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 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.

    (ii)　　The balance draught system uses
    (a) only FD fan　　　　　　　　　　(b) only FD fan
    (c) PA fan　　　　　　　　　　　　(d) both FD fan and ID fan.

    (iii)　　The commercial sources of energy are
    (a) solar, wind, biomass
    (b) fossil fuel, hydro power and nuclear energy
    (c) wood, animal wastes and agriculture wastes
    (d) none of the above.

    (iv)　　Match the followings (cause-effect)

1. Feedwater hardness	A. Corrosion
2. Dissolved oxygen, low pH	B. Coagulation
3. Suspended solids, oils, greases, fats etc	C. Scale formation
4. Alum	D. Foaming

    (a) 1-B, 2-C, 3-D, 4-A　　　　　　(b) 1-A, 2-D, 3-C, 4-B
    (c) 1-C, 2-D, 3-B, 4-A　　　　　　(d) 1-C, 2-A, 3-D, 4-B.

    (v)　　NO_X formation in boiler during combustion can be reduced by
    (a) increasing the flame temperature　　(b) increasing the excess air
    (c) decreasing the flame temperature　　(d) none of these.

(vi) The fluctuation of load demand is successfully countered by
(a) 1-element drum level control
(b) 2-element drum level control
(c) 3-element drum level control
(d) none of these.

(vii) Reheat cycle in steam power plant is used to
(a) utilized heat of flue gases
(b) increase thermal efficiency
(c) improve condenser performance
(d) reduce loss of heat.

(viii) The modern steam turbines are
(a) impulse turbines   (b) reaction turbines
(c) impulse-reaction turbines   (d) none of these.

(ix) In boilers the feed water treatment is done mainly to eleminate _____ troubles
(a) corrosion   (b) scale formation
(c) carry over   (d) all of these.

(x) The function of surge tank in hydro-power plant is
(a) to supply water at constant pressure
(b) to produce surges in the penstock pipe
(c) to relieve water hammer pressure in the penstock pipe
(d) none of these.

Group – B

2. (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 deaerator.

(6 + 2) + 4 = 12

3. (a) What do you mean by furnace draft? Describe the operation of balance draft system with neat sketch.

(b) Describe alternator cooling system.

(2 + 6) + 4 = 12

Group – C

4. (a) Explain how liquid level of pressurized tank is measured using DP cell.

(b) Explain 3-element drum level control technique with suitable PI diagram. Which element is used as feed-forward signal in this control technique and why?

5 + (5 + 2) = 12

5. (a) What is the importance of superheated steam? Describe the operation of steam temperature control loop with suitable PI diagram.

(b) Explain the necessity of the excess air for combustion of fossil fuel.

(2 + 6) + 4 = 12

Group – D

6. (a) State the necessity of the safety interlocks. Describe interlocks recommended for start-up of boiler auxiliaries.

(b) Describe the measurement method of turbine shell expansion with suitable schematic diagram.

(4 + 4) + 4 = 12

7. (a) What is an alarm annunciator? Describe the sequences followed by the annunciator for its operation.

(b) Describe the lube oil pressure control loop with suitable PI diagram.

(2 + 6) + 4 = 12

Group – E

8. (a) Describe how impurities cause scale formation.

(b) Describe the mechanical methods used for treatment of feedwater impurities.

4 + 8 = 12

9. (a) State the possible sources of NO_X generation in thermal power plant. Describe the possible pollutions made by NO_X emission. Describe post combustion NO_X control techniques.

(b) Describe the control mechanism used in nuclear reactor.

(2 + 2 + 4) + 4 = 12