Reg. No. : | | | | | | | | | | | |

R 3009

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Third Semester

Aeronautical Engineering

AE 1201 — AERO ENGINEERING THERMODYNAMICS

(Regulation 2004)

Time : Three hours Maximum : 100 marks

(Steam Tables/Mollier Charts to be permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define - First law of thermodynamics.

2. What is an Isothermal Process? Derive an expression for the Work done during an Isothermal Process.

3. For a Given compression ratio; the air standard diesel cycle is less efficient than air standard Otto cycle. Explain.

4. Discuss the pressure ratio, cut-off ratio.

5. What is meant by Specific Steam Consumption in a rankine cycle?

6. Define co efficient of nozzle with the help of *h*-s diagram.

7. What are the components in the vapour compression refrigeration system?

8. Give the properties of refrigerants. State - Define Clausius inequality.

9. Explain the effect of inter cooling in a multi stage reciprocating compressor.

10. What is meant by clearance ratio?

PART B — (5 × 16 = 80 marks)

11. (a) A certain quantity of air has a volume of 0.028 m^3 at a pressure of 1.25 bar and 25°C. It is compressed to a volume of 0.0042 m^3 according to a law $pv^{1.3}$ = constant. Find the final temperature and work done during compression. Also determine the reduction in pressure at a constant volume to bring the air back to its original volume.

Or

(b) A gas initially at 603 K expands until its volume is 5.2 times the initial volume according to pv^n = constant. If the initial and final pressures are observed to be 8.5 bar and 1 bar, determine

(i) Index of expansion

(ii) Work done per kg of gas and

(iii) Heat exchange per kg of gas

Assume Cv = 0.712 kJ/kg K and υ = 1.4.

12. (a) An air standard diesel cycle has a compression ratio of 20. The pressure at the beginning of compression stroke is 1 bar and the temperature is 27°C. The maximum temperature of the cycle is 2500°C. Determine the efficiency of the Engine, Pressure and Temperature at all salient point.

Or

(b) An engine working on Dual cycle the Pressure and Temperature at the beginning of cycle are 100°C and 1 bar. The compression ratio is 10, the max pressure is limited to 70 bar and total heat supplied of air is 1680 kJ. Find the following.

(i) Pressure and Temperature at all salient point

(ii) Determine the efficiency of the Engine.

13. (a) Dry saturated steam at a pressure of 10.0 bar is expanded in a nozzle to a pressure of 0.7 bar. With the help of a mollier diagram, find the velocity and dryness fraction of steam issuing from the nozzle if the friction is neglected. Also find the velocity and dryness fraction of steam. If 5% of the heat drop is lost in friction.

Or

(b) Simple Rankine Cycle works between the Pressure of 30 bar and 0.04 bar. The initial condition of steam being dry saturated. Calculate the Cycle Efficiency, Work Ratio and Specific Steam Consumption. Also find the Cycle Efficiency when the pump is neglected.

14. (a) A Vapour Compression Refrigerator uses R–12 as refrigerant and the liquid in the evaporator is at –15°C. The temperature of this refrigerant are the delivery from the compressor is 15°C. When the vapour is condensed at 10°C, find the COP, if

(i) there is no under-cooling

(ii) the liquid is cooled by 5°C before expansion by throttling

Find the increase in COP. Take the Specific Heat at Constant Pressure for Super Heated Vapour as 0.64 kJ/mg K and that for liquid as 0.94 kJ/kg K. The table provides the properties of the refrigerant.

Temperature in °C	Enthalpy		Entropy	
	Liquid	Vapour	Liquid	Vapour
–15	22.3	180.88	0.0904	0.7051
10	45.4	191.76	0.1750	0.6921

Or

(b) Explain the working principles of vapour absorption refrigeration with a neat sketch.

15. (a) In a two stage compressor in which inter–cooling is perfect, prove that work done in the compressor is minimum when the pressure in the inter–cooler is geometric mean between the initial and final pressure. Draw the P–V diagram for Two Stage Compression.

Or

(b) Sketch and explain the working of Single Stage reciprocating Air Compressor.