National Institute of Technology, Srinagar
Department of Mechanical Engineering
Assignment-1

Subject: Element of Mechanical Engineering (MEL 100) **Submission Date: 10-05-2020**

Work & Heat

1) The piston of an oil engine of area 0.0045 m^3 moves downward 75 mm, drawing in 0.00028 m^3 of fresh air from the atmosphere. The pressure in the cylinder is uniform during the process at 80 kPa, while atmospheric pressure is 101.325 kPa, the difference being due to the flow resistance in the induction pipe and the inlet valve. Estimate the displacement work done by the air finally in the cylinder.

2) A mass of gas is compressed in a quasi-static process from 80 kPa, 0.1m^3 to 0.4 MPa, 0.03 m^3. Assuming that the pressure and volume are related by pv^n = Constant, find the work done by the gas system.

3) A system of volume *V* contains a mass *m* of gas at pressure *p* and temperature T. The macroscopic properties of the system obey the following relationship

$$(P+ a/V^2)(V-b)= mRT$$

Where a, b and R are constants.
Obtain an expression for the displacement work done by the system during a constant-temperature expansion from volume V_1 to volume V_2. Calculate the work done by a system which contains 10 kg of this gas expanding from 1m^3 to 10 m^3 at a temperature of 293 K. Use the values a= 15.7 ×10 Nm^4, b= 1.07× 10^{-2} m^3 and R= 0.278 kJ/kg-K.

4) If a gas of volume 6000 cm^3 and at pressure of 100 kPa is compressed quasistatically according to pV^2= constant until the volume becomes 2000 cm^3, determine the final pressure and the work transfer.

5) A mass of 1.5kg of air is compressed in a quasi-static process from 0.1 MPa to 0.7 MPa for which pv= Constant. The initial density of air is 1.16 kg/m^3. Find the work done by the piston to compress the air.

NOTE: Students have to submit this assignment on 10-05-2020 to their class instructor on their email ID.

Details are as:
CSE- Dr. Manoj Kumar (manojkumar@nitsri.net)
EE- Dr. Manoj Kumar (manojkumar@nitsri.net)
E&C- Dr. M.S. Charoo (shaficharoo123@nitsri.net)
IT- Dr. H.S. Pali (hspali@nitsri.net)