

**POWER PLANT INSTRUMENTATION
(AEIE 4143)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

**Group – A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) In a steam power station, the choice of high temperature steam is for
 - (a) increasing the efficiency of boiler alone
 - (b) increasing the efficiency of turbine alone
 - (c) increasing overall efficiency
 - (d) none of the above.
 - (ii) Primary air is that air which is used to
 - (a) reduce the flame length
 - (b) increase the flame length
 - (c) transport the dry coal into the furnace
 - (d) provide air round the burners for getting optimum combustion.
 - (iii) In a steam power plant the function of a condenser is
 - (a) to maintain pressure below atmospheric to increase work output from the prime mover
 - (b) to receive large volumes of steam exhausted from steam prime mover
 - (c) to condense large volume of steam to water which may be used again in boiler
 - (d) all the above.
 - (iv) In coal fired thermal power plant the pulverized coal is used for
 - (a) saving fuel
 - (b) better combustion
 - (c) obtaining more heat
 - (d) none of these.

- (v) Blowing down of the boiler water is the process to
 - (a) control the solid concentration in the boiler water by removing some of the concentrated saline water
 - (b) increase the steam temperature
 - (c) reduce the boiler water pressure
 - (d) none of these.
- (vi) Swelling of boiler drum level occurs when
 - (a) load demand increases
 - (b) steam demand increases
 - (c) boiler pressure decreases
 - (d) all of the above.
- (vii) NO_x formation in boiler during combustion can be reduced by
 - (a) increasing the flame temperature
 - (b) decreasing the flame temperature
 - (c) increasing the excess air
 - (d) none of these.
- (viii) Economizer is used to heat
 - (a) air
 - (b) feed water
 - (c) flue gases
 - (d) all above.
- (ix) The purpose of deaeration is to
 - (a) remove the dissolved gases in the feed water
 - (b) heat the feed water
 - (c) heat the air in the water
 - (d) none of these.
- (x) The function of moderator in a nuclear reactor is
 - (a) to slow down the fast moving neutrons
 - (b) to speed up the fast moving neutrons
 - (c) to start the chain reaction
 - (d) to terminate the chain reaction.

Group – B

2. (a) Briefly discuss the air-flue gas circuit of a thermal power plant with a suitable block diagram.
- (b) State the function of economiser.
- (c) Describe the operation of unit system of pulverised coal handling plant.

5 + 3 + 4 = 12

3. (a) Describe the operation of Rankine cycle with respect to P-V and T-S diagram. Hence derive the expression for efficiency of the cycle.
 (b) State the function of dearator.

$$(6 + 2) + 4 = 12$$

Group - C

4. (a) Why excess air is assured during combustion?
 (b) Explain the operation of oxygen trimmed cross limiting combustion control system used in coal fired power plant with necessary PI diagram.

$$4 + 8 = 12$$

5. (a) Describe the method of boiler drum level measurement using DP cell.
 (b) Explain the 3-element drum level control technique with suitable PI diagram. Which element is used as feed-forward signal in this control technique and why?

$$3 + 3 + 6 = 12$$

Group - D

6. (a) Describe different emergency shutdown conditions in a power plant.
 (b) Why vibrations of the turbine need to be monitored? Explain the measurement scheme for turbine vibration with suitable diagram.

$$4 + (2 + 6) = 12$$

7. (a) Why is it necessary to measure turbine casing expansion? Describe the method of turbine casing expansion measurement with suitable diagram.

- (b) Draw and explain the lube oil temperature control loop.

$$(2 + 6) + 4 = 12$$

Group - E

8. (a) Classify different types of feedwater impurities. Describe how impurities cause Corrosion?

- (b) Describe two mechanical ways of feedwater impurities treatment.

$$(4 + 4) + 4 = 12$$

9. (a) Describe different combustion control methods to reduce the generation of NO_x.
 (b) State the functions of moderator and coolant used in nuclear power plant.

$$8 + 4 = 12$$