UNIVERSITI TUN HUSSEIN ONN MALAYSIA

PEPERIKSAAN AKHIR
SEMESTER II
SESI 2010/2011

NAMA KURSUS	:	MEKANIK BENDALIR II
KOD KURSUS	:	BDA 3023
PROGRAM	:	3 BDD
TARIKH PEPERIKSAAN	:	APRIL / MEI 2011
JANGKA MASA	:	3 JAM
ARAHAN	:	JAWAB **EMPAT (4)** SOALAN DARIPADA LIMA (5) SOALAN.

KERTAS PEPERIKSAAN INI MENGANDUNGI LIMA (5) MUKASURAT

Q1 a) Describe with the aid of diagrams the following terms for pipe flow:

i). entrance length for a fully developed laminar flow;

ii) entrance length for a fully developed turbulent flow; and

iii) shear stress for viscous flow in pipe.

[9 marks]

b) As shown in **Figure Q1(b)**, the velocity profile for laminar flow in a pipe is quite different from that for turbulent flow. The velocity profile for laminar flow is parabolic; while the velocity profile for turbulent flow can be approximated by the power-law profile.

i) For laminar flow, determine at what radial location you would place a Pitot Tube if it is to measure the average velocity in the pipe.

ii) Repeat part b(i) for turbulent flow with Re = 10,000.

[16 marks]

Q2 a) Give the definition of 'potential flow' and derive its governing equation.

(9 marks)

b) Consider the flow field given by $\mathbf{V} = xy^2\,\mathbf{i} - (1/3)\mathbf{y}^3\,\mathbf{j}$.

i) Show that the velocity field represents a possible incompressible flow.

ii) Determine the acceleration at point (x,y) = (1,2).

iii) Determine the expression for the stream function, ψ.

(16 marks)

Q3 a) Explain the boundary layer characteristics of uniform upstream flow pasts through a fixed plat plate and it's transitional from laminar to turbulence. Provide an appropriate sketch.

(10 marks)

b) A cyclist is able to attain a maximum speed of 30 km/hr on a calm day. The total mass of rider and bike is 65 kg. The rolling resistance of the tires is F_R=7.5N, and the drag coefficient and frontal area are C_D=1.2 and A=0.25m^2. The cyclist bets that:

i. she can maintain a speed of 24 km/hr even though there is a headwind (wind moving in opposing direction to the cycling) of 10 km/hr.

ii. she can attain a top speed of 40 km/hr while cycling with wind support. Which, if any, bets does she win? Take air density, ρ=1.23kg/m^3.

(15 marks)

Q4 a) Describe compresible flow through a convergent-divergent nozzle. How and where does the shock wave occur in the nozzle ?

(10 marks)

b) An ideal gas flows isentropically through a converging-diverging nozzle. At a section in the converging portion of the nozzle; area, A_1 = 0.1 m^2 ; pressure p_1 = 600 kpa (abs); temperature, $T_1 = 20^\circ$C, and Mach number, M_{a1} = 0.6. For section (2) in the diverging part of the nozzle, determine A_2 , p_2 , and T_2 if M_{a2} = 3.0 and the gas is :

i) air; and

ii) helium.

Physical properties :

Air ; ρ = 1.23 kg/m^3; μ = 1.79 x 10^{-5} Ns/m^2; R = 2.869x10^2 J/kgK and k = 1.40

Helium ; ρ = 0.166 kg/m^3; μ = 1.94 x 10^{-5} Ns/m^2; R = 2.077x10^3 J/kgK and k = 1.66

(15 marks)

Q5 a) Explain briefly the following efficiencies of a centrifugal pump :

i) manometric efficiency;

ii) volumetric efficiency;

iii) mechanical efficiency; and

iv) overall efficiency.

(10 marks)

b) A centifugal pump impeller whose external diameter and width at the outlet are 0.80 m and 0.10 m respectively is running at 550 rpm. The angle of impeller vanes at outlet is 40 $^{\circ}$. The pump delivers 0.98 m^3 of water per second under effective head of 35 m. If the pump is driven by a 500 kW motor, determine ;

i) the manometric efficiency;

ii) the overall efficiency;

iii) the mechanical efficiency.

Assume water enters the vanes radially at inlet.

(15 marks)

FINAL EXAMINATION

SEMESTER / SESSI	:	SEM II / 2010/2011	PROGRAM	:	3 BDD
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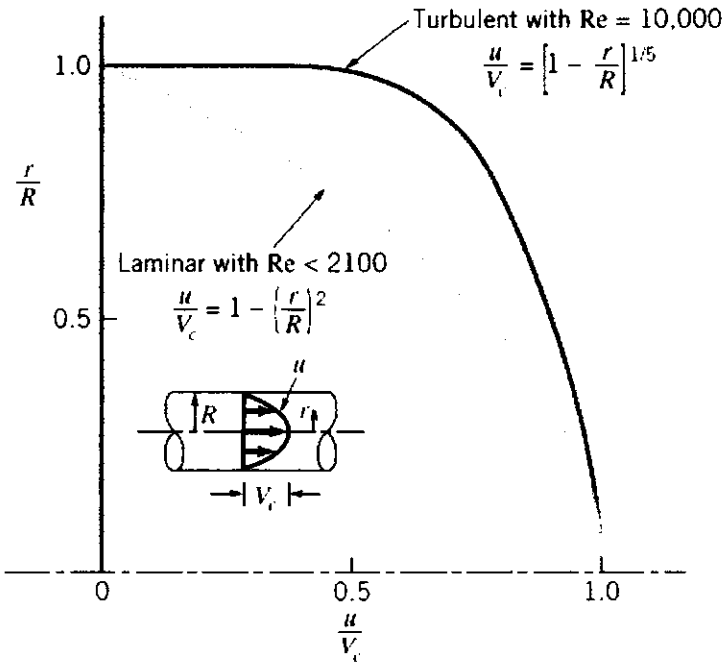

FIGURE Q1(b)