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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR

MALAYSIA FRANCE INSTITUTE

FINAL EXAMINATION

SEPTEMBER 2014 SEMESTER

SUBJECT CODE	:	**FRD 20103**
SUBJECT TITLE	:	**THERMODYNAMICS**
LEVEL	:	**DIPLOMA**
TIME/DURATION	:	**9.00 AM – 12.00 PM (3 HOURS)**
DATE	:	**5 JANUARY 2015**

INSTRUCTIONS TO CANDIDATES

1. **Please read the instructions given in the question paper CAREFULLY.**
2. **This question paper is printed on both sides of the paper.**
3. **Please write your answers on the answer booklet provided.**
4. **Answer should be written in blue or black ink except for sketching, graphic and illustration.**
5. **This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer two (2) question only.**
6. **Answer all questions in English.**
7. **A psychrometric chart and P-H diagram is provided in the appendix section.**

THERE ARE 4 PRINTED PAGES OF QUESTIONS EXCLUDING THIS PAGE AND APPENDIX

SECTION A (TOTAL : 60 MARKS)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1 (20 marks)
Complete the Table Q1 for R-134a:

TABLE Q1: R-134a Properties Table

T ^{o}C	P kPa	h kJ/kg	x
	600	180	
-10			0.6
-14	500		
	1200	300.61	
44			1.0

Question 2 (20 marks)

Saturated water vapour at 200°C is isothermally condensed to a saturated liquid in a piston-cylinder device as shown in Figure Q2 below. Answer these questions:

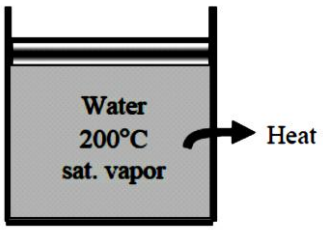


Figure Q2: Water Contain in Piston Cylinder Device

(a) Write down an energy balance equation for the process.

(6 marks)

(b) What is the pressure and temperature at the end of the process?

(6 marks)

(c) Calculate the boundary work done for the process.

(8 marks)

Question 3 (20 marks)

Air enters a gas turbine at 100 kPa and 350°C and leaves at 100 kPa and 40°C. If the mass flow rate through the turbine is 2 kg/s as shown in Figure Q3 below, answer the followings:

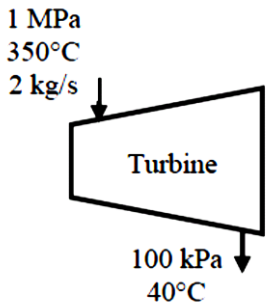


Figure Q3: Air Enters Gas Turbine

(a) State the ideal gas law equation.

(2 marks)

(b) Calculate volume flow rate at the turbine inlet.

(9 marks)

(c) Calculate volume flow rate at the turbine outlet.

(9 marks)

SECTION B (TOTAL : 40 MARKS)

INSTRUCTION : Answer ONLY TWO (2) questions.
Please use the answer booklet provided.

Question 4 (20 marks)

An adiabatic steady-flow device compresses argon at 200 kPa and 27°C to 2 MPa. If the argon leaves this compressor at 550°C as shown in Figure Q4 below, calculate:

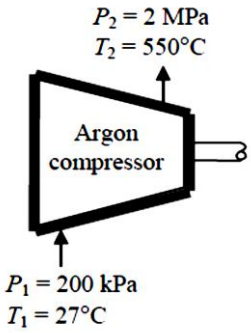


Figure Q4: Argon Entering Compressor

(a) The exit temperature in Kelvin if the compression process is isentropic.

(10 marks)

(b) The compressor isentropic efficiency ($ή_{is}$)?

(10 marks)

Question 5 (20 marks)

A refrigerator uses refrigerant-134a as the working fluid and operates on an ideal vapor-compression refrigeration cycle between 0.16 (evaporating pressure) and 0.8 MPa (condensing pressure). The mass flow rate of the refrigerant is 0.4 kg/s. From the P-h diagram in the appendix determine:

(a) The rate of heat removal from the refrigerated space (Q_L) in kW

(5 marks)

(b) Power input to the compressor (W_{in}) in kW

(5 marks)

(c) The rate of heat rejection to the environment (Q_h) in kW and

(5 marks)

(d) Coefficient of Performance (COP)

(5 marks)

Question 6 (20 marks)

Air enters an evaporative cooler at 1 atm, 36°C, and 20 % relative humidity at a rate of 4 m^3/min, and it leaves with a relative humidity of 90 % as shown in Figure Q5. By assuming that the temperature of the water supplied is equal to the outlet air temperature and the process follows constant wet bulb temperature, determine by using the psychrometric chart attached in the appendix section:

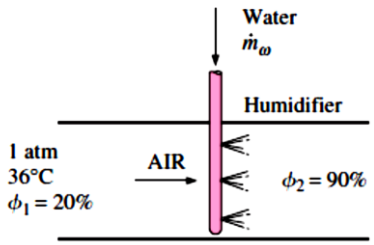


Figure Q5 Schematic of a humidifier

(a) Plot the process on the psychrometric chart attached.
(Detached psychrometric chart and submit with answer booklet)

(4 marks)

(b) $T_{wet\ bulb,}$ ω and *v* at the inlet to the evaporator.

(4 marks)

(c) $T_{wet\ bulb}$ and ω at the outlet of the evaporator.

(4 marks)

(d) Mass flow rate of the dry air.

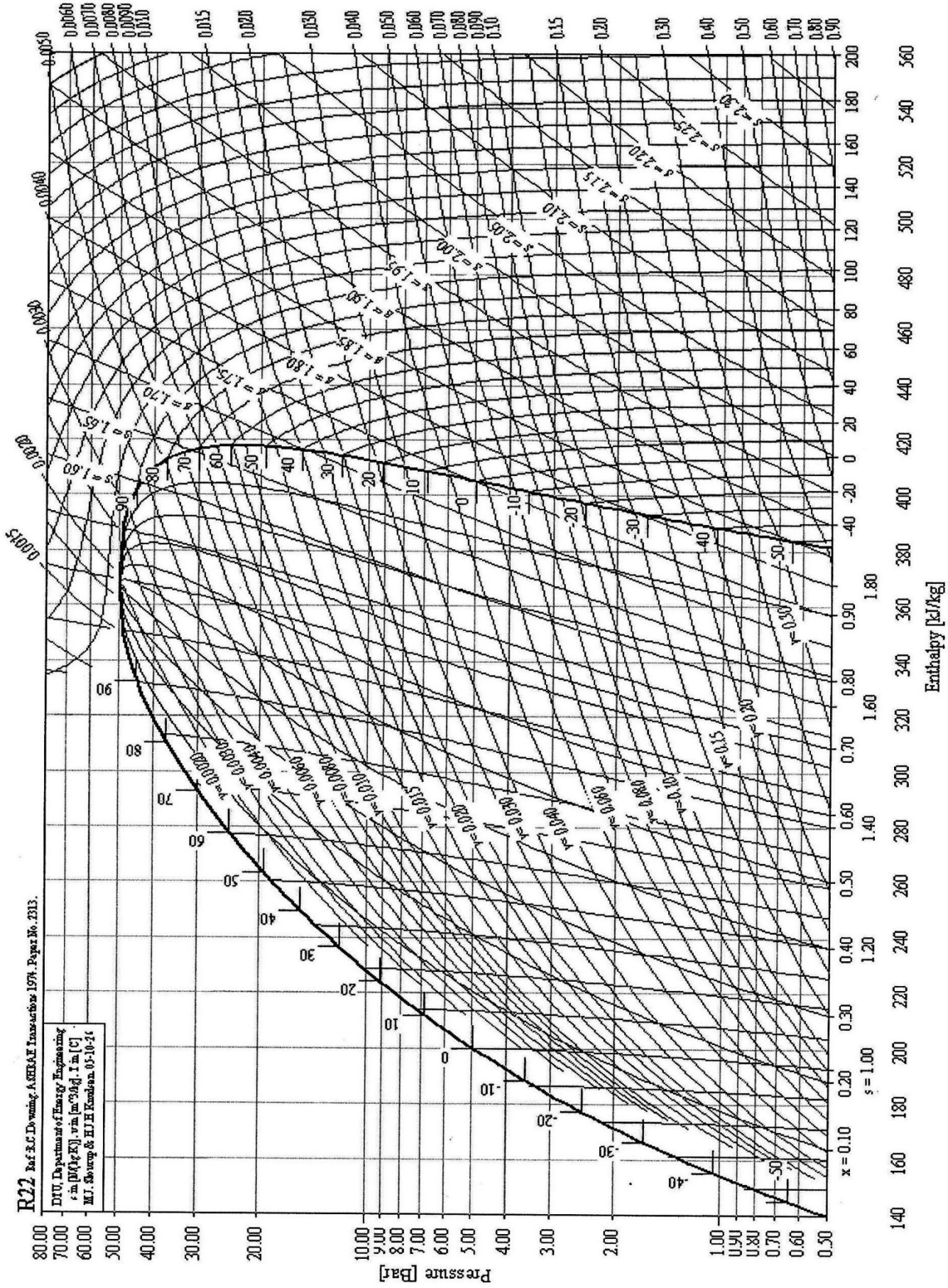
(4 marks)

(e) Mass flow rate of the water supplied m_w .

(4 marks)

END OF QUESTION

Appendix


R22
Ref. R.C. Downing, ASHRAE Transactions 1974, Paper No. 2313.
DTU, Department of Energy Engineering
Pressure [Bar]
Enthalpy [kJ/kg]
x = 0.10
s = 1.00