Code No: 153BZ

**R18**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech II Year I Semester Examinations, March - 2022**
**THERMODYNAMICS**
**(Mechanical Engineering)**

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

**Answer any five questions**
**All questions carry equal marks**
- - -

1.a) Explain different forms of work transfer from thermodynamic point of view? Explain them with an example each.

b) When a closed system executes a certain non- flow process have the work and heat interactions. Those values per degree rise in temperature are given by the relations $dW/dT = (4 - 0.08\ T)$ kJ/K and $dQ/dT = 1.00$ kJ/K. Then calculate the Increase (or) decrease in the Internal energy of the system if it is to operate between the temperature limits of $200^0$C and $500^0$C. [7+8]

2.a) What is the concept of temperature? How the temperature measurement is evolved? Explain with one of the measurement.

b) A fluid at a pressure of 5.0 bar and with specific volume of 0.4 $m^3$/kg, contained in a cylinder behind a piston expands reversibly to a final pressure of 0.8 bar according to a law $P = C/V^2$. Then calculate the work done by the fluid on the piston and heat transfer during the process. [7+8]

3.a) Explain the importance of Joules experiment to prove the first law of thermodynamics and discuss its importance.

b) Steam enters a nozzle at a pressure of 7 bar and 205 $^0$C. Initial enthalpy being 2850 kJ/kg and leaves at a pressure of 1.5 bar. The initial velocity of steam at the entrance is 40 m/s and the exit velocity from the nozzle is 700 m/s. The mass flow rate through the nozzle is 1400 kg/h. The heat loss from the nozzle is 11705 kJ/ h. Determine the final enthalpy of steam and the nozzle exit area, if the specific volume is 1.24 $m^3$/ kg. [7+8]

4.a) Show that the Kelvin Plack statement and Claussius statement of second law of thermodynamics are same.

b) A reversible heat engine working between two thermal reservoirs at the temperatures of 875 K and 315 K drives a reversible refrigerator which operates between the same 315 K reservoir and a reservoir at 260 K. The engine is supplied 2000 kJ of heat and the network output from the composite system is 350 kJ. Calculate the heat transfer to the refrigerator and the net heat interaction with the reservoir at 315 K temperature. [5+10]

5.a) Steam initially at a pressure of 10.5 bar 0.96 dry throttled to a pressure of 1 bar. Find the final condition of steam. Also calculate the change of entropy per kg of steam. Assume $C_p$ for super heated steam = 2.1 kJ/kg K.

b) Derive the equation for the estimation of gas constant in terms of specific heats for perfect gas. [8+7]

6.a) Explain the free expansion and throttling processes. Discuss its practical applications.

b) Obtain the constants for Vander Waal's equation and discuss the importance of compressibility factor charts. [7+8]

7.a) An air water vapour mixture has a relative humidity of 60% at 1 atmosphere and 30 $^0$C. Determine per 100 m$^3$ of the mixture (i) mass of water vapour and (ii) mass of dry air.

b) Explain the processes involved in operation of steam power plant and explain the corresponding cycle and derive the equation for efficiency. [8+7]

8.a) Draw P-h and T-s chart for vapour compression refrigeration system and explain the principle of operation.

b) A diesel engine has a clearance volume of 220 cm $^3$ and a bore and stroke of 15 cm and 20 cm respectively. The inlet conditions are 100 kN/m$^2$ and 20$^0$C. The maximum temperature of the engine is 1400 $^0$C. Calculate (i) Ideal thermal efficiency of cycle and (ii) mean effective pressure. [7+8]

**---ooOoo---**