ME 211 Thermodynamics   Name _____
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Spring, 2013

Third Hour Exam

Education does not mean teaching students what they do not know,
it means teaching them to behave as they do not behave. -Julius Ruskin

(5 pts)   1.   Flow energy in a moving stream is: a)momentum exchange between the fluid and the walls of the pipe or duct, b)energy transfer due to heat to the surroundings, c)work required to overcome the inherent sheer stress (viscosity) of the fluid, d)energy change due to turbulence within the fluid, e)none of these.

(5 pts)   2.   Two hundred kilograms of water flow into a water reservoir in a twenty minute period while 75 kilograms of water flow out of the reservoir in a fifteen minute period. Determine the rate of water increase or decrease (dm/dt) in kg/s.

(5 pts)   3.   The velocity of air moving in a square duct is measured at 30 m/s. The temperature and pressure of the air in the duct are 30 C and 100 kPa. The area of the duct is 0.4 m2. Determine the mass flow rate of air in kg/s.

(10 pts) 4.   The internal energy of nitrogen (R = 0.296 kJ/kg K) at 40 C and 100 kPa is 44 kJ/kg.
         a.   Determine the specific volume in m3/kg.
         b.   Determine the enthalpy of the Nitrogen in kJ/kg.

(35 pts) 5. Cold air at 100 kPa and 7 C at a mass flow rate of 0.5 kg/s is mixed with warm air at 100 kPa and 34 C in a ventilation duct before exiting into a room at 100 kPa. The total mass flow rate of the exiting air is 1.4 kg/s. Determine the temperature of the exiting air.

(40 pts) 6. Steam enters a turbine at 2 MPa and 400 C with a inlet velocity of 50 m/s. and exits the turbine at 10 kPa with a quality of 90% and a velocity of 180 m/s. The power produced by the turbine is measured at 5 MW. Determine the mass flow rate of the steam through the turbine in kg/s.