



**B.E DEGREE EXAMINATIONS: NOV/DEC 2014**

(Regulation 2013)

Third Semester

**AUTOMOBILE ENGINEERING**

U13AUT302: Thermodynamics and Thermal Engineering

**(Use of approved steam tables, pscrometric chart and HMT data book are allowed)**

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. For a throttling device.
  - a) Enthalpy is constant
  - b) Entropy is constant
  - c) Velocity is constant
  - d) Pressure is constant
2. Heat and Work are called ..... functions.
3. A process in which only heat transfer and no mass transfer is known as
  - a) Closed system
  - b) Open system
  - c) Isolated system
  - d) None of the above
4. .... cycle is more efficient for the same compression ratio
5. The compression ratio is given by
  - a) Total volume/clearance volume
  - b)  $P_2/P_1$
  - c) Clearance volume/ specific volume
  - d) Clearance volume/ total volume
6. Isothermal efficiency of compressor is ratio of .....
7. If the dryness fraction is 1 , then the quality of steam is said to be
  - a) Wet
  - b) Dry saturated
  - c) Super heated
  - d) Saturated water
8. Steam nozzle converts ..... energy into -----
9. Ratio of the actual specific humidity and the saturated specific humidity is
  - a) Latent heat
  - b) Relative humidity
  - c) Humidity ratio
  - d) Degree of saturation
10. ....kW heat is removed by 1 Ton capacity refrigerator.

**PART B (10 x 2 = 20 Marks)**  
**(Not more than 40 words)**

11. What is quasi static process?
12. List the various SFEE applications.
13. State Kelvin-Planck statement of second law of thermodynamics.
14. Compare otto,diesel and duel cycles for same maximum pressure.
15. Define Mean Effective pressure.
16. What are the advantages of multi stage compressor?
17. Calculate the dryness fraction of steam which has 2 kg of water in suspension with 35 kg of steam.
18. Classify steam nozzles.
19. Outline the importance of evaporative cooling.
20. Define COP of a refrigerator.

**PART C (5 x 14 = 70 Marks)**  
**(Not more than 400 words)**

**Q.No. 21 is Compulsory**

21. In an air compressor, air flows steadily at the rate of 0.5 kg/s. The air enters the compressor at 7m/s with a pressure of 1 bar and a specific volume of 0.95 m<sup>3</sup>/kg. It leaves the compressor at 5 m/s with a pressure of 7 bar and a specific volume of 0.19 m<sup>3</sup>/kg. The internal energy of the air leaving the compressor is 90 kJ/kg greater than that of the air entering. The cooling water in the compressor jackets absorbs heat from the air at the rate of 58 kJ/s. Find i) Power required to drive the compressor and ii) Ratio of inlet pipe diameter to outlet pipe diameter. Use steady flow energy Equation to solve this problem.
22. a) (i) Derive an expression for the Air standard efficiency of Diesel cycle (10)  
(ii) Draw the P-V and T-S diagram of duel cycle and state the various processes (4)

**(OR)**

- b) An engine working on the Otto cycle has a volume of 0.5m<sup>3</sup> and pressure 1 bar and temperature 27°C at the beginning of compression. At the end of the compression stroke the pressure is 12 bar. Heat added during constant volume process is 220 kJ by 0.58 kg of air. Calculate the pressures, temperatures and volumes at the salient points in the cycle.

23. a) Steam at 20 bar,  $360^{\circ}\text{C}$  is expanded in a steam turbine 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, assuming ideal processes find per kg of steam the net work and the cycle efficiency

**(OR)**

- b) A single acting reciprocating compressor has cylinder diameter and stroke of 150 and 200 mm respectively. The compressor sucks air at 1 bar and  $25^{\circ}\text{C}$  and delivers at 10 bar, while running at 150 rpm. Find the indicated power of the compressor. Take  $n=1.3$

24. a) An air conditioning plant is to be designed for a small office for winter conditions.

Outdoor conditions :  $10^{\circ}\text{C}$  DBT and  $8^{\circ}\text{C}$  WBT

Required indoor conditions :  $20^{\circ}\text{C}$  DBT and 60 % R.H.

Amount of air circulation :  $0.3 \text{ m}^3/\text{min}/\text{person}$

Seating capacity of the office : 50.

The required condition is achieved first by heating and then by adiabatic humidifying. Find the following: Heating capacity of the coil in kW and capacity of the humidifier.

**(OR)**

- b) Explain the working principle of a Vapour Compression Refrigeration system with a neat sketch

25. a) (i) Explain Fourier's law of heat conduction with neat sketch. (10)  
(ii) Classify heat exchangers based on its applications (4)

**(OR)**

- b) The interior temperature of a refrigerator is maintained at  $7^{\circ}\text{C}$ . The walls are constructed with two mild steels sheets 3 mm thick with 5 cm of glass wool insulation between them. Find the rate of heat removed from the refrigerator when it is kept in a kitchen room. The temperature in the kitchen is  $28^{\circ}\text{C}$ . take K for glass wool and mild steel as  $0.04 \text{ W}/\text{m}^{\circ}\text{C}$  ,  $40 \text{ W}/\text{m}^{\circ}\text{C}$  respectively.

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