Queen Mary University of London

Thermodynamics 1 DEN107

Problem Set 07 (due week 9, Mon 2012mar05)

Insert the SEMS homework coverpage as 1st page; this question sheet with original signatures as the 2nd page; then attach your solutions in subsequent pages. Your solutions are due before 3.30 pm on Monday March 5th 2012 in the cabinet outside the SEMS office.

By signing below I certify that I will not obtain the teaching assistant's (TA) signature for students other than myself, and that I will not forge the TA's signature on this page. Violators will be prosecuted in accordance to QMUL procedures. Please fill in the five items below.

Student Surname:	
Student Forenames:	
Student ID (9 digits):	
Student signature:	
TA confirms tutorial attendance (signature):	

50% of the assignment grade will be deducted if the TA signature above is missing

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Problem 1

Do problem 6-09 (from the notes) for spring constant k =1,400,000 N/m

Problem 2

Do problem 6-10 (page 104 of the notes) for m^{A} =3.9 kg and m^{B} =5.8 kg.

Problem 3

(a) Steam is at a state having absolute pressure equal to atmospheric and specific entropy 4.1188 kJ/(kg.K). Calculate:
- the quality (dryness);
- the specific enthalpy; and
- the specific volume

(b) Mass flow rate of water of 1 kg/s is flowing at atmospheric pressure p_{at} = 1 atm around a heating device which is kept at constant temperature 900 K. Use the water property tables provided and evaluate the energy that must be supplied by the resistance heater along its length so that:

- in a pre-heating segment water goes from state 1, 25 degrees C; to state 2, saturated liquid at 100 degrees C;

- in a follow-on evaporating segment water goes from state 2, saturated liquid at 100 degrees C; to state 3, saturated vapor at 100 degrees C; and

- in a follow-on superheating segment water goes from state 3, saturated vapor at 100 degrees C, to state 4, superheated vapor at 400 degrees C.

(c) The heating device is kept at 800 K throughout its length. Evaluate the entropy generated by irreversibility in the heating process from state 1 to state 4 in part (b).

HINT: For bulk flow systems the changes of energy are given by changes in enthalpy.

Problem 4

Do problem 6 of homework 6 (which now becomes part of homework 7 instead of homework 6)