Roll No. | | | | | | | | |

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B.E (Full Time) End Semester DEGREE EXAMINATION, NOV / DEC 2011

Fourth Semester

Common to Manufacturing / Industrial Engineering

ME 551 - THERMODYNAMICS

(Regulation 2004)

Time : 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. Define Thermodynamic Equilibrium.
2. Define Entropy.
3. Why air standard efficiency is determined for a power cycle?
4. Draw the port timing diagram of a two stroke petrol engine.
5. What is the function of fusible plug in a boiler?
6. What is meant by compounding in steam turbine?
7. Define volumetric efficiency of an air compressor.
8. Define Psychometry.
9. How the cooling is effected through fins?
10. Define counter flow heat exchanger.

Part – B (5 x 16 = 80 marks)

11. a) 10 kg of fluid per minute goes through a reversible steady flow process. The properties of fluid at the inlet are : p_1 = 1.5 bar, ρ_1 = 26 kg/m^3, C_1 = 110 m/s and u_1 = 910 kJ/kg and at the exit are p_2 = 5.5 bar, ρ_2 = 5.5 kg/m^3, C_2 = 190 m/s and u_2 = 710 kJ/kg. During the passage, the fluid rejects 55 kJ/s and rises through 55 metres. Determine:
    i) The change in enthalpy (Δh)
    ii) Work done during the process (W).

12. a) The minimum pressure and temperature in an Otto cycle are 100 kPa and 27°C. The amount of heat added to the air per cycle is 1500 kJ/kg.
    i) Determine the pressures and temperatures at all points of the air standard Otto cycle.
    ii) Also calculate the specific work and thermal efficiency of the cycle for a compression ratio of 8 : 1.

    Take for air : c_v = 0.72 kJ / kg K, and γ = 1.4.

    OR

    b) Air enters the compressor of a gas turbines plant operating on Brayton cycle at 1 bar, 27°C. The pressure ratio in the cycle is 6. If $W_T = 2.5\ W_C$, where W_T and W_C are the turbine and compressor work respectively, calculate the maximum temperature and the cycle efficiency.

13. a) Explain the construction and working of a high pressure power generation steam boiler.

OR

b) Explain the construction and working with velocity diagram of a reaction type steam turbine.

14. a) A single-acting two-stage air compressor delivers air at 18 bar. The temperature and pressure of the air before the compression in L.P. cylinder at 25°C and 1 bar. The discharge pressure of L.P. cylinder is 4.2 bar. The pressure of air leaving the intercooler is 4 bar and the air is cooled to 25° C. The diameter and stroke of L.P. cylinder are 40 cm and 50 cm respectively. The clearance volume is 5% stroke in both cylinders. The speed of the compressor is 200 r.p.m. Assuming the index of compression and re-expansion in both cylinders as 1.25, c_p for air = 1.004 kJ / kg K, find :

i) Power required to run the compressor, and
ii) Heat rejected in intercooler / min.

OR

b) Explain the construction and working of vapour compression refrigeration system, with necessary H-S diagram.

15. a) Derive the relation for the determination of intermediate surface temperature of a two cylinder combination with thermal logging on the outside.

OR

b) Explain the process of convective heat transfer over a flat plate with necessary numerical relations and illustration.