TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING
DIPLOMA IN MARINE ENGINEERING (DMAE 4)

EMR 2218
THERMOFLUIDS II

END OF SEMESTER EXAMINATIONS

YEAR 2 SEMESTER 2

SERIES: DECEMBER, 2013

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. You should have the following for this examination:
   - Answer Booklet
   - Scientific Calculator
   - Drawing Instruments

2. This paper consists of **FIVE** Questions.
3. Answer **ANY THREE** Questions.
4. All Questions carry equal marks.
5. **This paper consists of THREE printed pages.**

Question ONE

(a)   Define the following terms:

        (i)   Uniform flow
        (ii)   Steady flow
        (iii)   Path line
        (iv)   Turbulent flow
        (v)   Bernrnellis theorem

(10 marks)

$$\rho A_1 V_2 = \rho A_2 V_2$$

(b)   (i)   Show that the continuity equation is   .   **(5 marks)**

        (ii)   A siphon has a uniform circular bore of 75mm diameter and consists of a bent pipe with its crest 1.8m above water level discharging into the atmosphere at a level 3.6m below water level. Find the velocity of flow and the discharge.   **(5 marks)**

Question TWO

(a)   Define the following:

        (i)   Orifice
        (ii)   Venturimeter
        (iii)   Mean velocity
        (iv)   Viscous flow
        (v)   Unsteady flow

(10 marks)

(b)   (i)   Derive an expression for the loss of head which occurs when flow posses through a sudden contraction in a pipeline. Assume vena contracta forms inside the smaller pipe and express the head lost in terms of the coefficient of contraction and velocity in the smaller pipe.   **(5 marks)**

        (ii)   How do you minimize expansion and contraction losses?   **(5 marks)**

Question THREE

A gasoline engine in a large truck takes in 1000J of heat and delivers 2000J of mechanical work per

$$L_c = 5 \times 10^4 \, J/g.$$

cycle. The heat is obtained by burning gasoline with heat of combustion,

(a)   What is the thermal efficiency of this engine?
(b)   How much heat is discarded in each cycle?

(c) How much gasoline is burned in each cycle?

(d) If the engine goes through 25 cycles per second, what is the power output?

(e) How much gasoline is burned per hour?

(20 marks)

Question FOUR

A Carnot engine takes 2000J of heat from a reservoir at 500K, does some work, and discards some heat to a reservoir at 350K.

(a) How much work does it do?

(b) How much heat is discarded?

(c) What is the efficiency?

(d) If the cycle is run backward as a refrigerator, what is the coefficient of performance?

(20 marks)

Question FIVE

(a) One kilogram of ice at 0°C is melted and converted to water at 0°C. Compute its change in entropy, assuming that the melting is done reversibly. The heat of fusion of water is $Lf = 3.34 \times 10^5 J/kg.$

(5 marks)

(b) One kilogram of water at 0°C is heated to 100°C. Compute its change in entropy. **(5 marks)**

(c) Suppose 1kg of water at 100°C is placed in thermal contract with 1kg of water at 0°C. What is the total change in entropy? Assume that the specific heat of water is constant at 4190J/kg.K over this temperature range. **(10 marks)**