Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017

COURSE NAME	:	ENGINEERING MECHANICS
COURSE CODE	:	BDU 10503
PROGRAMME	:	1 BDC/1 BDM
EXAMINATION DATE	:	DECEMBER 2016/ JANUARY 2017
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS **ONLY** 1. ANSWER **TWO (2)** QUESTIONS FROM **SECTION A** 2. ANSWER **TWO (2)** QUESTIONS FROM **SECTION B**

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

SECTION A

Q1 (a) Resolve force $\mathbf{F}_1$ and $\mathbf{F}_2$ shown in Figure **Q1(a)** into components acting along the u and v axes. Then determine the resultant of forces $\mathbf{F}_1$ and $\mathbf{F}_2$.

(10 marks)

(b) Figure **Q1(b)** shows two forces $\mathbf{F}_1$ and $\mathbf{F}_2$ act on the bolt. If the resultant force $\mathbf{F}_R$ has a magnitude of 50 N and coordinate direction angles $\alpha = 110$ deg and $\beta = 80$ deg, determine:

(i) Force $\mathbf{F}_R$ in vector form
(ii) Magnitude of $\mathbf{F}_2$
(iii) Coordinate direction angles of $\mathbf{F}_2$

(15 marks)

Q2 (a) Figure **Q2(a)** shows a force $F = 80$ N acting at the edge of a pipe (point A). Determine:

(i) The projected force F along axis AB of the pipe.
(ii) The angle θ between pipe segment BA and BC.
(iii) Moment of force F about axis BC.

(15 marks)

(b) Determine the equivalent resultant force of the loading depicted in Figure **Q2(b)**. Then specify where its line of action intersect to the bar, measured from point O.

(10 marks)

Q3 A truss is subjected to a load P at the pin A as shown in Figure **Q3**.

(a) Explain the concept of zero-force members
(b) Calculate the force in each member of the truss as the function of P and state whether the members are in tension or compression.
(c) Determine the maximum force P that can be applied to the truss so that none of the members are subjected to a force exceeding either 2.5 kN in tension or 2 kN in compression.

(25 marks)

SECTION B

Q4 (a) Describe briefly the following terms.
(i) Kinematic
(ii) Kinetic

(4 marks)

(b) Figure **Q4(b)** shows jet plane is travelling at a speed of 120 m/s then decreasing to 40 m/s^2 when it reaches point A. Determine:
(i) The magnitude of its acceleration when it is at point A
(ii) The direction of flight measured from the x axis when it reached point A

(10 marks)

(c) At the instant shown in Figure **Q4(c)**, car A has a speed of 20 km/h, which is being increased at the rate of 300 km/h^2 as the car enters an expressway. At the same instant, car B is decelerating at 250 km/h^2 while traveling forward at 100 km/h. Determine the velocity and acceleration of A with respect to B.

(11 marks)

Q5 In Figure **Q5,** the weights of A and B are 100 kg and 300 kg, respectively. The weight and friction of pulleys and cables are negligible. The coefficient of frictions between A, B and the planes is 0.25.

(a) If A and B are released from rest, predict and give reason in which direction the system will slides.

(12 marks)

(b) Determine the velocity of the system at 5 seconds after it started to slide.

(6 marks)

(c) If B is being replaced by an electrical motor, determine the power needed by the motor to maintain a constant velocity (as obtained in Q5(b)) of A.

(7 marks)

Q6 (a) A bob of the pendulum is released from rest at the horizontal position shown in Figure **Q6(a)**. If the mass of the bob is 0.2 kg, and the length of the cord is 0.8 m, determine its speed and the tension in the cord at the instant the bob passes through its lowest position.

(6 marks)

(b) The 100 kg block A as shown in the Figure **Q6(b)** is released from the rest. If the masses of the pulleys and the cord are neglected, determine the speed of the 20 kg block B in 2 seconds.

(11 marks)

(c) The 10 kg block shown in Figure **Q6(c)** rests on the smooth incline. If the spring is originally stretched 0.5 m. Determine the total work done by all the forces acting on the block when a horizontal force $P = 400$ N pushes the block up the plane $s = 2$ m.

(8 marks)

- END OF QUESTIONS -

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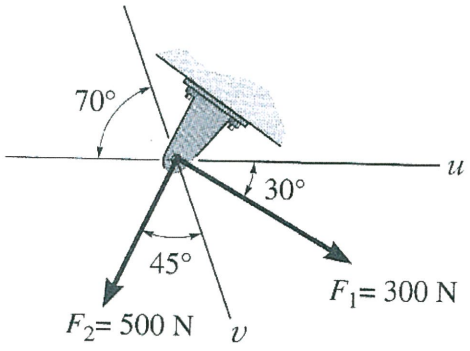

FIGURE Q1(a)

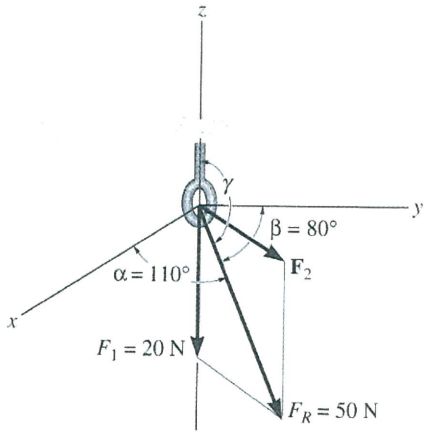

FIGURE Q1(b)

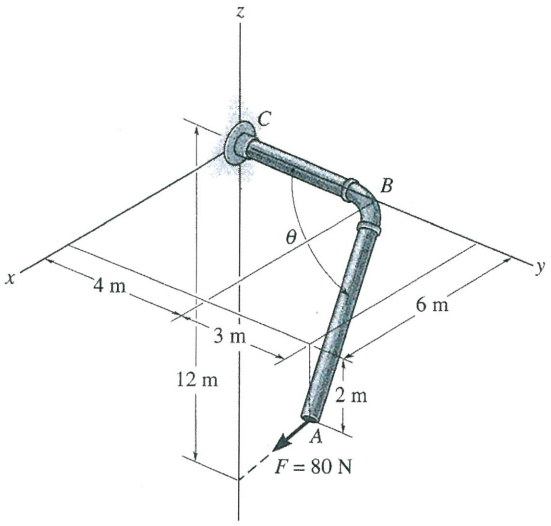

FIGURE Q2(a)

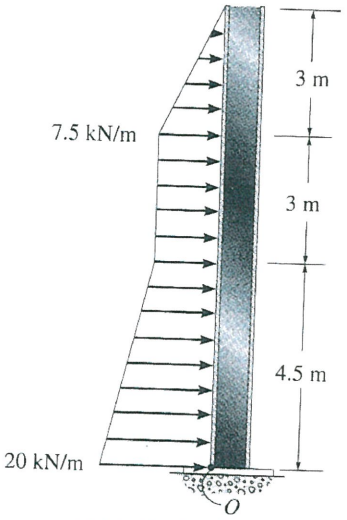

FIGURE Q2(b)

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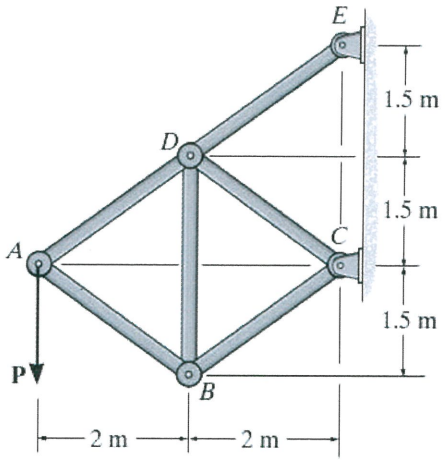

FIGURE Q3

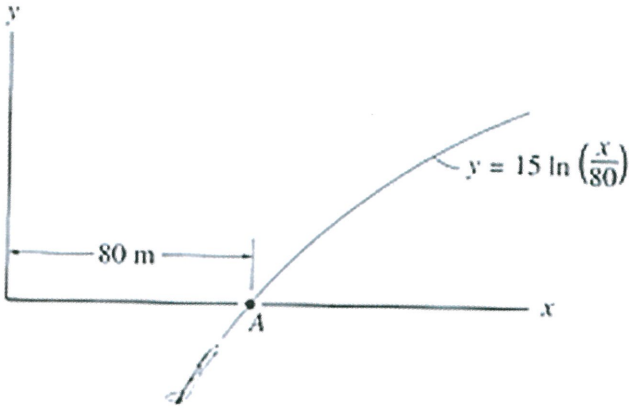

FIGURE Q4(b)

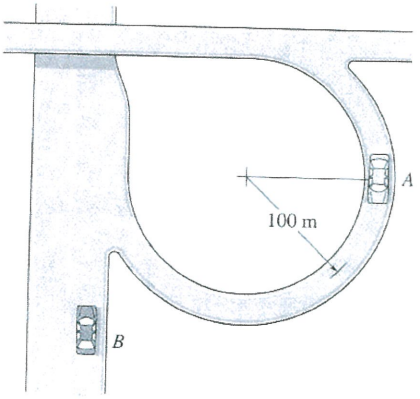

FIGURE Q4(c)

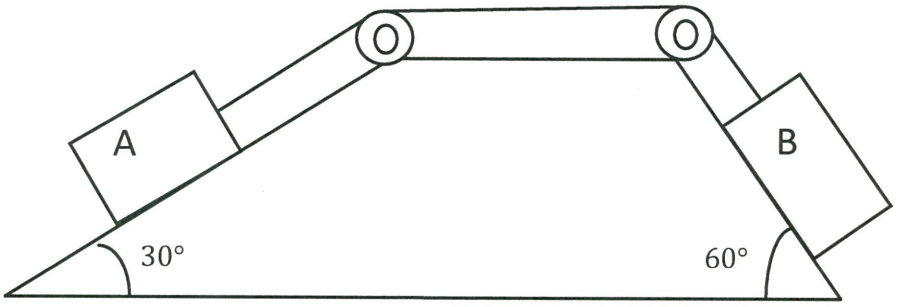

FIGURE Q5

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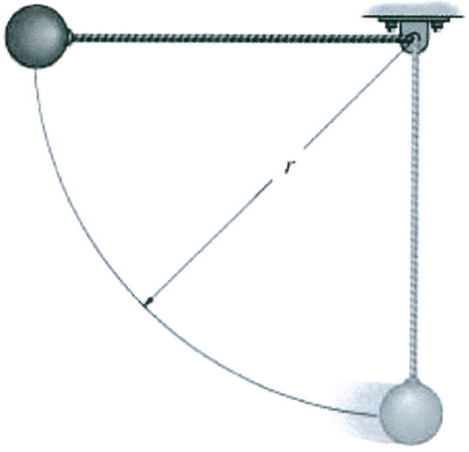

FIGURE Q6(a)

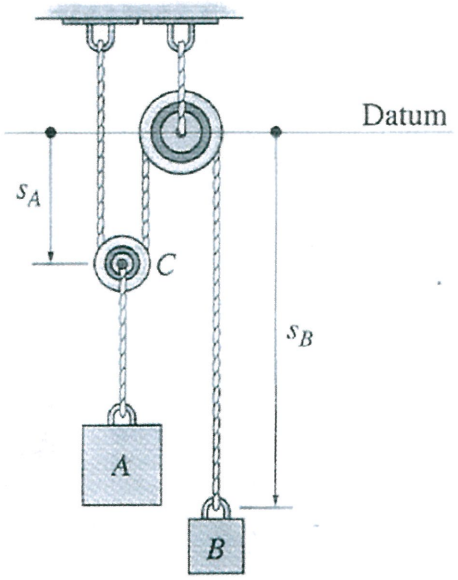

FIGURE Q6(b)

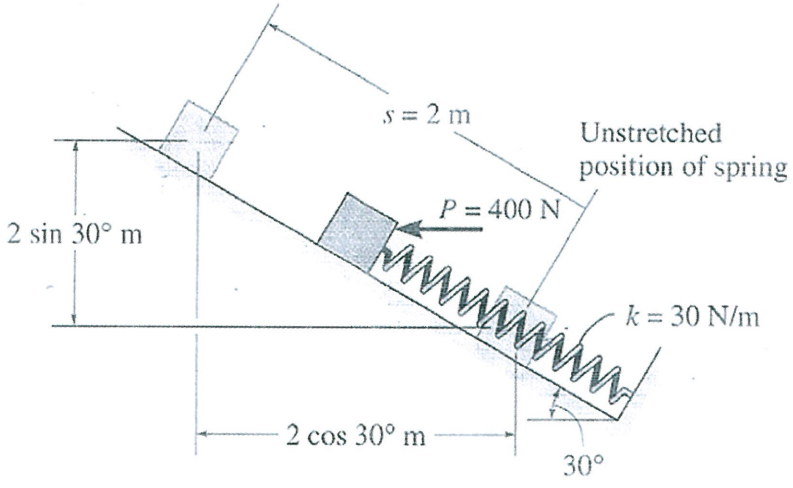

FIGURE Q6(c)