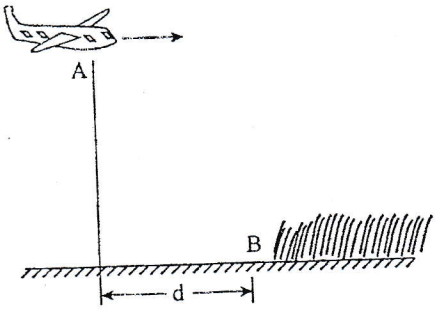
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Baishakh

Exam.	Back		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

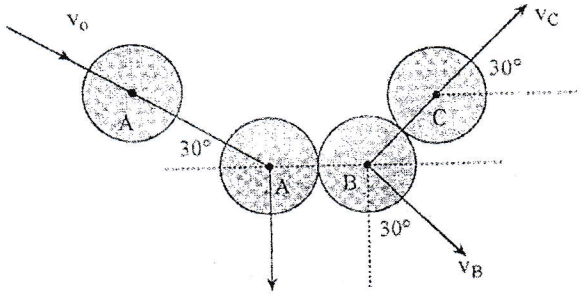
Subject: - Applied Mechanics *(Dynamics) (CE 501)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. An airplane used to drop water on brushfires is flying horizontally in a straight line at 315 km/h at an altitude of 80 m. Determine the distance d at which the pilot should release the water so that it will hit the fire at B. [4]



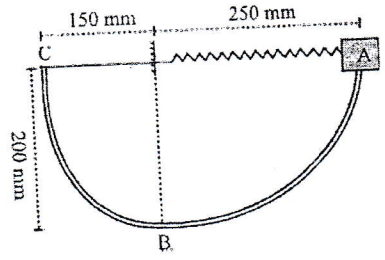
2. Explain variable system of particles. In the game of pool, ball A is moving with a velocity v_0 of magnitude $v_0 = 4.57$m/s. When it strikes ball B and C, which are at rest and aligned as shown. After the collision, three ball moves as indicated and assuming friction less surfaces and perfectly elastic impact, determine the V_A, V_B. Take $V_C = 3.42$ m/s. [2+6]



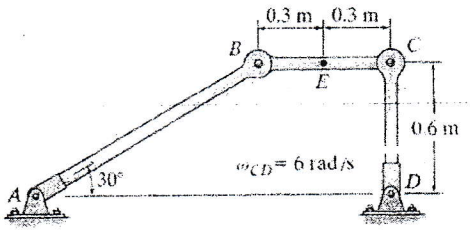
3. Explain about the conservation of energy in study of kinetics of particles with relevant equation 5 kg collar is attached to a spring and slides without friction in a vertical plane along a curved rod ABC. The spring is undeformed when its length is 100 mm and its constant is 800 N/ m. If the collar is released at 'A' with no initial velocity, determine its velocity. [2+6]

   a) AS it passes B

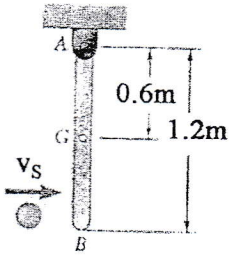
   b) As it reaches at C.



4. If link CD has an angular velocity of w_{CD} = 6 rad/s, determine the velocity of point E on link BC and the angular velocity of link AB at the instant shown. Explain General plane motion (GPM) [8+2]



5. A 3 –kg sphere with an initial velocity of 5 m/s strikes the lower end of an 8- kg rod AB. The rod is hinged at A and initially at rest. The coefficient of restitution between the rod and sphere is 0.8. Determine the angular velocity of the rod and the velocity of the sphere immediately after impact. Explain D' Alemberts Principle. [2+8]



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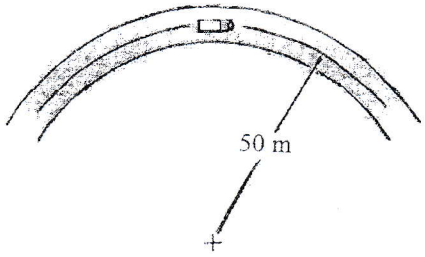
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

Exam.	Regular		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

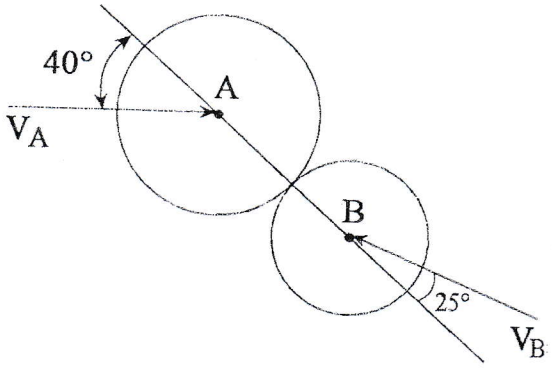
Subject: - Applied Mechanics (Dynamics) *(CE 501)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

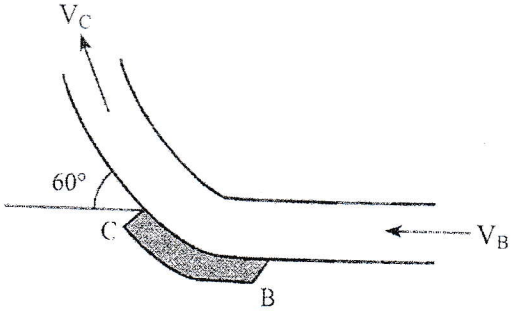
1. The truck travels along a circular road that has a radius of 50 m at a speed of 4 m/s. For a short distance when t = 0, its speed is then increased by $a_t = (0.4t)$ m/s^2, where t is the seconds. Determine the speed and the magnitude of the truck's acceleration when t = 4s. [4]



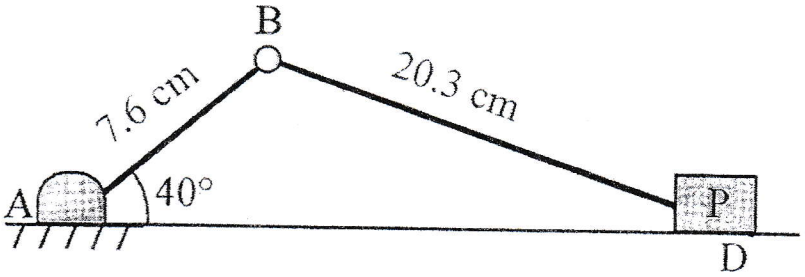
2. Two frictionless balls (m_A = 6 kg, m_B = 3 kg) strike each other as shown in figure. The coefficient of restitution between the balls is e = 0.67. Find the velocities of A and B after the impact if initial velocity are v_A = 3 m/s and v_B = 4.5 m/s. Explain the principle of work and energy with governing equation. [6+2]



3. Define linear and angular momentum of system of particles. A nozzle discharges a stream of water of cross-sectional area A = 100 mm^2 with a speed of v = 60 m/s and the stream is deflected by a fixed vane as shown in figure. The mass density of water ρ = 1000 kg/m^3. Determine the resultant force $\vec{F}$ exerted on the stream by fixed vane. [2+6]

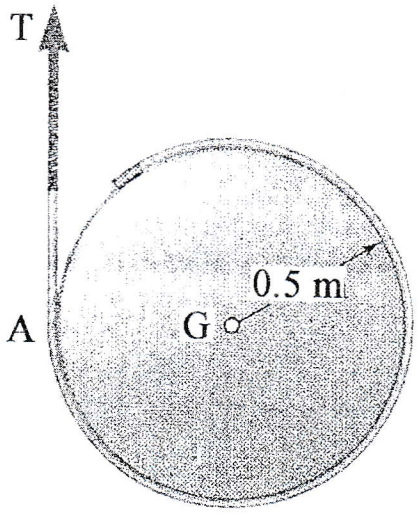


4. Define Instantaneous centre of rotation (ICR) with examples. Crank AB of the engine system has a constant clockwise angular velocity of 2000 rpm. For the crank position shown, calculate angular acceleration of rod BD and acceleration of piston P (point D). [Take $\omega_{BD} = 61.87$ rad/s (ccw) and $v_D = 13.2558$ m/s ($\rightarrow$) (if necessary)] [2+8]



5. Explain the principle of impulse and momentum for the plane motion of rigid body. A cord is wrapped around a homogeneous disk of radius r = 0.5 m and mass m = 15 kg. If the cord is pulled upward with a force $\vec{T}$ of magnitude 200 N, determine [4+6]

   a) the acceleration of the center of the disk.
   b) the angular acceleration of the disk.
   c) the acceleration of the cord.



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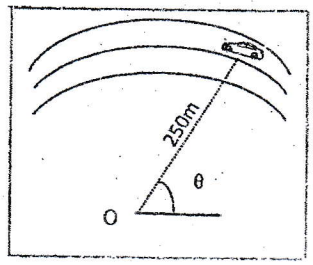
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

Exam.	Regular		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

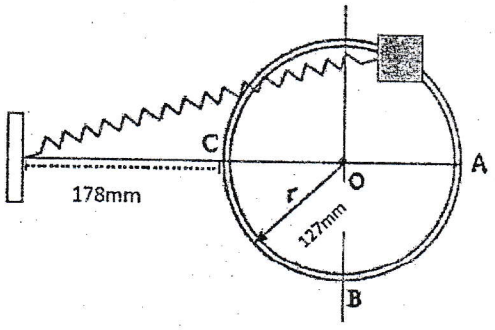
Subject: - Applied Mechanics (Dynamics) *(CE 501)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

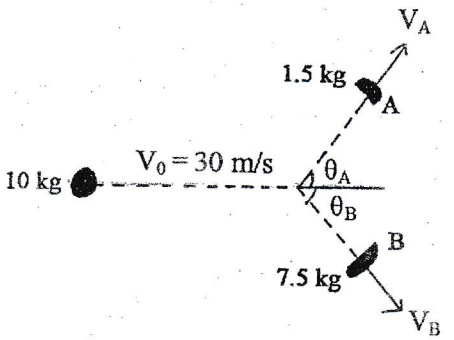
1. A radar gun at 'O' rotates with the angular velocity of $(d\theta/dt) = 0.15$ rad/sec and angular acceleration of $(d^2\theta/dt^2) = 0.025$ rad/sec^2 at the instant $\theta = 40°$, as it follows the motion of the car travelling along the circular road having radius of r = 250 m. Determine the magnitude of velocity and acceleration of the car at this instant. [4]



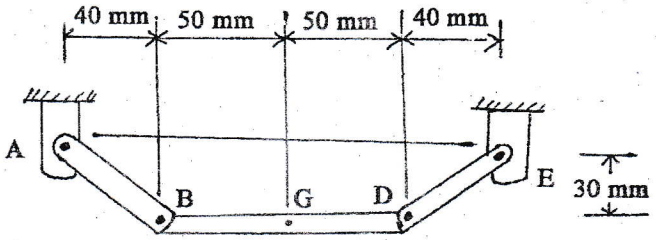
2. A 0.45 kg collar is attached to a spring and slides without friction along a circular rod in a vertical plane. The spring has an undeformed length of 127 mm and a constant K = 146 N/m. Knowing that the collar is released from being held at A, determine the speed of the collar and the normal force between the collar and the rod as the collar passes through B. [8]



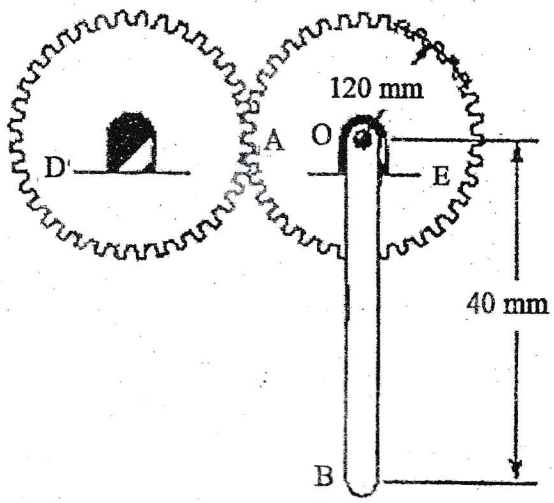
3. Define angular momentum for a system particle. A 10 kg projectile is moving with a velocity of 30 m/s when it explodes into two fragments A and B weighing 2.5 kg and 7.5 kg respectively, knowing that immediately after the explosion, fragments a and B travel in the directions defined respectively by $\theta_A = 45°$ and $\theta_B = 30°$, determine the velocity of each fragment. [2+4]



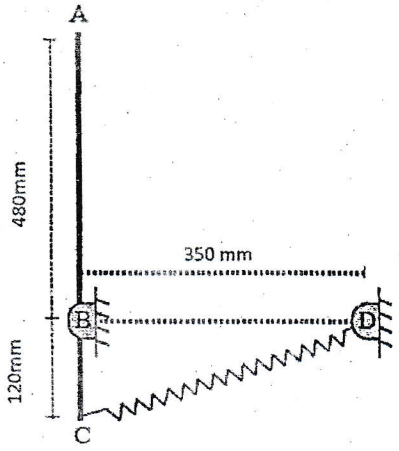
4. Define General plain motion with suitable example. Knowing that at the instant shown rod AB has zero angular acceleration and an angular velocity of 15 rad/s counter clockwise. Determine [2+6]
   a) angular acceleration of arm DE
   b) the acceleration of Point D.



5. The portion AOB of the mechanism is actuated by gear D and at the instant shown has a clockwise angular velocity of 8 rad/s and a counter clockwise aqngular acceleration of 40 rad/s^2. Determine tangential force exerted by gear D. Take m_E = 4 kg, $\bar{k}_E$ = 85 mm and m_{OB} = 3 kg [8]



6. A slender 4 kg rod can rotate in a vertical plane about a pivot at B. A spring of constant k = 400 N/m and of unstretched length 150 mm is attached to the rod as shown. Knowing that the rod is released from rest in the position shown, determine its angular velocity after it has rotated through 90°. [6]



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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Kartik

Exam.	Back		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

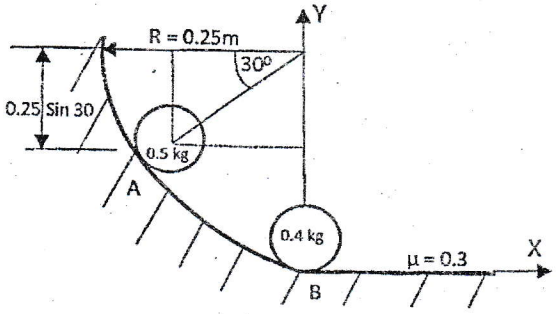
Subject: - Applied Mechanics (Dynamics) *(CE 501)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

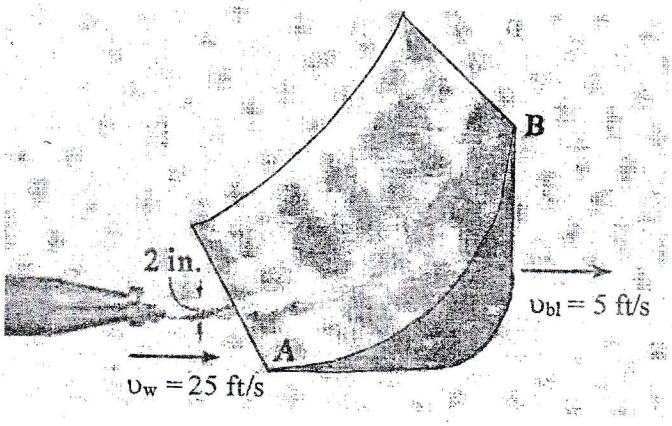
1. A bullet is fired into a viscous medium with an initial velocity of 80 m/s. The resistance of the medium produces a resistance equal of $a = (-0.5\ v^3)\ m/s^2$, where v is in m/s. Calculate the bullet's velocity and position 3 sec after it is fired. [4]

2. a) Differentiate the concept of "work-energy" and "impulse-momentum" principles for study of kinetics of particle. [2]

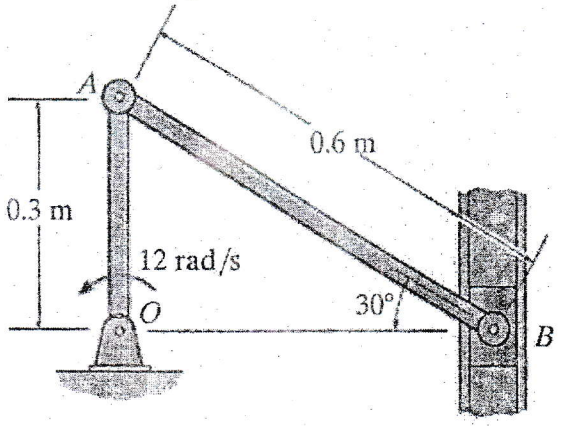
   b) A particle having mass 0.5 kg is released from rest and strikes the stationary particle of mass 0.4 kg as shown in figure. Assume the impact is direct and elastic. If the horizontal surface has a kinetic coefficient of friction $\mu = 0.3$. Locate the final position of each mass from the origin of x-axis. [6]



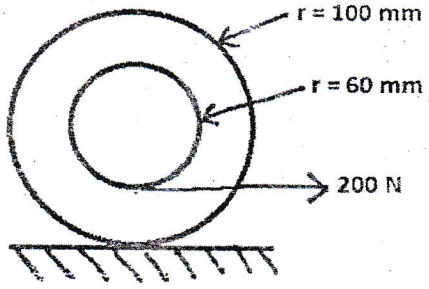
3. A 2-in –diameter water jet having a velocity of 25 ft/s impinges upon a single moving blade as shown in figure. If the blade moves with a constant velocity of 5 ft/s away from the jet, determine the horizontal and vertical components of force which the blade is exerting on the water. What power does the water generate on the blade? Water has a specific weight of 62.4 lb/ft^3. [6]



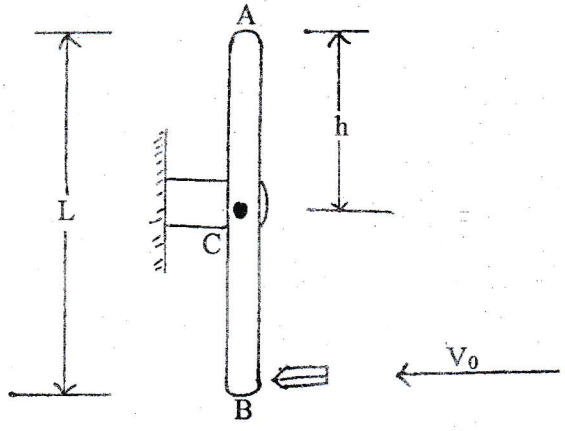
4. If crank OA rotates with an angular velocity 12 rad/s, determine the velocity of piston B, velocity of midpoint of AB and the angular velocity of rod AB at the instant shown. Define constrained motion with examples. [6+2]



5. A wheel is wrapped around the inner drum of a wheel and pulled horizontally with a force of 200 N. The wheel has a mass of 45 kg and radius of gyration of 70 mm. Knowing that $\mu_s = 0.2$ and $\mu_k = 0.15$, determine the acceleration of G and angular acceleration of wheel. [8]



6. A bullet weighing 40 gm is fired with horizontal velocity of 600 m/s into the lower end of a slender 7 kg bar of length L = 600 mm. Knowing that h = 260 mm and that the bar is initially at rest, determine (a) the angular velocity of bar immediately after the bullet becomes embedded, (b) the impulsive reaction at C, assuming that the bullet becomes embedded in 0.001 s. [6]



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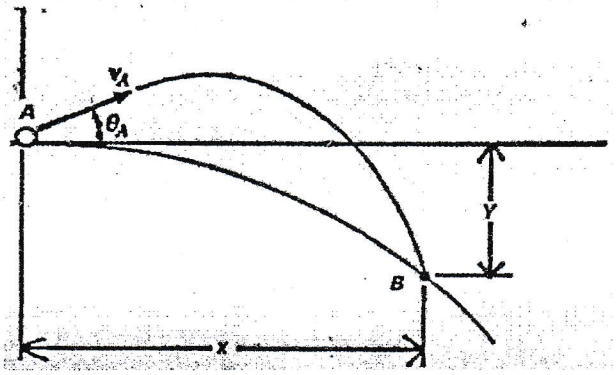
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Ashwin

Exam.	Back		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1½ hrs.

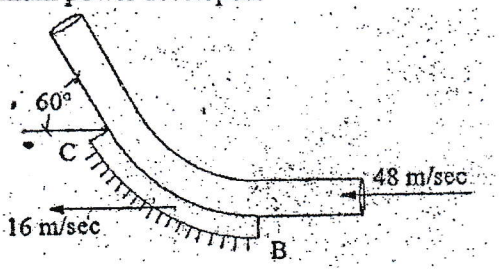
Subject: - Applied Mechanics (Dynamics) *(CE 501)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt <u>All</u> questions.*
- ✓ *The figures in the margin indicate <u>Full Marks</u>.*
- ✓ *Assume suitable data if necessary.*

1. The ball at A is kicked such that $\theta_A=30°$. If it is strikes the ground at B having co-ordinates x=15 ft and y=-9 ft, determine the speed at which it is kicked. [4]

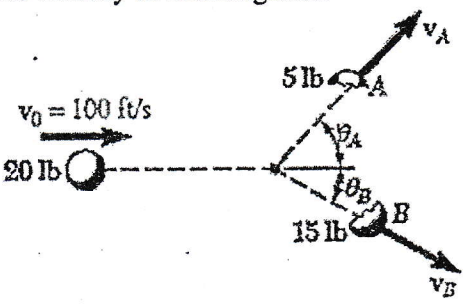


2. A nozzle discharges a stream of water of cross sectional area A = 4000 mm^2 with a speed v = 48m/sec, and the stream is deflected by a fixed vane which is moving in the same direction of water flow with constant speed of 16 m/sec as shown in figure. The mass density of water ρ=1000 kg/m^3. Determine the resultant force exerted on the stream by the fixed vane and maximum power developed. [5+3]

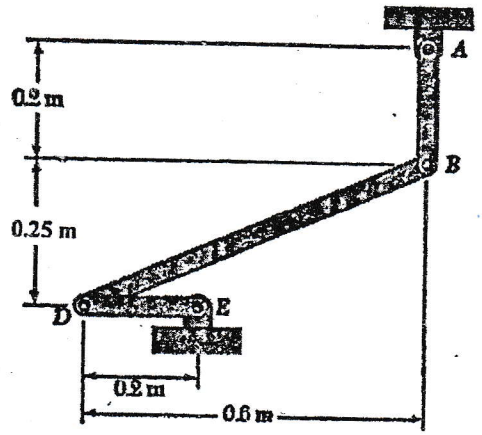


3. Define angular momentum for a rigid body in plane motion with examples. [4]

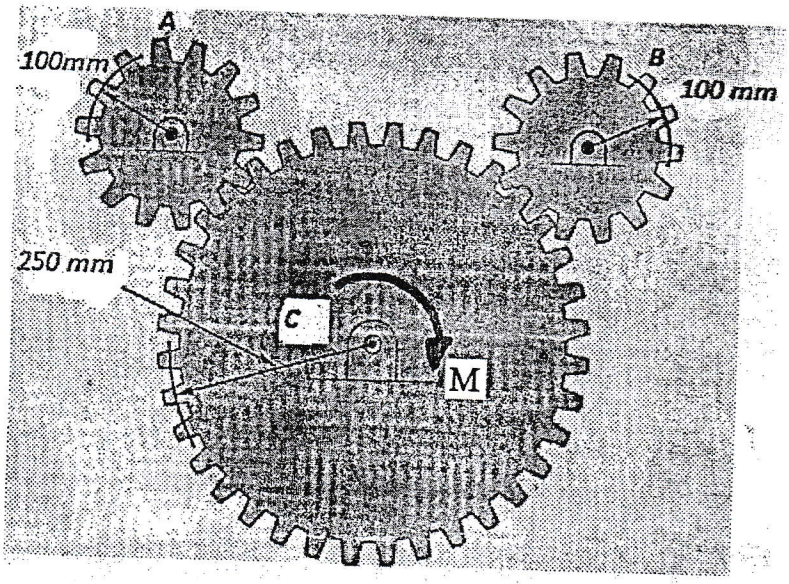
4. A 20-lb projectile is moving with a velocity of 100 ft/s when it explodes into two fragments A and B, weighing 5 lb and 15 lb, respectively. Knowing that immediately after the explosion, fragments A and B travel in directions defined respectively by $\theta_A=45°$ and $\theta_B=30°$, determine the velocity of each fragment. [6]



5. Define Coriolis acceleration of a rigid body in general plane motion. For the figure shown knowing that at the instant shown the velocity of point D is 2.4 m/s upward, determine (a) the angular velocity of rod AB, (b) the velocity of the midpoint of rod BD. [2+8]



6. Each of gear A and B has a weight of 2.5 Kg and radius of gyration **of 100 mm** inch while gear C has a weight of 12.5 kg and radius of gyration of 180 **mm. A** couple M of magnitude of 10 N-m is applied to gear C. Determine a) number of **revolution** of gear C required for its angular velocity to increase from 100 to 450 rpm **a) the** corresponding tangential force on gear A. [8]



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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Chaitra

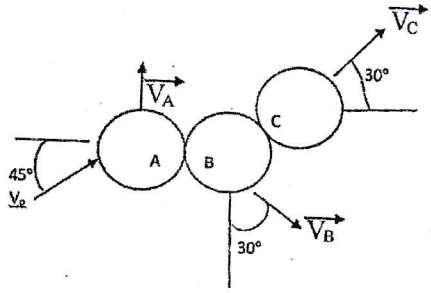
Exam.	Regular		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

Subject: - Applied Mechanics (Dynamics) *(CE 501)*

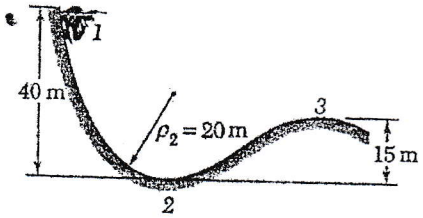
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Derive the radial and transverse components of acceleration when a particle moves in a curvilinear path. [6]

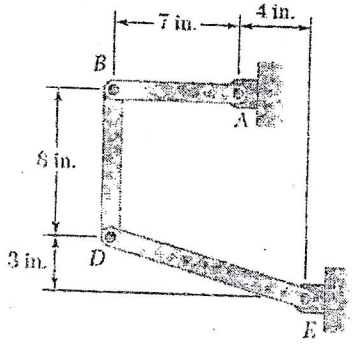
2. In a game of pool ball A is moving with a velocity V_0 of magnitude 5m/s when it strikes balls B and C, where at rest and aligned shown knowing that after the collision the three balls move in the directions indicated and assuming frictionless surfaces and perfectly elastic impact, determine the magnitude of the velocities V_A, V_B and V_C. [6]



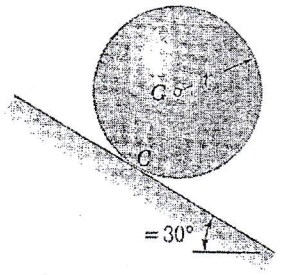
3. Derive the coefficient of restitution for two particles involve in direct central impact. A 30 KN car starts from rest at point 1 and moves without friction down the track shown. Determine the force exerted by the track on the car at point 2, and the minimum safe value of the radius of curvature at point 3. [4+4]



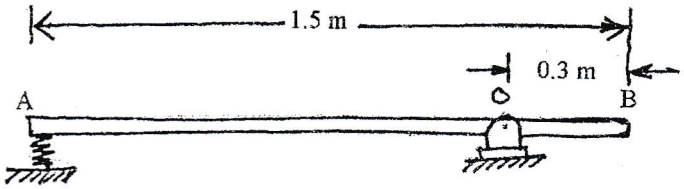
4. Define instantaneous center of rotation with example. In the position shown, bar AB has an angular velocity of 6 rad/s clockwise. Determine the angular velocity of bar BD. [3+5]



5. A sphere of weight 80 KN is released with no initial velocity and rolls without slipping on the incline. Determine: a) the minimum value of the coefficient of friction, b) the velocity of G after the sphere has rolled 15 ft and c) the velocity of G if the sphere were to move 20 ft down a frictionless incline. [6]



6. A 15kg slender rod AB is 1.5m long and is pivoted about a point O which is 0.3m from the end B. The other end is pressed against a spring of constant K = 300KN/m until the spring is compressed 25mm. The rod is then in horizontal position. If the rod is released from this position, determine the angular velocity as the rod passed through a vertical position. [6]



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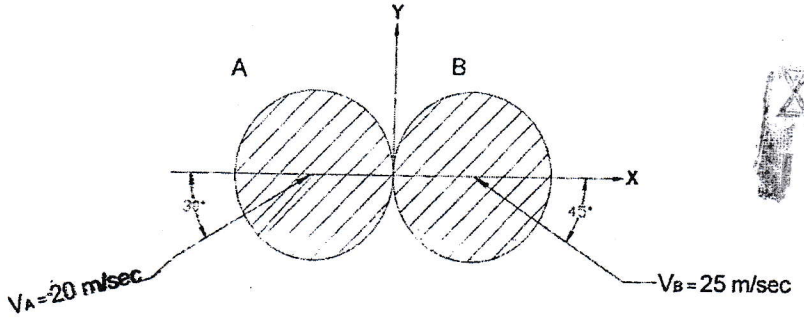
06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

Exam.	Back		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

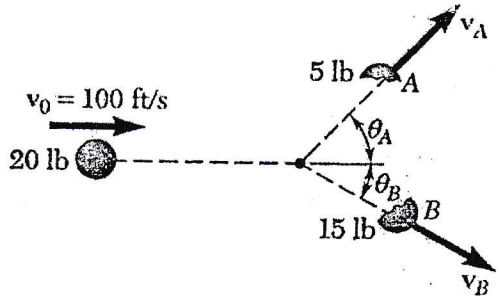
Subject: - Applied Mechanics (Dynamics) *(CE501)*

- ✓ Candidates **are required** to give their answers in their own words as far as practicable.
- ✓ *Attempt **All questions**.*
- ✓ *The figures **in the** margin indicate **Full Marks**.*
- ✓ *Assume **suitable data** if necessary.*

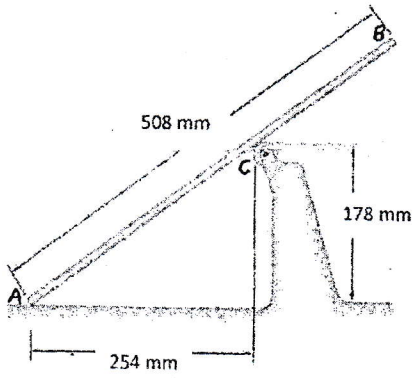
1. The magnitude **and** direction of the velocities of two balls A and B having masses 1.2kg and 1.8kg **respectively** before they strike each other are shown as in figure below. Assuming **e = 0.84,** determine the velocity of each ball after the impact. How much K.E. will be lost **due to the** impact? [8]



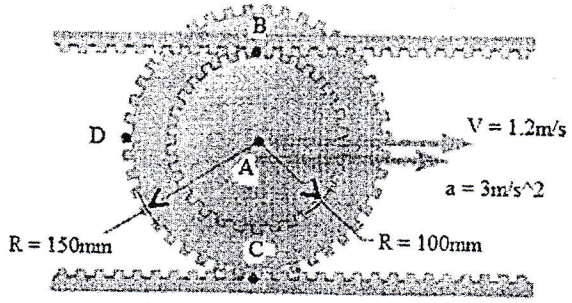
2. A 20-lb **projectile** is moving with a velocity of 100 ft/s when it explodes into 5 and 15-lb fragments. **Immediately** after the explosion, the fragments travel in the directions $\theta_A = 45°$ **and** $\theta_B = 30°$. Determine the velocity of each fragment. [8]



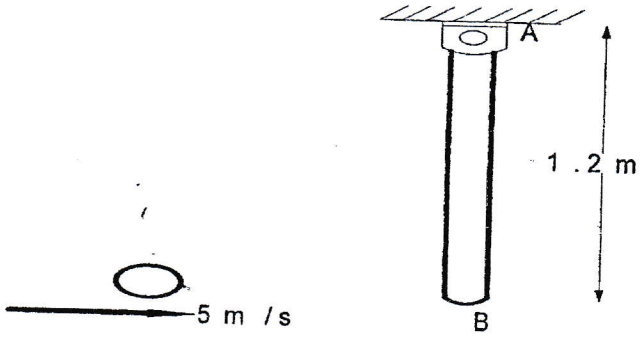
3. Rod AB **moves over** a small wheel at C while end A moves to the right with a constant velocity of **635 mm/s.** At the instant shown, determine (a) the angular velocity of the rod, (b) the **velocity of** end B of the rod. [8]



4. The center of the double gear has a velocity and acceleration to the right of 1.2m/s and 3m/s2, respectively. The lower rack is stationary. Determine (a) the angular acceleration of the gear, and (b) the acceleration of points B, C and D. [8]



5. A 2.5-kg sphere moving horizontally to the right with an initial velocity of 7m/s strikes the lower end an 10-kg rod AB. The rod is suspended from a hinge at A and is initially at rest. Knowing that the co-efficient of restitution between the rod and the sphere is 0.890, determine the angular velocity of the rod and the velocity of the sphere immediately after the impact. [8]



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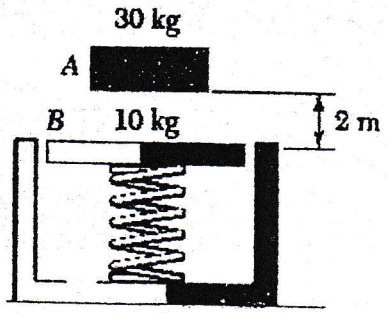
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

Exam.	Regular / Back		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1½ hrs.

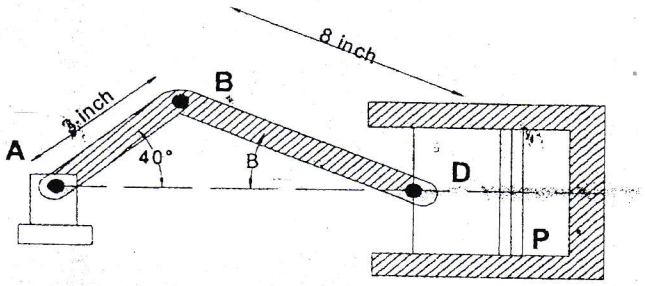
Subject: - Applied Mechanics (Dynamics) *(CE 501)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

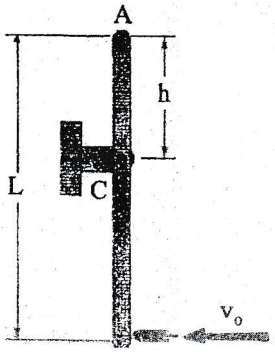
1. Define relative velocity and acceleration with suitable example. [2+2]
2. A 30-kg block is dropped from a height of 2m onto the 10-kg pan of a spring scale. Assuming the impact to be perfectly plastic, determine the maximum deflection of the pan. The constant of the spring is k=30 kN/m. [8]



3. Explain general plane motion of rigid bodies with suitable example. [4]
4. Derive an expression for the force exerted on the system due to change in mass over time. Show that the final acceleration increases when system loses mass. [6]
5. Define centre of rotation. In an engine system as shown in the figure below, crank AB has a constant clockwise angular velocity of 1800 rpm. For the crank position as shown, determine (a) the angular velocity of the connecting rod BD and (b) the velocity of the piston P. [2+8]



6. A bullet weighting 40gm is fired with a horizontal velocity of 600m/s into the lower end of a slender 7 kg bar of length L=600mm. Knowing that h=240mm and that the bar is initially at rest, determine [8]
   a) the angular velocity of the bar immediately after the bullet becomes embedded.
   b) The impulsive reaction at C, assuming that the bullet becomes embedded in 0.001s.



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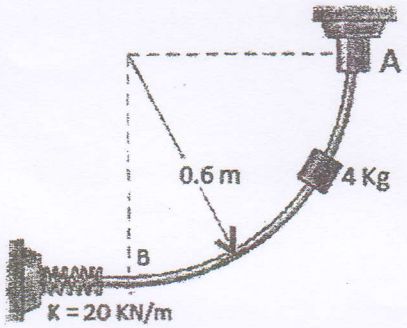
06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Chaitra

Exam.	Regular		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

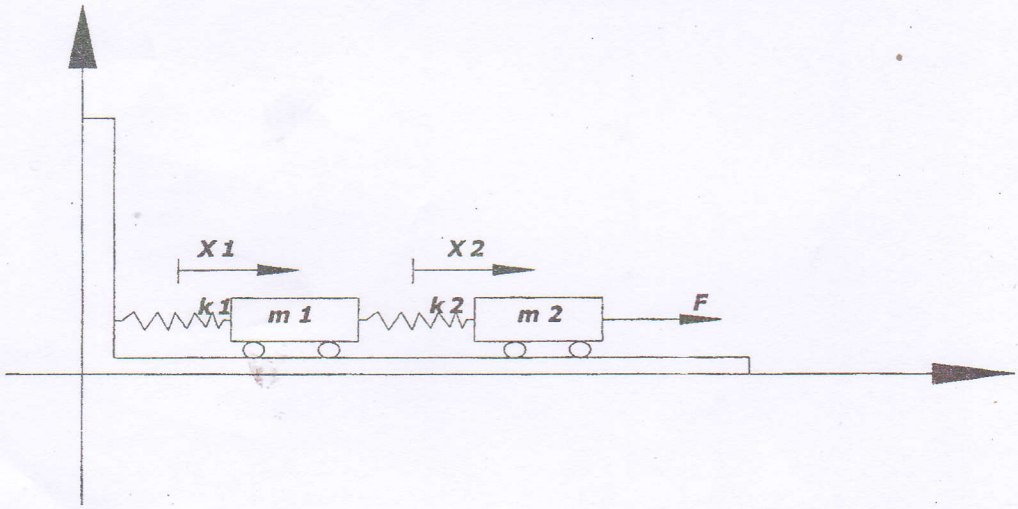
Subject: - Applied Mechanics (Dynamics) *(CE501)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

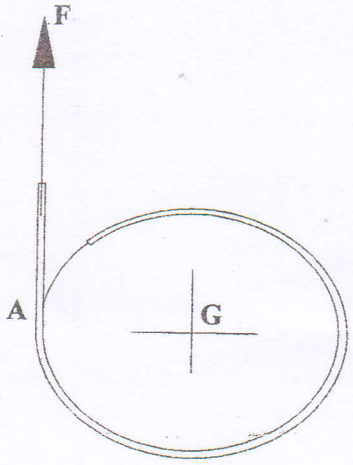
1. Derive relations for the radial and transverse components of the acceleration when a particle is moving curvilinearly. [4]
2. The 4 kg slider is released from rest from position A and slides down the frictionless rod in vertical plane. Determine a) the velocity 'v' of the slider as it strikes the spring b) maximum deflection of spring. [8]



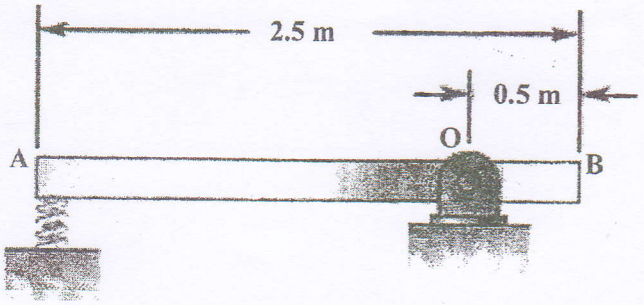
3. Two masses shown in figure oscillate on the smooth plane in the x-direction.
   a) Write the differential equation of motion for each mass
   b) Find the equation of motion for the center of the mass.
   c) Write the expression for kinetic and potential energy of the system of particles. [6]



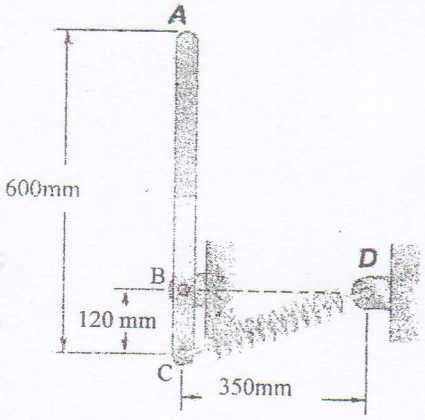
4. A cord is wrapped around a homogenous disk of radius r = 0.5 m and mass 20kg. If the cord is pulled upward with a force of magnitude F = 250N, determine (a) the angular acceleration of the disk, (b) the acceleration of the disk and (c) the acceleration of the cord. [6]



5. A 15 kg slender rod pivots about the point O. The other end is pressed against a spring (k = 300 kN/m) until the spring is compressed one inch and the rod is in a horizontal position. If the rod is released from this position, determine its angular velocity and the reaction at the pivot as the rod passes through a vertical position. [8]



6. Define impulsive motion and eccentric impact. A slender 4 kg rod can rotate in a vertical plane about a pivot at B. A spring of constant k = 400 N/m and of unstretched length 150 mm is attached to the rod as shown. Knowing that the rod is released from rest in the position shown, determine its angular velocity after it has rotated through 90°. [2+6]



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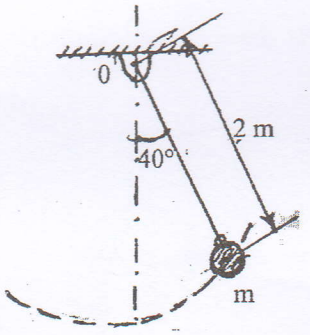
06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

Exam.	Back		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

Subject: - Applied Mechanics (Dynamics) *(CE501)*

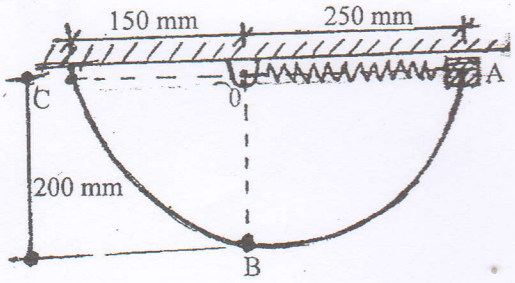
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. The bob of a 2 m pendulum describes an arc of circle in a vertical plane. If the tension in the cord is 2.5 times the weight of the bob for the position shown. Find the velocity and acceleration of the bob in the given position. [4]

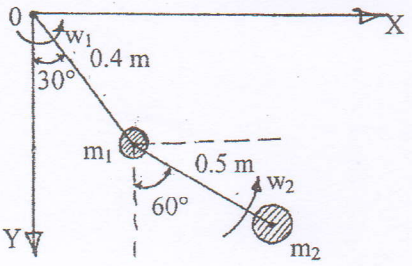


2. a) What is the principle of conservation of energy of a system? Illustrate it with suitable example. [3]

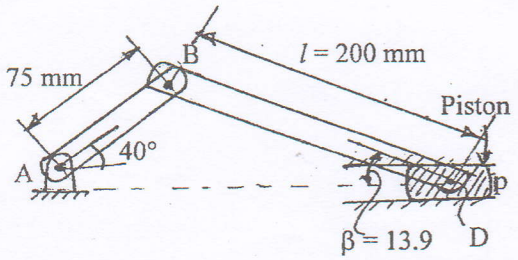
   b) 2 kg collar is attached to a spring and slides without friction in a vertical plane along the curved rod ABC. The spring is undeformed when its length is 100 mm and its constant is 800 N/m. If the collar is released at 'A' with no initial velocity, determine its velocity (a) as it passes through 'B' (b) as it reaches at 'C' [5]



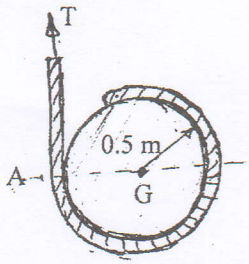
3. Derive the expression for resultant force for the system of variable mass. A double pendulum as shown in figure below oscillates in X-Y plane. At the instant shown, $w_1 = 4$ rad/sec CCW and $w_2 = 5$ rad/sec CCW. What will be the angular momentum about 'O' at this instant, if $m_1 = 3$ kg and $m_2 = 4$ kg? Note that the lower pendulum is connected to mass 'm_1' by a pin joint and is free to rotate about this point. [4+4]



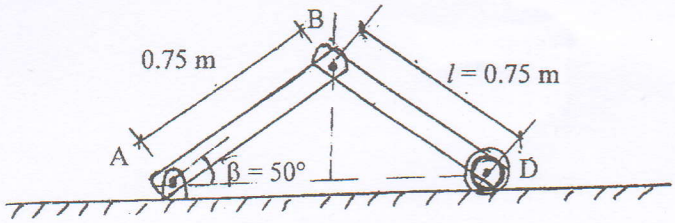
4. What is the meaning of corioli's acceleration in plane motion of Rigid body? Crank AB of the engine system shown in figure below, has a constant clockwise angular velocity of 2000 rev/min. For the crank position as shown in figure below, determine the angular acceleration the connecting rod 'BD' and the acceleration of point 'D'. Given that the value of w_{BD} = 61.9 rad/sec and the angle made by rod BD with horizontal β = 13.9. [8]



5. A cord is wrapped around a homogeneous disk of radius r = 0.5 m and mass m = 15 kg. If the cord is pulled upward with force $\vec{T}$ of magnitude 180 N, determine (a) the acceleration of the center of the disk (b) the angular acceleration of the disk (c) the acceleration of the cord. [4]



6. Differentiate the central and Eccentric impact of the body. Each of the two slender rods as shown in figure below is 0.75 m long and has a mass of 6 kg. If the system is released from rest when β = 50°, determine (a) the angular velocity of rod "AB" when 'β' = 20° (b) the velocity of point 'D' at the same instant. [2+6]



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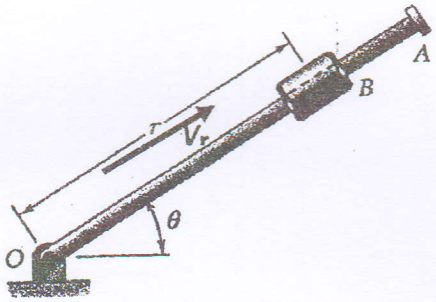
05 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

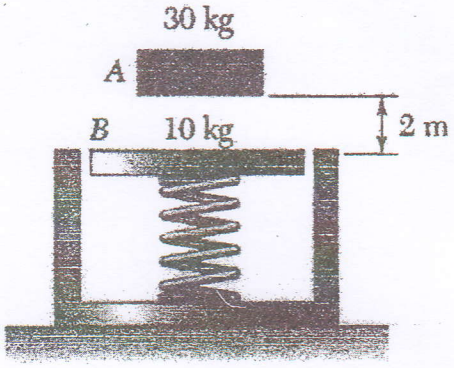
Subject: - Applied Mechanics (Dynamics) *(CE501)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

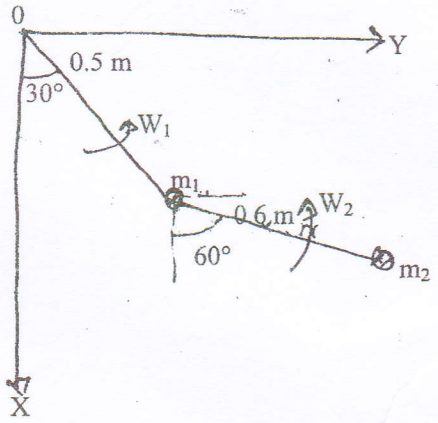
1. Rotation of the arm about O is defined by $\theta = 0.75t^2$ where θ is in radians and t in seconds. Collar B slides along the arm such that $r = 1\text{-}0.3t^2$ where r is in meters. After the arm has rotated through 45°, determine (a) the total velocity of the collar, (b) the total acceleration of the collar and (c) the relative acceleration of the collar with respect to the arm. [6]



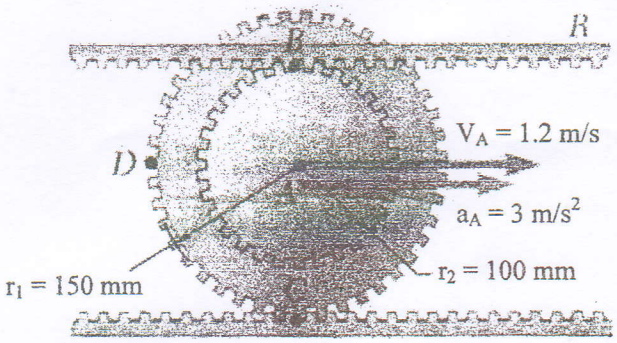
2. A 30 kg block is dropped from a height of 2 m onto the 10 kg pan of a spring scale. Assuming the impact to be perfectly plastic, determine the maximum deflection of the pan. The constant of the spring is k = 20 kN/m. [8]



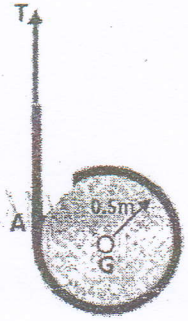
3. A double pendulum as shown in figure below oscillates in the X-Y plane. As shown in figure below, $W_1 = 2$ rad/sec. CCW and $W_2 = 4$ rad/sec CCW. What is $\vec{H}_0$ at this instant if $m_1 = 1$ kg and $m_2 = 2$ kg. The lower pendulum is connected to mass m_1, by a pin joint and is free to rotate about this point. [8]



4. The center of the double gear has a velocity and acceleration to the right of 1.2 m/s and 3 m/s^2, respectively. The lower rack is stationary. Determine (a) the angular acceleration of the gear and (b) the acceleration of points B, C and D. [8]



5. A chord is wrapped around a homogeneous disk of radius r = 0.5 m and mass m = 30 kg as shown in figure below. If the cord is pulled upward with a force T of magnitude 200N, determine (a) the acceleration of the center of the disk (b) the angular acceleration of the disk (c) the acceleration of the chord. [6]



6. Derive the expression for the resultant force on the system with variable mass. [4]

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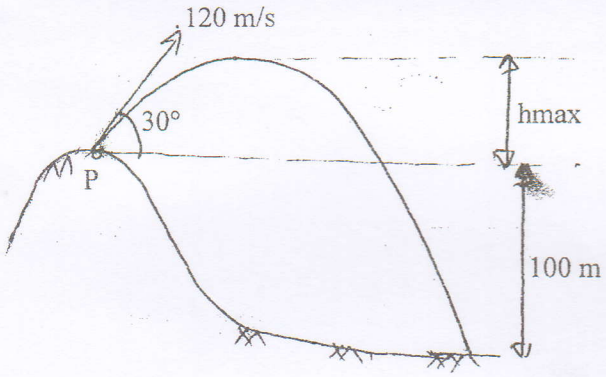
06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

Exam.	Regular		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

Subject: - Applied Mechanics (Dynamics) *(CE501)*

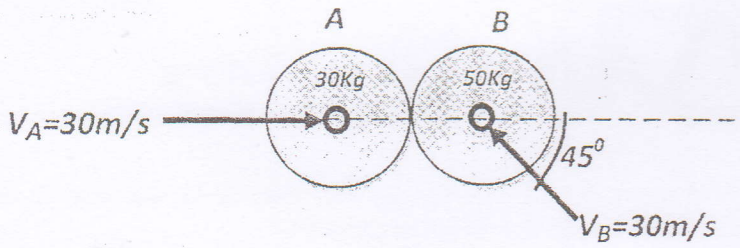
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. A bullet is fined at an angle of 30° to the horizontal from a point 'P' on a hill and it strikes a target which is 100m lower than the level of projection. The initial velocity of the bullet is 120 m/s. Neglecting the air resistance calculate: [6]



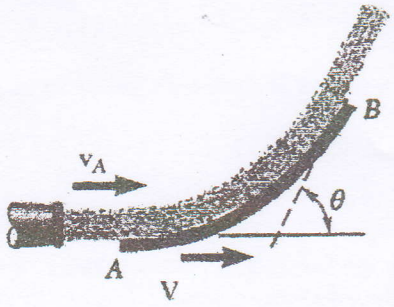
i) The maximum height to which the bullet will rise above the horizontal
ii) The actual velocity with which it will strike the target
iii) The total time required for the flight of bullet

2. The magnitude and direction of the velocities of two frictionless balls with the mass m_A = 30 kg and m_B = 50kg before they strike each other are shown in figure below. Assume e = 0.9, determine the magnitude and direction of the velocity of each ball after the impact. [8]

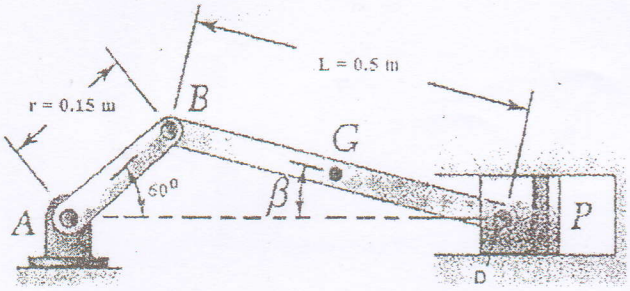


3. A nozzle discharges a stream of water of cross-sectional area "A" with a velocity V_A. The stream is deflected by single blade which moves to the right with a constant velocity V. Assuming that the water moves along the blade at a constant. Determine: [8]

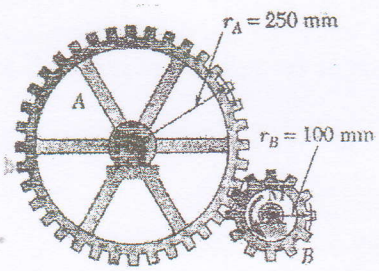
   i) The component of forces exerted by the blade on the stream.
   ii) The velocity V for which maximum power is developed.



4. Crank AB of the engine system has a constant clockwise angular velocity of 200 rpm, which makes the angle 60° with horizontal level. For the crank position shown in figure below. Determine the angular acceleration of the connecting rod BD and the acceleration of point D. [8]



5. The system is at rest when a moment of M = 8 N-m is applied to gear B. Neglecting friction (a) determine the number of revolutions of gear B before its angular velocity reaches 540 rpm and (b) tangential force exerted by gear B on gear A. [6]



$m_A = 10\,\text{kg}$ $\bar{k}_A = 200\,\text{mm}$
$m_B = 3\,\text{kg}$ $\bar{k}_B = 80\,\text{mm}$

6. Deduce an expression which shows the relation for the force exerted by the vane on the stream while you are dealing with the steady stream of particles. [4]

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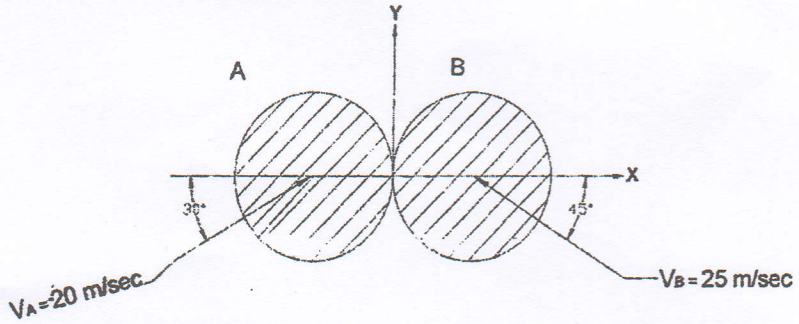
06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

Exam.	Back		
Level	BE	Full Marks	40
Programme	BCE, BGE	Pass Marks	16
Year / Part	II / I	Time	1 ½ hrs.

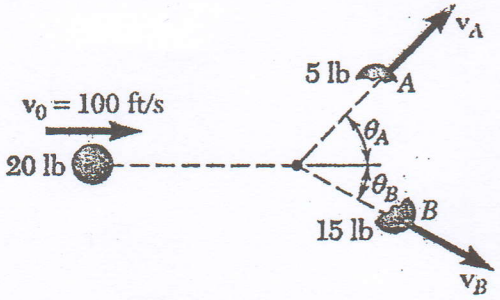
Subject: - Applied Mechanics (Dynamics) *(CE501)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All questions**.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

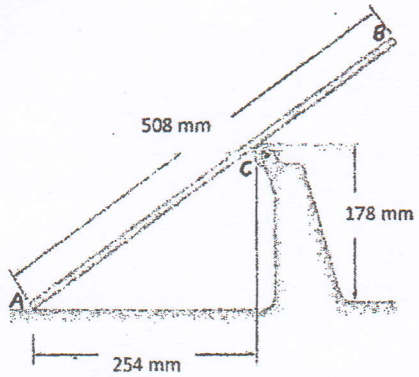
1. The magnitude and direction of the velocities of two balls A and B having masses 1.2kg and 1.8kg respectively before they strike each other are shown as in figure below. Assuming **e = 0.84**, determine the velocity of each ball after the impact. How much K.E. will be lost due to the impact? [8]



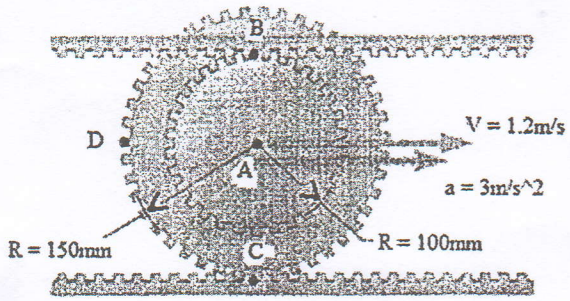
2. A 20-lb projectile is moving with a velocity of 100 ft/s when it explodes into 5 and 15-lb fragments. Immediately after the explosion, the fragments travel in the directions $\theta_A = 45°$ and $\theta_B = 30°$. Determine the velocity of each fragment. [8]



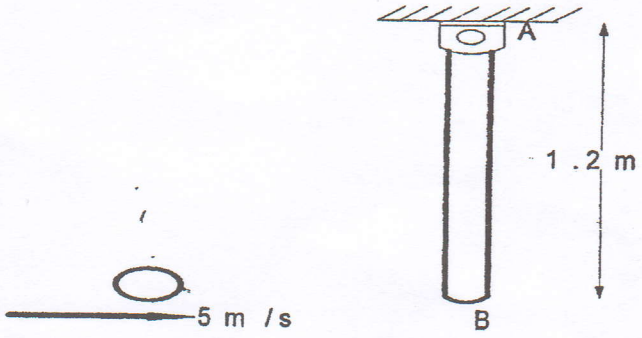
3. Rod AB moves over a small wheel at C while end A moves to the right with a constant velocity of 635 mm/s. At the instant shown, determine (a) the angular velocity of the rod, (b) the velocity of end B of the rod. [8]



4. The center of the double gear has a velocity and acceleration to the right of 1.2m/s and 3m/s2, respectively. The lower rack is stationary. Determine (a) the angular acceleration of the gear, and (b) the acceleration of points B, C and D. [8]



5. A 2.5-kg sphere moving horizontally to the right with an initial velocity of 7m/s strikes the lower end an 10-kg rod AB. The rod is suspended from a hinge at A and is initially at rest. Knowing that the co-efficient of restitution between the rod and the sphere is 0.890, determine the angular velocity of the rod and the velocity of the sphere immediately after the impact. [8]



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