Code No: 53017 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, February/March - 2016
THERMODYNAMICS
(Common to ME, AE, AME)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1.a) What is meant by quasi static process and explain any practical example of such process.

b) A system with initial internal energy of 300 kJ is receiving heat of 280 kJ at constant volume process and rejects heat of 260 kJ at constant pressure when 60 kJ of work is done on the system. The system is brought to its original state by an adiabatic process. Calculate the adiabatic work and value of internal energy at salient points. [5+10]

2.a) What is a PMMI? Why is it impossible?

b) A turbine operates under steady flow conditions, receiving steam at the following state: pressure 1.2 MPa, temperature 188^{0}C, enthalpy 2785 kJ/kg, velocity 33.3 m/s and elevation 3 m. The steam leaves the turbine at the following state: pressure 20 kPa, enthalpy 2512 kJ/kg, velocity 100 m/s, and elevation 0 m. Heat is lost to the surroundings at the rate of 0.29 kJ/s. If the rate of steam flow through the turbine is 0.42 kg/s, what is the power output of the turbine in kW? [7+8]

3.a) Write the differences between refrigerator and heat pump? Describe the COP for both of them?

b) The capacity of refrigerator is 280 tons. Determine the quantity of ice produced at 0^{0}C within 24 hours when water is supplied at a temperature of 20^{0}C. [6+9]

4.a) Explain pressure-temperature diagram for a pure substance.

b) A vessel contains one kg of steam which contains 1/3 liquid and 2/3 vapour by volume. The temperature of the steam is 151.86^{0}C. Find the quality, specific volume and specific enthalpy of the mixture. [5+10]

5. An ideal gas cycle of three processes uses Argon (Mol. wt. 40) as a working substance. Process 1-2 is a reversible adiabatic expansion from 0.015 m^3, 650 kPa, 270^{0}C to 0.066 m^3. Process 2-3 is a reversible isothermal process. Process 3-1 is a constant pressure process in which heat transfer is zero. Sketch the cycle in the P-V and T-s planes, and find

a) The work transfer in process 1-2,

b) The work transfer in process 2-3, and

c) The net work of the cycle. Take γ= 1.67. [5+5+5]

6.a) Write short notes on:

i) Mole fraction
ii) Volumetric analysis
iii) Dry bulb temperature.

b) An air water vapour mixture has a relative humidity of 60 % at 1 atmosphere and 30^0C. Determine per $100m^3$ of the mixture:

i) Mass of water vapour
ii) Mass of dry air.

[6+9]

7.a) Draw P-V and T-s diagram of Dual combustion cycle and explain various processes constituting the cycle.

b) Derive an expression for efficiency and mean effective pressure of Dual combustion cycle. [7+8]

8.a) Derive the expression for COP of Bell Coleman cycle when the compression and expansion are isentropic.

b) An air refrigerating plant operates between 1.6 bar and 8 bar. The capacity of the plant is 5.5 ton. The temperature of the air entering the compressor and into an air engine is -4^0C and 29^0C respectively. The compression and expansion processes are polytropic with exponent n = 1.35. Determine the COP and the net power input for the plant. [6+9]

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