PVP 14

Code: ME4T2

II B.Tech - II Semester – Regular/Supplementary Examinations – April 2017

APPLIED THERMODYNAMICS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks

11 x 2 = 22

1.

a) Write a short note on adiabatic flame temperature.
b) State the advantages and disadvantages of reheating.
c) What are the essentials of a good steam boiler?
d) State the functions of draught and classify the boiler draughts.
e) Write the classification of steam boilers.
f) Draw the velocity diagram of single stage impulse turbine and name its nomenclature.
g) Differentiate between impulse and reaction turbines.
h) Compare the jet and surface condenser.
i) Write a short note on vacuum efficiency.
j) Write a short note on clearance in compressors.
k) Define slip factor for a centrifugal compressor.

PART – B

Answer any ***THREE*** questions. All questions carry equal marks.

3 x 16 = 48 M

2. a) With a neat sketch explain the regenerative cycle. 8 M

b) Steam at a pressure of 20 bar and 250^0 C enters a turbine and leaves it finally at a pressure of 0.05 bar. Steam is bled off at pressure of 5.0, 1.5 and 0.3 bar.
Assuming (i) that the condensate is heated in each heater upto the saturation temperature of the steam in that heater, (ii) that the drain water from each heater is cascaded through a trap into the next heater on the low pressure side of it, (iii) that the combined drains from the heater operating at 0.3 bar are cooled in a drain cooler to condenser temperature, calculate the following:

i) Mass of bled steam for each heater per kg of steam entering the turbine.

ii) Thermal efficiency of the cycle.

iii) Thermal efficiency of the Rankine cycle.

iv) Theoretical gain due to regenerative feed heating.

v) Steam consumption in kg/kWh with or without regenerative feed heating, and Quantity of steam passing through the last stage nozzle of a 50000 KW turbine with and without regenerative feed heating.

8 M

3. a) Write the comparison between Fire tube and water tube boilers. 8 M

b) Explain with neat sketch the construction and working principle of Benson boiler and write the advantages of Benson boiler. 8 M

4. a) What is compounding? What are the different methods of Compounding? With a neat sketch explain any one type of compounding. 8 M

b) In a De Laval turbine steam issues from the nozzle with a velocity of 1200 m/s. The nozzle angle is 20^0,the mean blade velocity is 400 m/s, and the inlet and outlet angles of blades are equal. The mass of steam flowing through the turbine per hour is 1000 kg, calculate: 8 M

i) Blade angles

ii) Relative velocity of steam entering the blades.

iii) Tangential force on the blades.

iv) Power developed

v) Blade efficiency.

5. a) With a neat sketch explain parallel-flow type low level jet condenser. 8 M

b) With a neat sketch explain evaporative surface condenser. 8 M

6. a) In an axial flow compressor, the overall stagnation pressure ratio achieved is 4 with overall stagnation isentropic efficiency 85 per cent. The inlet stagnation pressure and temperature are 1 bar and 300 K. The mean blade speed is 180 m/s. The degree of reaction is 0.5 at the mean radius with relative air angles of 12^0 and 32^0 at the rotor inlet and outlet respectively. The work done factor is 0.9. calculate: 8 M

i)Stagnation polytropic efficiency.

ii) Number of stages.

iii) Inlet temperature and pressure.

iv) Blade height in the first stage if the hub-tip ratio is 0.42, mass flow rate 19.5 kg/s.

b) Compare the centrifugal and axial flow compressors. 8 M