Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016

COURSE NAME	:	MECHANICAL SCIENCES
COURSE CODE	:	BEF 25903
PROGRAMME	:	BACHELOR OF ELECTRICAL ENGINEERING WITH HONOURS
EXAMINATION DATE	:	DECEMBER 2015 / JANUARY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

Q1 (a) Explain the definition of moment of a force about a point and give the example of its application

(5 marks)

(b) **FIGURE Q1 (b)** shows a continuous frame ABC subjected to three 3 concentrated loadings. The frame has a fixed support at point A. Determine the moment of each of the three forces about point A.

(15 marks)

Q2 (a) Define the following terms:

(i) Displacement, Δs

(ii) Velocity, v

(iii)Acceleration, a

(6 marks)

(b) An *s-t* graph of bicycle moves along a straight track from rest is shown in **FIGURE Q2 (b)**. Knowing that $s = 0$ m at $t = 0$ s, construct:

(i) the *v-t* graph for the given time interval

(7 marks)

(ii) the *a-t* graph for the given time interval

(7 marks)

Q3 (a) Define three types of forces need to consider in the kinetics of particles analysis

(6 marks)

(b) The 80 kg crate moves on a horizontal plane with acceleration $a = 2s/t^2$ as shown in **FIGURE Q3 (b)**, where s is displacement. Suppose it is displaced $12\ m$ away within $4\ s$ time interval;

(i) draw the Free Body Diagram (FBD) of the system

(4 marks)

(ii) define the acceleration, a of the crate

(2 marks)

(iii) determine the coefficient of kinetic friction, μ_k

(8 marks)

Q4 (a) Define the following terms and give an example for each:

(i) Compressible fluid

(ii) Incompressible fluid

(4 marks)

(b) Explain what is manometer and list 3 common types of manometers that always used in measuring fluids pressure.

(6 marks)

(c) Two chambers with water at their base are separated by a piston with a diameter of 30 cm and 25 N weight, as shown in **FIGURE Q4 (c)**. Calculate the gauge pressure in chambers A and B, if the values of h_1 = 50 cm and h_2 = 25 cm respectively.

(10 marks)

Q5 (a) Define the following terms and explain the relation between them.

(i) Mass flow rates, $\dot{m}$

(ii) Volume flow rates, $\dot{v}$

(5 marks)

(b) Express the Bernoulli equation in three different ways using:

(i) energies

(ii) pressures

(iii)heads

(3 marks)

(c) Determine the diameter orifice, d_o if under ideal conditions the flowrate of seawater through the orifice meter shown in **FIGURE Q5(c)** is to be 0.0019 m^3/s with pressure difference of $p_1 - p_2$ = 16.3 kPa. The pipe diameter is 50.8 mm and the contracta coefficient is assumed to be 0.63. Take the density of seawater as 1025 kg/m^3.

(12 marks)

Q6 (a) (i) List down and show two types of water turbines by using appropriate sketches.

(ii) Discuss the characteristic of these turbines in terms of head and volume flow rate

(8 marks)

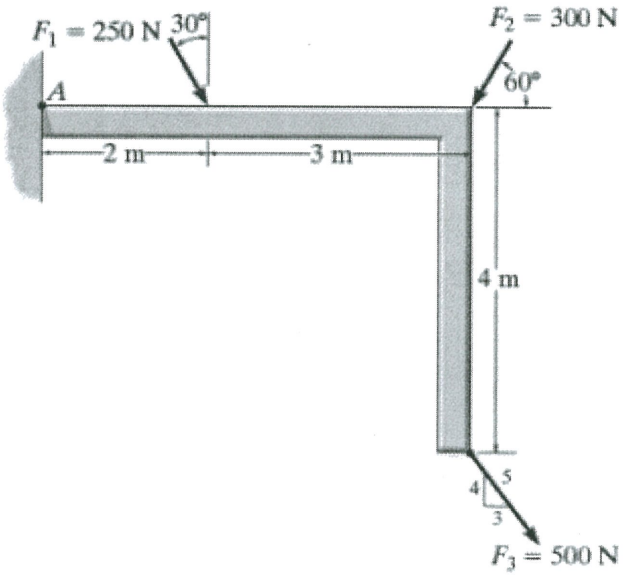
(b) Water is to be pumped from basement (point 1) to the second floor of building through the copper pipe with diameter of 1.9 cm at a flow rate of 0.000756 m^3/s as shown in **FIGURE Q6(b)**. If the viscosity of water, $\mu = 1.12 \times 10^{-3}$ Ns/m^2 and the friction factor, $f = 0.021$, calculate the pump power required.

(12 marks)

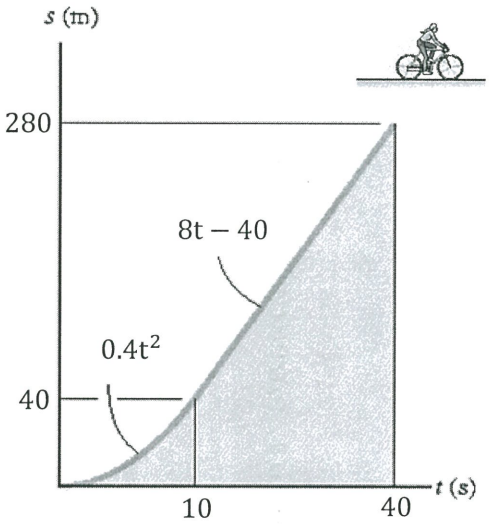
- END OF QUESTION –

FINAL EXAMINATION

SEMESTER/SESSION : SEM I/ 2015/2016
COURSE NAME : MECHANICAL SCIENCES
PROGRAMME : BEV
COURSE CODE : BEF 25903



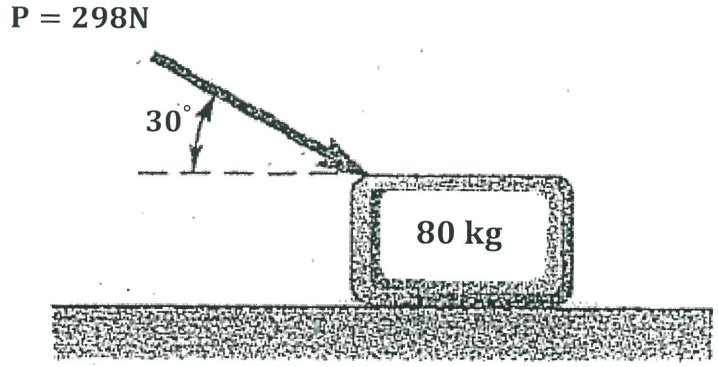
FIGURES Q1(b)



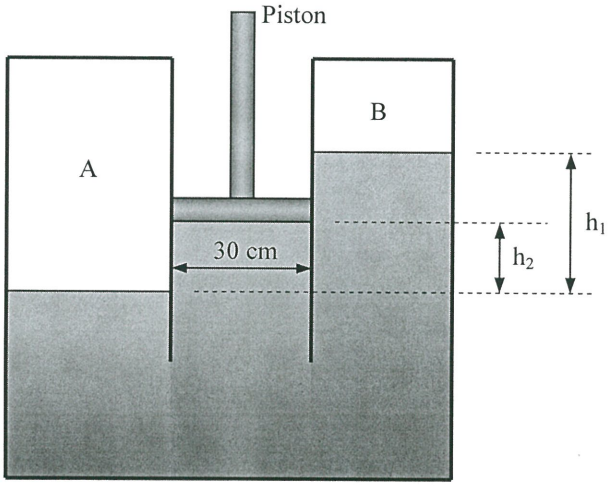
FIGURES Q2(b)

FINAL EXAMINATION

SEMESTER/SESSION : SEM I/ 2015/2016
COURSE NAME : MECHANICAL SCIENCES
PROGRAMME : BEV
COURSE CODE : BEF 25903



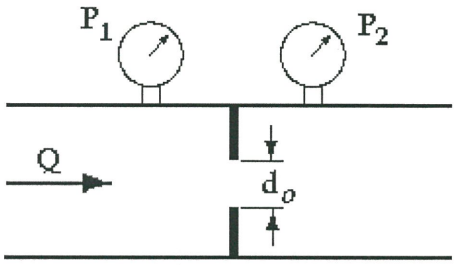
FIGURES Q3(b)



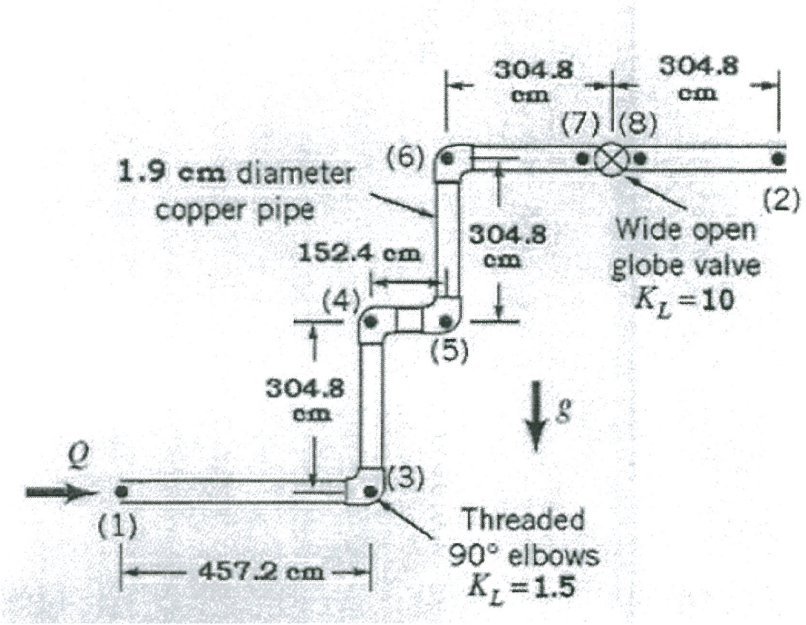
FIGURES Q4(c)

FINAL EXAMINATION

SEMESTER/SESSION : SEM I/ 2015/2016
COURSE NAME : MECHANICAL SCIENCES
PROGRAMME : BEV
COURSE CODE : BEF 25903



FIGURES Q5(c)



FIGURES Q6(b)

FINAL EXAMINATION

SEMESTER/SESSION : SEM I/ 2015/2016 PROGRAMME : BEV
COURSE NAME : MECHANICAL SCIENCES COURSE CODE : BEF 25903

USEFULL FORMULAS

$$s = s_0 + v_0 t + \frac{1}{2} a t^2$$

$$v = v_0 + at$$

$$v^2 = v_0^2 + 2as$$

$$\mathbf{a} = \mathbf{a}^{\mathbf{n}} + \mathbf{a}^{\mathbf{t}}$$

$$\mathbf{a}^{\mathbf{n}} = r\omega^2 = \frac{v^2}{r}$$