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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR

MALAYSIA FRANCE INSTITUTE

FINAL EXAMINATION

JANUARY 2014 SESSION

SUBJECT CODE	:	**FRB 20102/ FMB 32202/ FRB 10702**
SUBJECT TITLE	:	**BASIC THERMODYNAMICS / THERMODYNAMICS**
LEVEL	:	**BACHELOR**
TIME/DURATION	:	**12.45pm - 2.45pm** **2 HOURS**
DATE	:	05 JUN 2014

INSTRUCTIONS TO CANDIDATES

1. **All questions carry equal marks.Answer ANYFOUR (4) questionsin English.**
2. **Please write your answers on the answer booklet provided.**
3. **Answer should be written in blue or black ink except for sketching, graphic and illustration.**
4. **This question paper consists one sectiononly.**

THERE ARE 4 PRINTED PAGES OF QUESTIONS EXCLUDING THIS PAGE.

INSTRUCTION: Answer ONLY FOUR (4) questions
Please use the answer booklet provided.

Question 1

A 1 m^3 tank contains air at 25 °C and 500 kPa is connected through a valve to another tank that contains 5 kg of air at 35 °C and 200 kPa. The valve isthen opened and the entire system is allowed to reach thermal equilibrium with surrounding at 20 °C. Calculate the volume of the second tank and the final equilibrium pressure of air.

(25 marks)

Question 2

A frictionless piston-cylinder device initially contains 1 kg saturated liquid of refrigerant 134a (R-134a) at 40 °C. The piston is free to move, and maintains a pressure of 900 kPa on the refrigerant. The refrigerant is heated to 75 °C. Calculate the work doneduring this process.

(25 marks)

Question 3

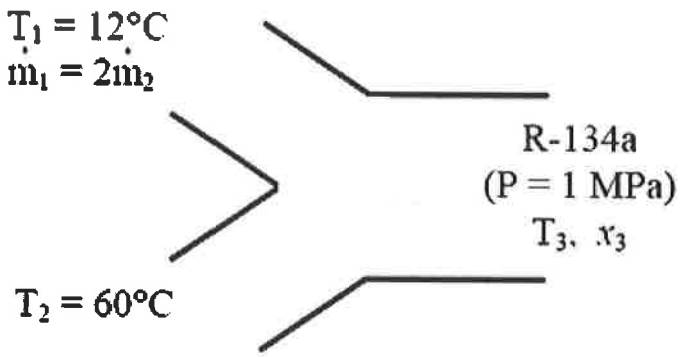

FIGURE Q3: Refrigerant R-134a Stream Mixer

Referring Figure Q3 shows a stream of refrigerant-134a at 1 MPa and 12°C is mixed with another stream at 1 MPa and 60°C. If the mass flow rate of the cold stream is twice that of the hot one, determine:

a) Write energy & mass balances for the process

(5 marks)

b) h_1 and h_2 in kJ/kg

(10 marks)

c) h_3 in kJ/kg, T_3 in °Cand x_3(quality at state 3)

(10 marks)

Question 4

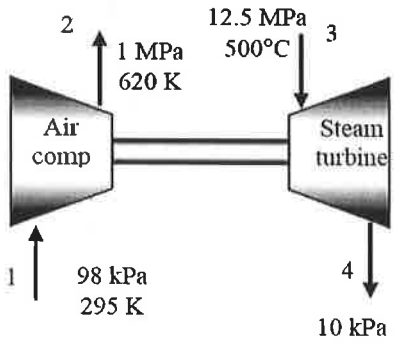

FIGURE Q4: Steam Turbine Generator System

Referring Figure Q4 shows an adiabatic air compressor is to be powered by a direct-coupled adiabatic steam turbine that is also driving a generator. Steam enters the turbine at 12.5 MPa and 500 deg C at a rate of 25 kg/sec and exit at 10 kPa and a quality of 0.92. Air enters the compressor at 98 kPa and 295 K at a rate of 10 kg/sec and exits at 1 MPa and 620 K. Determine:

a) Determine the compressor work input in kW by using the air table in the appendix

(5 marks)

b) Derive the energy balance equation for the steam turbine

(6 marks)

c) Determine the enthalpies at the inlet and exit of the steam turbine in kJ/kg and the exit temperature of the steam in $^{\circ}C$

(6 marks)

d) Determine the turbine work output and the net power delivered to the generator in kW

(8 marks)

Question 5

Steam enters an adiabatic steam turbine steadily at 8 MPa and 450 °C and leaves at 50 kPa and 100 °C. If the power output of the turbine is 5 MW, answer the following questions:

a) Draw the schematic diagram of the system and its T-s diagram

(5 marks)

b) Calculate the isentropic efficiency of the turbine

(10 marks)

c) Calculate the mass flow rate of the steam flowing through the turbine

(10 marks)

END OF QUESTION