Name:____________________________ Instructor:____________ ENGR 222 - Quiz 7
Section:__________

Allowed Materials: *pencils and/or pens.*

ExamForm := 75

Honor Statement: *On my honor, I promise that I have not received any unauthorized assistance on this exam (I didn't look at another student's paper, I didn't view any unauthorized written materials, I didn't talk or listen to another student, I didn't use an unauthorized calculator, I didn't use any electronic device, any visual or auditory signals, or any other techniques of exchanging information with others.) I have maintained the highest standards of academic integrity while completing this exam.*

*Signed:*____

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1. *(2 point deduction for failure to complete this problem!)*

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Bubble:	For Course Section:	
01	001	Hollins
02	002	Reeves
03	003	Reis

- Write in all of the indicated information in the boxes of your response form.
- Darken the appropriate circles to encode the corresponding information.
- Write your name on this exam and sign the Honor Statement.

Notes:
- If your last name is too long, just write the first 10 letters.
- **"F.I."** and **"M.I."** are your first and middle initials, respectively
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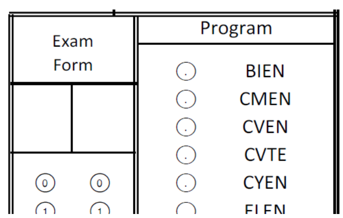

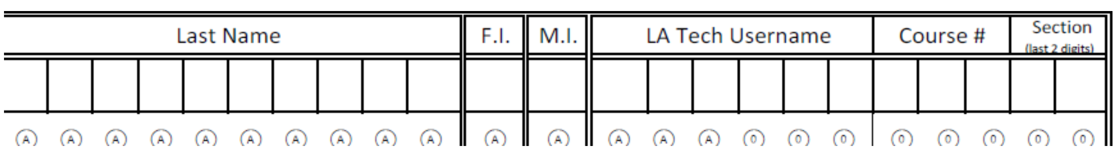

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"I properly completed all required items in problem 1, so I will not lose these points"} \\ \text{"B"} & \text{"I did not properly complete problem 1 because I am fine with losing these points."} \end{pmatrix}$$

Please put your final answers on the answer sheet that was given to you. You must show your work to receive full credit.

The words "steam" and "water" may be used interchangably. Check the tables to determine the phase of the system.

Unless the problem states otherwise, assume that the atmospheric pressure is 101.325 kPa or 14.7 psia.

Read the questions carefully and CHECK YOUR UNITS.

You may write on the exam. There is additional space on the back if you need it.

If you made any marks in your steam table, please erase them before turning in your packet.

Good luck!

2. (10 points) Which term(s) would NOT be included in an entropy balance for an open system? (Bubble in ALL answers that apply.)

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"entropy transfer from heat"} \\ \text{"B"} & \text{"entropy transfer from work"} \\ \text{"C"} & \text{"entropy transfer from mass flow"} \\ \text{"D"} & \text{"entropy consumption"} \\ \text{"E"} & \text{"entropy generation"} \end{pmatrix}$$

3. (10 points) What kind of compressor process requires the minimum amount of work?

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"isentropic"} \\ \text{"B"} & \text{"isothermal"} \\ \text{"C"} & \text{"adiabatic"} \\ \text{"D"} & \text{"polytropic"} \\ \text{"E"} & \text{"isobaric"} \end{pmatrix}$$

4. (10 points) In what type of system is the following equation true? (Bubble only ONE)

$$\Delta S_{sys} = S_{gen}$$

$$\text{Choices} = \begin{pmatrix} \text{"A"} & \text{"reversible"} \\ \text{"B"} & \text{"isolated"} \\ \text{"C"} & \text{"open"} \\ \text{"D"} & \text{"adiabatic"} \\ \text{"E"} & \text{"closed"} \end{pmatrix}$$

5. (10 points) Steam enters an insulated, reversible turbine at $P_1 = 2.5 \cdot \text{MPa}$ and $T_1 = 300 \cdot °\text{C}$. It leaves at $P_2 = 150 \cdot \text{kPa}$ and $x_2 = 90.0301 \cdot \%$. Determine the specific entropy generated in this process.

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.00 \\ \text{"B"} & 1.44 \\ \text{"C"} & 1.59 \\ \text{"D"} & 1.73 \\ \text{"E"} & 1.87 \\ \text{"F"} & 2.01 \\ \text{"G"} & 2.15 \\ \text{"H"} & 2.30 \\ \text{"I"} & 2.44 \end{pmatrix} \cdot \frac{\text{kJ}}{\text{kg} \cdot \text{K}}$$

6. (10 points) A pump $\text{requires} = 32 \cdot \text{kW}$ to increase the pressure of (light) oil at 25°C $\text{from} = 65 \cdot \text{kPa}$ $\text{to} = 1.5 \cdot \text{MPa}$ at a rate $\text{of} = 950 \cdot \frac{\text{L}}{\text{min}}$. The isentropic efficiency of the pump is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 62.33 \\ \text{"B"} & 65.21 \\ \text{"C"} & 68.11 \\ \text{"D"} & 71.00 \\ \text{"E"} & 73.91 \\ \text{"F"} & 76.82 \\ \text{"G"} & 79.71 \\ \text{"H"} & 82.63 \end{pmatrix} \cdot \%$$

7. (10 points) An adiabatic compressor receives saturated R-134a vapor at $P_1 = 120 \cdot \text{kPa}$, and compresses it to $P_2 = 320 \cdot \text{kPa}$ and $T_2 = 60 \cdot °\text{C}$. Determine the isentropic efficiency.

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 24.80 \\ \text{"B"} & 25.99 \\ \text{"C"} & 27.16 \\ \text{"D"} & 28.39 \\ \text{"E"} & 29.59 \\ \text{"F"} & 30.79 \\ \text{"G"} & 32.01 \\ \text{"H"} & 33.21 \end{pmatrix} \cdot \%$$

8. (10 points) An adiabatic turbine receives steam at $P_1 = 400 \cdot \text{psia}$ and $T_1 = 500 \cdot °\text{F}$. Steam leaves the turbine at $P_2 = 170 \cdot \text{psia}$, and the isentropic $\text{efficiency} = 69 \cdot \%$. Determine the actual power output of the turbine if the mass flow $\text{rate} = 0.81 \cdot \frac{\text{lbm}}{\text{s}}$.

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 21.12 \\ \text{"B"} & 24.08 \\ \text{"C"} & 26.99 \\ \text{"D"} & 29.93 \\ \text{"E"} & 32.87 \\ \text{"F"} & 35.85 \\ \text{"G"} & 38.79 \\ \text{"H"} & 41.75 \end{pmatrix} \cdot \frac{\text{Btu}}{\text{s}}$$

9. (10 points) A piston-cylinder $\text{containing} = 1.1\,\text{kg}$ of argon at 100kPa and $T_1 = 310\,\text{K}$ is heated by a Bunsen burner flame $\text{at} = 1250\,\text{K}$ until its volume doubles. The entropy generated is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 0.1826 \\ \text{"B"} & 0.2005 \\ \text{"C"} & 0.2188 \\ \text{"D"} & 0.2367 \\ \text{"E"} & 0.2548 \\ \text{"F"} & 0.2728 \\ \text{"G"} & 0.2909 \\ \text{"H"} & 0.3087 \end{pmatrix} \cdot \frac{\text{kJ}}{\text{K}}$$

10. (10 points) A refrigerator in your kitchen $\text{draws} = 0.39 \cdot \frac{\text{Btu}}{\text{s}}$ of electric power and has a $\text{COP} = 2.4$. The air inside the fridge is $35\,°\text{F}$, while the air in the kitchen is $72\,°\text{F}$. The rate of entropy generation for this system is closest to:

$$\text{Choices} = \begin{pmatrix} \text{"A"} & 3.45 \times 10^{-4} \\ \text{"B"} & 3.89 \times 10^{-4} \\ \text{"C"} & 4.32 \times 10^{-4} \\ \text{"D"} & 4.74 \times 10^{-4} \\ \text{"E"} & 5.17 \times 10^{-4} \\ \text{"F"} & 5.59 \times 10^{-4} \\ \text{"G"} & 6.02 \times 10^{-4} \\ \text{"H"} & 6.45 \times 10^{-4} \end{pmatrix} \cdot \frac{\text{Btu}}{\text{s} \cdot \text{R}}$$

11. (10 points) Air at $T_1 = 300\,K$ and $P_1 = 540 \cdot kPa$ enters an adiabatic nozzle with negligible velocity.
Determine the exiting velocity at $P_2 = 360 \cdot kPa$ if the isentropic efficiency is 100%.
Assume the specific heat is constant at 300K.

$$Choices = \begin{pmatrix} "A" & 166.28 \\ "B" & 184.35 \\ "C" & 202.29 \\ "D" & 220.43 \\ "E" & 238.65 \\ "F" & 256.83 \\ "G" & 274.94 \\ "H" & 293.13 \end{pmatrix} \cdot \frac{m}{s}$$

END OF EXAM

SCRATCH PAPER

Bubble:
01
02
03

For Course Section:	
001	Hollins
002	Reeves
003	Reis

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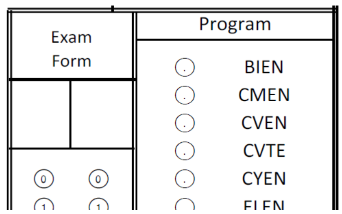

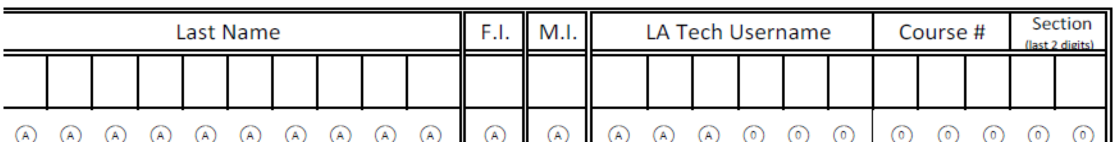

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Read the questions carefully and CHECK YOUR UNITS.

If a question does not contain enough information to solve, please select the appropriate answer "not enough information".

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Good luck!

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Key =

	1
1	"A"
2	"BD"
3	"B"
4	"B"
5	"A"
6	"D"
7	"E"
8	"H"
9	"E"
10	"G"
11	"F"