UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016

COURSE NAME	:	STATIC AND DYNAMIC
COURSE CODE	:	DAC 10303
PROGRAMME	:	2 DAA
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) Define **two (2)** differences between mass and weight.

(4 marks)

(b) Explain about the force resultant system.

(4 marks)

(c) Refer **Figure Q1(c)**, using theorem Pythagoras method determine the resultant force that acts on bolt A and the corresponding angle θ.

(4 marks)

(d) **Figure Q1(d)** shows an initial design sketch of part of the roof that supported by the cables AB and AC. The forces cables exert on the pylon (BC) to which they are attached are represented by the vectors F_{AB} and F_{AC}. The magnitude of the forces are F_{AB} = 200 kN and F_{AC} = 120 kN. Determine the magnitude and direction of the sum of the forces exerted on the pylon by the cables by using trigonometry.

(8 marks)

Q2 (a) Sketch diagram that represent:

(i) Moment of a force

(2 marks)

(ii) Moment of couples

(2 marks)

(b) State **four (4)** moment of couples characteristics.

(4 marks)

(c) Analyze and determine the forces acting on the brace shown in **Figure Q2(c)** by an equivalent resultant and couple moment acting at point A.

(12 marks)

Q3 (a) Draw a single span beam structure supported by a roller at one end and fixed end on the other side.

(3 marks)

(b) Draw the free body diagram of the strcture in **Q3(a)**.

(2 marks)

(c) Explain the conditions for rigid body equilibrium in 2 dimension.

(3 marks)

(d) The block of weight 200 kg is pulled by rope with a pulley and connected with a small block of *m* kg. A 400 N force also acts horizontally as shown in **Figure Q3(d)**. If the coefficients of friction between the block and plane are $\mu_s = 0.3$ and $\mu_k = 0.25$:

(i) Draw the free-body diagrams at 200 kg block

(4 marks)

(ii) Determine the N force

(2 marks)

(iii) Determine the friction force in this two situations where m = 4 kg and m= 10 kg. Determine whether the block is moving or in the verge of impending motion. (Assume no friction at the pulley)

(6 marks)

Q4 (a) Explain briefly about friction law.

(2 marks)

(b) Describe about static and stability mechanism.

(6 marks)

(c) Determine the centroid of the composite area as shown in **Figure Q4(c)** and with the aid of sketching, shows the location of centroid.

(12 marks)

Q5 (a) Explain **two (2)** differences between centre of gravity and centroid of a body.

(4 marks)

(b) Identify laws of motion as below:

(i) Newton's first law of motion

(2 marks)

(ii) Newton's second law of motion

(2 marks)

(c) The position of a particle in a straight line is given by $s = t^3 - 4t^2 - 10t + 40$ which s is the distance in meters and t is time in seconds. Compute on a time when the velocity is zero.

(4 marks)

(d) A car bumper is designed to bring a 3600 kg car to a stop from a speed of 4.46 m/s at displacement 300 mm. Assuming the constant deceleration, analyze and determine the average force on the bumper when it stop.

(8 marks)

Q6 (a) Explain briefly the term:

(i) Displacement and distance

(2 marks)

(ii) Speed and velocity

(2 marks)

(b) Clarify the general curvilinear motion.

(4 marks)

(c) Three small sphere A, B and C with a mass of 6 kg, 8 kg and 14 kg respectively are arranged aline as shown in **Figure Q6(c)**. Initially, the sphere B is placed in the static condition, while the sphere A is moving with a velocity $8u$ towards sphere B and sphere C move to the right direction with a velocity $2u$. The elastic coefficient between sphere A and B is 3/4 and between B and C is 1/2. Determine:

(i) The velocity of sphere A and B after the first collision. Explain the condition of both spheres.

(5 marks)

(ii) The lost of energy from the first collision between sphere A and B.

(2 marks)

(iii) The velocity of sphere B and C after the second collision. Explain the condition of both spheres.

(5 marks)

- END OF QUESTIONS-

FINAL EXAMINATION

SEMESTER/SESSION: SEM I 2015/2016
COURSE NAME: STATIC AND DYNAMIC

PROGRAMME: 2 DAA
COURSE CODE : DAC 10303

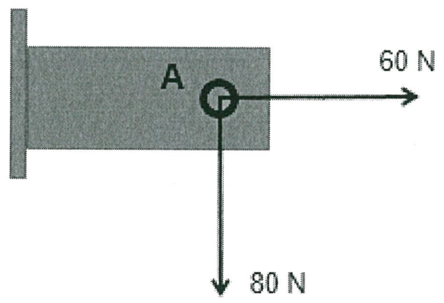

FIGURE Q1(c)

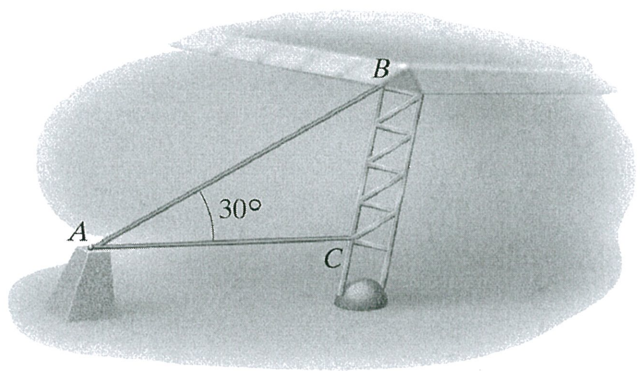

FIGURE Q1(d)

FINAL EXAMINATION

SEMESTER/SESSION: SEM I 2015/2016
COURSE NAME: STATIC AND DYNAMIC

PROGRAMME: 2 DAA
COURSE CODE : DAC 10303

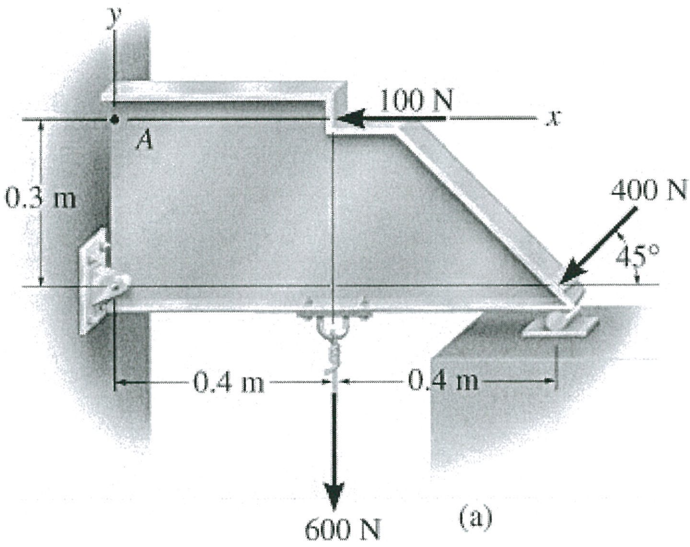

FIGURE Q2(c)

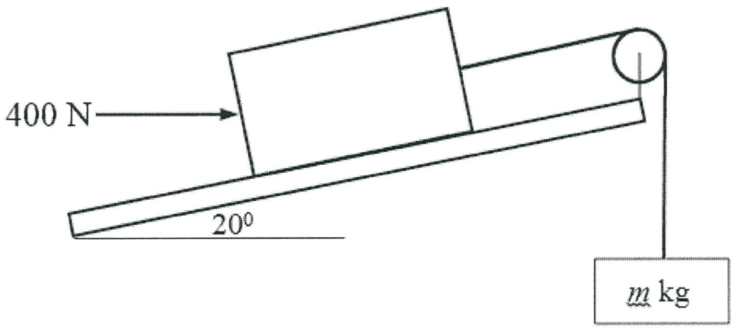

FIGURE Q3(d)

FINAL EXAMINATION

SEMESTER/SESSION: SEM I 2015/2016
COURSE NAME: STATIC AND DYNAMIC

PROGRAMME: 2 DAA
COURSE CODE : DAC 10303

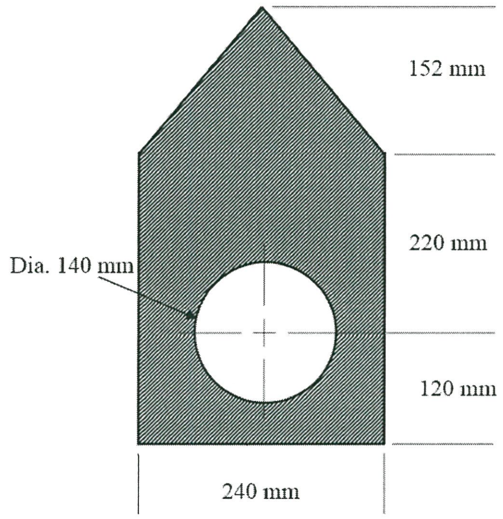

FIGURE Q4(c)

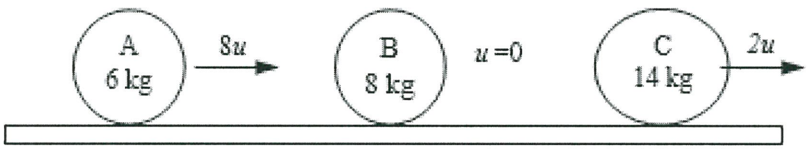

FIGURE Q6(c)

FINAL EXAMINATION

SEMESTER/SESSION: SEM I 2015/2016 PROGRAMME: 2 DAA
COURSE NAME: STATIC AND DYNAMIC COURSE CODE : DAA 10303

LIST OF EQUATION

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

$$v = v_0 + at$$

$$v^2 = v_0^{\ 2} + 2as$$

Elastic Collision

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

$$m_1u_1 - m_2u_2 = m_1v_1 + m_2v_2$$

$$m_1u_1 + 0 = m_1v_1 + m_2v_2$$

Inelastic Collision

$$m_1u_1 + m_2u_2 = (m_1 + m_2)v_1$$

Coefficient of Elasticity

$$\frac{v_2 - v_1}{u_1 - u_2} = e \quad ....0 \le x \le 1$$

If e = 0, the material is not elastic
If e=1, the material is fully elastic.
If e = 0, inelastic collision, $v_1 = v_2 = v \rightarrow m_1u_1 + m_2u_2 = (m_1 + m_2)v$
If e = 1, elastic collision, $v_2 - v_1 = u_1 - u_2$

Hooke's Law

$$U = \tfrac{1}{2} Fx \quad @ \; \tfrac{1}{2} Fs$$

$$= \tfrac{1}{2} kx^2$$

$$= \tfrac{1}{2} k(\Delta x)^2$$

Energy, power , work

$$E = mgh$$

$$E = \tfrac{1}{2} mv^2$$

$$P = \frac{Work}{time} = \frac{W(J)}{T(s)}$$

$$Work = \frac{1}{2} F \cdot (\Delta x)^2$$