[03 – 3112]

III/IV B.E. DEGREE EXAMINATION.

First Semester

Mechanical Engineering

ENGINEERING THERMODYNAMICS — II

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR questions from the remaining

Use of Steam Tables, Refrigeration Tables, Mollier and P-h charts is permitted.

1. (a) What are the methods used in reducing the speed of the turbine rotor?

(b) Why the magnitude of Reheat factor always greater than unity?

(c) Define Condenser efficiency and vacuum efficiency.

(d) Differentiate Heat engine and Reversible heat engine.

(e) What are the limitations of First law of Thermodynamics?

(f) Define Helmholtzs function and Gibbs function.

(g) State the organs of a Steam condensing plant.

2. (a) Distinguish between 'Enthalpy' and 'heat capacity'.

(b) A student made the following erroneous statement in a laboratory report on Bomb Calorimetry. "_H = _E+P_V. Since the bomb calorimetry process is a constant volume one, _V = 0 and _E = _H. Explain in detail why this arrangement is incorrect.

3. (a) Explain with the help of neat diagrams a Regenerative cycle. Derive also an expression for its thermal efficiency.

(b) In a regenerative cycle the inlet conditions are 40 bar and 4000C. Steam is bled at 10 bar in regenerative heating. The exit pressure is 0.8 bar. Neglecting pump work, determine the efficiency of the cycle.

4. (a) Explain what is meant by critical pressure ratio of a nozzle.

(b) Dry saturated steam enters a steam nozzle at pressure of 12 Bar and is discharged at a pressure of 1.5 Bar and dryness fraction 0.95. What will be the final velocity of steam? Neglect initial velocity. If 12% of heat drop is lost in friction. Find the percentage reduction in the final velocity.

5. (a) What do you mean by compounding of steam turbines? Discuss various methods of compounding steam turbines.

(b) A velocity compounded impulse turbine has two rows of moving blades with a fixed row of guide blades between them. The steam leaves the nozzle at 900 m/s in a direction at 180 to the plane of rotation. Blade speed is 150 m/s and the blade outlet angles for first moving blade 24°, fixed blade 26° and second moving blade 30°. Friction factor is 0.9 for all rows. Determine thrust and power developed for the steam supply of 1.25 kg/s.

6. (a) A surface condenser deals with 2100kg of steam per hour and the air leakage amounts to 0.8 kg per hour. The temperature of air pump suction is 35 0C and the vacuum is 680 mm of Hg when the barometer reads 760 mm of Hg. Determine the capacity of wet air pump which has a volumetric efficiency of 75%.

(b) What are the functions of condensers in a steam power plant? Explain with a simple diagram.

7. In a Bell Coleman refrigeration cycle, 10450 kJ of heat is extracted from the brine per minute, which is circulated around the cold chamber at 0°C and 1 bar. The air coming out from the cold chamber is compressed to 2 bar isentropically by the compressor. The compressed air is cooled to 40°C without pressure loss in the inter cooler. The cooler air expands isentropically in an air expander to the cold chamber pressure of 1 bar and again taken to the chamber. Find

(a) COP and

(b) Power required to run the compressor.

8. (a) Discuss the essential properties of an ideal refrigerant.

(b) Name various psychrometric processes and show each of them on psychrometric chart? Which of these properties is most suitable in summer?