Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(ICE)/SEM-8/IC-801C/2012

2012

POWER PLANT INSTRUMENTATION

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 : 10 × 1 = 10

   i) UV detector is used to measure the temperature of

   a) Boiler metal tube b) Furnace flame

   c) Feed water d) Steam.

   ii) SO_x & NO_x emission is determined by

   a) Gas chromatography b) NDIR analyzer

   c) Zirconia probe d) Balance.

   iii) In fire tube boiler, the fluid exists outside the capillary tube is

   a) Hot flue gas b) Natural water

   c) DM water d) Steam.

   iv) A full tidal cycle is of the duration of

   a) 6 hrs b) 12 hrs

   c) 12 hrs 25·2 min d) 24 hrs.

v) Which one of the following is not an element of hydroelectric power plant ?

a) Catchment area b) Surge tanks

c) Powerhouse d) Evaporator.

vi) The function of a flue gas analyzer is to indicate the

a) fuel / air ratio burned in the furnace

b) temperature of the flue gas

c) grade of fuel being used

d) all of these.

vii) Power output of a wind turbine generator is proportional to

a) V b) V^2

c) V^3 d) V^4.

(V is wind velocity).

viii) The furnace temperature can measure by using

a) RTD

b) Thermocouple

c) Bimetallic Thermometer

d) none of these.

ix) ESP is used to control

a) CO in air b) SPM in air

c) CO_2 in air d) SO_x / NO_x in air.

x) Air velocity in ducts is measured by

a) Venturimeter b) Pitot tube

c) Orifice plate d) LVDT.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. a) Explain B-T-C-P cycle of Stem Power Plant. 3

   b) What are the advantages of Condenser in Steam Power Plant ? 2

3. Why is 3-element control employed for drum level control ? With net control loop diagram explain the 3-element control. 2 + 3

4. How is a liquid level in a boiler drum measured ? Explain.

5. Mention where are vibration, expansion & contraction to be measured & monitored in a power plant cycle. What technique is used usually for expansion-contraction measurement ?

6. What is hydrazine ? Why is it used in water/system cycle in a power plant ?

GROUP – C
(Long Answer Type Questions)

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

7. What is balance draft ? How is the draft of the furnace measured ? Draw a loop for control of the furnace draft & explain its operation. 2 + 3 + 10

8. Write short notes on any *three* of the following : 3 × 5

   a) Quality monitoring of water in power plant

   b) Single element drum level control

   c) All fuel ratio control of a furnace

   d) Instrumentation in coal handling plants.

9. a) What are the important boiler protection parameters ? 2

   b) What are the different methods for controlling superheated steam temperature ? 3

   c) With a net control loop diagram, explain the steam temperature control by using two stage de-superheater. 6

   d) How the pH and dissolved oxygen can be measured for feedwater ? 4

10. a) What are the measurand and manipulated variables in 3-element boiler drum level control ? 2

    b) How are swelling and shrinking problems taken care by 3-element drum level control ? 7

    c) Explain with neat sketch, the alarm annunciation system of a boiler in thermal power plant. 6

11. a) Which control strategy is adopted in boiler combustion control ? Explain it with control flow chart. Why is O_2 trimming required in combustion control ? 1 + 6 + 2

    b) What are the critcria for development of waste heat recovery system in a power plant ? Explain the working principle of any one waste heat recovery system used in thermal power plant. 2 + 4