

Plant Utilities

P. Pages : 2

Time : Three Hours

**NIR/KW/18/3775**

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Due credit will be given to neatness and adequate dimensions.
 9. Assume suitable data whenever necessary.
 10. Diagrams and chemical equations should be given whenever necessary.
 11. Illustrate your answers whenever necessary with the help of neat sketches.
 12. Use of non programmable calculator is permitted.

1. a) Explain three laws of thermodynamics. 6
- b) What do you understand by property of a system? Distinguish between extensive and intensive properties of a system. 7

OR

2. a) Define the following terms: 6
- i) Sensible heat of water
 - ii) Latent heat of vaporisation
 - iii) Dryness fraction of steam.
- b) Determine the quantity of heat required to produce 1kg of steam at a pressure of 6 bar at a temperature of 25°C, under the following conditions: 7
- i) When the steam is wet, having a dryness fraction 0.9;
 - ii) When the steam is dry saturated; and
 - iii) When it is superheated at a constant pressure at 250°C, assuming mean specific heat to be 2.3 kJ / kg K .

3. a) What are the differentiating features between a water tube and fire tube boiler? 6
- b) Explain the necessity of boiler Mountings and accessories in steam boiler. 7

OR

4. a) A coal fired boiler plant consumes 400kg of coal per hour. The boiler evaporates 3200kg of water at 44.5°C into the superheated steam at a pressure of 12 bar and 274.5°C. If the calorific value of fuel is 32760 kJ/kg of coal Determine 6
- i) Equivalent evaporation from and at 100°C and
 - ii) Thermal efficiency of the boiler
- b) What are the functions of a boiler chimney? Why is no chimney provided on a locomotive boiler? 7

5. a) Give the classification of steam turbines. 7
- b) Draw the combined velocity triangle for a single stage reaction turbine and derive an expression for workdone per stage. 7

OR

6. a) Explain the term 'Compounding of steam turbine' What are the different methods of reducing rotor speed? 7
- b) In one stage of a reaction steam turbine, both the fixed and moving blades have inlet and outlet blade tip angles of 35° and 20° respectively. The mean blade speed is 80m/s and the steam consumption is 22500 kg per hour. Determine the power developed in a pair. 7
7. a) Discuss the list of advantages and disadvantages of a two stroke cycle engine over a four stroke one. 6
- b) Show that the efficiency of Otto cycle is a function of compression ratio only. 7

OR

8. a) An ideal Diesel engine has a diameter 150mm and stroke 200mm. The clearance volume is 10 percent of the swept volume. Determine the compression ratio and the air standard efficiency of the engine if the cut-off takes place at 6 percent of the stroke. 6
- b) Write short note on 'Spark Plug'. 7
9. a) For a atmospheric air having a average dry bulb temperature of 25°C and average relative humidity of 50% Find 6
- i) Specific humidity, ii) Dew point temperature
- iii) Wet bulb temperature, iv) Partial pressure of water vapour,
- v) Specific volume and
- vi) Enthalpy of atmospheric air using psychrometry chart.
- b) Differentiate between Natural draft cooling tower and Induced draft cooling tower. 7

OR

10. a) Write short note on 'Forced draft cooling tower'. 6
- b) Discuss the components of cooling tower. 7
11. a) A machine working on a Carnot cycle operates between 305K and 260K. Determine the C. O. P. when it is operated as 6
- i) A refrigerating machine ii) A heat pump iii) A heat engine
- b) Write short note on 'VCRS' vapour compression refrigeration system. 8

OR

12. a) State the properties of a good refrigerant. What are the normal refrigerants used. 7
- b) Describe briefly with the help of a diagram, the vapour absorption system of refrigeration. 7
In what way this system is advantageous over the vapour compression system?
