UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION (ONLINE) SEMESTER I SESSION 2020/2021

COURSE NAME	:	FLUID MECHANICS II
COURSE CODE	:	BDA 30203
PROGRAMME	:	BDD
EXAMINATION DATE	:	JANUARY/FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	1. PART A : ANSWER THREE (3) FROM FOUR (4) QUESTIONS.
		2. PART B : ANSWER ALL QUESTIONS.

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THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

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PART A : ANSWER **THREE** (3) FROM **FOUR** (4) QUESTIONS

Q1 (a) Describe briefly the characteristic of fully developed laminar flow.

(5 marks)

(b) From governing laws for fully developed laminar flow, derive an equation for fully developed laminar flow that shows the relation between flowrate and pressure gradient.

(15 marks)

Q2 (a) Describe briefly the advantage and disadvantage of using Moody Chart in calculating the value of friction factor.

(5 marks)

(b) **Figure Q2(b)** shows water at 30^0C flows through a 15 mm diameter 1.9 m long rubber hose from a spray tank. The air pressure inside the spray tank is 150 kPa. Determine the flowrate of the water at the nozzle if the loss coefficient at entrance, loss coefficient for the nozzle and the friction factor for the rubber hose are 0.5, 0.75, 0.11 respectively.

(15 marks)

Q3 (a) Describe briefly the definition of potential flow.

(5 marks)

(b) The mass balance for a control volume can be defined as any change of mass within the control volume is equal to the net gain of mass flowing into the volume through the control surface. Based on this definition, derive the equation of mass balance for 3 dimensional, unsteady and compressible fluid flow.

(15 marks)

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Q4 (a) Describe briefly the effect of drag and lift force on ground vehicle.

(5 marks)

(b) A sports car has a frontal area of 1.68 m^2 and drag coefficient of 0.32 when windows and sunroof are closed. The drag coefficient increase to 0.41 when the sunroof is open. If the temperature of air is 30^{0}C, determine the additional power consumption of the car when the sunroof is open at 90 km/h

(6 marks)

(c) A jumbo airplane has a mass of 400 000 kg when fully loaded with 400 passengers and take off at a speed of 250 km/h. If the air temperature is 20^{0}C, determine the take off speed when the airplane has 100 empty seats. Assume each passenger with luggage is 140 kg and the wing and flap settings are maintained the same.

(9 marks)

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PART B : ANSWER **ALL** QUESTIONS.

Q5 (a) Explain briefly the use of hydraulic scaling in determining the pump performance.

(5 marks)

(b) A small centrifugal pump is used to pump a 30^0C water at the rate of 6 L/s with input power of 3.73 kW and efficiency of 70 %. If the diameter of the pump is 20 cm and operate at 1200 rpm, determine head, capacity and power coefficient.

(6 marks)

(c) After graduation, you work for a pump manufacturing company The chief engineer tells you to use pump in question **Q5(b)** to pump gasoline with specific gravity of 0.7. Determine the new flowrate, input power and head.

(9 marks)

Q6 (a) Explain briefly the different between incompressible and compressible fluid flow.

(5 marks)

(b) Air at pressure and temperature of 200 kPa, 373.2 K flows through a duct at Mach Number of 0.8. The gas constant and specific heat ratio of air are 0.287 kJ/kg.k and 1.4 respectively. Determine;

(i) air velocity;

(ii) stagnation pressure;

(iii) stagnation temperature; and

(iv) stagnation density.

(8 marks)

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(c) Nitrogen enters a converging diverging nozzle from a reservoir at a pressure of 700 kPa and temperature of 400 K. The gas constant and specific heat ratio of nitrogen are 0.2968 kJ/kg.k and 1.4 respectively. Determine;

(i) critical pressure
(ii) critical temperature,
(iii) critical density; and
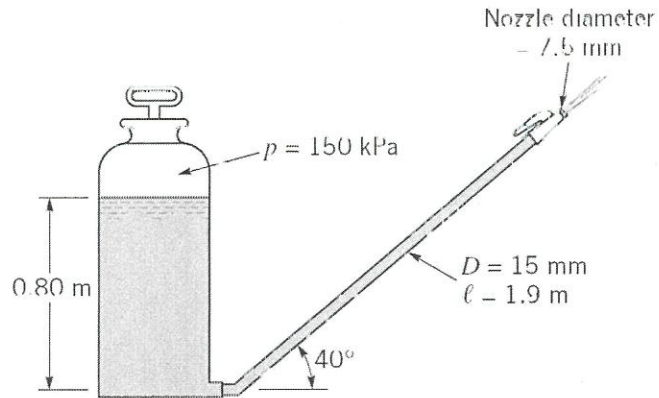(iv) critical velocity,

(7 marks)

- END OF QUESTION –

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Figure Q2 (b)

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