1	L2
6	Explain with neat sketch working principle of a solar cell.	[10]	CO2	L2

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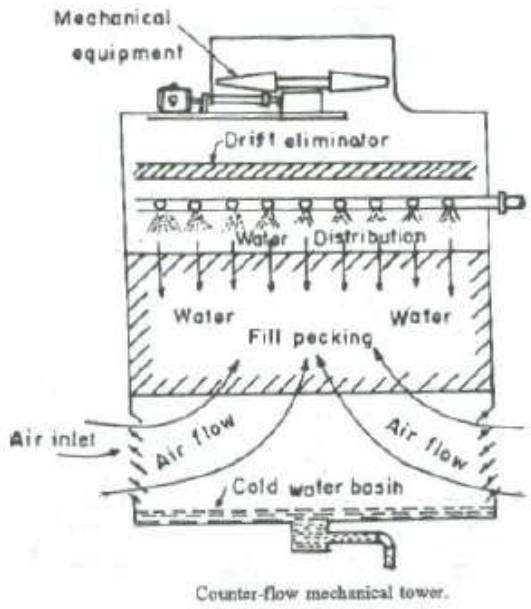
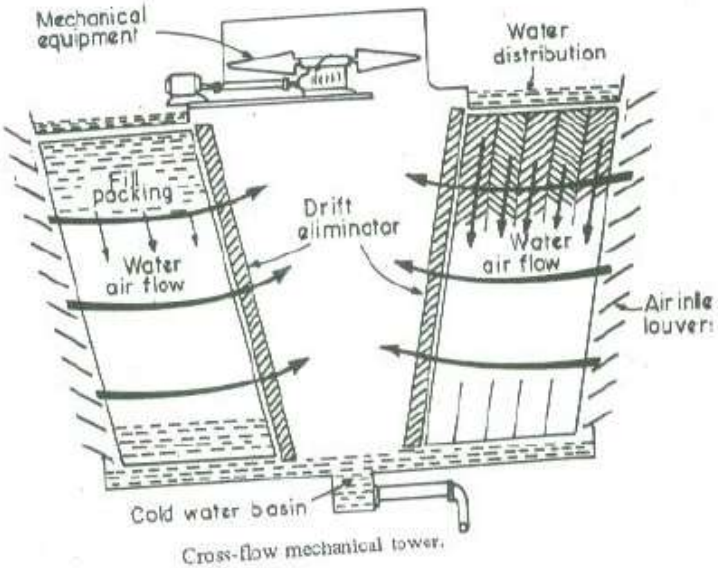
Mechanical draught cooling towers.



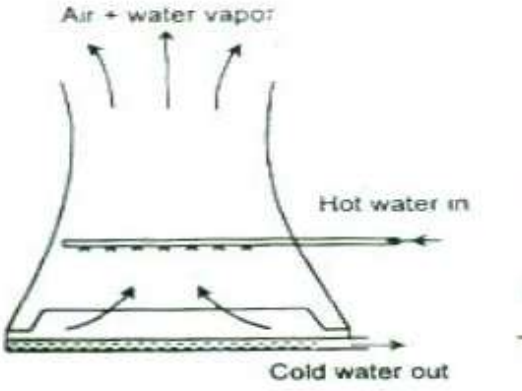
Counter-flow mechanical tower.



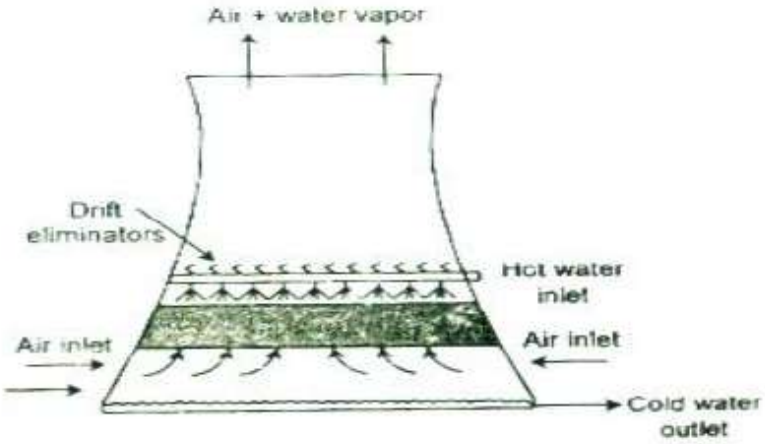
Cross-flow mechanical tower.

In this case air is moved by one or more mechanically driven fans. The fan could be of forced draught (FD) type or Induced draught (ID) type. The FD fan is mounted on the lower sides to force air in to the tower while in ID type ID fan is located on the top of the tower. FD type is thermodynamically superior but it is having s=disadvantages like leakage, recirculation of hot and moist air and frost accumulation at fan in lets during winter operation. Therefore induced draught type wet cooling towers are commonly used. In this type air enters through the large openings provided at the bottom of the tower at slow velocity and passes through the fill. The fan located at the top of the tower exhausts the hot humid air in to the atmosphere. The fans are propeller type and driven by electric motor. The blades of the fan are usually made of cast aluminum, stainless steel or fiber glass to safe guard against the corrosion.

Natural draught cooling towers



Natural Draught Cooling Tower.



Counter-flow Natural Draught Cooling Tower.

In this type of cooling towers there are no fans. These towers depend for air flow upon the natural driving pressure caused by the difference in densities between the cool out side air and the hot humid air inside. The driving pressure differential is expressed as

$$\otimes Pd = (\rangle o - \rangle i)\, gH ,$$

Where H is height of tower above the fill, ⟩o and ⟩I are densities of air out side and inside .

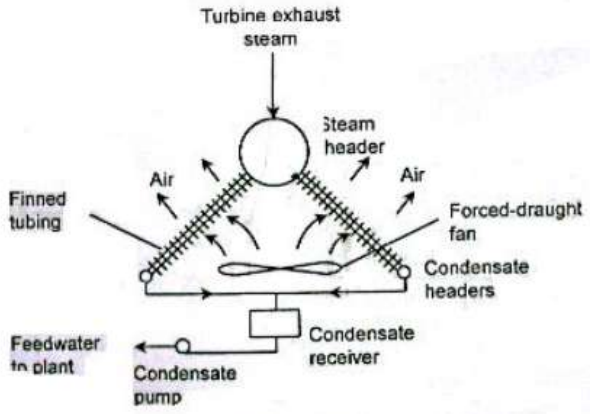
Since (⟩o-⟩i) is relatively small , so H must be large enough to cause desired ⊗Pd and as a result natural draught cooling towers are very tall towers .Towers are usually of hyperbolic profiles and due to this natural draught towers are called by name hyperbolic towers. The advantage of this type of towers is that their greater resistance to outside wind loading compared to other shapes. The natural draught towers may be counter flow type or cross flow type. In counter flow the fill is inside where as in cross flow the sits out side the tower.

2.

Dry cooling towers:

Dry cooling towers are those in which water pass through the finned tubes over which the cooling air is passed. A dry cooling tower can be either mechanical draught or natural draught. They are very suitable where there is scarcity of water. The plant could be located on fuel source site to avoid transportation cost . They are less expensive and maintenance costs are low. The main disadvantage is less efficient than wet type, work at high back pressure which decreases the plant out put and efficiency. Dry cooling towers are of two types direct and indirect

Direct dry cooling towers:



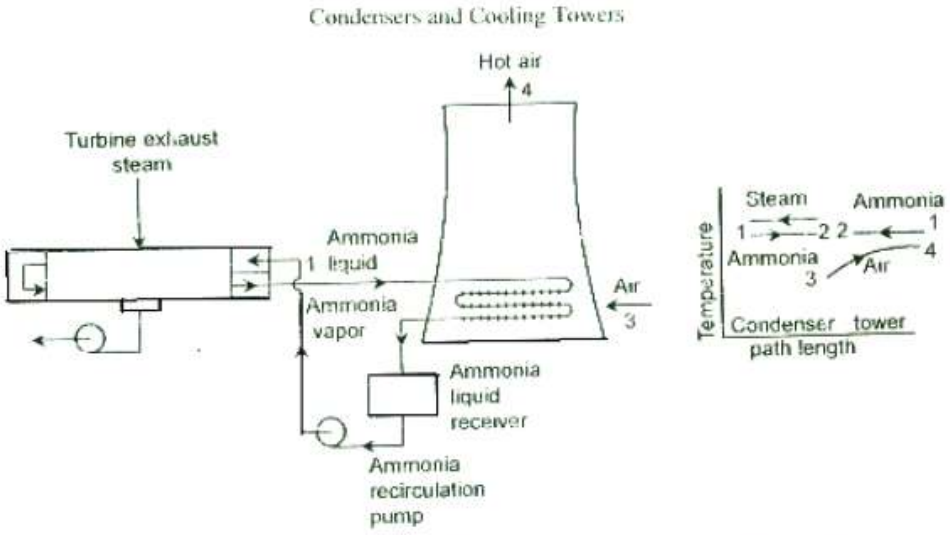
A Direct Dry-Cooling Tower.

In this type of cooling tower turbine exhaust steam is admitted in to a steam header through large ducts and is condensed as it flows downward through a large number of finned tubes or coils arranged in parallel which are cooled by the atmospheric air flowing in a natural draught cooling towers or forced draught fan. The condensate flows by gravity and gets collected in condenser receiver from where it is pumped in to the plant feed water system.

Indirect dry cooling tower

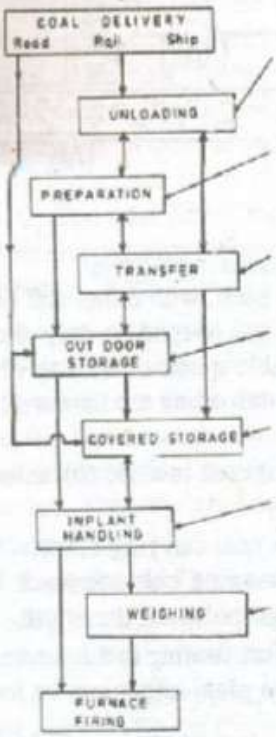
There are three design concepts available for indirect dry cooling towers

i) With conventional surface condenser.



Indirect dry-cooling Tower With a Surface Condenser and Ammonia as Coolant.

It uses a conventional surface condenser in which circulating water goes through the finned tubes cooled by atmospheric air in the tower. The finned tubes may be either cooled by air through natural draught or induced draught system. This design is similar to the design of two heat exchangers in series and thus two temperatures drops , one between steam and water and another one between water and air. If this type of towers is used in the plant efficiency will be low compared to once through system.



Unloading Equipments

[Car shakers, rotary car dampers, unloading towers and bridges, self-unloading boats, lifts trucks, cranes and buckets.

Preparing Equipments

[Crushers, sizers, driers.

Transfer Equipments

[Belt conveyor, Screw conveyor, Bucket elevator, skip hoist, flight conveyor.

Storage Equipments

[Bulldozer, scraper, tramways, cranes and conveyor systems.

Covered Storage Equipments

[Bins, bunkers, indicators, gates and values.

[Some equipments which are used for coal transfers.

Weighing Devices

[Scales, coal metres and samplers.

Fig. Chart showing operations and devices used in coal handling plant.

COAL TRANSFER EQUIPMENTS

'Transfer' means the handling of coal between the unloading point and the final storage point from here it is discharged to the firing equipment. The following equipment may be used for transfer of coal:

1 Belt conveyors
2 Screw conveyors
3 Bucket elevator and conveyor
4 Pivoted bucket conveyor
5 Grab bucket conveyor
6 Flight conveyers (or scrapers)
7 Skip hoists
8 Mass flow conveyor
9 Chutes.

4

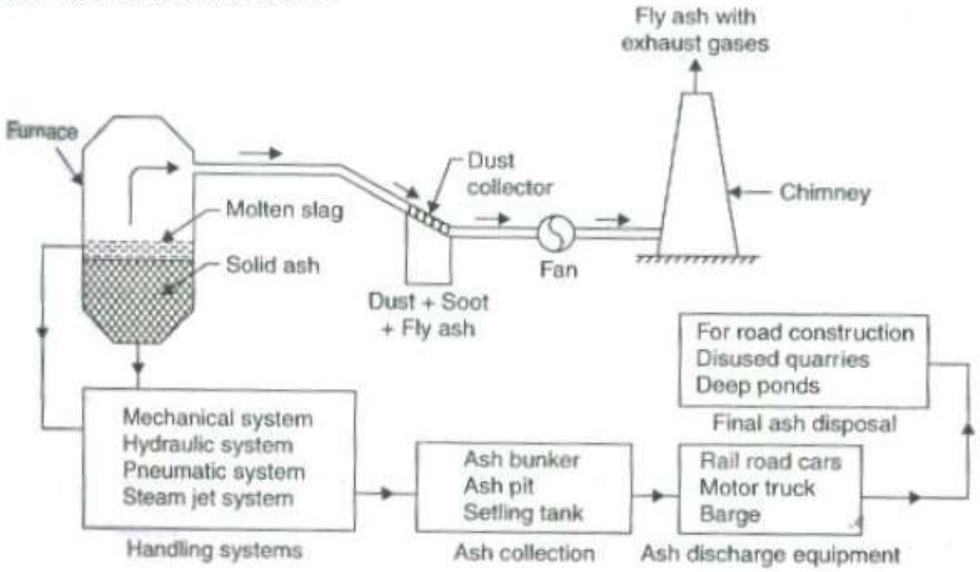
ASH HANDLING

A huge quantity of ash is produced in central stations, sometimes being as much as 10 to 20% o the total quantity of coal burnt in a day. Hundreds of tonnes of ash may have to be handled every day in large power stations and mechanical devices become indispensable. A station using low grade fuel has to deal with large quantities of ash.

Handling of ash includes :

(i) Its removal from the furnace.
(ii) Loading on the conveyers and delivery to the fill or dump from where it can be disposed off by sale or otherwise.

ASH HANDLING SYSTEM



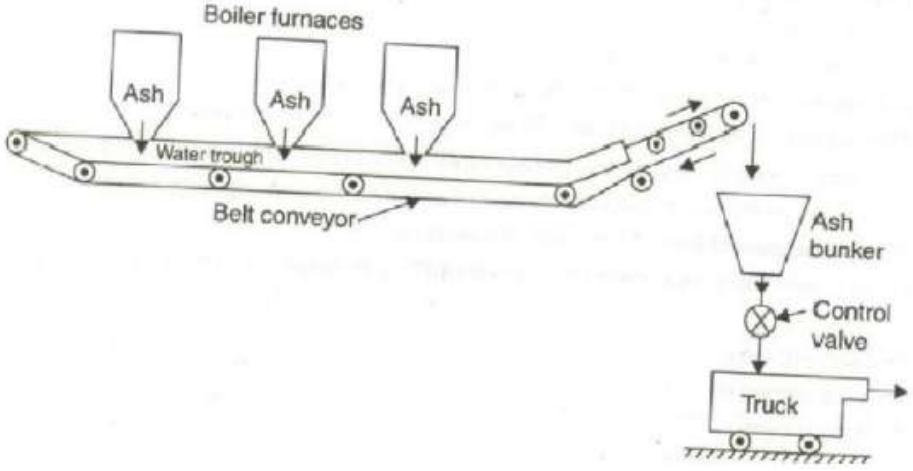
The ever increasing capacities of boiler units together with their ability to use low grade high ash content coals have been responsible for the development of modern ash handling systems. The

general layout of the components used in modern ash handling and dust collection plant is shown in Fig.

The modern ash-handling systems are mainly classified into four groups:

1. Mechanical handling system.
2. Hydraulic system.
3. Pneumatic system.
4. Steam jet system.

Mechanical ash handling system



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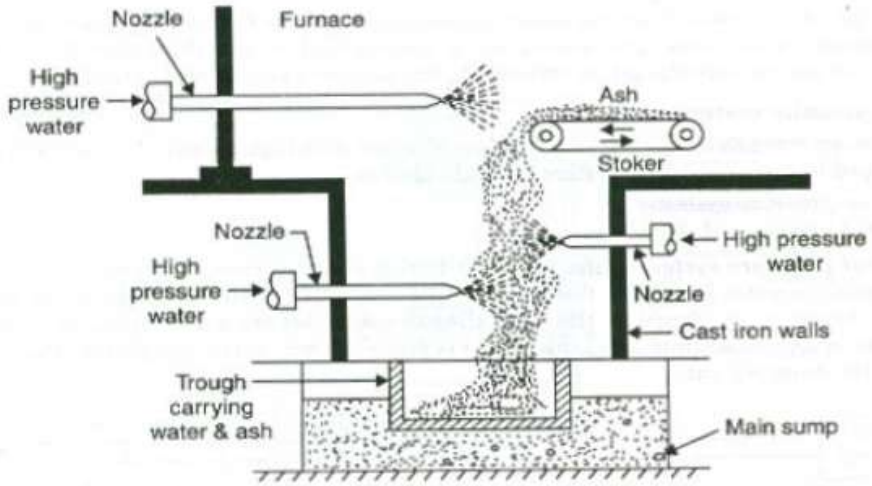

The ash hoppers below the boilers are fitted with water nozzles at the top and on the sides. The top nozzle quench ash and side nozzle provide driving force to carry the ash through a trough. The cooled ash with high velocity water is carried to the sump. The water is re circulated again after separating it out from the ash. Capacity of the system is 120 tons /hr and distance is 1000 meters.

Advantages

1) The system is clan , dustless, totally enclose and pollution free.
2) The ash can be discharged at a considerable distance.