Code No: NR210304 **NR**

II B.Tech I Semester Supplementary Examinations, May 2005
THERMODYNAMICS
(Common to Mechanical Engineering and Aeronautical Engineering)
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A new temperature scale in degrees N is to be defined. The boiling and freezing points on this scale are 400^o N and 100^oN respectively.
   (a) Correlate this with
      i. Centigrade scale and
      ii. Fahrenheit scale.
   (b) What will be the reading on new scale corresponding to 60^oC.

2. In a steady flow apparatus 140kJ of work is done by each kg of fluid. The specific volume of the fluid, pressure and velocity at the inlet are $0.37m^3$/kg, 600 kpa and 16 m/s. The inlet is 32 m above the floor and the discharge pipe is at the floor level. The discharge conditions are $0.62m^3$/kg, 100kpa and 300m/s. The total heat loss between the inlet and discharge is 9kJ per kg of fluid. Find whether specific internal energy increase or decrease.

3. (a) State and explain any four factors which render processes irreversible.
   (b) A reversible heat engine receives heat from a reservoir at 700^0C and rejects heat to another reservoir at temperature T_2. A second heat engine receives the heat rejected by the first engine and rejects heat to a sink at 37^0C. Calculate temperature T_2 for
      i. equal efficiency for both engines
      ii. equal work for both engines

4. (a) Explain third law of Thermodynamics.
   (b) A tank holds 1 kg of air at 100 kPa, 40^0C, and another tank holds 1 kg of air at 200 kPa, 40^0C. The atmosphere is at 100 kPa, 20^0C. In which tank is the stored energy is greater? Determine the availability of the air in each tank.

5. (a) Derive an expression for heat transfer in a non flow constant volume process.
   (b) How much heat would be necessary to raise temperature of 1.5Kg of a gas from 90^0C to 225^0C, the volume remaining constant during the heat supply. Specific heat of gas at constant volume may be taken as 0.71KJ/Kg K.
   (c) The charge in a gas engine cylinder is compressed through a volume ratio of 5. Find the final pressure if the initial pressure is 0.9 bar absolute and the law of compression is $pv^{1.29} = C$.

6. Dry bulb and wet bulb temperature of moist air are found as 30^0C and 21^0C respectively. From the psychometric chart obtain:

(a) Relative humidity

(b) Humidity ratio

(c) Specific enthalpy

(d) Dew point temperature

(e) Specific volume of the mixture.

7. With a neat sketch, explain orsat apparatus and its use.

8. Steam enters the high pressure turbine of a steam power plant which operates on the ideal reheat Rankine cycle at 6MPa and 450^0C and leaves as saturated vapor. Steam is then reheated to 400^0C before it expands to a pressure of 7.5kPa. Heat is transferred to the steam in the boiler at a rate of 4x104kJ/s. Steam is cooled in the condenser by the cooling water from a nearby river, which enters the condenser at 15^0C. Show the cycle on a T-s diagram with respect to saturation lines, and determine the pressure at which reheating takes place, the net power output, the thermal efficiency and the minimum mass flow rate of the cooling water required.

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