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

1. Read the passage and answer the following questions   1 x 5 = 5

Arid regions in the southwestern United States have become increasingly inviting playgrounds for the growing number of recreation seekers who own vehicles such as motorcycles or powered trail bikes and indulge in hill-climbing contests or in carving new trails in the desert. But recent scientific studies show that these off-road vehicles can cause damage to desert landscapes that has long-range effects on the area's water-conserving characteristics and on the entire ecology, both plant and animal. Research by scientists in the western Mojave Desert in California revealed that the compaction of the sandy arid soil resulting from the passage of just one motorcycle markedly reduced the infiltration ability of the soil and created a stream of rain runoff water that eroded the hillside surface. In addition, the researchers discovered that the soil compaction caused by the off-road vehicles often killed native plant species and resulted in the invasion of different plant species within a few years. The native perennial species required many more years before they showed signs of returning. The scientists calculated that roughly a century would be required for the infiltration capacity of the Mojave soil to be restored after being compacted by vehicles.

I. What is the main topic of the passage?
   (A) Problems caused by recreational vehicles
   (B) Types of off-road vehicles
   (C) Plants of the southwestern desert
   (D) The increasing number of recreation seekers
II. According to the passage, what is being damaged?
   (A) Motorcycles   (B) The desert landscape
   (C) Roads through the desert   (D) New plant species
III. According to the passage, the damage to plants is
   (A) unnoticeable   (B) superficial   (C) long-lasting   (D) irreparable
IV. According to the passage, what happens when the soil is compacted?
   (A) Little water seeps through   (B) Better roads are made
   (C) Water is conserved   (D) Deserts are expanded
V. Which of the following people would probably be most alarmed by the scientists' findings?
   (A) Historians   (B) Mapmakers   (C) Farmer   (D) Ecologists

2. **Join the following sentences :** 0.5x10=5
   a) The lawyer defended his client very well. He lost the case.
   b) Take some food with you. You will get hungry on the journey.
   c) That was my favorite book. I lost it yesterday in the bus.
   d) His wife encouraged him. He persevered.
   e) They were driven by the rain. They took shelter under a tree.
   f) This is the player. The committee selected him captain.
   g) He has already delivered a good performance. Nobody can question his eligibility.
   h) He is not educated. He possesses practical wisdom.
   i) She bought a red bag. She bought a matching red shoe.
   j) I received no reply. I sent another le tter.

3. **Write a story based on the prompt given. (120-150 words)** 7

   It was midnight. Muntasir was in deep sleep. Suddenly the phone rang......

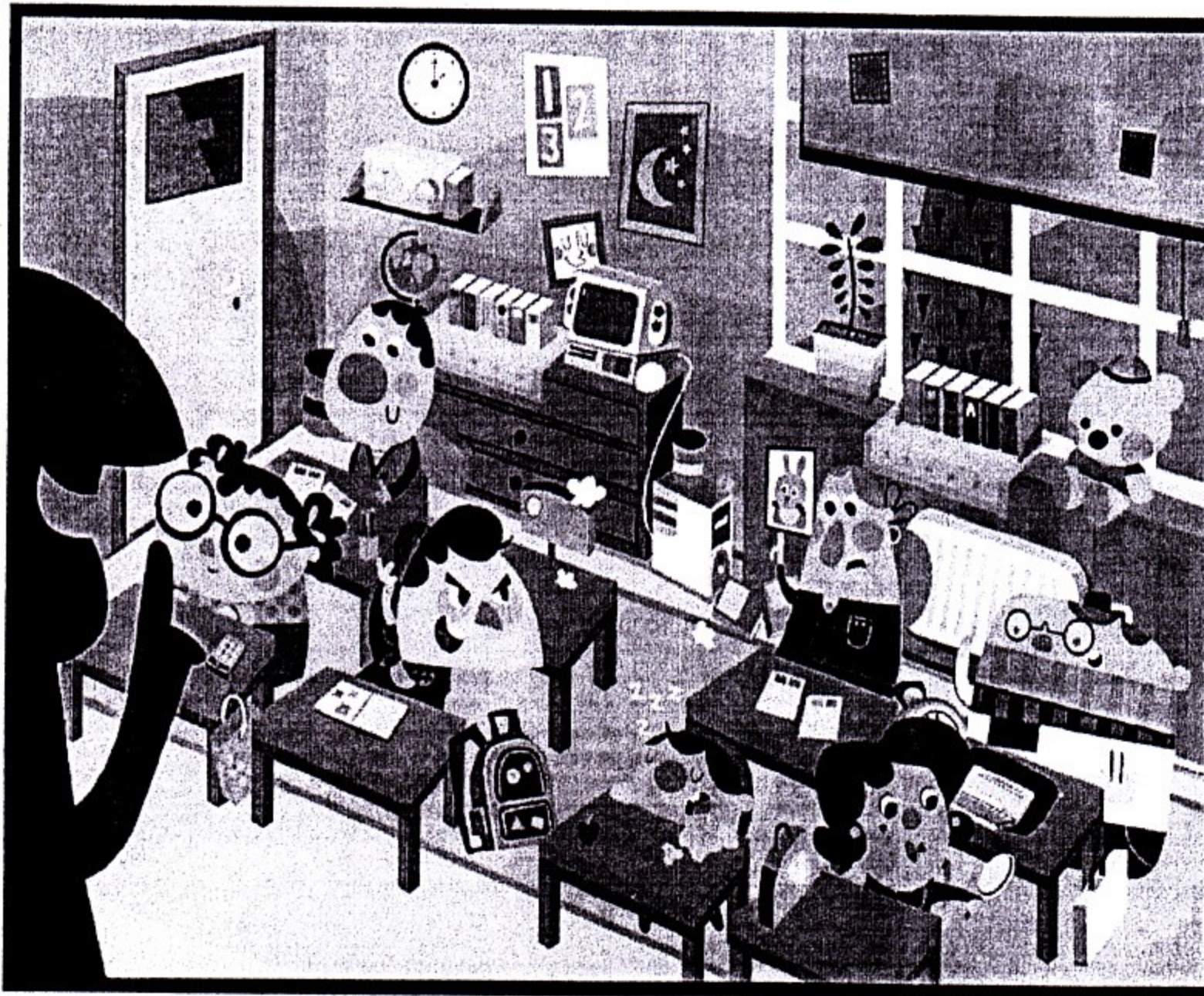4. Write a review of a movie that you have watched recently. (120 – 150 words) 7

5. The Cultural Club of the University of Asia Pacific arranged a day long Folk Festival on ebruary 4, 2018 at the university plaza. Write a report on it. (120-150 words) 7

6. **Describe the following picture (120- 150 words)** 7

7. **Write an essay on any <u>one (1)</u> of the following topics (250-280 words)** 12
   Is social networking really important?

   OR

   Future of tourism in Bangladesh

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2017
Program : B.Sc. Engineering (Civil)

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

Assume any missing data (if any) for both sections
Section: A
There are FOUR questions in this section. Answer any THREE.

1. (a) Jewelry gold and air are two examples of solution. Apply the concept of solution to explain these two examples. [7]
   (b) Boiling and freezing points of water change upon addition of a non-volatile solute. Explain these changes drawing the phase diagram of water and solution. [10]
   (c) The radiator fluid in an automobile is a mixture of water and ethylene glycol. As a result of freezing-point depression, radiators do not freeze in winter. How many grams of the antifreeze ethylene glycol [$CH_2(OH)CH_2(OH)$] would you add to a car radiator containing 6.75 L of water if the coldest winter temperature in your area is $-9.0°C$? Calculate the boiling point of this water-ethylene glycol mixture. [8]

2. (a) Define lattice energy and hydration energy. How do they play role in determining the solubility of an ionic solid in water? [4+6=10]
   (b) Camphor is a white solid that melts at 179.5°C. It has been used to determine the molecular masses of organic compounds because of its unusually large freezing-point-depression constant (40°C/m), which allows ordinary thermometers to be used. The organic substance is dissolved in melted camphor, and then the melting point of the solution is determined.
   i. A 1.07-mg sample of a compound was dissolved in 78.1 mg of camphor. The solution melted at 176.0°C. What is the molecular mass of the compound?
   ii. If the empirical formula of the compound is CH, what is the molecular formula? [15]

3. (a) Sketch and label the phase diagram of CO_2. Applying the phase rule calculate the degrees of freedom for all the regions and phase equilibrium in the diagram. [4+6=10]
   (b) "Solid CO_2 sublimes at normal atmospheric pressure (1 atm) instead of melting into liquid" – interpret this statement using the phase diagram. [8]
   (c) The pH of human arterial blood is 7.40. Determine the concentration of hydronium ion present in blood. [7]

4. (a) Illustrate the electron pair arrangement in CH_4, NH_3 and H_2O molecules. Comment on the bond angles in the molecules and explain if there is any difference. [10]
   (b) "NH_3 has a larger dipole moment than NF_3 does" - explain this statement by drawing the geometry and bond dipole moment in each molecule. [7]
   (c) Explain the bonding in XeF_4 and NH_3 molecules using VBT. [8]

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

5. (a) Define rate of reaction. What are the parameters that influence the reaction rate? [8]
   (b) 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 $t = 600$ s to $t = 1200$ s. Use the following data:

Time	$[N_2O_5]$
600 s	$1.24 \times 10^{-2} M$
1200 s	$0.93 \times 10^{-2} M$

[9]

(c) Shown below is a plot of the concentration of a reactant D versus time.
i. How do the instantaneous rates at points A and B compare?
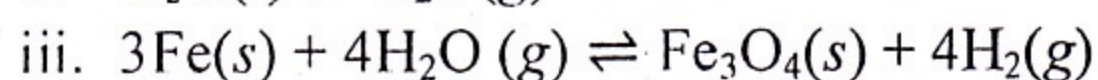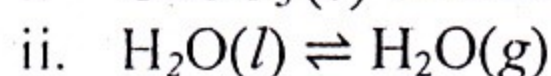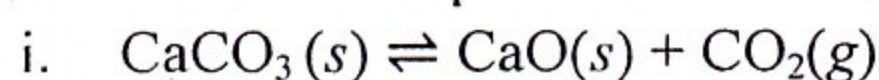ii. Is the rate for this reaction constant at all points in time? Explain your answer.
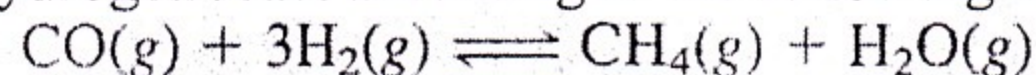

Time (s) ⟶
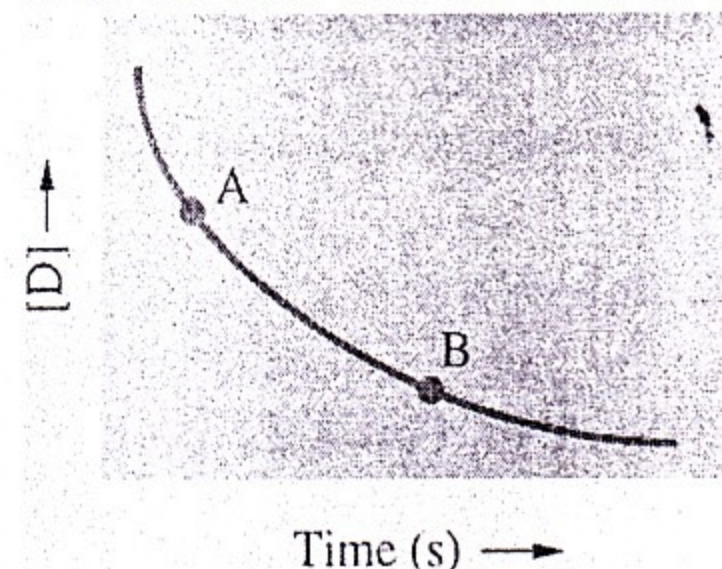
[8]

6. (a) Reaction quotient, Q_c, is an important parameter for determining the direction of reaction. Predict the direction of any reaction if:
   i. $Q_c > K_c$, ii. $Q_c = K_c$, iii. $Q_c < K_c$, where K_c is the equilibrium constant. [5]
   (b) Write down the equilibrium constant expression for the following chemical reactions:
   i. $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$
   ii. $H_2O(l) \rightleftharpoons H_2O(g)$
   iii. $3Fe(s) + 4H_2O(g) \rightleftharpoons Fe_3O_4(s) + 4H_2(g)$
   iv. $CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$ [8]
   (c) Carbon monoxide and hydrogen react according to the following equation:
   $$CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$$
   When 1.000 mol CO and 3.000 mol H_2 are placed in a 10.00-L vessel at 927°C (1200 K) and allowed to come to equilibrium, the mixture is found to contain 0.387 mol H_2O. What is the molar composition of the equilibrium mixture? How many moles of each substance are present? Calculate the equilibrium constant, K_c. [12]
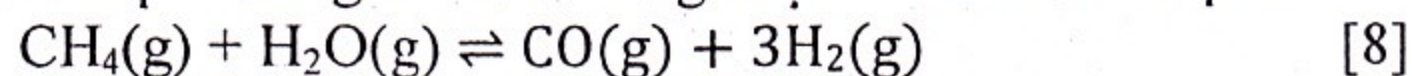
7. (a) Define enthalpy. Explain why enthalpy is an extensive property and why it is a state function. Give more examples of extensive property. [8]
   (b) Describe how a coffee-cup can be used as a calorimeter. Explain why calorimeter is important in thermochemistry. [9]
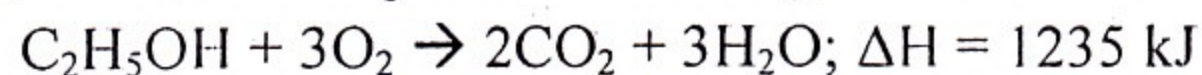   (c) Use values of $\Delta H°_f$ ($\Delta H°_f$ for $CS_2(g)$ is 116.9 kJ/mol and $CS_2(l)$ is 89.70 kJ/mol) to calculate the heat of vaporization ($\Delta H°_{vap}$) of carbon disulfide at 25°C. The vaporization process is:
   $$CS_2(l) \longrightarrow CS_2(g)$$
   [8]

8. (a) State and explain the Le Châtelier's Principle using the following reaction as an example.
   $$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$$ [8]
   (b) Ethanol generates heat according to the following reaction when it burns.
   $$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O; \Delta H = 1235 \text{ kJ}$$
   How many grams of ethanol do you need to burn if you want to raise the temperature of 5 L (density of water is 1 kg/L) of water from 25°C to its boiling point using ethanol as a fuel? Assume 100% combustion efficiency. [11]
   (c) Define heat of formation. Why is this important in thermochemistry? [6]

Page 2 of 2

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Fall-2017
Program: B. Sc. in Civil Engineering

Course Title: Mathematics-II   Course Code: MTH 103
Time: 3.00 Hours.   Full Marks: 150

There are **Eight** questions. Answer any **Six**. All questions are of equal value. Figures in the right margin indicate marks.

1. (a) Prove that $21x^2 - 21y^2 + 40xy + 44x + 122y - 17 = 0$ represents a pair of straight lines. Find the point of intersection and the angle between them.   9

   (b) Reduce the equation of the conic $x^2 - 4xy + y^2 + 8x + 2y - 5 = 0$ to its standard form.   12

   (c) Find the center of the conic $14x^2 - 4xy + 11y^2 - 44x - 58y + 71 = 0$.   4

2. (a) Define direction cosines and direction ratios of a line.   6

   (b) Show that the lines whose direction cosines are proportional to   9

   $$2,1,1 \ ; \ 4,\sqrt{3}-1,-\sqrt{3}-1 \ ; \ 4,-\sqrt{3}-1,\sqrt{3}-1$$

   are inclined to one another at angle $\frac{\pi}{3}$.

   (c) Find the direction cosines of two lines are connected by the relations   10

   $$l + m + n = 0 \quad \text{and} \quad 2lm + 2ln - mn = 0.$$

3. (a) Find the equation of the plane through the points $(2,3,1)$, $(1,1,3)$ and $(2,2,3)$.   7

   (b) Find the equation of the plane through the points $(-1,1,1)$ and $(1,-1,1)$ and perpendicular to the plane $x + 2y + 2z = 5$.   8

   (c) Show that equation of the plane through the point $(-1,3,2)$ and perpendicular to the planes $x + 2y + 2z = 5$ and $3x + 3y + 2z = 8$ is $2x - 4y + 3z = -8$.   10

4. (a) Find the equation of the straight line that intersect the lines   12

   $4x + y - 10 = 0 = y + 2z + 6$ and $3x - 4y + 5z + 5 = 0 = x + 2y - 4z + 7$ and passing through the point $(-1, 2, 2)$.

   (b) Show that the lines $\frac{x-5}{4} = \frac{y-7}{4} = \frac{z+3}{-5}$ and $\frac{x-8}{7} = \frac{y-4}{1} = \frac{z-5}{3}$ are coplanar. Find their intersection point and the equation of the plane in which they lie.   13

5. (a) If $\vec{A} = \cos xy\ \hat{\imath} + (3xy - 2x^2)\hat{\jmath} - (3x + 2y)\hat{k}$, then show that the order of   5

differentiation is immaterial, i.e. $\dfrac{\partial^2 \vec{A}}{\partial y\ \partial x} = \dfrac{\partial^2 \vec{A}}{\partial x\ \partial y}$.

(b) If $\emptyset(x, y, z) = xy^2 z$ and $\vec{A} = xz\ \hat{\imath} - xy^2\ \hat{\jmath} + yz^2\ \hat{k}$,   10

find $\dfrac{\partial^3}{\partial x^2 \partial z}(\emptyset\vec{A})$ at $(2, -1, 1)$.

(c) If $\vec{A} = A_1\hat{\imath} + A_2\hat{\jmath} + A_3\hat{k}$, $\vec{B} = B_1\hat{\imath} + B_2\hat{\jmath} + B_3\hat{k}$ and $\vec{C} = C_1\hat{\imath} + C_2\hat{\jmath} + C_3\hat{k}$ 10

prove that $\vec{A} \cdot (\vec{B} \times \vec{C}) = \vec{B} \cdot (\vec{C} \times \vec{A}) = \vec{C} \cdot (\vec{A} \times \vec{B})$.

6. (a) Define the Gradient, Divergence and Curl.   6

(b) Prove that $\vec{\nabla}^2 (\ln|\vec{r}|) = \dfrac{1}{r^2}$.   9

(c) Prove that (i) curl grad $\emptyset = \vec{0}$, (ii) div curl $\vec{A} = 0$. Where $\emptyset$ and $\vec{A}$ are scalar   10

and vector function of position (x, y, z) respectively.

7. (a) Evaluate $\iint\limits_S \vec{A} \cdot \hat{n}\ dS$ by taking a projection, where $\vec{A} = (x + y^2)\hat{\imath} - 2x\hat{\jmath} + 2yz\hat{k}$ 13

and S is that part of the plane $2x + y + 2z = 6$ which is located in the first

octant.

(b) If $\vec{F} = 4xz\ \hat{\imath} - y^2\ \hat{\jmath} + yz\ \hat{k}$, evaluate $\iint\limits_S \vec{F} \cdot \hat{n}\ dS$ where S is the surface of the   12

cube bounded by $x = 0$, $x = 1$, $y = 0$, $y = 1$, $z = 0$, $z = 1$.

8. (a) State Green's theorem in the plane. Verify Green's theorem in the plane for   12

$\oint_C [(3x^2 - 8y^2)\ dx + (4y - 6xy)\ dy]$, Where C is the closed curve of the

region bounded by $y = \sqrt{x}$ and $y = x^2$.

(b) State Stoke's theorem. Verify Stoke's theorem for $\vec{A}$, Where S is the upper half   13

surface of the sphere $x^2 + y^2 + z^2 = 1$ and $\vec{A} = (2x - y)\ \hat{\imath} - yz^2\ \hat{\jmath} - y^2 z\ \hat{k}$.

Also C is its boundary.

Course Title: Engineering Mechanics II   Course Code: CE 103
Time: 3.0 hours   Full Marks: 100(=10×10)

[Answer any 10 (Ten) of the following 14 (Fourteen) questions]

1. A trapezoidal block B, weighing 50 lb, is stuck between two rough blocks as shown in **_Figure 1_**.
    Coefficient of static friction between all contact surfaces is 0.20.
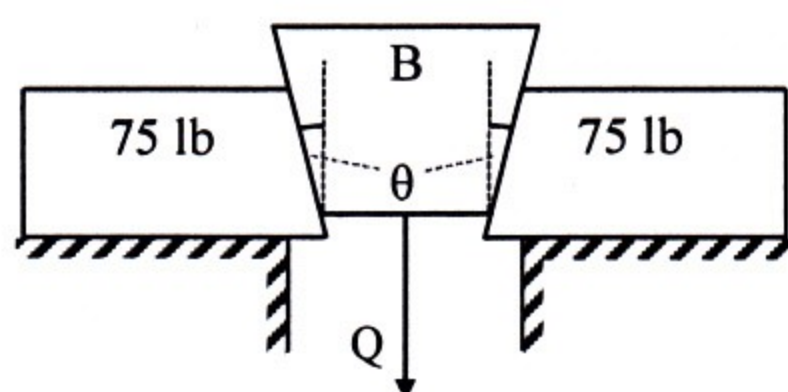   Calculate the necessary force Q that would initiate motion downwards if $\theta = 15°$.

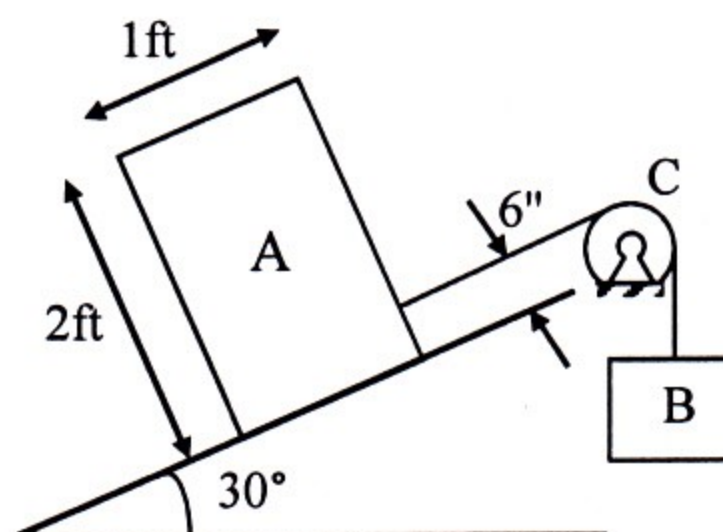
Figure 1   _Figure 2_

2. A homogenous body A weighing 500 lb rests on an inclined rough surface as shown in **_Figure 2_**.
    Block B is connected to A by a weightless cord over rough pulley C.
    If weight (W_B) of B causes A to be on the verge of tipping over, compute W_B.

3. Calculate mass moments of inertia of the wheel shown in **_Figure 3_** with respect to its rotating axis.
    The wheel comprises of 8 rectangular prisms.

Given,
Outer radius of wheel = 2'
Inner radius of wheel = 1'9"
Rectangular prism = 2" x1'5" x2"
Axle radius (outer) = 4"
Axle radius (inner) = 2"
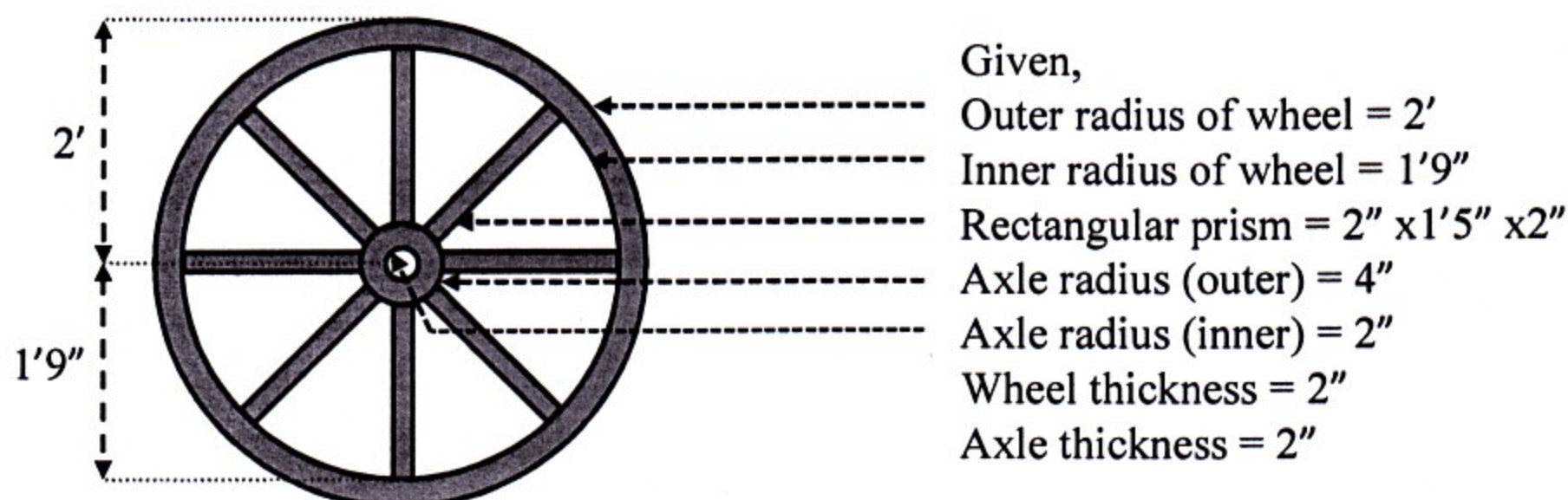Wheel thickness = 2"
Axle thickness = 2"

Figure 3

4. A directional sign is needed in a highway turn-off. A vehicle travels at a speed of 16 m/s while the
    design speed at turn-off is 8 m/s. To read and understand the sign, the driver took 2.5s and decelerate
    at the rate of 5 m/s².
    What is the minimum distance the direction sign should be placed in advance of the turn-off?

5. Starting from rest, a body rotates counterclockwise direction according to the equation
    $\theta = 0.5t^3 - 0.7t^2 + 0.6t$.
    After 4 seconds, calculate its:
    a) angular displacement
    b) angular velocity
    c) angular accleration.

6. A spring is attched to the ground at a horizontal angle of 30°. A ball weighing 100 gm compresses the spring to a length such that when released, the ball travels 15 ft horizontally as shown in **Figure 4**. Calculate the spring constant 'k' if spring deformation is 6 inch.
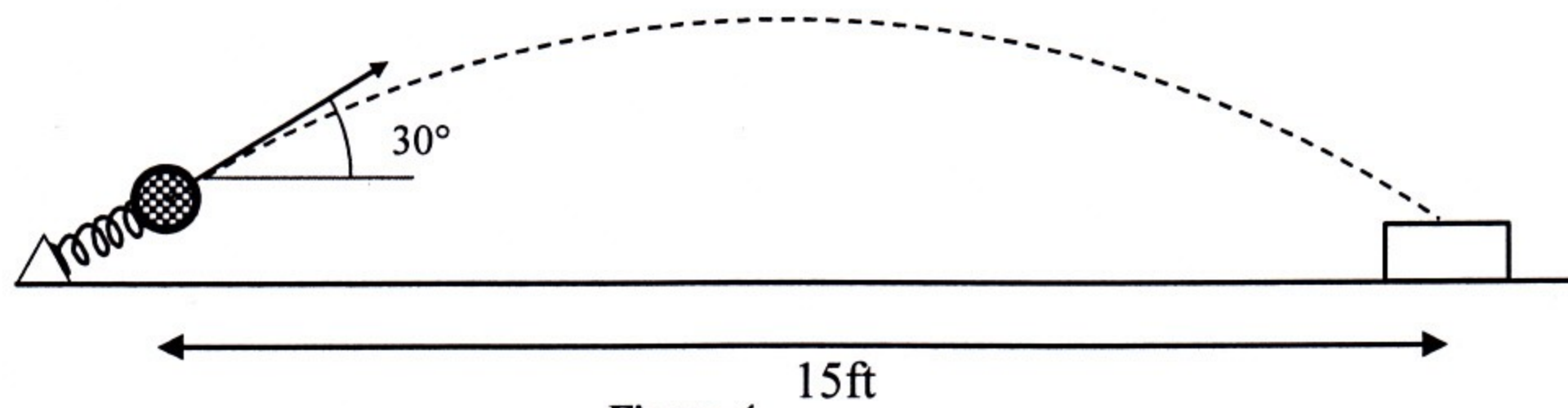

Figure 4

7. Block A and B are connected by a weightless cord that passes over guide C as shown in **Figure 5**. Block A starts with an initial velocity of 30 fps rightward and has a velocity of 15 fps after travelling 200 ft.
   a) If A weighs 300 lb, calculate weight of B.
   b) Calculate tension in each cable.
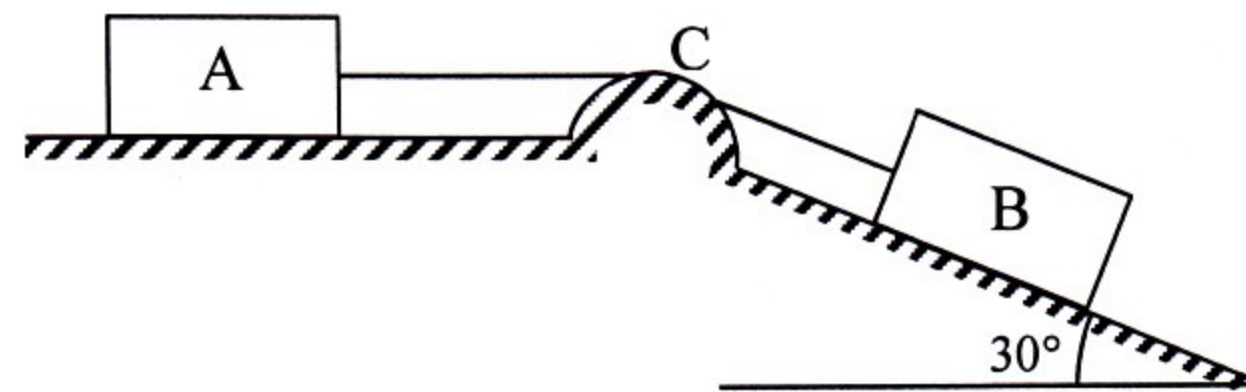

Figure 5

8. A push cart, shown in **Figure 6**, weighs 40 lb excluding wheels. Radius of gyration and weight of the wheels are 1.75′ and 10 lb respectively. The cart has a velocity of 3 fps when it passes point A.
   If half of its kinetic energy at A is used up against friction to move the cart up to B point, calculate distance AB.
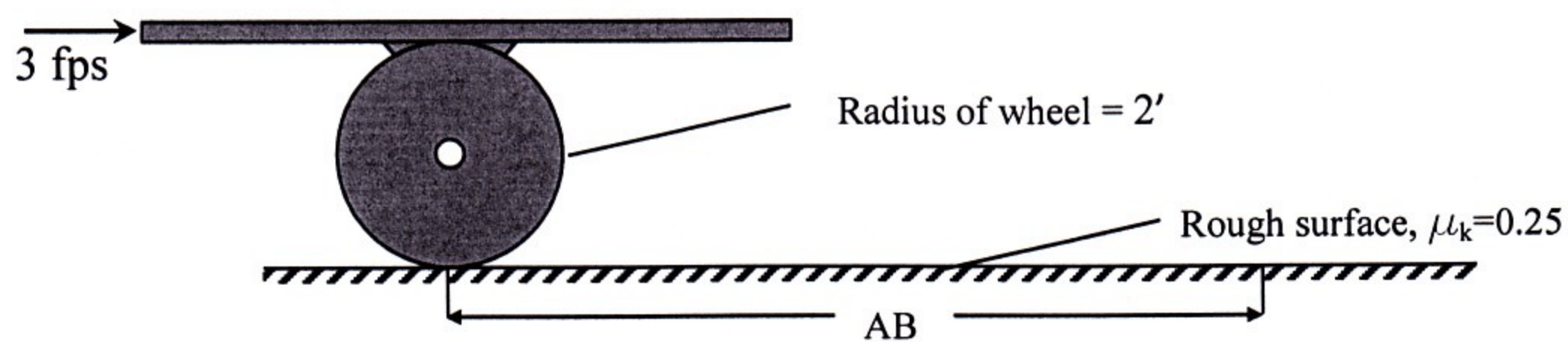   Assumption: tilting of cart is negligible.

Radius of wheel = 2′

Rough surface, μ_k=0.25

AB

Figure 5

9. The driver applies brake on a car which was moving towards a wall at 50 fps. From that point, it decelerates at 10 fps² and travels 40 ft to hit a straight rigid wall.
   If coefficient of restitution is 0.7, calculate
      a) Velocity of car just after direct impact
      b) Impulsive force exterted by the wall if the period of deformation is 0.05s.

10. In a carom game as shown in **Figure 6**, the striker is given an initial velocity of 5 m/s. If it makes a direct collision with coin B(e_1= 0.8), determine the velocity of B and the angle θ just after it rebounds from the side at C(e_2=0.6). Mass of striker and coin is 10g and 5g respectively.
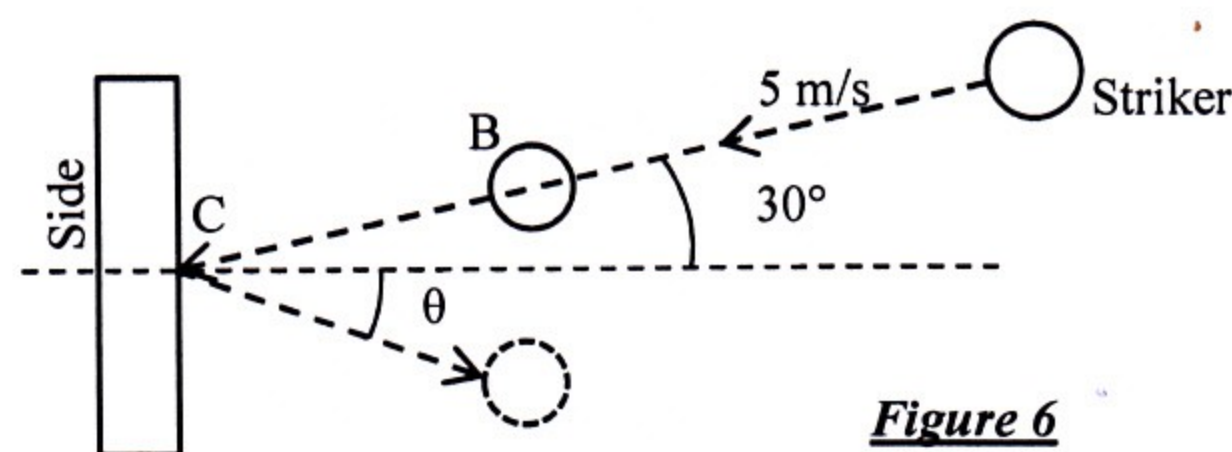

Figure 6

11. A jet of stream is flowing at the rate of w= 12 lb/ s as shown in *Figure 7*. The force exerted upon the fixed blade is 40 lb with an angle of 25° with X axis, when entrance velocity of jet stream is v_1. If v_1 changes, force exerted upon the fixed blade increases to 50 lb with an angle of 30° with X axis. Calculate the change in entrance velocities of the jet of stream, if it turns through an angle of 135° before discharge.
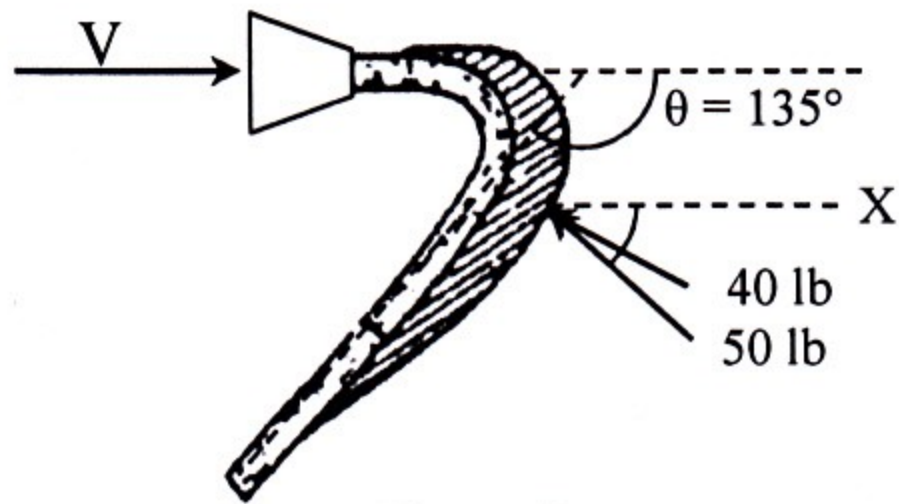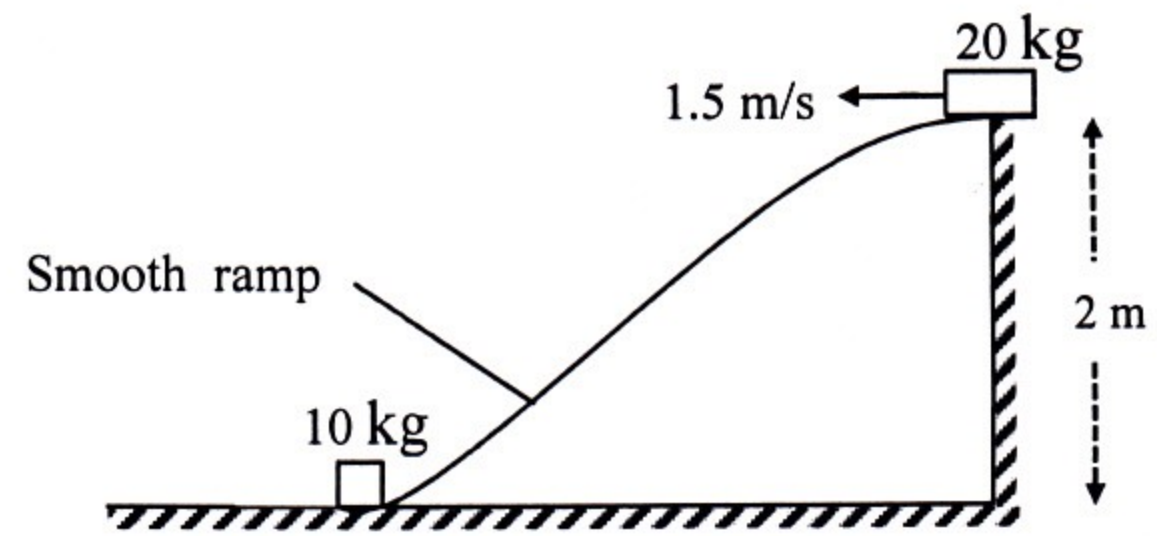

Figure 7

Figure 8

12. The 20 kg package has a speed of 1.5 m/s when it is delivered to a smooth ramp. After sliding down the ramp it lands onto a 10 kg package as shown in *Figure 8*.
Calculate the combined speed of the packages right after collision at the end of smooth ramp.

13. The traffic light weighing 8 lb, is located at the center of the intersection such that point D, shown in *Figure 9*, is 25 ft above ground. A 30 lb wind load is acting to the right along the 30 ft wide street. Calculate the forces in the three cables.
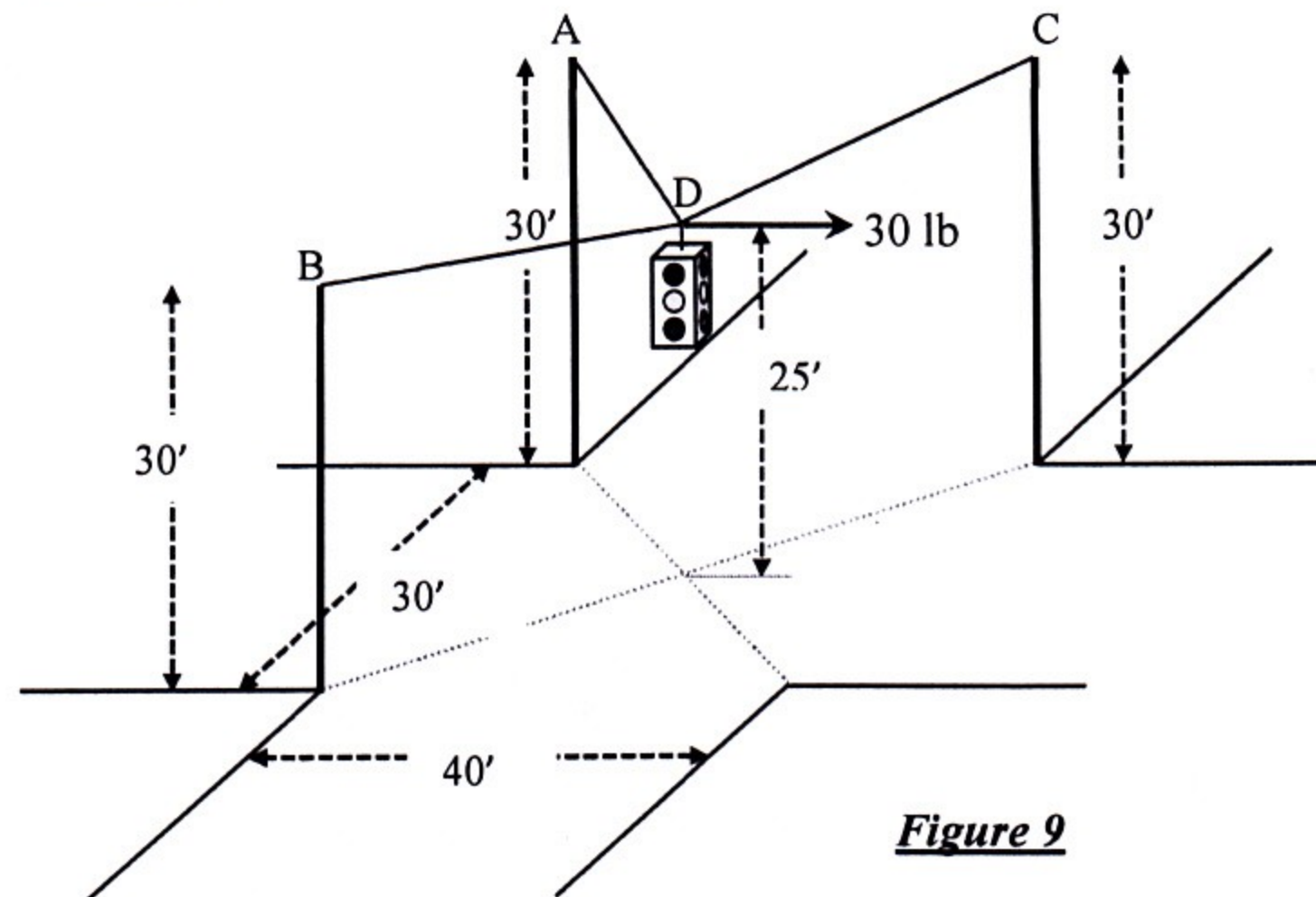

Figure 9

14. A table whose top is triangular in shape has a box weighing of 100 lb on it, as shown in *Figure 10*. The force on leg A, B, C are 45 lb, 15 lb and 40 lb respectively. Determine the distance of the box on the table from point A.
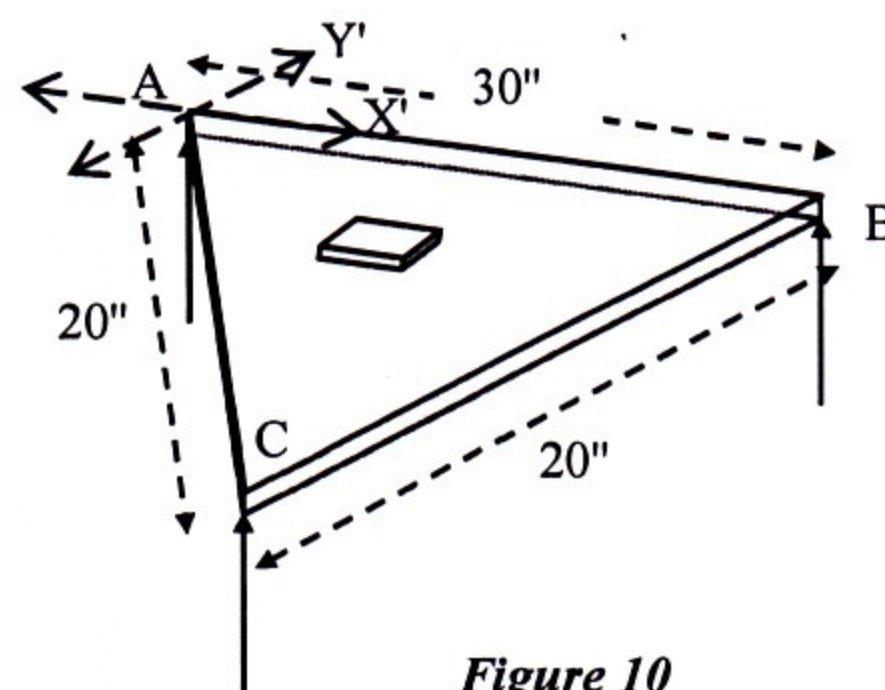

Figure 10

Course Title: Surveying	Course Code: CE 105
Time: 3 (Three) hours	Full Marks: 100

[Assume Reasonable Values for Any Missing Data]

PART – A
There are **NINE** questions in this section. Answer any **EIGHT**.　　　**8 x (5) =40**

1. (a) Define: Sensible Horizon, Zenith and Nadir.

　(b) Draw celestial sphere and show Zenith, Nadir, celestial horizon and sensible horizon for a particular position of an observer in the sphere.

2.　Explain the definition and necessity of super elevation? Draw a neat diagram of transition curve with its different elements.

3. (a) Write down some uses of contour maps.

　(b) Compile the names of different methods used in plane table surveying.

4. (a) Explain with figure how you will continue chaining past a pond.

　(b) Explain simple curve and compound curve.

5.　What is local attraction? Write down some of its sources and method of its detection in a place.

6.　Compare between 'Aerial Photogrammetry' and 'Terrestrial Photogrammetry'. Why photographs are overlapped in aerial photogrammetry?

7.　Explain the principles of remote sensing.

8.　Discuss the activities of Geographic Information System.

9.　A series of offsets were taken from a chain line to a curves boundary line at intervals of *15* metres:

　0, 2.65, 3.80, 3.75, 4.65, 3.60, 4.95, 5.85 m. Compute the area between the chain line, the curved boundary and the end offsets by average ordinate rule.

PART – B
There are **SEVEN** questions in this section. Answer any **FIVE**.　　　**5 x (12) = 60**

10. (a) The scale of an aerial photograph is *1 cm = 160 m* and the size of the photograph is 20 cm x 20 cm. If the longitudinal lap is *65%* and side lap is *35%*, **determine the number of the photographs required** to cover an area of *232* sq. km.

　(b) The following perpendicular offsets were taken from a chain line to an irregular boundary:

Chainage	0	10	25	42	60	75 m
Offset	15.5	26.2	31.8	25.6	29.0	31.5

Calculate the area between the chain line, the boundary and the end offsets.

11. (a) In an old map, line AB was drawn to a magnetic bearing of *148°40'* when the magnetic declination was *3°20' East*. To what magnetic bearing the line should be set now, if the present magnetic declination is *8°20' west?*

(b) A line was measured with a steel tape of 30 m, standardized at a temperature of 20°C and a pull of *10 kg*. Length of the line was found to be *1650* m but the temperature during measurement was *30°C* and pull applied was 15 kg.

Find the corrected length of the line. Cross sectional area of the tape was *0.025 cm²*. Coefficient of extension of the material of the tape per °C is *3.5 x 10⁻⁶* and modulus of elasticity of the material of tape is *2.1x 10⁶ kg/cm²*.

$$[C_t = \alpha(T_m - T_o) L, \; C_p = \frac{(P - P_o)}{AE} L]$$

12. A transition curve is required for a circular curve of *400 m* radius, the gauge being *1.5 m* between rail centre and maximum super-elevation restricted to *12 cm*. The transition is to be designed for a velocity such that no lateral pressure is imposed on the rails and the rate of gain of radial acceleration is *30 cm/ sec³*. **Calculate required length of transition curve and the design speed.**

$$[L = \frac{v^3}{\alpha R}]$$

13. The following consecutive readings were taken with a dumpy level:

6.21, 4.92, 6.12, 8.42, 9.81, 6.63, 7.91, 8.26, 9.71, 10.21

The level was shifted after 4th, 6th, and 9th readings. The reduced level at first point was *100 ft.*   Rule out a page of your answer- book as a level field book and fill all the columns. **Use collimation system and apply the usual arithmetical check. Indicate the highest and lowest points.**

14. Two tangents intersect at chainage *59+60*, the deflection angle being 50°30'. **Calculate the necessary data** for setting out a curve of *15 chains* radius to connect the two tangents if it is intended to set out the curve by offset from chords method. Take peg interval equal to 100 links, length of the chain being equal to *20 metres (100 links)*.

15. A railway embankment _400 m_ long is _12 m_ wide at the formation level and has the side slope _2 to 1_. The ground level at every _100 m_ along the centre line are as below:

Distance	0	100	200	300	400
R.L.	204.8	206.2	207.5	207.2	208.3

The formation level at zero chainage is _207.00_ and the embankment has a rising gradient of _1 in 100_. The ground is level across the centre line. **Calculate the volume of earthwork.**

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