Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech/(EE-PS)/SEM-3/PSM-301/2012-13

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.

Answer Question No. 1 in **Group-A** and any *two* each from **Group-B** and **Group-C**.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives and justify your answer from Q.1A(i) to Q.1A (iii) $7 \times 2 = 14$

   A. i) Fuel gas and combustion air pressure are in the order of 0 to 2000 mm Wg. Pressure measurement is done by

      a) Membrane or Capsule type sensors

      b) Bellows element

      c) LVDT type

      d) None of these.

   ii) The closed circuit television (CCTV) is found in many applications in thermal power plant. The most important is

      a) smoke and dust viewing from the chimey outlet

      b) for adjusting flame in the combustion chamber

      c) for scanning intruders for security reasons

      d) none of these.

iii) Which method is used to measure the drum level in high pressure boiler ?

a) Tdifferential pressure method

b) Float type method

c) Ultrasonic method

d) None of these.

B. Find out whether the following statements are *true* or *false* and justify your answer from Q.1B (iv) to Q.1B (vii) :

iv) For the control of system load frequency constant, boiler following control gives faster response than turbine following system.

v) Flue gas analysis is very important in thermal power plant for boiler combustion control process.

vi) Infrared technique can be used for flue gas analysis.

vii) Interlocks are mainly used in boiler operation for start-up and shut-down of boiler.

GROUP – B

(Short Answer Type Questions)

Answer any *two* of the following. 2 × 14 = 28

2. a) How does the air preheater operate ? Draw the *P* and *I* diagram of boiler combustion control system and specify each component.

b) Which temperature transducer is used in air preheater and why ? What is the significance of trimming of combustion control system ? 4 + 6 + 2 + 2

3. a) What is the ratio control scheme and where is it used in a power plant ? Explain superheated steam temperature control system with neat diagram.

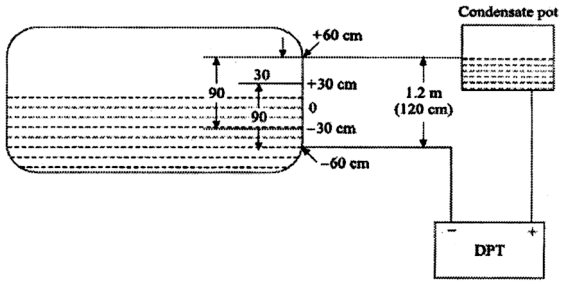
b) A differential pressure transmitter of 1·2 m Wg range is used to measure the boiler water drum level. Lower tapping and higher tapping are taken 60 cm equidistance from the centre of the drum. If the transmitter used is a two-wire 4-20 mA one and the indicator is calibrated for –60 cm to +60 cm water level, answer the following :

(i) Transmitter output at the + 30 cm level

(ii) Transmitter output at the – 30 cm level

(iii) What is the level if transmitter output is 12 mA ?

(Assume the error caused by density difference between boiler water and condenser water is negligible and the water head produced by steam is also negligible)



3 + 1 + 5 + 5

4. a) Why gas conductivity analysis is carried out in power plant ? What is the method for conductivity analysis ? Explain about it. Briefly describe pH measurement technique used in power plant.

b) Briefly discuss about the significance and methods of fuel analysis in the thermal power plant. 2 + 4 + 4 + 4

GROUP – C

(Long Answer Type Questions)

Answer any *two* of the following. 2 × 14 = 28

5. a) Suggest and illustrate the structure of a set of transducers used for measurement and control of different components in a 500 MW capacity thermal power plant.

   b) Briefly describe about the alarm system in a thermal power plant. What are the different kinds of interlocks used for boiler operation ? 7 + 4 + 3

6. a) What is turbine instrumentation ? How are the vibration and speed of a steam turbine measured ?

   b) What is turbine load control ? Explain the process with proper control circuit diagram. 2 + 4 + 8

7. a) What kind of analysis is performed on flue gas in thermal power plant and how ? What is the process of measurement of ash concentration in boiler stack ?

   b) Describe the operating principle of measurement for CO and dissolved oxygen. 4 + 4 + 6