Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	STATIC
COURSE CODE	:	BNP 10102
PROGRAMME	:	1 BNB
EXAMINATION DATE	:	JUNE 2015/JULY 2015
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

Q1 (a) Deferentiate between *mass* and *weight*.

(5 marks)

(b) Figure **Q1** shows the truss structure. Replace the loading system acting on the structure by an equivalent force and couple moment at point C (ignore the reaction at A and B). Calculate the resultant force and angle at point C.

(10 marks)

(c) If the structure in Figure **Q1** is in equilibrium, and support by roller at A and pinned at E, calculate the reaction of the structure.

(10 marks)

Q2 (a) Sketch a free body diagram of three dimension rigid body below:

(i) Roller

(1 mark)

(ii) Cable

(1 mark)

(iii) Ball and socket

(3 marks)

(b) The building slab is subjected to three parallel column loadings. Determine the equivalent resultant force in Figure **Q2 (a)** and specify its location (x,y, z).

(9 marks)

(c) In figure **Q2 (b)** determine the tension cables A and E and the x, y, z components of reaction at the ball and socket joint at C.

(11 marks)

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FINAL EXAMINATION

SEMESTER/SESSION: SEM II/2014/2015 PROGRAMME : 1 BNB
COURSE NAME : STATICS COURSE CODE: BNP10102

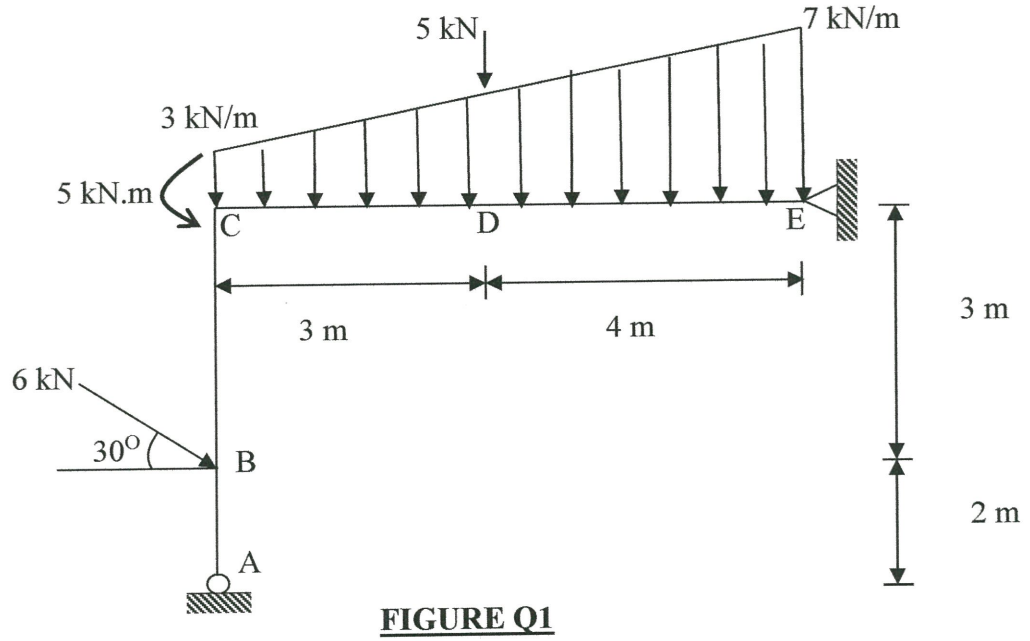

FIGURE Q1

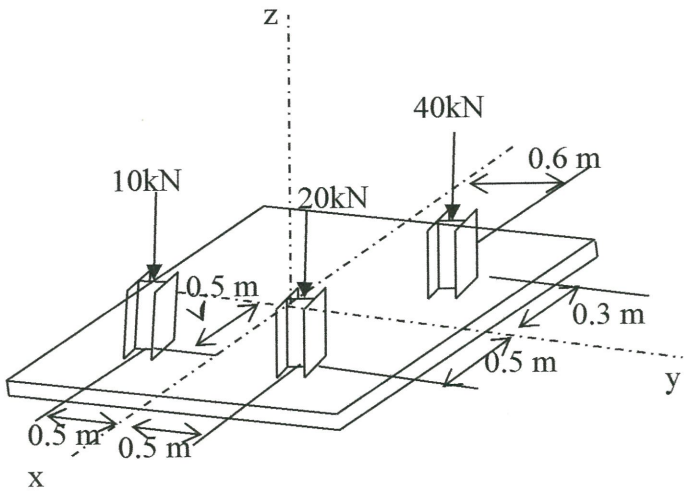

FIGURE Q2 (a)

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SEMESTER/SESSION: SEM II/2014/2015 PROGRAMME : 1 BNB
COURSE NAME : STATICS COURSE CODE: BNP10102

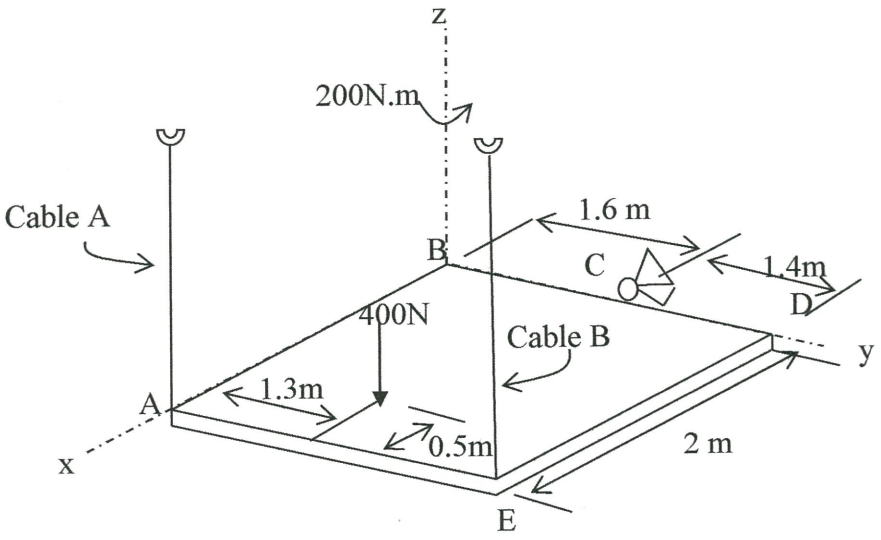

FIGURE Q2 (b)

Q3 (a) Briefly explain the friction law and its basic mechanism.

(7 marks)

(b) The block of weight 100 kg is pulled by rope with a pulley and connected with a small block of *m* kg. A 200 N force also acts horizontally as shown in Figure **Q3 (a)**. If the coefficients of friction between the block and plane are $\mu_s = 0.3$ and $\mu_k = 0.25$:

(i) Sketch the free-body diagrams.

(2 marks)

(ii) Calculate the friction force, if $m = 2$ kg and $m = 5$ kg. Determine whether the block is moving or in the verge of impending motion. (Assume no friction at the pulley)

(10 marks)

(c) Figure **Q3 (b)** shows the static equilibrium of pulley system that carries a block of weight 10 kN. Determine the tension force T in the cable of the pully system. Show appropriate free-body diagrams to support the calculation.

(6 marks)

Q4 (a) Defferentiate between "centre of gravity" and "centroid of a body".

(5 marks)

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

(8 marks)

(c) Determine the moment of inertia for the x-axis and y-axis of the shaded area as shown in Figure **Q4**.

(12 marks)

- END OF QUESTION -

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FINAL EXAMINATION

SEMESTER/SESSION: SEM II/2014/2015 PROGRAMME : 1 BNB
COURSE NAME : STATICS COURSE CODE: BNP10102

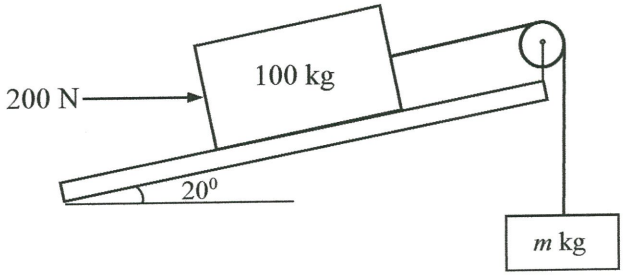

FIGURE Q3(a)

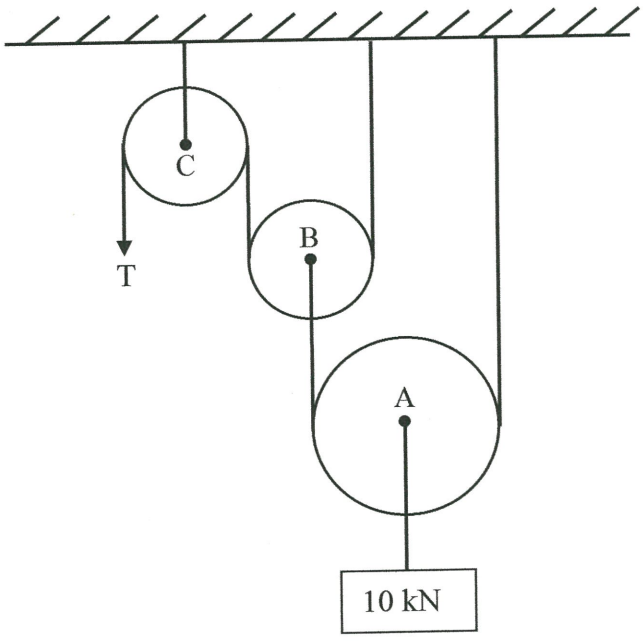

FIGURE Q3(b)

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FINAL EXAMINATION

SEMESTER/SESSION: SEM II/2014/2015 PROGRAMME : 1 BNB
COURSE NAME : STATICS COURSE CODE: BNP10102

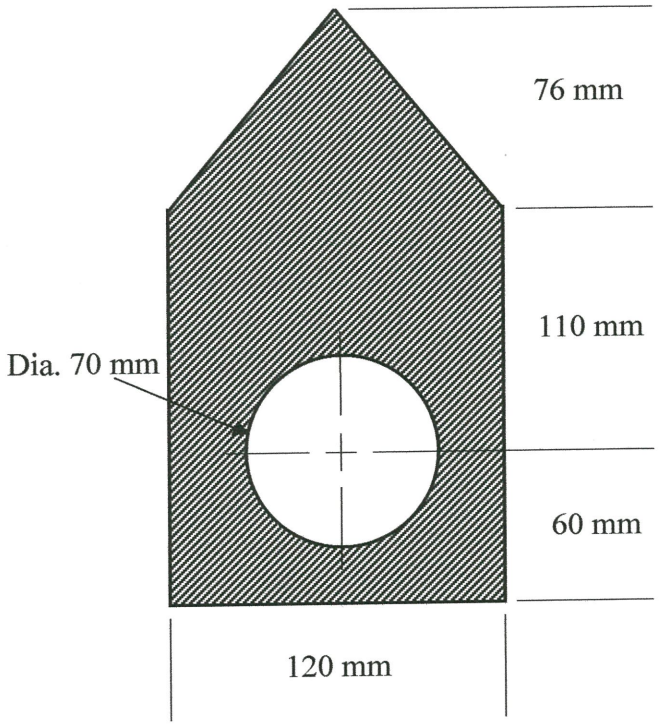


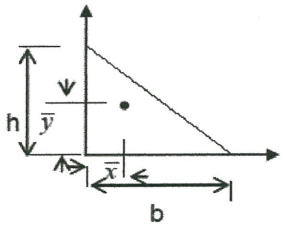
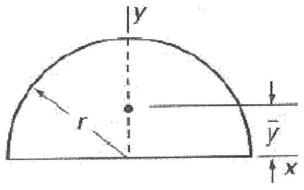
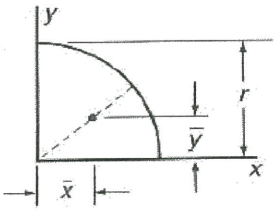
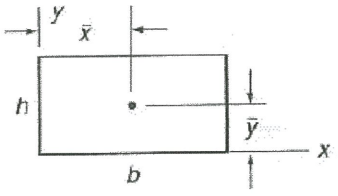
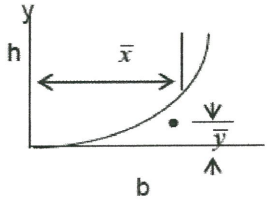
FIGURE Q4

FINAL EXAMINATION

SEMESTER/SESSION: SEM II/2014/2015 PROGRAMME : 1 BNB
COURSE NAME : STATICS COURSE CODE: BNP10102

APPENDIX

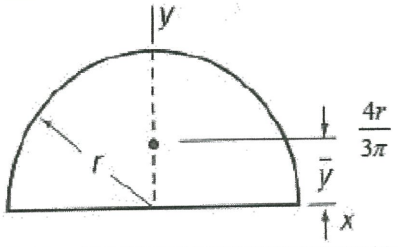
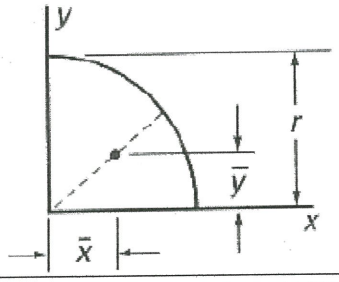
TABLE 1 : CENTROID

	SHAPE	$\bar{x}$	$\bar{y}$	A
Triangle		$\frac{b}{3}$	$\frac{h}{3}$	$\frac{1}{2}bh$
Semicircle		0	$\frac{4r}{3\pi}$	$\frac{\pi r^2}{2}$
Quarter circle		$\frac{4r}{3\pi}$	$\frac{4r}{3\pi}$	$\frac{\pi r^2}{4}$
Rectangle		$\frac{b}{2}$	$\frac{h}{2}$	bh
Parabolic spanderl		$\frac{3b}{4}$	$\frac{3h}{10}$	$\frac{bh}{3}$

FINAL EXAMINATION

SEMESTER/SESSION: SEM II/2014/2015 PROGRAMME : 1 BNB
COURSE NAME : STATICS COURSE CODE: BNP10102

TABLE 2 : MOMENT OF INERTIA

Semicircle		$I_x = I_y = \frac{1}{8}\pi r^4$ $J = \frac{1}{4}\pi r^4$
Quarter circle		$I_x = I_y = \frac{1}{16}\pi r^4$ $J = \frac{1}{8}\pi r^4$

FINAL EXAMINATION

SEMESTER/SESSION: SEM II/2014/2015 PROGRAMME : 1 BNB
COURSE NAME : STATICS COURSE CODE: BNP10102

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

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

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

$$E = mgh$$

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

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

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