**NAME:**

**29th Nov. 2006**
**ESL714: Power Plant Engg.**
**Major Test**

## Part-B (35 marks = 70 points)

**I MATCH THE FOLLOWING BY ARROWS : (39 points)**

**1. Water and fire tube boilers:** (4 points)

| | |
|---|---|
| | **Pressure < 20 Atm.** |
| **Water tube boiler** | |
| | **Upto 8-10 tonnes steam/hr** |
| **Fire tube boiler** | **Quicker response** |
| | **Large heights** |

**2. Requirement of primary and secondary air for combustion of coal on grate in the combustion chamber depends on the following:** (3 points)

| | |
|---|---|
| | **Volatile Matter** |
| **Primary air** | |
| | **Fixed carbon** |
| **Secondary air** | |
| | **Carbon-monoxide** |

**3. Pulverized coal burners** (4 points)

| | |
|---|---|
| | **Long Flame** |
| **U-flame burner** | |
| | **High Volatile Matter in Coal** |
| **Turbulent burner** | **High Fixed Carbon in Coal** |
| | **Short Flame** |

**4.** (3 points)

| | |
|---|---|
| **Moderate pressure** | **Once-through boiler** |
| **High pressure** | **Forced Circulation boiler** |
| **Supercritical pressure** | **Natural Convection boiler** |

5.

| Type of Boiler | Circulation (in kg water circulated per kg of steam produced) |
|---|---|
| Natural Circulation | 3 : 1 |
| Forced Circulation | 1 : 1 |
| Supercritical Boilers | 15 : 1 |

(3 points)

6. Types of Air Pre-Heaters/Economizers: (4 points)

| | |
|---|---|
| Economizers | Rotary regenerative |
| Air Pre-Heaters | Tube-type |
| | Plate-type |

7.

| Characteristics of solid fuels | Type of stokers | Important feature |
|---|---|---|
| Matting Coal | Chain grate | Relative motion Of top layer |
| Clinkering ash | Underfeed | Disengage |

(2 points)

8 Types of Superheaters: (4 points)

| | |
|---|---|
| | Primary Superheater |
| Horizontal type | Secondary Reheater |
| Pendant type | Primary Reheater |
| | Secondary Superheater |

9. .Match the following basic features of the steam turbines:

( 5 points )

*Less pressure drop per stage

* Impulse turbine

*High flow friction losses

* Steam leakage across blades

* Reaction turbine

*Blades thicker in the middle

*Axial Thrust

10. **Multi-stage steam turbines** (4 points)

* Velocity compounded turbines

* Minimum number of stages

*Maximum number of stages

* Pressure compounded impulse turbines

*Double flow

*Pressure compounded reaction turbines

*Need for flow reversal between stages

11. **Types of Feed Water Heaters** ( 3 points)

Extra pump for each FWH

Open Feed Water Heater

Better heat transfer

Closed Feed Water Heater

Deaeration

II. **CIRCLE the <u>MOST APPROPRIATE</u> answer :** (3 points)

1. **Forced circulation water tube boilers are not common in spite of the fact that they have higher heat transfer rates due to the following reasons:**

**(i) They require a large power input for the circulating pump**

**(ii) Fear of the pump failure**

**(iii) They have small diameter tubes**

**III. Tick ALL the correct answers:** (4 points)

1 **Impulse turbine is generally used in the initial stages of the Multi-stage steam turbines because:**

**(i)** **It has partial admission of steam**

**(ii)** **It has high efficiency due to the high steam velocities**

**(iii)** **It provides large pressure drop per stage**

**(iv)** **Impulse turbines are best suited for multi-stage operation**

2. **Which of the following are true for the case of velocity compounding:** (4 Points)

**(i)** **High steam velocities**

**(ii)** **Axial Thrust**

**(iii)** **Steam leakage across blades**

**(iv)** **Need for flow reversal between stages**

**IV Draw neatly:** (2X4 points)

1. **Complete the sketch of combustion of coal on grate showing the entry of primary and secondary air.**

2. **For combustion of pulverized coal, draw the U-flame showing the entry of primary and secondary air.**

**V. Answer very briefly and clearly:**

**1. Why is the drum of a fire tube boiler much larger than the water tube boiler for same rate of steam production?**

(4 points)

**2. Why is dearation of feed water befor feeding essential?**

(2 points)

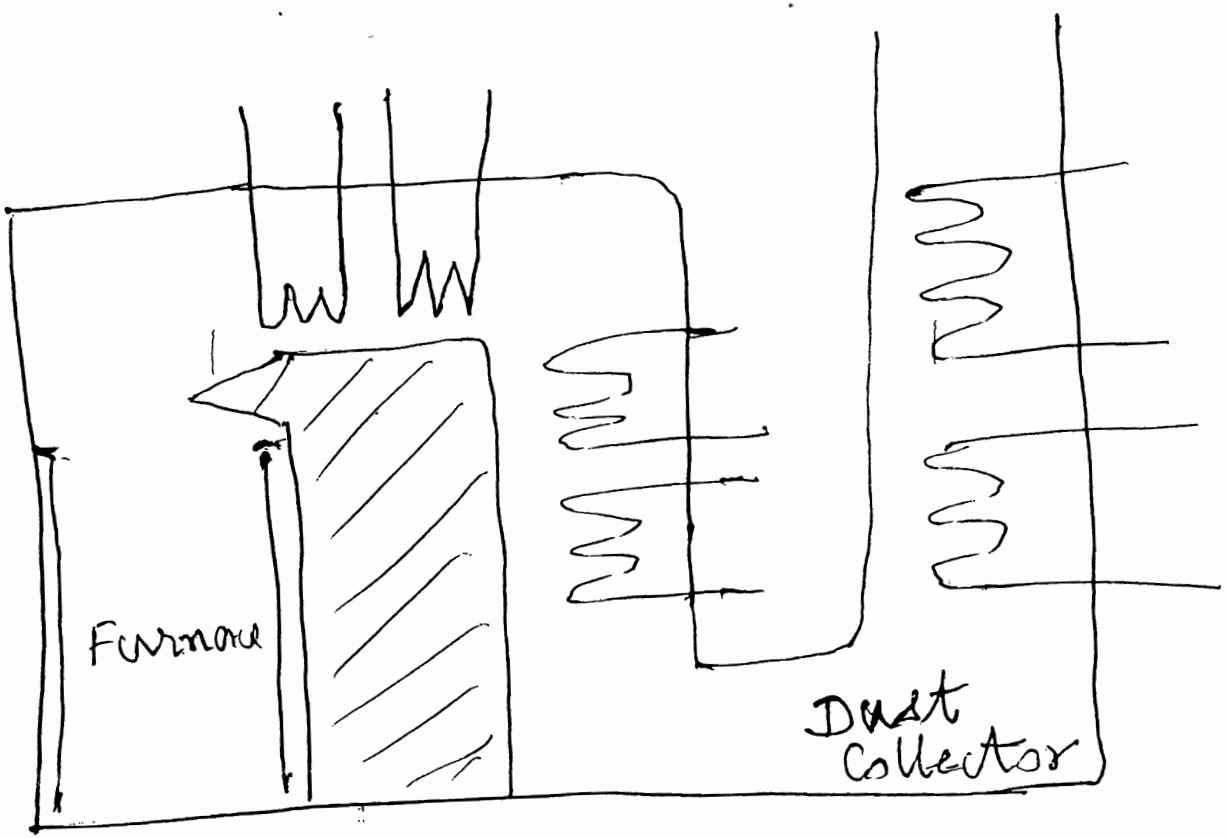
**VI. Answer <u>ANY ONE</u> of the following:**

In the shown steam generator, label clearly the positions of <u>primary and secondary</u> **superheaters and reheaters** economizer, and air pre-heater clearly in relation to the goose- neck.

= OR=

Draw clearly to scale the velocity triangles at inlet and oulet of the moving blades of an impulse turbine. Also mention which velocities do **u, c,** and **w** refer to

(6 points)


Furnace
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