14658

B. Tech 4th Semester Examination

Heat Power Engineering (O.S.)

ME-4005

Time : 3 Hours   **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C, D of the question paper and all subparts of the questions in Section E. Use of non-programmable calculator, steam table and Mollier chart is allowed.

SECTION - A

1. A sample of coal with C = 78%, H_2 = 5%, O_2 = 8%, S = 2%, N_2 = 2%, and remaining ash, is burnt in a furnace with 50% excess air. The temperature of flue gas at the entry of chimney is 325°C and the atmospheric temperature is 15°C. The heat carried away per kg of moisture in the flue gas is 2940 kJ. Calculate the heat loss in flue gas per kg of coal. Take C_p for O_2, N_2, and air as 1.008 kJ/kgK and C_p for CO_2, SO_2 from flue gas as 1.05 kJ/kg.K.

(20)

2, Give a complete classification of boilers. With the help of a neat sketch describe the working of a Lanchashire boiler.   (20)

SECTION - B

3. In a reheat cycle steam at 550°C expands in an HP turbine till it becomes saturated vapour. It is reheated at constant pressure to 400°C and then expands in a L.P. turbine to 40°C. If the

moisture content at turbine exhaust is given to be 14.67%, find out (a) the reheat pressure, (b) the pressure of steam at inlet to the HP turbine, (c) the net work output/kg and (d) the cycle efficiency. Assume all processes to be ideal.   (20)

4. A steam turbine develops 185 kW with a consumption of 16.5 kg/kWhr. The pressure and temperature of steam entering the nozzle are 12 bar and 220°C. The steam leaves the nozzle at 1.2 bar. The diameter of the nozzle at throat is 7 mm. Find the number of nozzles.   (20)

SECTION - C

5. In a Parson reaction turbine the fixed and moving blades are of same shape but reversed in direction. The angles of the receiving tips are 35° and of the discharging tips are 20°. Find the power developed for a steam consumption of 1 kg/min, when the blade speed is 100 m/sec. Also calculate diagram efficiency and axial thrust.   (20)

6. What is the condition of maximum efficiency for impulse turbine? Explain with combined velocity diagram the velocity compounded impulse turbine.   (6+14=20)

SECTION - D

7. Define degree of reaction. With neat sketches explain various types of governing in steam turbines.   (4+16=20)

8. With the help of neat sketches describe the workings of 'jet' and 'surface' condensers.   (20)

SECTION - E

9. (a) Define 'carbonisation' and 'gasification' with examples.

    (b) Define 'vacuum efficiency' and 'condenser efficiency'.

    (c) What is 50% reaction? What are the characteristics of 50% reaction?

(d) List the advantages of a regenerative Rankine cycle.

(e) Draw the schematic diagram of a binary vapour cycle.

(f) Differentiate between 'proximate' and 'ultimate' analysis of a solid fuel.

(g) Define axial discharge. What are the conditions for axial discharge?

(h) Differentiate between boiler mountings and accessories with examples.

(i) Explain the significance of critical pressure ratio.

(j) Explain the effect of friction on the performance of nozzle.

(10×2=20)