

CS/B.TECH (ICE)/SEM-8/IC-801C/2013

2013

POWER PLANT INSTRUMENTATION AND CONTROL

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 any *ten* of the following :

10 × 1 = 10

i) Which one of the following is not a fuel for nuclear
pioneer plant

- | | |
|----------------------------|-----------------------------|
| a) ${}_{92}\text{U}^{233}$ | b) Coal |
| c) ${}_{92}\text{U}^{235}$ | d) ${}_{94}\text{Pu}^{239}$ |

ii) Which one of the following is a component of nuclear
reactor ?

- | | |
|--------------|-----------------|
| a) Moderator | b) Boiler |
| c) Turbine | d) Superheater. |

iii) Temperature of the fireball is of the

- | | |
|-----------|-----------|
| a) 540°C | b) 460°C |
| c) 1500°C | d) 150°C. |

iv) Furnace draft pressure is regulated by

- a) Radial control of FD fan
- b) Axial control of FD fan
- c) Radial vane control of ID fan
- d) Axial vane control of ID fan.

v) Maximum heat loss in a thermal power plant occurs in

- | | |
|--------------|-------------------|
| a) condenser | b) superheater |
| c) turbine | d) none of these. |

vi) Which one of the following is a low head and high
discharge turbine ?

- | | |
|-------------------|-------------------|
| a) Kaplan turbine | b) Pelton turbine |
|-------------------|-------------------|

- c) Deriaz turbine d) Francis turbine.

vii) The function of superheater is

- a) heating water to produce steam
- b) removing water droplets from steam and thereby producing superheated steam.
- c) to reheat feed water
- d) none of these.

viii) The extraction turbine is useful

- a) when only one output of steam is needed
- b) when two or more outlets are provided to use the steam for different uses.
- c) when steam at very low pressure is needed
- d) all of these.

ix) The power of a wind turbine generator is proportional to

- a) V b) V^2
 - c) V^3 d) V^4 .
- [V is the wind velocity]

x) The function of a deaerator is

- a) to reheat feed water
- b) to eliminate dissolved O_2 & CO_2 from feed water
- c) to heat steam
- d) all of these.

xi) Which one of the following can be used as a pollution monitoring device ?

- a) Gas chromatograph
- b) RTD
- c) Thermocouple
- d) None of these.

xii) In a multiple burner system which one is best flame detector ?

- a) Flame Ionization Rod

- b) IR detectors
- c) UV detectors
- d) All of these

GROUP – B
(Short Answer Type Questions)
 Answer any *three* of the following.

3 × 5 = 15

2. State the different components of a nuclear power plant ?
 What are the advantages and disadvantages of CANDU
 (Canadium deuterium uranuim) reactor ?
3. How pH and dissolved oxygen can be measured from feed
 water in a thermal power plant ?
4. What are the process parameters that must be measured for
 a turbine ? Why is vibration measurement essential for
 turbine ? Describe the process of vibration measurement in a
 turbine.
5. Theoretically calculate the power that can be obtained from a
 windmill having the following specifications :
 (Assume the density of air is 1.2 kg/m³)

2 + 3

1 + 2 + 2

A = Swept Area = 10 m²

V = Velocity of wind = 200 km/hr.

Calculate the rate of make up water to a boiler plant if the
 average feed water rate is 100T/hr, the water loss in the
 baler system including blow down is 3% of the input and the
 steam loss in the turbine is 2% of its input.

2 + 3

6. What is blow down ? Name the three different drafts in case
 of boiler ? Describe the process of controlling of any nuclear
 reactor.

1 + 1 + 3

GROUP – C
(Long Answer Type Questions)
 Answer any *three* of the following.

3 × 15 = 45

7. a) Explain the B-T-C-P cycle of a steam power plant.
- b) How are the shrinking and swelling problems taken care
 of in a steam power plant by using 3-element boiler
 drum level control.
- c) Describe the process of steam flow measurement in a
 boiler.
8. a) Describe the process of feed forward plus feedback
 steam temperature control.

3

6

6

7

- | | |
|---|-------|
| b) Describe the different processes used for the measurement of dissolved oxygen in a boiler. | 8 |
| 9. a) Explain the method of measuring dust particle in flue gas. | 2 |
| b) Explain with a neat sketch the alarm annunciation system of a boiler in a thermal power plant. | 7 |
| c) With a neat sketch describe the role of attemperator in the water side steam temperature control in a thermal power plant. | 6 |
| 10. a) Name the classification of turbines based on process conditions. | 2 |
| b) What are the basic differences between the safety control systems and process control system in a turbine ? | 3 |
| c) Name the four critical parameters which are to be monitored and controlled in a turbine. | 2 |
| d) Describe the method of conductivity measurement of feed water in a thermal power plant. | 5 |
| e) What are the main auxiliary system of a thermal power plant ? | 3 |
| 11. Write short notes on any <i>three</i> of the following : | 3 × 5 |
| a) Electrostatic Precipitator | |
| b) Fast breed reactor | |
| c) Infrared flue gas Analyzers | |
| d) Measurement of CO ₂ in flue gas. | |
| e) Advantages of three-element drum level control over two-element drum level control. | |
| f) Mechanical type dust collectors. | |