Name: _____CM Box: _____

Circle your section:

Lui – 01 Lui – 02 Mech – 07

ES 202
Fluid & Thermal Systems

Examination III
February 12, 2007

Problem	Score
1	/ 50
2	/ 25
3	/ 25
Total	/100

Clearly show all work for credit.

Open TABLE ONLY

One side of an 8.5" x 11" equation sheet is allowed.
Laptops allowed
No EES allowed

Please hand in your equation sheet with your exam.

Density of water at standard conditions is assumed to be 1000 kg/m^3 in this exam.

Problem 1 (50 points)

(a) Complete the table of thermodynamic property information shown below for **Water.** Skip the shaded boxes. You are encouraged to use the blank space on this page and the next as work space.

Numerical answers should be provided with an **accuracy of at least 4-significant figures**. (Round-off can get you in trouble!)

Please use the following abbreviations as required:

CL = compressed (subcooled) liquid
SL = saturated liquid
SM = saturated two-phase mixture
SV = saturated vapor
SHV = superheated vapor
NA = not applicable
INSUF = insufficient information

State	Pressure P (MPa)	Temperature T (^{o}C)	Quality, x	Specific Volume v (m^3/kg)	Specific Enthalpy h (kJ/kg)	Phase
1		250				SV
2		250	0.70			
3	3.0	250				
4	3.0			0.02500		
5	3.0	100				
6	3.0				5000	

State 1:

State 2:

State 3:

State 4:

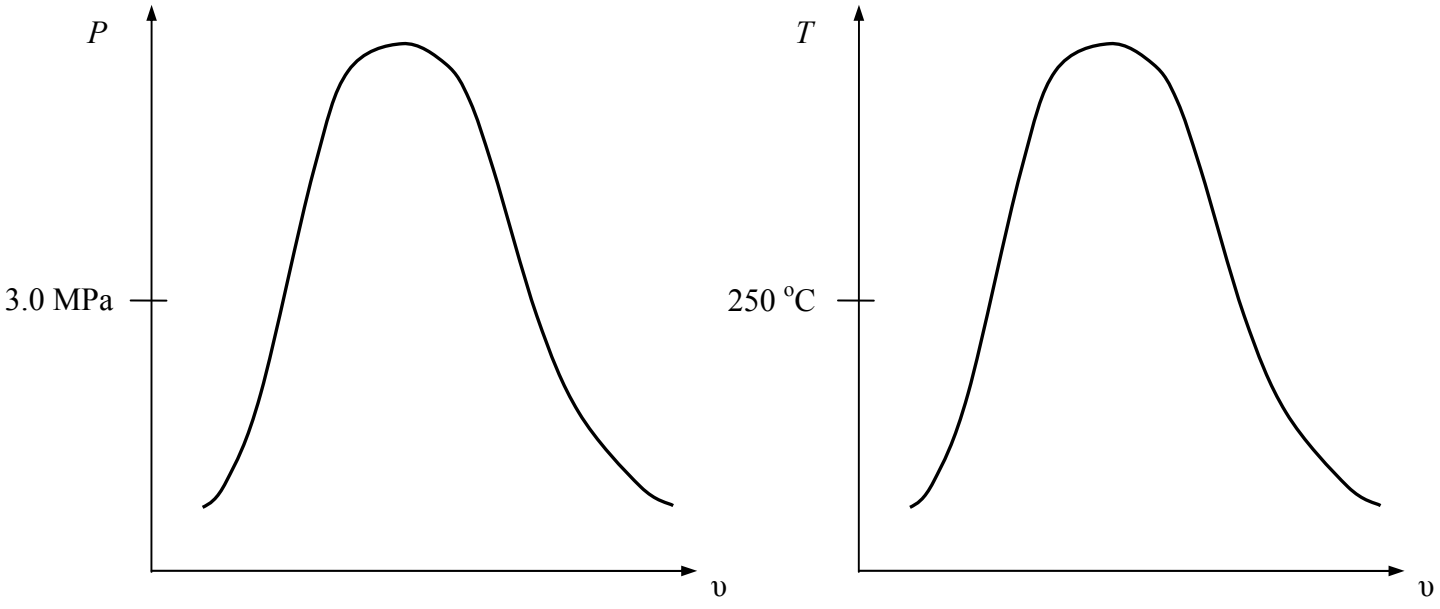
State 5:

State 6:

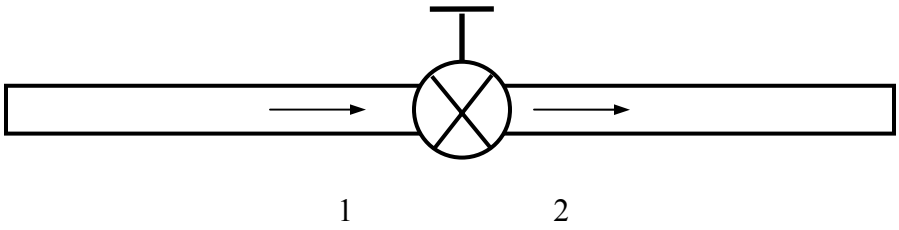
(b) On the following *P*-*v* diagram and *T*-*v* diagram,

i. Carefully sketch the 3.0 MPa isobar and the 250 ^{o}C isotherm on both diagrams.

ii. Carefully locate all six states (1-6) from Problem 1 (a). Take care to correctly locate the states relative to the saturation curves and the appropriate isotherm and isobar.



Problem 2 (25 points)
Saturated Refrigerant-134A with a quality of 30% is throttled through a valve from 400 kPa to 100 kPa.

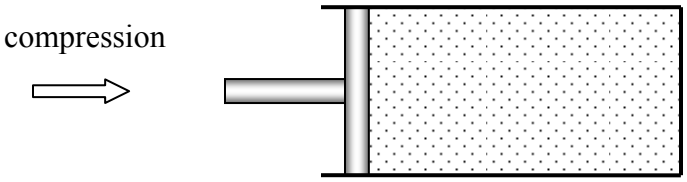


a) Determine the quality at the valve exit.
b) Determine the entropy generation per unit mass flow across the valve, in J/kg-K.

Clearly show **all your work and logic** for FULL credit! Do NOT just substitute numbers into a special form of any conservation and accounting principles.

Problem 3 (25 points)

0.2 m^3 of air is compressed rapidly in a piston-cylinder device from room conditions (P_1 = 100 kPa, T_1 = 300 K) to 8 MPa and 1100 K. The compression happens so fast that it can be modeled by an adiabatic process.



a) Determine the final volume of air, in cm^3.
b) Determine the work done on the air during the compression, in kJ.
c) Determine the entropy generation during the compression, in J/K.

Clearly show **all your work and logic** for FULL credit! Do NOT just substitute numbers into a special form of any conservation and accounting principles.