Register Number.....

B.E. DEGREE EXAMINATIONS: OCTOBER/NOVEMBER – 2008

Third Semester

AERONAUTICAL ENGINEERING

U07AR301 -Aero Engineering Thermodynamics

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (20 x 1 = 20 Marks)

1. Work done in free expansion process is
   A. Zero B. Minimum C. Maximum D. Positive

2. Internal energy of a perfect gas depends on
   A. Temperature, Specific heats and Pressure B. Temperature, Specific heats and Enthalpy
   C. Temperature, Specific heats and Entropy D. Temperature only

3. Second law of thermodynamics defines
   A. Heat B. Work C. Enthalpy D. Entropy

4. For any reversible process, the change in entropy of the system and surroundings is
   A. Zero B. Positive C. Negative D. Infinite

5. Otto cycle is also known as
   A. Constant pressure cycle B. Constant temperature cycle C. Constant volume cycle
   D. Constant enthalpy cycle

6. Compression ratio of diesel engine is in the range of
   A. 2 to 3 B. 7 to 10 C. 16 to 20 D. 10 to 15

7. In Brayton cycle pressure ratio (r_p) is
   A. $r_p = p_2/p_1$ B. $r_p = p_2 * p_1$ C. $r_p = p_2 - p_1$ D. $r_p = p_2 + p_1$

8. The power available in the shaft is known as
   A. Indicated Brake Power B. Net work done C. Brake Power
   D. Friction Power

9. Rankine cycle comprises of
   A. Two isentropic processes and two constant volume processes
   B. Two isentropic processes and two constant pressure processes
   C. Two isothermal processes and two constant volume processes
   D. Two isothermal processes and two constant pressure processes

10. Dryness fraction of the wet steam is
    A. Less than one B. Greater than one C. Equal to one D. Zero

11. The thrust produced per unit weight flow of propellant is
    A. Propeller thrust B. Jet thrust C. Specific thrust
    D. Specific impulse

12. The refrigerant should have _____ boiling point and _____ viscosity.
    A. Low, Low B. Low, High C. High, Low D. High, High

13. The ratio between heat extracted and the work done is
A. Efficiency B. COP C. Heat ratio D. Work ratio

14. 1 Ton of Refrigeration equal to
A. 210 kJ/min B. 220 kJ/min C. 3.5 kJ/min D. 35 kJ/min

15. The temperature registered by ordinary thermometer is
A. DBT B. WBT C. DPT D.RH

16. Which of the component is not used in Vapour Absorption Refrigeration System
A. Generator B. Condenser C. Compressor D. Evaporator

17. In reciprocating compressors the clearance ratio is given by
A. Total volume of cylinder/Clearance volume
B. Swept volume of cylinder/Clearance volume
C. Clearance volume/ Swept volume of cylinder
D. Clearance volume/ Total volume of cylinder

18. Mechanical efficiency of reciprocating air compressor is expressed as
A. (B.P/I.P) B. (I.P/B.P) C. (F.P/B.P) D. (F.P/I.P)

19. In a two stage compressor efficiency will be maximum when
A. $P_2=\sqrt{P1-P3}$ B. $P_2=\sqrt{P1/P3}$ C. $P_1=\sqrt{P2P3}$ D. $P_2=\sqrt{P1P3}$

20. The efficiency of Vane type air compressor as compared to roots air compressor for the same pressure ratio
A. More B. Less C. Same D. May be more or less

PART B (5 x 16 = 80 Marks)

21. (a) At the inlet to a certain nozzle the enthalpy of fluid passing is 2800kJ/kg, and the velocity is 50 m/s. At the discharge end the enthalpy is 2600 kJ/kg. The nozzle is horizontal and there is negligible heat loss from it.
(i) Find the velocity at exit of the nozzle.
(ii) If the inlet area is 900 cm^2 and the specific volume at inlet is 0.187m^3/kg, find the mass flow rate.
(iii) If the specific volume at the nozzle exit is 0.498m^3/kg, find the exit area of nozzle. (16)

(OR)

(b) (i) State Kelvin-Planck and Clausius statements of second law. (6)
(ii)Write Clausius inequality. 300 kJ/sec of heat is supplied at a constant fixed temperature of 290°C to a heat engine. The heat rejection takes place at 8.5°C. The following results were obtained:
(i) 215 kJ/sec are rejected
(ii) 150 kJ/sec are rejected
(iii) 75 kJ/sec are rejected
Classify which of the result report a reversible cycle or irreversible cycle, or impossible results. (10)

22. (a) An engine working on the Otto cycle is supplied with air at 0.1 Mpa, 35°C. The compression ratio is 8. Heat supplied is 2100 kJ/kg. Calculate the maximum pressure and temperature of the cycle, the cycle efficiency, and the mean effective pressure. Plot P-V and T-s diagrams.
(For air c_p = 1.005 kJ/kg K, c_v = 0.718 kJ/kg K, and R = 0.287 kJ/kg K) (16)

(OR)

(b) (i) Discuss the theoretical and actual PV diagrams of a diesel engine. (8)
(ii) Compare four stroke and two stroke cycle engines. (8)

23. (a) (i) Write the continuity and Energy equations. (4)
(ii) In a steam turbine steam at 20 bar, 360C is expanded to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assume ideal processes; find per kg of steam the net work done and the cycle efficiency. (12)

(OR)

(b) A rocket operating at an altitude of 20 km with the following data:
Propellant flow rate = 1 kg/sec; Thrust chamber pressure = 2450 K; Nozzle area ratio =0; Thermodynamic properties of the exhaust gases: γ=1.3; R=355 J/kg K. Calculate:
(i) Thrust (ii) effective jet velocity (iii) Specific impulse. (16)

24. (a) With help of neat sketch, explain the working principle of Vapour Compression Refrigeration System (VCRS). (16)

(OR)

(b) Explain with neat diagram the working of central system of air-conditioning. (16)

25. (a). An air compressor takes in air at 1 bar and 20°C and compresses it according to law $pv^{1.2}$ = constant. It is then delivered to a receiver at a constant pressure of 10 bar. R = 0.287 kJ/kg K. Determine:
(i) Temperature at the end of compression
(ii) Work done
(iii) Heat transferred during compression per kg of air. (16)

(OR)

(b) (i) Differentiate between reciprocating and rotary compressors. (6)
(ii) Explain the working principle of Screw compressor and Sliding vane compressor. (10)

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