POWER PLANT INSTRUMENTATION
(AEIE 4231)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

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

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) Secondary air is supplied by
(a) FD fan
(b) ID fan
(c) Both FD and ID fan
(d) None of these

(ii) Economizer is used to heat
(a) Feed water
(b) Air
(c) Flue gases
(d) All of these.

(iii) 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

(iv) Strategy used to achieve less temperature changes as steam load increases is by using
(a) Convection super heaters only
(b) Radiation super heaters only
(c) Convection and radiation super heaters in parallel
(d) Convection and radiation super heaters in series

(v) What is the actual turbine inlet temperature in Rankin cycle?
(a) 540°C
(b) 700 °C
(c) 850 °C
(d) 900 °C

(vi) Blade erosion in steam turbines takes place due to
(a) High temperature steam
(b) High rotational speed
(c) Droplets in steam
(d) High flow rate.

(vii) Increase in turbine speed indicate that load demand
(a) Increases
(b) Decreases
(c) Remain same
(d) None of these

(viii) Seismic probe is used to measure
(a) Eccentricity
(b) Case expansion
(c) Vibration
(d) Turbine speed

(ix) The function of surge tank in hydro-power plant is to
(a) Supply water at constant pressure
(b) Produce surges in the penstock pipe
(c) Relieve water hammer pressure in the penstock pipe
(d) Supply water at constant head

(x) In coal fired thermal power plant ESP is used to remove/reduce emission of
(a) H_2O vapour
(b) SO_x
(c) NO_x
(d) Particulate matter

Fill in the blanks with the correct word

(xi) Economizer recovers heat from _____.

(xii) _____ is used as a coolant in nuclear power plants.

(xiii) _____is/are used to achieve less temperature changes as steam load increases.

(xiv) Shrinking of boiler drum level occurs due to _____.

(xv) In hydro power plant _____ energy is converted into mechanical energy

Group - B

2. (a) Explain operation of water tube boiler with a net sketch. *[(CO1) (Remember/LOCQ]*
(b) State the stages of the turbine commonly used in power plant. How do they installed to neutralise the axial thrust? *[(CO1) (Analyse/IOCQ)]*
(c) Lowering of condenser pressure increase the efficiency of the reheat Rankin cycle. Explain using a T-S diagram. State the drawbacks of this technique.
[(CO2) (Analyse/IOCQ)]

4 + (1 + 2) + (4 + 1) = 12

3. (a) What do you mean by furnace draft? Why furnace draft is maintained slightly below atmospheric pressure? *[(CO1) (Remember/LOCQ, Analyse /IOCQ)]*

(b) State the function of dearator and how it works? *[(CO1) (Analyse/IOCQ)]*

(c) Explain operation of ESP with schematic diagram. *[(CO1)(Remember/LOCQ)]*

(1 + 2) + 4 + 5 = 12

Group - C

4. (a) Why is it important to consider at least three device for boiler drum level measurement? Describe how the required process signal is computed? *[(CO4)(Analyse/IOCQ)]*

(b) State the types of super heaters used in coal fired thermal power plant and describe the same. *[(CO1)(Remember/LOCQ)]*

(c) State the mechanisms used for fire side control of steam temperature. *[(CO3)(Apply/IOCQ)]*

(2 + 2) + (2 + 2 + 2) + 2 = 12

5. (a) Analyse the reason behind maintaining of negative atmospheric pressure in furnace? With suitable PI diagram explain how FD fan dampers are used for furnace draft control? *[(CO3)(Analyse/IOCQ)]*

(b) How the liquid level of a pressurised boiler drum can be measured? *[(CO2)(Analyse/IOCQ)]*

(c) Describe the operation of attemperator with necessary diagram. *[(CO3)(Remember/LOCQ)]*

(2 + 4) + 3 + 3 = 12

Group - D

6. (a) List the fundamental minimum conditions that must be met before steam is charged into the turbine. How do stem demand signal is generated? *[(CO4) (Understand/LOCQ)]*

(b) The starting sequence of various boiler auxiliaries is configured as follows: (i) Regenerative air heaters, (ii) Induced draft (ID) fans, (iii) Forced draft (FD) fans, (iv) Primary air (PA) fans, (v) Pulverisers and (vi) Coal feeders. Design start interlock system using logic gates. *[(CO4) (Create/HOCQ)]*

(c) State six important parameters monitored by Turbine Supervisory Instrumentation (TSI) system. *[(CO5) (Remember/LOCQ)]*

(2 + 2) + 5 + 3 = 12

7. (a) Describe with suitable schematic diagram the lubrication system for Turbo-Alternator. *[(CO5) (Understand/LOCQ)]*

(b) With necessary schematic diagram, explain how turbine speed can be measured using hall sensor. *[(CO5) (Evaluate/HOCQ)]*

(c) Draw the schematic for measurement of casing expansion and explain the same. *[(CO5) (Analyse/IOCQ)]*

4 + 4 + 4 = 12

Group - E

8. (a) Explain one method of combustion control techniques that prevents the formation of NO_x during combustion. *[(CO6) (Analyse/IOCQ)]*

   (b) What do you mean by water hammer? Describe how water hammer can be avoided using a schematic diagram. *[(CO1) (Analyse/IOCQ)]*

   (c) Describe the qualities of the moderator element in a nuclear power plant. *[(CO1) (Remember /LOCQ)]*

4 + 4 + 4 = 12

9. (a) State the condition for sustained chain reaction in nuclear power plant. Also state the requirements of fission process. *[(CO1)(Remember/LOCQ)]*

   (b) Describe the process of indirect cooling of nuclear reactor with necessary schematic diagram. *[(CO1)(Remember/LOCQ)]*

   (c) Explain flue gas recirculation technique used to reduce NO_x emission. *[(CO6)(Apply/IOCQ)]*

(1 + 3) + 4 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	43.76	46.87	9.37