Course Code: HSS 103   Course Title: English Language II
Time: **3** hour   Full Marks: **50**

1. **Join the following sentences correctly**   (5 x 1 = 5)

   a. He was afraid. He ran away.
   b. Here is the book. I borrowed the book from you.
   c. I went there to meet his father. I did not find him there.
   d. He brought a blue shirt. He bought a matching blue jeans pant.
   e. The sail boat was stranded. There was not enough wind.

2. **Use appropriate Modals**   (5 x 1 = 5)

   a. There are plenty of tomatoes in the fridge. You .... (cannot/could not/need not) buy any.
   b. .... (can/should/may) you stand on your head for more than a minute?
   c. Take an umbrella because it .... (will/should/may) rain later.
   d. The visitors .... (must not/will not/ cannot) walk outside the border.
   e. He had been working for more than 11 hours. He .... (can/ must/would) be tired after such a heavy work

3. **Read the following passage and answer the questions**   (6 x 1 = 6)

A peace movement is a social movement that seeks to achieve ideals such as the ending of a particular war (all wars), minimize inter-human violence in a particular place or type of situation, including ban of guns, and is often linked to the goal of achieving world peace. Means to achieve these ends include advocacy of pacifism, non-violent resistance, diplomacy, boycotts, demonstrations, peace camps; supporting anti-war political candidates and banning guns, creating open government, direct democracy; supporting people who expose war-crimes or conspiracies to create wars and making laws. Different organizations involved in peace may have some diverse goals, but one common goal is sustainability of peace. Peace movement is basically an all-encompassing "anti-war movement". It is primarily characterized by a belief that human beings should not wage war on each other or engage in violent conflicts over language, race, natural resources, religion or ideology. It is believed that military power is not the equivalent of justice. The peace movement tends to

oppose the proliferation of dangerous technologies and weapons of mass destruction, in particular, nuclear weapons and biological warfare. Moreover, many object to the export of weapons including hand-held machine guns and grenades by leading economic nations to lesser developed nations.

Choose the correct answer from the alternatives (4 x 1 =4)

(i) **What is sometimes linked to the goal of achieving world peace?**
   a. Social movement   b. Ideals   c. Non-violence   d. Peace-movement

(ii) **Pacifism is ………………..**
   a. The doctrine that all violence is unjustifiable   c. Consultancy
   b. Bureaucracy   b. Related to the Pacific Ocean

(iii) **Who export(s) weapons to the lesser developed nations?**
   a. America   b. Germany   c. Russia   d. Leading economic powers

(iv) **What is not the equivalent of justice?**
   a. Warfare   b. Anti-war movement
   c. Sustainability of peace   d. Military power

Answer the following questions (2 x 1 = 2)

(v) **What does a peace movement seek to achieve?**
(vi) **What does a peace movement tend to oppose?**

4. **Write a report on "A Blood Donation camp"** (ca. 100-120 words)   (6 x 1 = 6)

5. **In the question you will find first 3 sentences of a story. Continue the story using your own imagination. (ca. 100-120 words)**   (6 x 1 = 6)

   I was not responsible for the conflict between Milon and Topu. It started from the birthday party of Mithun. We all were enjoying the program but suddenly we heard Nayeem's shouting………………..

6. **Write a review on a film you have recently enjoyed. (ca. 100-120 words)**   (6 x 1 = 6)

7. **Write a composition on any one (01) of the followings (ca. 250 words)**   (10 x 1 = 10)
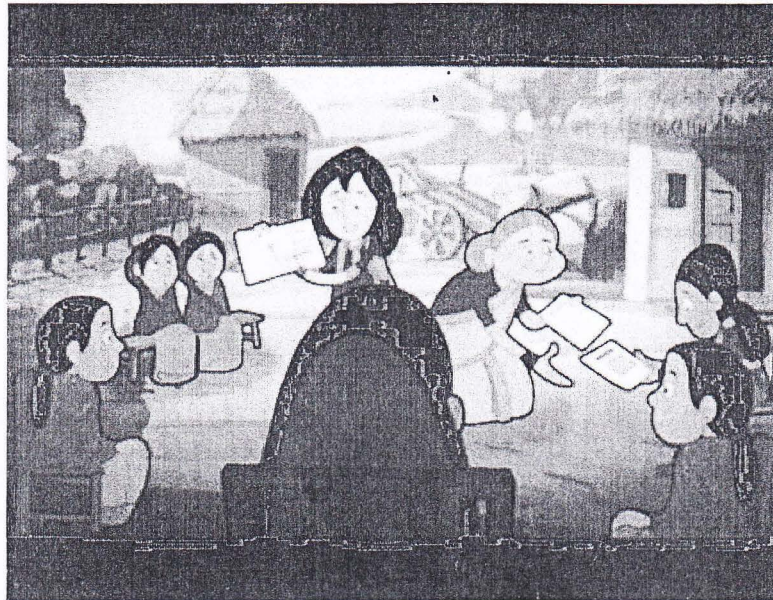
   a. Country Life vs. City Life

   b. Higher Education System in Bangladesh

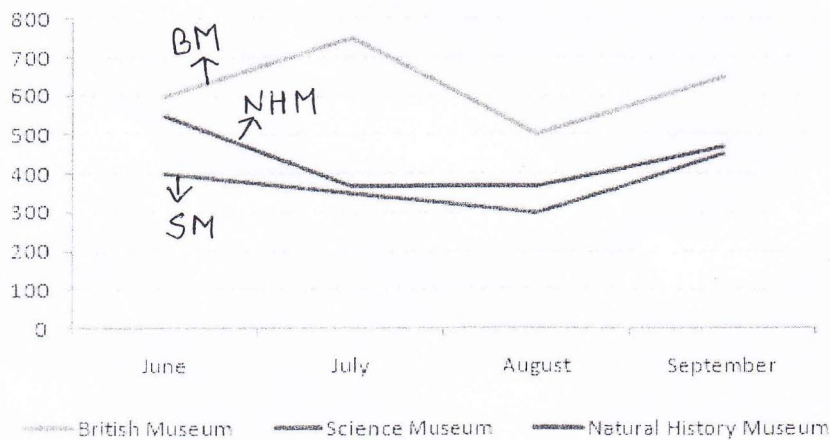8. Describe the following Picture: (6 x 1 = 6)

OR

The line graph below gives information about the number of visitors to three London museums between June and September 2013. Summarise the information by selecting and reporting the main features, and make comparisons where relevant. (ca. 100-120 words)

Number of visitors per month in summer, 2013 (in thousands)

Course Title: Chemistry   Course Code: CHEM111
Time: 3 hours   Full Marks: 150

Section: A
There are FOUR questions in this section. Answer any THREE

1. (a) Define solution. What are the two factors that influence the solubility? Give examples.   [8]
   (b) Define lattice energy and hydration energy. How do they play role in determining the
   solubility of solid in water?   [8]
   (c) Explain the behavior of ideal and non-ideal solutions based on the Raoult's law.   [9]

2. (a) Which of the following compounds is likely to be more soluble in water: C_4H_9OH or C_4H_9SH?
   Explain your answer.   [8]
   (b) Describe how the solubility of gas depends on temperature and pressure.
   13.5 g of acetylene, C_2H_2, dissolves in 1 L of acetone at 0.50 atm pressure. If the partial pressure
   of acetylene is increased to 6 atm, what is its solubility in acetone?   [17]

3. (a) What are the colligative properties? Explain briefly all these properties using appropriate
   graph where necessary.   [15]
   (b) An aqueous solution of glucose is prepared by dissolving 0.2 g of glucose ($C_6H_{12}O_6$) in 100
   mL water. What are the boiling point and the freezing point of this solution? Boiling-point-
   elevation constant (K_b) and freezing-point-depression constant (K_f) of water are 0.512 and
   1.858°C/m, respectively.   [10]

4. (a) What are colloids? Describe Tyndall effect?   [8]
   (b) What are the hydrophobic and hydrophillic colloids? Give example.   [10]
   (c) Define association colloid. How are the micelles formed?   [7]

Section: B
There are FOUR questions in this section. Answer any THREE

5. (a) Define average rate of reaction. What are the variables that affect the reaction rate?
   Calculate the average rate of decomposition of N_2O_5, $-\Delta[N_2O_5]/\Delta t$, by the reaction
   $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$
   during the time interval from $t = 200$ s to $t = 600$ s (regard all time figures as significant). Use the
   following data:

Time	$[N_2O_5]$
200 s	$1.56 \times 10^{-2}\ M$
600 s	$0.98 \times 10^{-2}\ M$
                                                                                                   [16]
   (b) What is meant by reaction order? How can it be calculated from the rate law?   [9]

6. (a) Define equilibrium constant and reaction quotient. Write the equilibrium constant expression
   K_c for the synthesis of NH_3 from N_2 and H_2.
   A 50.0 L reaction vessel contains 1.00 mol N_2, 3.00 mol H_2, and 0.500 mol NH_3. Will more
   ammonia be formed or be dissociated when the mixture goes to the equilibrium at 400 °C? The
   equation is

$$N_2(g) + 3H_2(g) \rightleftharpoons NH_3(g)$$
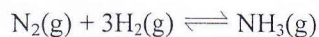
K_c is 0.500 at 400° C   [13]

(b) Define equilibrium constants K_c and K_p. How are they related? Calculate the K_p for the methanation reaction if $K_c = 3.92$ at 25°C. The reaction is:

$$CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$$ [12]
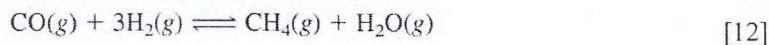
7. (a) Define homogeneous and heterogeneous chemical equilibria. Give examples.   [9]
   (b) Explain Le Châtelier's principle. What are the three ways you can apply to alter the equilibrium composition and possibly increase the yield of product?   [8]
   (c) Hydrogen sulfide dissociates on heating: $2H_2S(g) \rightleftharpoons 2H_2(g) + S_2(g)$
   When 0.100 mol H_2S was put into a 10.0-L vessel and heated to 1132°C, it gave an equilibrium mixture containing 0.0285 mol H_2. What is the value of K_c at this temperature?   [8]

8. (a) Explain why enthalpy is a state function and is an extensive property. Derive a relationship between enthalpy, internal energy, and pressure-volume work.   [10]
   (b) What is calorimeter? Describe a coffee cup calorimeter?   [8]
   (c) Manganese metal can be obtained by reaction of manganese dioxide with aluminum.
   $$4Al(s) + 3MnO_2(s) \rightarrow 2Al_2O_3(s) + 3Mn(s)$$
   What is ΔH for this reaction? Use the following data:
   $$2Al(s) + 3/2O_2(g) \rightarrow Al_2O_3(s); \Delta H = -1676 \text{ kJ}$$
   $$Mn(s) + O_2(g) \rightarrow MnO_2(s); \Delta H = -520 \text{ kJ}$$ [7]
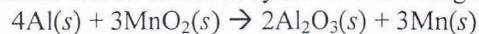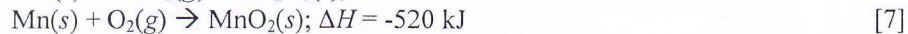
Course Title: Surveying
Time: 3 hrs

Course Code: CE 105
Full Marks: 50

A. Answer any 10 (10x2 = 20)

1. Define Plane Surveying and Geodetic Surveying.
2. What are different sources of errors in chain surveying? Distinguish clearly between cumulative and compensating errors.
3. Explain 3-4-5 method.
4. Define Back Tangent and Forward Tangent.
5. What is centrifugal ratio?
6. Write two field applications of photogrammetric surveying.
7. Differentiate between active and passive remote sensing.
8. Write the stages of an idealised remote sensing.
9. What do you understand by Geographic Information System?
10. What is transition curve? Why is it used?
11. Define Bench Mark and Datum.

B. Answer any 4 (4x5 =20)

1. The length of a survey line was measured with a 20 m chain and was found to be equal to 1200 metres. As a check, the length was again measured with a 25 metres chain and was found to be 1212 m. On comparing the 20 m chain with the test gauge, it was found to be 1 decimetre too long. Find the actual length of the 25 m chain used.
2. Calculate the sag correction for a 30 m steel under a pull of 100 N in three equal spans of 10 m each. Weight of one cubic cm of steel =0.078 N. Area of cross section of tape = 0.08 sq. cm.
3. In an old map a line AB was drawn to a magnetic bearing of 5°30′ the magnetic declination at the time being 1° East. To what magnetic bearing should the line be set now if the present magnetic declination is 8°30′ East.
4. Determine the radial offset to be set out at ½ chain interval along the tangents to locate a 16 chain curve. The length of each chain being 20 m.
5. Calculate the ordinates at 10 metres distance for a circular curve having a long chord of 80 metres and a versed sine of 4 metres.

C. Answer any one (1x10 =10)

1. Two tangents intersect at chainage 59+60, the deflection angle being 50°30′. Calculate the necessary data for setting out a curve of 15 chain radius to connect the two tangents if it is intended to set out the curve by offset from chords. Take peg interval equal to 100 links, length of the chain being equal to 20 metres (100 links).
2. The following consecutive readings were taken with a level and 5 metre levelling staff on continuously sloping ground at a common interval of 20 metres: 0.385, 1.030, 1.925, 2.825, 3.730, 4.685, 0.625, 2.005, 3.110, 4.485. The reduced level of the first point was 208.125 m. Calculate the reduced levels of the points by rise and fall method and also the gradient of the line joining the first and the last point.

Course Title : Surveying   Course Code: **CE105 (B)**
Time : 3hours   Full Marks : 120

Section- A: Answer any 3 (Three) out of 4 (Four)

1. (a) State the purpose(s) of "Check Line" and "Base Line" in case of Chain surveying. [05]

   (b) Write down the steps of field work in chain surveying. What is the necessity of Reconnaissance? [05]

   (c) A survey line **ABC** cuts the banks of a river at **B** and **C**, and to determine the distance **BC**, a line **BE** 80 m long was set out roughly parallel to the river. A point **D** was then found in **CE** produced and middle point **F** of **DB** was determined. **EF** was then produced to **G**, making **FG** equal to **EF**, and **DG** produced to cut the survey line in **H**. **GH** and **HB** were found to be 30 and 70 meters long respectively. Find the distance from **B** to **C**. [10]
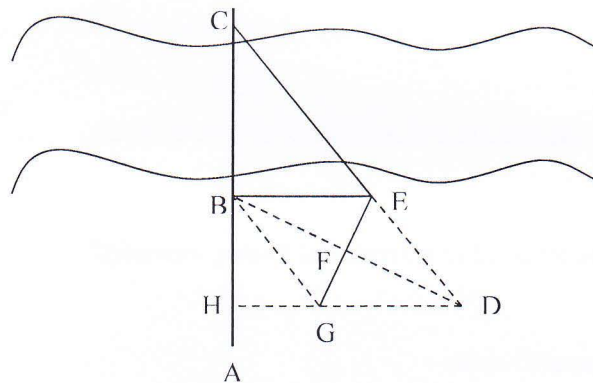
2. (a) Compare between the following : [10]
      i) True Meridian and Magnetic Meridian
      ii) Chain Surveying and Traversing

   (b) The following interior angles were measured with a sextant in a closed traverse. The bearing of the line **AB** was measured as 60° with the prismatic compass. Calculate the bearings of all the other line if ∠A = 140°10′ ; ∠B = 99°8′ ; ∠C =60°22′ ; ∠D = 69°20′ [10]

3. (a) State the characteristics of contours. [05]

   (b) What are the methods of locating contours? [03]

   (c) Briefly Discuss : Differential Leveling and Reciprocal leveling [06]

   (d) The scale of an aerial photograph is 1 cm = 100 m. And the size of the photograph is 24 cm x 24 cm. If the longitudinal lap is 65% and side lap is 35%, determine the number of photographs to cover an area of 15 km x 10 km. [06]

4. (a) Define : Barometric Leveling and Trigonometric Leveling   [06]
   (b) The following data are taken from an old level book where some readings are   [14]
       missing (indicated by "?"). Some calculations (Rise/ Fall/ R.L) are also missing in
       the level book. Calculate the missing data and fill up the table. Apply necessary
       checks.

Stations	Staff reading (m)			Rise (m)	Fall (m)	R.L(m)	Remarks
	Back	Inter	Fore				
A	1.1					?	
B		?			?	?	
C	2.1		1.8		0.5	?	Turning Point
D	?		4.1		?	?	Turning Point
E			3.0	1.5		20.2	Bench Mark

Section- B: Answer any 3 (Three) out of 4 (Four)

5. (a) What are the field works involved in a Terrestrial Photogrammetry?   [04]
   (b) Define the following :   [04]
       i) Crab and Drift
       ii) Longitudinal and Lateral Overlap

   (c) The optical axis of phototheodolite of *A* and *B* are inclined inwards at 32° and 21° angles. [12]
       Focal length = 300 mm. Distance between stations =120 m. RL of camera axis at station *A*
       is 10 m.
       Calculate
       (i)Horizontal distances of point *P* from stations *A* and *B*
       (ii)RL of camera axis at station *B*
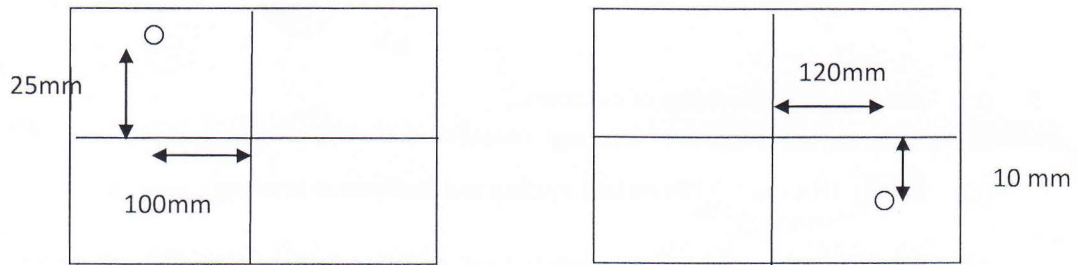
6. (a) Define the following: [04]
       (i)Zenith and Nadir
       (ii)Latitude and Departure
   (b) How positions are computed in GPS? What are the three segments of GPS?   [04]

(c) A closed traverse was conducted round an obstacle and the following measurements are [12] made. Find out the missing lengths. (i.e. DE and EA)

Side	Length (m)	Bearing
AB	500	98°30′
BC	620	30°20′
CD	468	N61°30′W
DE	?	230°
EA	?	S59°50′E

7. (a) Briefly discuss the Simpson's rule & Trapezoidal rule of calculation of area. Write down [05] their comparison.

(b) A series of offsets were taken from a chain line to a curved boundary line at intervals [10] of 10 meters in the following order.

0, 3.65, 4.80, 2.70, 3.60, 4.95, 5.85 m.

Compute the area between the chain line, the curved boundary and the end offsets by :
(i) Trapezoidal rule (ii) Simpson's Rule

(c) Write short note on : Remote Sensing [05]

8. (a) By drawing a simple circular curve show the following: [04]
i) Point of intersection, ii) point of curve, iii) point of tangency, iv) deflection angle

(b) Calculate the volume of earth work by Prismoidal formula in a road embankment with the [12] following data :

Chainage along Center Line	0	100	200	300	400
Ground level	201.70	202.90	202.40	204.70	206.90

Formation level at chainage 0 is 202.30, top width is 2.00 ft , side slopes are 2 to 1. The longitudinal gradient if the embankment is 1 in 100 rising. The ground is assumed to be level all across the longitudinal section.

(c) What are the field of applications of GIS. [04]

1. (a) Transform the equation $2x^2 + 4xy + 3y^2 - 8x + 6y - 7 = 0$ to rectangular axis   7+8
        through the point $(2, -1)$ and inclined at an angle $\theta = 45°$.

    (b) Find the angle between the lines $2x + 4y - 2z + 3 = 0 = 4x - 2y + 6z + 5$ and   10
        $5x - 4y + 3x - 5 = 0 = x - y - 2z$.

2. (a) Find the equation of the plane passing through the points $(-1, 2, -3)$ and $(3, 1, 2)$ 12+3
        and perpendicular to the plane $2x - 8y + z = 1$. Also find perpendicular distance
        from $(-2, 1, 3)$ to the resulting plane.

    (b) Find the equation of the plane through the points $(2, 3, 1), (1, 1, 3)$ and $(2, 2, 3)$. Also   8+2
        show that these three points along with $(-3, -4, 5)$ are coplanar.

3. (a) Show that the straight line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ cuts the sphere   10+5

        $x^2 + y^2 + z^2 + 2x - 4y - 6z + 5 = 0$. Also find the points of intersection.
        For what values of k the plane $2x - 2y + z - k = 0$ touches the given sphere?

    (b) Show that the equation $6x^2 + 5y^2 + 4z^2 - 12x - 20y + 4z - 33 = 0$ 10
        represents an ellipsoid. Also find its centre and lengths of the semi-axes

4. (a) Given $a = 4\hat{\imath} - \hat{\jmath} - 3\hat{k}$, $b = 2\hat{\imath} + 5\hat{\jmath}$ and $c = \hat{\imath} + 3\hat{\jmath} - 2\hat{k}$. Verify the formula   10
        $$a \times (b \times c) = (a \cdot c)b - (a \cdot b)c$$

    (b) Find the unit vector perpendicular to each of the vectors $3\hat{\imath} - 5\hat{\jmath} + \hat{k}$ 10
        and $2\hat{\imath} - 4\hat{\jmath} - 7\hat{k}$. Also find the angle between them.

    (c) Find the vector equation of the line passing through the points $(1, 1, 1) and (3, 3, 3)$.   5
        Also show that the resulting line is perpendicular to the vector $s = -2\hat{\imath} + \hat{\jmath} + \hat{k}$.

5. (a) Find the perpendicular distance of the point $(7, 6, 7)$ from the line   15

$$\frac{x-2}{2} = \frac{y-1}{3} = \frac{z-3}{6}$$

   (b) Prove that, if the mid points of the consecutive sides of any quadrilateral are   10
       connected by straight lines then the resulting quadrilateral is a parallelogram.

6. (a) Find the directional derivative of $\varphi = x^2yz + 4xz^2$ at $(1, -2, -1)$ in the direction of   10
       the vector $a = 2\hat{\imath} - \hat{\jmath} - 2\hat{k}$.

   (b) If the displacement vector of a moving particle is   10

$$r = e^{-t}\hat{\imath} + 2\cos 3t\,\hat{\jmath} + 2\sin 3t\,\hat{k}$$

       where t is the time, then find its velocity vector(v) and acceleration vector(a) at
       $t = 0$.

   (c) If $= 5t^2\hat{\imath} + t\hat{\jmath} - t^3\hat{k}$, find $\frac{d}{dt}(A.A)$.   5

7. (a) Prove that, $\nabla^2\left(\frac{1}{|r|}\right) = 0$ where $r = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$.   13

   (b) If $A = x^2y\hat{\imath} - 2xz\hat{\jmath} + 2yz\hat{k}$ find $curlcurlA$ at $(-1, -1, 1)$.   12

8. (a) Evaluate $\iint\limits_{S} \vec{A}\cdot\hat{n}\,ds$, where $\vec{A} = yz\hat{\imath} + x\hat{\jmath} - 3y^2z\hat{k}$ and S is the surface of the   13

       cylinder $x^2 + y^2 = 16$ included in the first octant between $z = 0$ and $z = 2$.

   (b) If $\vec{A} = 3xy\hat{\imath} - y^2\hat{\jmath}$, evaluate $\int_{C} \vec{A}\cdot d\vec{r}$, where C is the curve in the $xy - plane$,   12

       $y = 2x^2$, from $(-1, 3)$ to $(2, 2)$.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2016
Program: B. Sc. Engineering (Civil)

Course Title: Engineering Mechanics II

Course Code: CE 103(Section A)

Time: 3 hours

Full Marks: 100 (= 10 × 10)

Section A
(Answer **any 4** out of **6** questions in this section)

1. Determine the mass moment of inertia of the cone shown in **Figure 1** about its centroidal axis and express the result in terms of total mass 'm' of the cone. The material has a constant density 'ρ'.
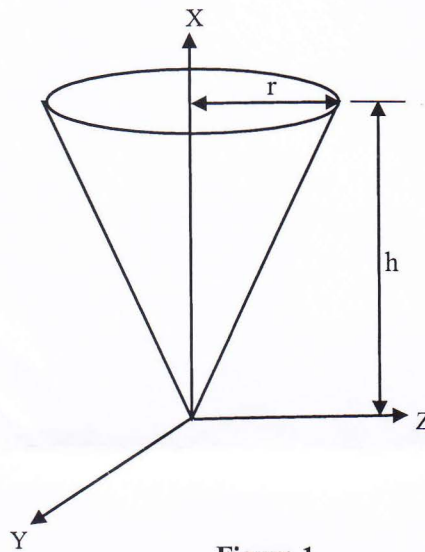
Figure 1

2. The assembly in **Figure 2** is composed of three homogeneous bodies: the 10 kg cylinder, the 2 kg slender rod and the 4 kg sphere. For this assembly, determine Mass moment of inertia with respect to X axis (I_x) and Y axis (I_y).
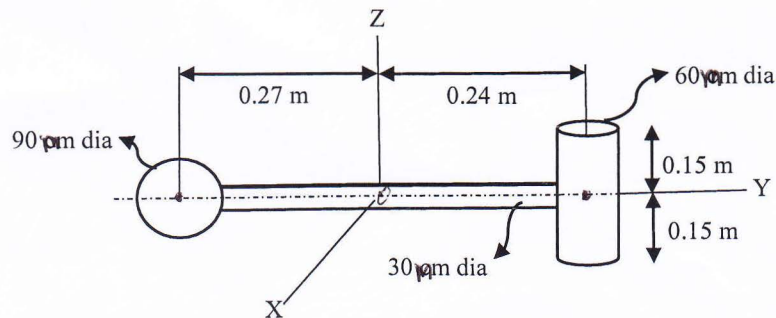
Figure 2

3. Beam AB is subjected to a uniform load of 2 k/ft and is supported at B by post BC as shown in **Figure 3**. If the coefficient of static friction at B and C are $f_B = 0.2$ and $f_C = 0.5$, determine the force P needed to pull the post out under the beam. Neglect weight of the members and thickness of beam.

2 k/ft

A

B

18.75"

POST

14'

6.25"

P

C
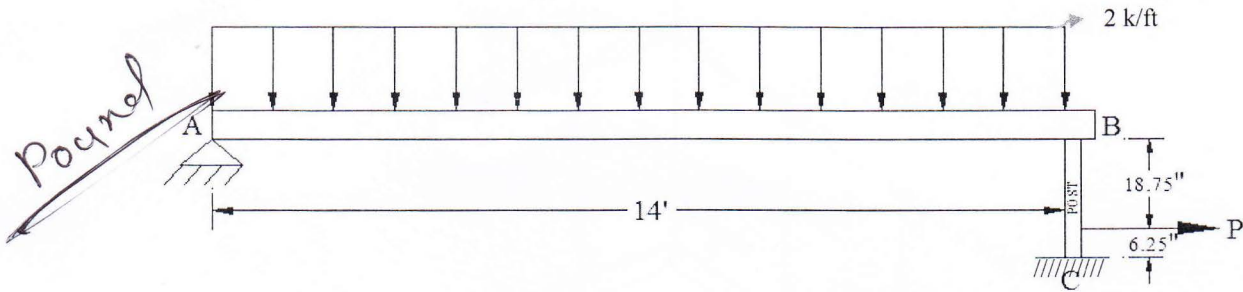
Figure 3

4. The maximum tension that can be developed in the cord shown in **Figure 4** is 1000 N. If the massless pulleys at A and B are free to rotate and the coefficient of static friction at pulley A and B is $f_A = 0.25$ and $f_B = 0.35$, determine the maximum weight W that can be lifted by the cord.

Chord

$f_A = 0.25$

27°

A

$f_B = 0.35$

T

B

W
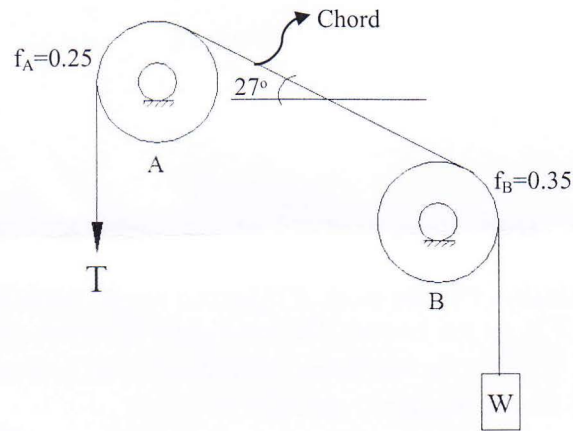
Figure 4

5. Determine the minimum horizontal force P required to lift the 100 kg cylinder shown in **Figure 5**. The coefficient of static friction at the contact points A and B are $f_A = 0.6$ and $f_B = 0.2$ respectively and the coefficient of static friction between the wedge and the ground is $f_C = 0.3$.

Cylinder
Weight=100 kg

A

10°

B

P

Wedge

C
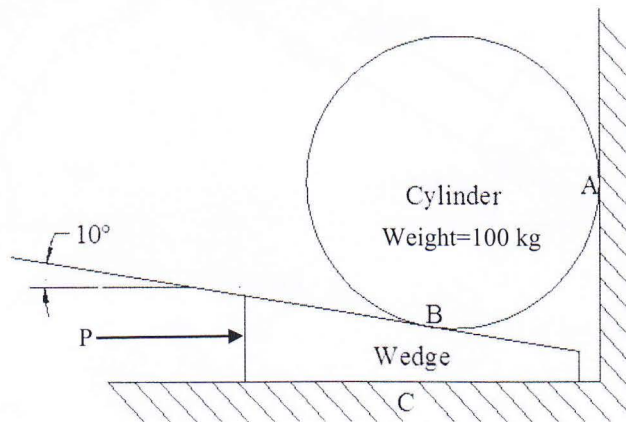
Figure 5

6. A member in **Figure 6** is supported by three cables AB, CD and EF. Two 150 N loads are acting along Z direction at point C and E. Determine the tension in each cable. Given, the weight of the member is 500 kN/m.
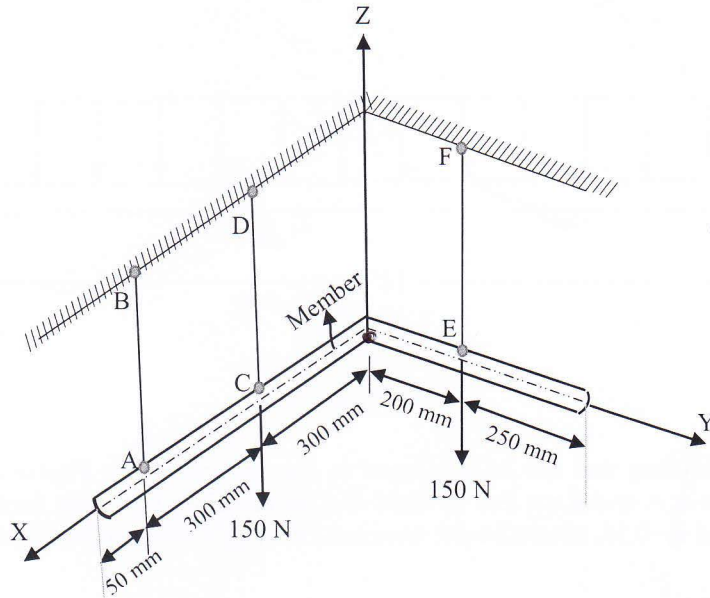
Figure 6

Section B
(Answer **any 4** out of **6** questions in this section)

7. Determine the velocity of **70 lbs** block **A** if the two blocks are released from the rest and **50 lbs** block **B** moves **3 ft** up the incline. The coefficient of kinetic friction between block **A** and inclined plane is $^1/_3$ and the coefficient of kinetic friction between block **B** and inclined plane is ¼. What is the tension in cable **C** and cable **D**?
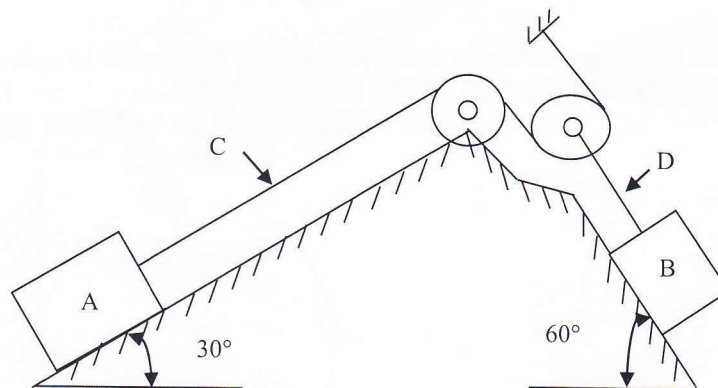
Figure 7

8. Crates **A** and **B** (shown in the figure) weigh **120 lb** and **50 lb**, respectively. If they start from rest, determine their velocity when t=**5 sec**. Also, find the force exerted by crate **A** on crate **B** during the motion. The coefficient of kinetic friction between the crates and the ground is $\mu_k = 0.25$.

P=100 lb → A   B
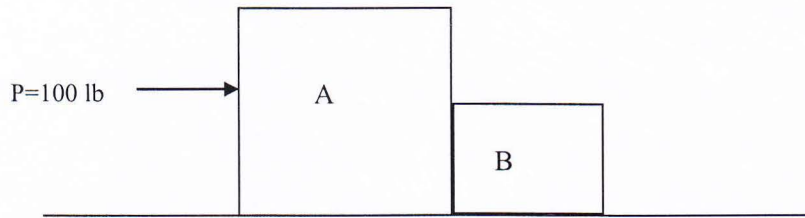
Figure 8

9. The **3.0 Mg** car travels along the circular road of **95 m** radius. If the traction force of the wheels on the road is $F = (150\, t^2)$ N, where t is in seconds, determine the velocity of the car when **t = 5 sec**. Initially the car was travelling with a speed of **1.2 m/s**.

10. The **90 kg** uniform crate initially rests on the inclined surface. If a force as shown starts to pull the crate, determine the power output developed by the force at **t = 6 sec**. The coefficient of static and kinetic friction between the crate and the surface are $\mu_s = 0.20$ and $\mu_k = 0.15$.

$F = 40\,t + 100$

40°
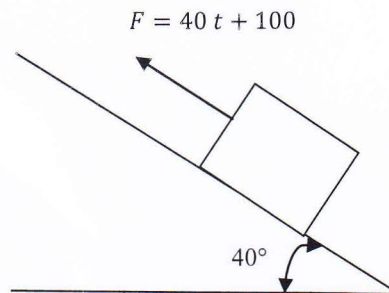
Figure 9

11. A small projectile is fired vertically downward into a fluid medium with an initial velocity of **60 m/s**. Due to the drag resistance of the fluid the projectile experiences a deceleration of $a = (-0.4\ v^3)$ m/ s^2 , where v is in m/s . Determine projectile's velocity and position after **2 s** after it is fired.

12. The crate **B** and cylinder **A** have a mass of **200 kg** and **75 kg**, respectively. If the system is released from rest, determine the velocity of the crate and cylinder when **t= 3 sec**. Neglect the mass of the pulleys.
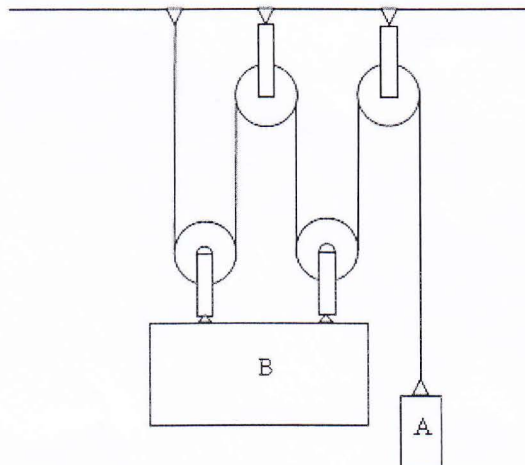
B

A

Figure 10

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2016
Program: B. Sc. Engineering (Civil)

Course Title: Engineering Mechanics II

Time: 3 hours

Course Code: CE 103(Section B)

Full Marks: 100 (= 10 × 10)

Section A
(Answer **any 4** out of **6** questions in this section)

1. Block A and B shown in Figure 1 weigh 30 lb and 60 lb respectively. If the coefficient of friction is assumed to be 0.25 for all surfaces, what inclined force P is needed to cause motion of the block A to impend to the left? The rope is horizontal.
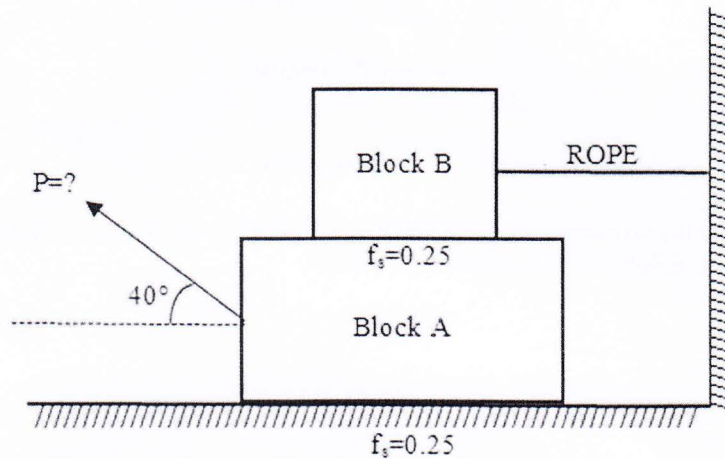
Figure 1

2. A slender brass rod of uniform cross section has been welded at the center of the base of a cast-iron cone as shown in Figure 2. Weight of the rod and unit weight of cast-iron are 25 lb and 490 lb/ft³, respectively. Calculate the radius of gyration of this composite mass with respect to Y axis.
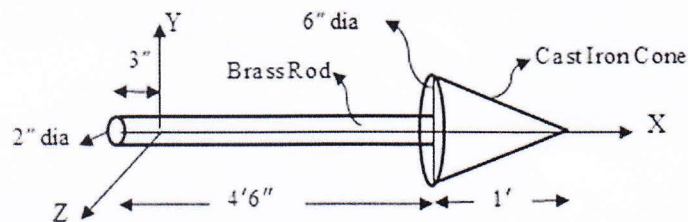
Figure 2

3. A 16 kg triangular plate is supported by three wires as shown in Figure 3. Knowing that a = 200 mm, determine the tension in each wire.
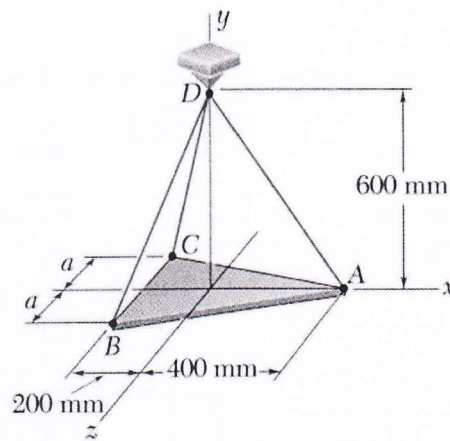
Figure 3

4. Determine the mass moment of inertia of the composite body shown in Figure 4 about Y axis. It is given that unit weight of the material is 150 lb/ft³.
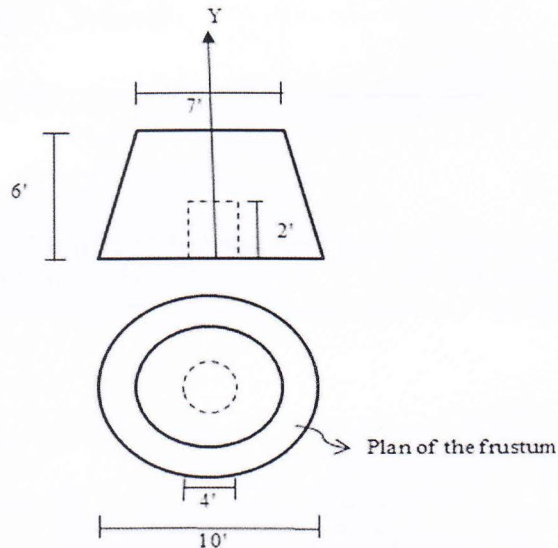

Plan of the frustum

Figure 4

5. The body A in Figure 5 weighs 200 lb. The coefficient of static friction is 0.3 between A and the inclined plane and 0.2 between the rope and the weightless drums. What value of W will cause motion of the body A to impend up the plane?
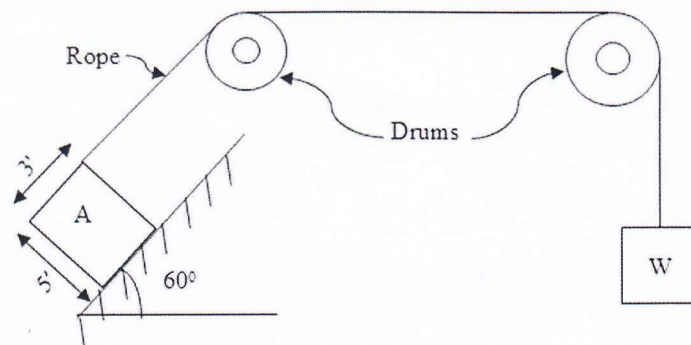
Figure 5

6. The 150lb crate shown in Figure 6 is supported by cables AB, AC and AD. Determine the tensions in these cables.
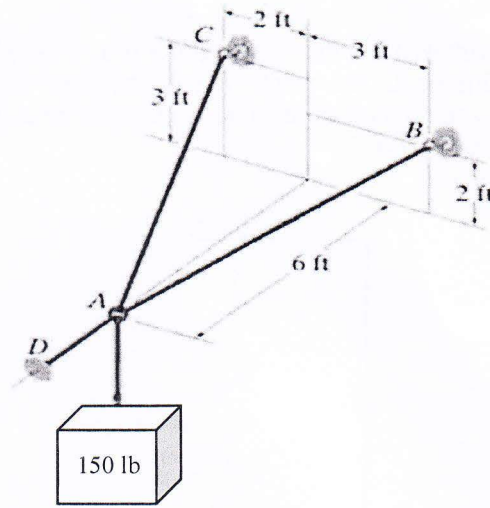
Figure 6

Section B

(Answer **any 6** out of **8** questions in this section)

7. A ball is thrown from the tower with a velocity of 20 ft/s as shown in **Figure 7**. Determine the
   (i)   x and y coordinates to where the ball strikes the slope.
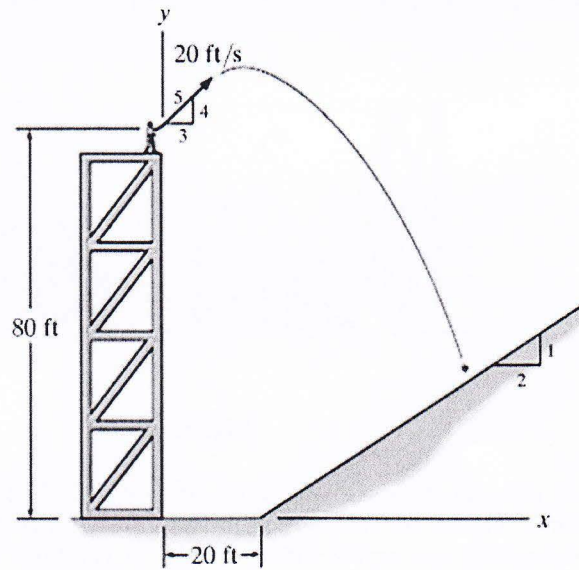   (ii)   speed at which the ball hits the ground.

Figure 7

8. The position of a particle moving along a straight line is defined by the relation: $x = (12t^3 - 18t^2 + 2t + 5)$ ft/s, where x is expressed in feet and t in seconds. Determine the
   (i)   Time at which velocity will be zero,,
   (ii)   Position and distance travelled by the particle at that time,
   (iii)   Acceleration of the particle at that time.
   (iv)   Distance travelled by the particle from t=3s to t=5s.

9. A spring having K=100 lb/ft has the free length of 6 ft. A weight of W=500 lb is attached to the spring as shown in Figure 8. The weight W is being acted upon by 200 lb force. Compute the work done by the system in moving the block to its right by a distance of 8 ft. Surface roughness between W and the surface is 0.2.
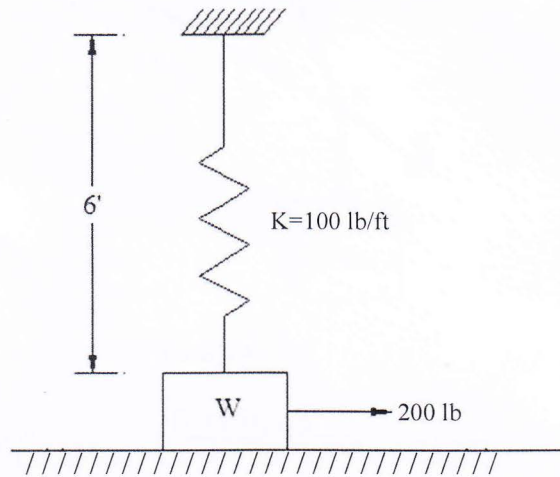

Figure 8

10. A 70 kg skate boarder shown in Figure 9 coasts down the circular track. If he starts from rest when $\theta = 0°$, determine the magnitude of the normal reaction the track exerts on him when $\theta = 45°$.
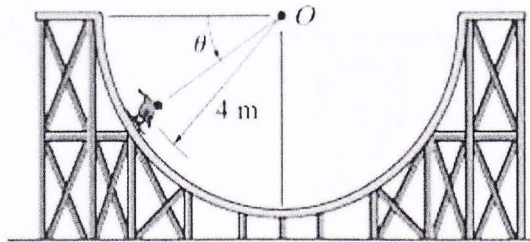

Figure 9

11. A 60 lb block of material 'B' is moving to the left with a velocity of 20 ft/s down a rough 15° incline as shown in Figure 10. It is struck by a 0.25 lb projectile 'A' moving parallel to and upward to the right along the incline with a velocity of 1800 ft/s. The projectile embeds itself in the block. The coefficient of friction between B and the incline is 0.3.
    (i) What is the resulting velocity of A & B?
    (ii) During what length of time does the block move after the impact?
    (iii) How far does it move?
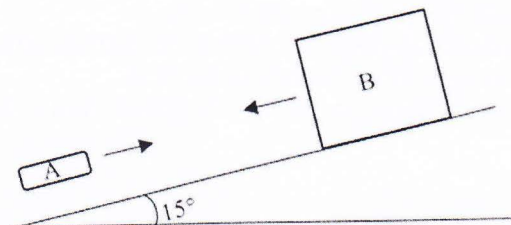   (iv) How much kinetic energy is lost at impact?

Figure 10

12. If the system in Figure 11 is initially at rest, determine the velocity of the blocks 15 s after their release. Given, Co-efficient of kinetic friction = 0.3.
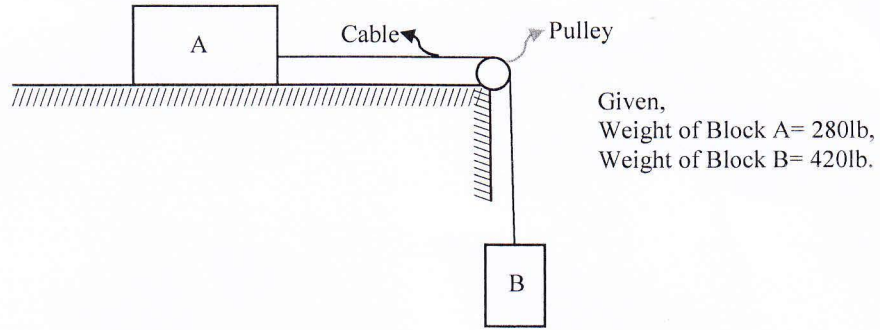

Cable

Pulley

A

B

Given,
Weight of Block A= 280lb,
Weight of Block B= 420lb.

Figure 11

13. The bag A, having a weight of 60 N, is released from rest at the position $\theta = 0°$, as shown in Figure 12. After falling to $\theta = 90°$, it strikes a 180 N box B. If the coefficient of restitution between the bag and box is e = 0.4, determine the velocities of the bag and box just after impact. What is the loss of energy during collision?
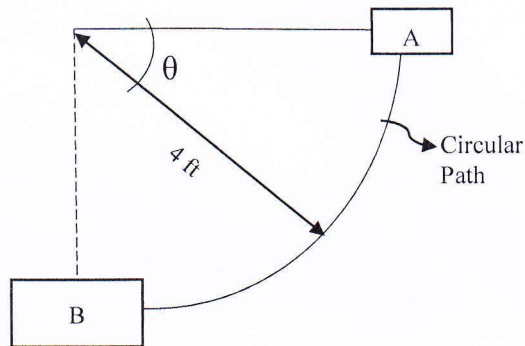

θ

A

4 ft

Circular
Path

B

Figure 12

14. A spring is used to stop a 60 kg package which is sliding on a horizontal surface. The spring has a contant K=20 kN/m and is held by the cable so that it is initially compressed by 120 mm. Assume that the package has a velocity of 2.5 m/s in the position A shown in Figure 13. If the spring is additionaly compressed by 40 mm after being struck by the package, determine the
    (i)   Coefficient of kinetic friction between the package and the surface
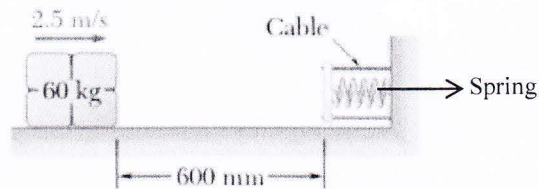   (ii)   Velocity of the package as it passes A after being rebounded.

2.5 m/s

Cable

60 kg

Spring

600 mm

Figure 13