UNIVERSITY OF BOLTON

SCHOOL OF BUILT ENVIRONMENT & ENGINEERING – RAK CAMPUS

BENG (HONS) MECHANICAL ENGINEERING/

SEMESTER 2 EXAMINATIONS 2008/2009

THERMOFLUIDS

MODULE NO: AME1014

Date: Wednesday, 27 May 2009 **Time: 17.00 p.m. – 19.00 p.m.**

INSTRUCTIONS TO CANDIDATES:

There are SIX questions on this paper

Answer ANY FOUR questions.

All questions carry equal marks.

CANDIDATES REQUIRE:

Formula Sheet

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Q1 a) State the difference between Fluids and Solids. (10 marks)

b) Describe, with sketches, a method of measuring atmospheric pressure. (8 marks)

c) A manometer connected to a pipe indicates a negative pressure of 50mm of mercury. What is the absolute pressure in the pipe if the atmospheric pressure is 1 bar? (7 marks)

Total 25 marks

Q2 a) Explain the meaning of deformation in fluid. (5 marks)

b) Describe, in detail, Newton's experiment on viscosity. (13 marks)

c) At what depth below the surface of oil, relative density 0.8, will produce a pressure of 120 kPa. (7 marks)

Total 25 marks

Q3 a) Explain the term surface tension and state the effect of temperature on its value. (8 marks)

b) A venturi meter with an entrance of 0.3m and a throat diameter of 0.2m is used to measure the volume of gas flowing through a pipe. The discharge coefficient of the meter is 0.96. Assuming the specific weight of the gas to be constant at 19.62 N/m^3, calculate the volume flowing when the pressure difference between the entrance and the throat is measured as 0.6m on a water U-tube manometer. (17 marks)

Total 25 marks

Q4 a) Water has a surface tension of 0.4 N/m, in a 3mm diameter vertical tube, if liquid rises 6mm above the liquid outside the tube, calculate the contact angle. (8 marks)

b) Water is being fired at 20 m/s from a hose of 80mm diameter into the atmosphere. The water leaves the hose through a nozzle with a diameter of 25mm at its exit. Find the pressure just upstream of the nozzle and the force on the nozzle. (17 marks)

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Q5 a) Explain, in detail, the first law of thermodynamics. (10 marks)

b) A closed system of mass 5kg undergoes a process in which there is a heat transfer of 150 kJ from the system to the surroundings. The work done by the system is 75 kJ. If the initial specific internal energy is 450 kJ/Kg, what is the final specific internal energy. Neglect changes in kinetic and potential energy. (15 marks)

Total 25 marks

Q6 a) Define :

(i) Temperature (2 marks)
(ii) Heat transfer (2 marks)
(iii) Work transfer (2 marks)
(iv) Internal energy (2 marks)
(v) Thermodynamic system (2 marks)

b) A closed system initially at rest on the surface of the earth undergoes a process for which there is a net energy transfer to the system by work of magnitude 200 kJ. During the process there is a net heat transfer of energy from the system to its surroundings of 30 kJ. At the end of the process, the system has a velocity of 60 m/s at an elevation of 60 m. The mass of the system is 25 Kg, and the local acceleration of gravity g = 9.8 m/s^2. Determine the change of internal energy of the system for the process.
(15 marks)

Total 25 marks

END OF QUESTIONS

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Formulae Sheet

$$P = F/A$$

$$\rho = m/v$$

$$\dot{m} = \rho AV$$

$$P = P_g + P_{atm}$$

$$P = \rho gh$$

$$\textit{Bulk Modulus } \beta = -\frac{dP}{dv/v}$$

$$\tau = \mu \, du/dy$$

$$h = \frac{4\sigma}{\rho g s d}$$

$$Z_1 + \frac{P_1}{\rho g} + \frac{V_1^2}{2g} = Z_2 + \frac{P_2}{\rho g} + \frac{V_2^2}{2g}$$

$$V_1 = \sqrt{\frac{2g\,h\left(\frac{\rho_L}{\rho} - 1\right)}{\left(\frac{a_1}{a_2}\right)^2 - 1}}$$

$$Q - W = \Delta U + \Delta PE + \Delta KE$$

$$W = \int P dV$$

$$P V^n = C$$

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$$W = \frac{P_1 V_1 - P_2 V_2}{n - 1}$$

$$W = P\,(v_2 - v_1)$$

$$W = PV \ln\left(\frac{V_2}{V_1}\right)$$

$$Q = C_d A \sqrt{2gh}$$

$$V_1 = C\sqrt{2g\ h_2\left(\frac{\rho g_m}{\rho g} - 1\right)}$$

$$\sum F = \frac{\Delta M}{\Delta t} = \Delta \dot{M}$$

$$F = \rho\, QV$$

$$Re = V\, L\, \rho/\mu$$