



UNIVERSITI KUALA LUMPUR
MALAYSIA FRANCE INSTITUTE

FINAL EXAMINATION
JANUARY 2011 SEMESTER

SUBJECT CODE : FRD 20103
SUBJECT TITLE : THERMODYNAMIC
LEVEL : DIPLOMA
TIME/DURATION : 9.00am – 12.00pm
(3 HOURS)
DATE : 12 MAY 2011

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 is provided in the appendix section.

THERE ARE 4 PRINTED PAGES OF QUESTIONS AND 2 PAGES OF APPENDIX, EXCLUDING THIS PAGE.

SECTION A (TOTAL: 60 MARKS)

INSTRUCTION: Answer ALL questions.**Please use the answer booklet provided.****Question 1**

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, answer the followings:

(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)

Question 2

Complete this table for water:

Table Q2: Properties of Water

T °C	P kPa	v m ³ /kg	Phase
50		4.16	
	200		Saturated Vapour
250	400		
110	600		

(2.5marks each)

Question 3

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

- (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)

SECTION B (TOTAL : 40 MARKS)

INSTRUCTION : Answer ONLY TWO (2) questions.

Please use the answer booklet provided.

Question 4

An ideal vapour compression refrigeration cycle that uses R 134-a as its working fluid maintains a condenser at 1000 kPa and the evaporator at 4°C. Answer these questions:

- (a). Sketch the cycle on the $P - h$ diagram (The diagram is attached in the appendix section and to be returned with the answer sheet).
(5marks)
- (b). The rate of heat removal from the refrigerated space (Q_L).
(5 marks)
- (c). Power input to the compressor (W_{in}).
(5 marks)
- (d). Coefficient of performance (COP).
(5 marks)

Question 5

Air enters a 40-cm-diameter cooling section at 1 atm, 32°C and 30% relative humidity at 18 m/s. Heat is removed from the air at a rate of 1200 kJ/min and the moisture content of the air remains constant. Answer these questions:

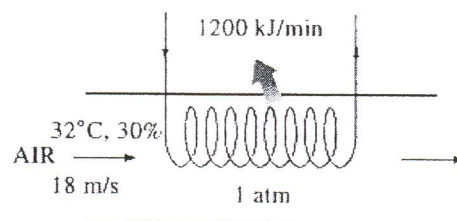


Figure Q5 : Schematic for question 5

- (a). Plot the process on the psychrometric chart attached (The chart is attached in the appendix section and to be returned with the answer sheet).
(5 marks)
- (b). Write down an energy balance for the process.
(5marks)
- (c). The temperature at the exit of the cooling system.
(5 marks)
- (d). The relative humidity at the exit of the cooling system.
(5 marks)

Question 6

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, calculate:

- (a). The exit temperature in Kelvin if the compression process is isentropic.
(10 marks)
- (b). The compressor isentropic efficiency (η_{is})?
(10 marks)

END OF QUESTION

APPENDIX



ASHRAE Psychrometric Chart No. 1
Normal Temperature
Barometric Pressure: 101.325 kPa

© 1992 American Society of Heating,
Refrigerating and Air-Conditioning Engineers, Inc.

Sea Level

