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

B.E. (Part Time) End Semester DEGREE EXAMINATION, APR / MAY 2008

Second Semester

Common to Industrial Engineering / EEE

PTME 251 - THERMODYNAMICS

(Regulation 2002)

Time: 3 Hours Max. Marks 100

INSTRUCTIONS
Approved Steam Tables and HMT data book Permitted
Assume any missing data with proper justification

Answer All Questions

PART A (10 x 2 = 20 Mark)

1. What is meant by thermodynamic equilibrium?
2. How do you define change in entropy? and what is its significance?
3. How does the air standard efficiency of diesel cycle varies with compression ratio and cut-off ratio?
4. Compare two stroke engines with four stroke engines.
5. Differentiate between the wet steam and super heated steam.
6. What are the needs for the boiler testing?
7. What is the stage efficiency of a steam turbine?
8. What are the advantages of multistage compression?
9. What is the critical insulation?
10. What are the merits and limitations of forced convection?

PART B (5 x 16=80 Mark)

11) (i) Briefly discuss various reasons for irreversibility. [4]
(ii) Sate and prove the equivalence of two statements of thermodynamics. [4]
(iii) Air at 30° C and 1 bar is compressed reversibly from 5 m^3 to 1 m^3. Calculate the final temperature, pressure, the work done, heat transferred and change in entropy if the index of compression is 1, 1.25 and 1.4 respectively.Assume C_p = 1.005 kJ/kg°K, C_v = 0.718 kJ / kg°K. [8]

12) (a) In an diesel cycle, the condition of air at the beginning of compression is 30° C and 1.02 bar. The pressure at the end of the compression is 75 bar. The a mounts of heat added at constant pressure is 800 kJ/kg. Calculate the (i) Compression ratio and cut-off ratio, (ii) Cycle Efficiency and (iii) mean effective pressure. [6+4+6].

(OR)

(b) A gas turbine unit has a pressure ratio of 8 :1 and maximum cycle temperature of 1000°C. The isentropic efficiencies of the compressor and turbine are 0.85 and 0.95 respectively. Calculate the cycle efficiency. Compare this efficiency with the simple ideal cycle efficiency with your comments.? [8+4+2]

13) (a) (i)1 kg of steam initially dry saturated at 1 MPa, expands in a cylinder, following, the law $pv^{1.13} = C$. The pressure at the end of expansion is 0.1 Mpa. Determine the final volume and final dryness fraction, the work done, the change in internal energy and the heat transferred. [10]

(ii) Explain the working of a simple steam power plant with suitable cycle diagram. [6]

[OR]

(b) (i) Differentiate between the boiler accessories and mountings [4]

(ii) A single stage impulse turbine rotor has a diameter of 1.2 m running at 3000 r.p.m. The nozzle angle is 18°. Blade speed ratio is 0.42. The ratio of the relative velocity at outlet to relative velocity at inlet in 0.9. The outlet angle of the blade is 3° smaller than the inlet angle. The steam flow rate is 5 kg / sec. Draw the velocity diagram and find the velocity of whirl, axial thrust on the bearing, blade angles and power developed [12].

14) (a) (i) What are the merits of rotary compressors ? [4]

(ii) An air compressor compresses 60 kg/min of air to 16 bar pressure from 1 bar and 300K. Calculate the power required and isothermal efficiency. If a two stage compressor is used, find the percentage change in power and efficiency. [12]

[OR]

(b) (i) Give the typical layout of Summer Air Conditioning Plant. [6]

(ii) An ammonia refrigerator works between 10°C and 38°C the vapour being dry at the end of isentropic compression. There is no under-cooling of liquid ammonia, and the liquid is expanded through a throttle valve after leaving the condenser. Calculate power per TR, C.O.P. Sketch the cycle on T-s diagram. Table of Properties of Ammonia is given below: [10]

Temp °C	Enthalpy kJ / kg hf	hfg	hg	Entropy (Liquid) kJ/kg °K	Entropy (Vapour) kJ/kg °K	Specify volume (Vapour)
-10	-808.71	1296.47	487.76	5.5257	10.4539	0.41949
-38	-581.57	1108.34	526.77	6.3111	9.8742	0.08817

C_p for liquid = 4.75 kJ/kg°K, C_p for vapour = 3.00 kJ/kg°K

15) (a) (i) Compare heat transfer by conduction with that by convection. [4].

(ii) A composite insulating wall has three layers of material held together by 3 cm diameter aluminium rivet per 0.1 m^2 of surface. The layers of materials comprise 10 cm thick brick with hot surface at 200°C, 1 cm thick timber with cold surface at 10°C. These two layers are interposed by a third layer of insulating material 25 cm thick. The conductivities of materials are: k(brick) = 0.95 W / m ° K, k(insulation) = 0.115 W / m ° K, k (wood) = 0.175 W / m ° and k(aluminium) = 200 W / m ° K. If the heat transfer is assumed to take place only in one direction normal to the layers, determine the percentage increase in heat transfer rate due to rivets. [12]

(b) (i) Explain the mechanism of heat transfer in fins and role of fins in industries [6]

(ii) Water entering at 10°C is heated to 40°C in the tube of 2 cm ID at a mass flow rate of 0.01 kg/s. The outside of the tube is maintained at uniform heat flux of 15 kW/m^2. Neglecting any entrance effect, find the Reynolds number, heat transfer coefficient, length of the pipe required for 30° rise in mean temperature, inner surface temperature at the outlet and friction factor. [10]