TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Ashwin

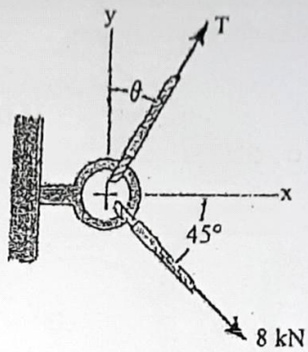
Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, BME, BGE	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Applied Mechanics (*CE 451*)

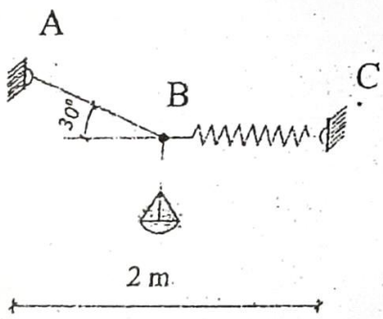
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Describe the scope and importance of applied mechanics in engineering. Define rigid body and deformable body. [2+2]

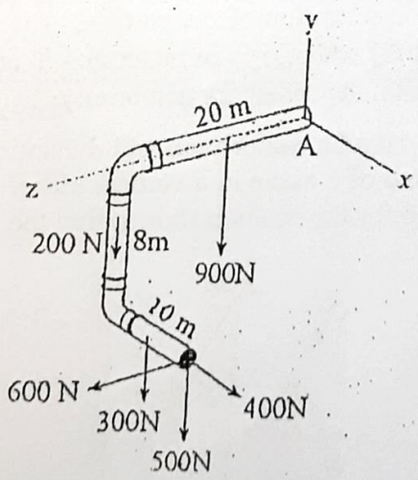
2. a) If the magnitude of the resultant force is to be 9 kN directed along the positive x-axis. Determine the magnitude of force T acting on the eyebolt and its angle θ. [4]



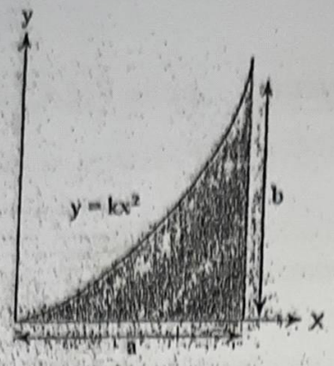
b) A lamp is held in between two fixed A and C through cord and spring respectively. Determine the required length of cord AB so that the 9 kg can be suspended in the position shown, where BC is horizontal. The undeformed length of spring BC is 0.4 m and the spring constant, K = 300N/m. [5]



3. Explain the reduction of system of forces to wrench. Find the resultant of the force system at point A. The 300-N 200-N, and 900-N loads are at the centers of the pipe sections. [3+7]

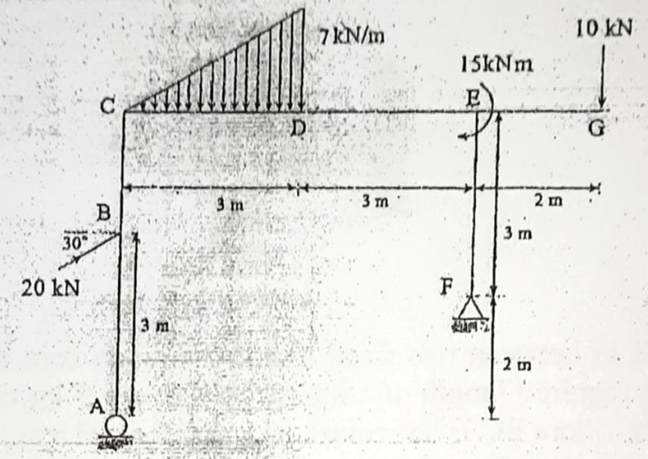


4. Determine centroid of the shaded plane and find the moment of inertia about centroidal x-axis of the shaded plane area. [6+6]

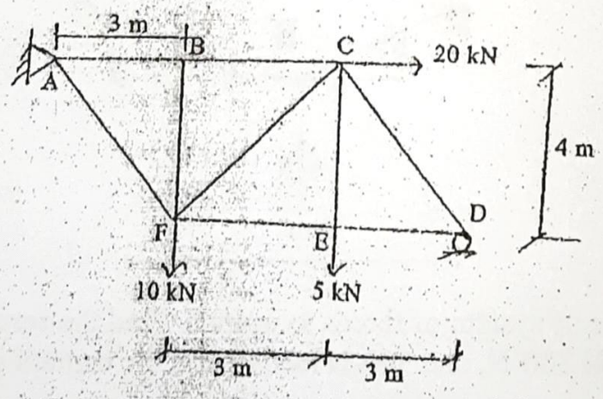


5. Explain the four different situations that can occur when a rigid body is in contact with a horizontal surface having coefficient of static and kinetic friction as μ_s and μ_k respectively. [4]

6. Draw axial force, shear force and bending moment diagram; and obtain salient features for the given frame loaded as shown in figure. [13]

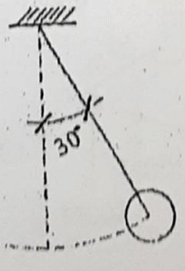


7. What are the assumptions of perfect truss? Determine the force developed in the members BC, BF, FE and FC of the given truss. [2+6]



8. Determine the velocity and acceleration of the particle, if it moves along a curved path defined by $r = 3\theta$ and $\theta = t^2/3$, where, r is in meter and 't' is in seconds. Given that the instant angle is $\theta = \pi/3$. Explain dependent motion briefly. [7+3]

9. Describe linear momentum, angular momentum and dynamic equilibrium. The bob of a 5 m pendulum describe an arc of a circle in a vertical plane. If the tension in the cord is 3 times the weight of the bob for the position shown, find the velocity and acceleration of the bob in that position. [3+7]



***

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Jestha

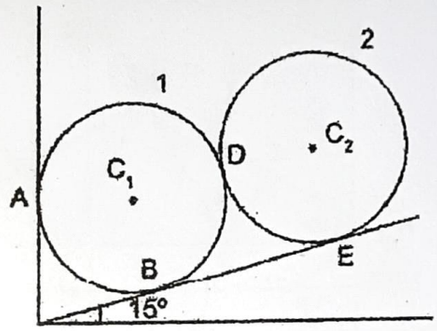
Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, BME, BGE	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Applied Mechanics (*CE 451*)

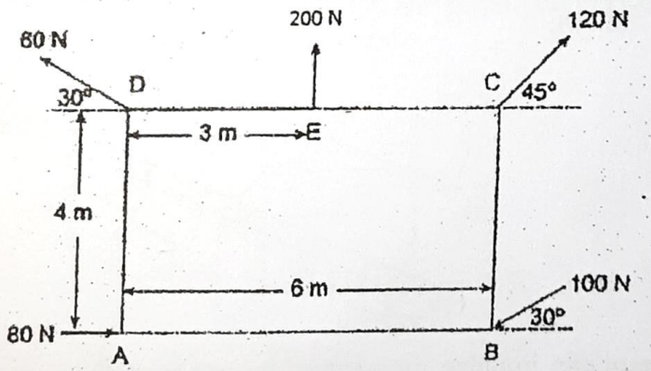
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Explain the concept of rigid body and deformable body. [4]
2. What is free body diagram? The cylinder 1 and 2 of same diameter rest in an inclined surface which makes an angle of 15° with horizontal as shown in figure below. Determine reactions at contact points. Take [2+8]

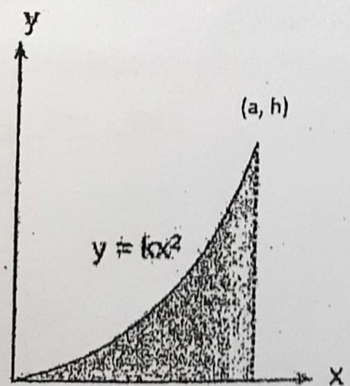
   Weight of cylinder 1 (W_1) = 100 N
   Weight of cylinder 2 (W_2) = 200 N



3. A plate measuring 6 m × 5 m is acted upon by a set of forces in its plane as shown in figure. Determine the magnitude direction and position of resultant force. State and prove varignon's theorem. [6+3]

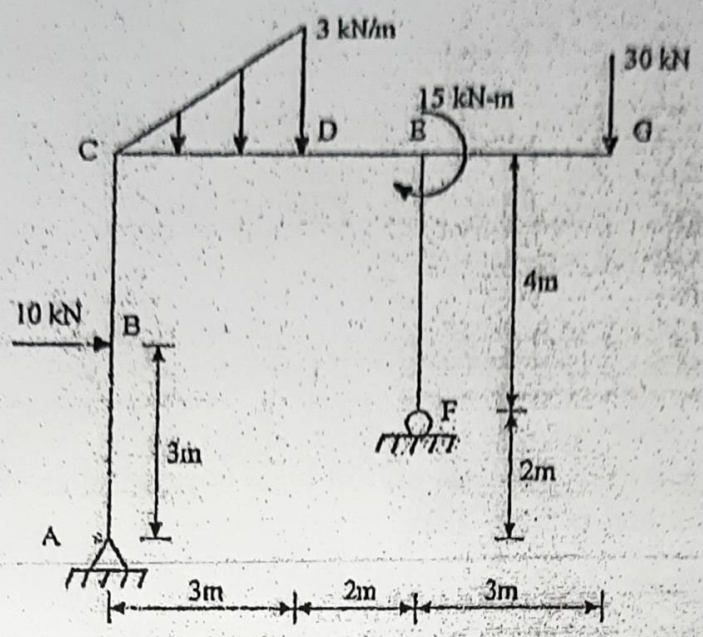


4. Define moment of inertia and radius of Gyration. Calculate the M.O.I. for the following figure about centroidal x-axis. [3+9]

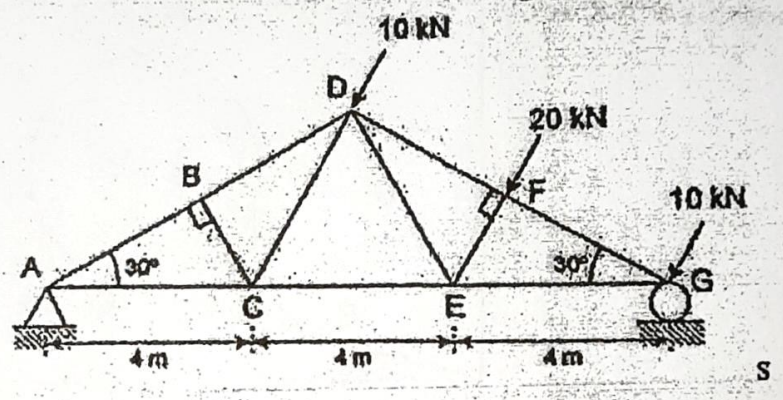


5. List the Engineering examples of usage of friction.

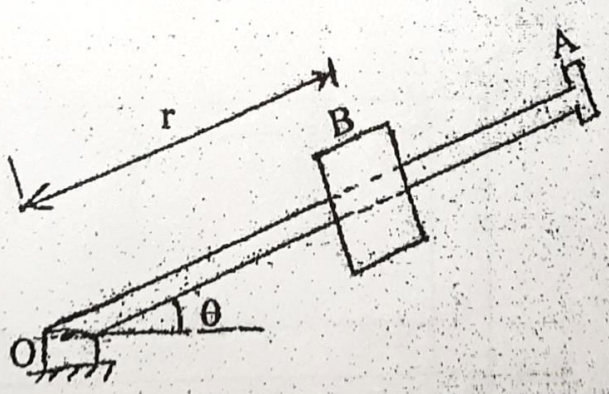
6. Draw axial force, shear force and bending moment diagram of the given frame. Indicate salient features of any. [4] [13]



7. Determine the member forces in BD, CE and CD for given truss. [8]



8. The rotation of the arm shown in figure is governed by $\theta = 0.4t + 0.04t^3$, where θ in radians and t in seconds. Collar B slides along the arm in such a way that its distance from O is $r = 0.4 + 0.08t^2$, where in meters and t in seconds. Calculate the magnitudes of the velocity and acceleration of the collar for the instant when t = 4 sec. Explain dependent motion. [8+2]



9. Explain about the impulse momentum principle of the particle. The resultant external force acting on a 4 kg particle in space is $\vec{F} = 12t\vec{i} - 24t^2\vec{j} - 50t^3\vec{k}\ N$. Initially particle is at rest and at origin. Determine y-component of acceleration, velocity and position at the instant of 4 seconds. [2+8]

***

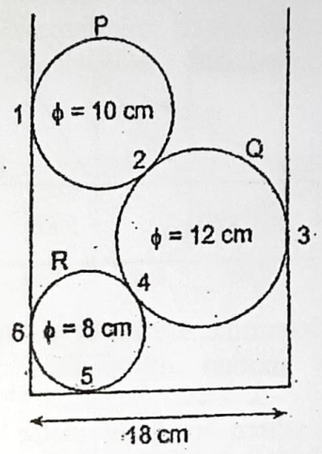
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BME, BGE, BCH	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

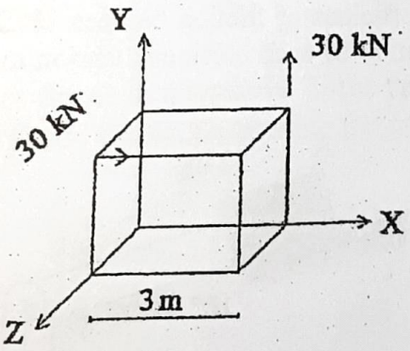
Subject: - Applied Mechanics *(CE 451)*

- ✓ 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.*

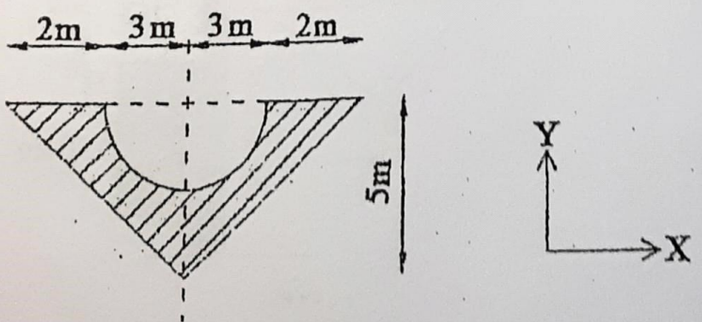
1. "Objects do not necessarily need to be small to be accurately idealized as a particle in the study of mechanics". Justify the statement with suitable example. [4]
2. Define the free body diagram with examples. Compute all the unknown reactions and contact forces from the given figure. Given, weight of P, Q and R are 2 kN, 4 kN and 2 kN respectively. Their diameters are shown in the figure. [2+7]



3. Two forces of the same magnitude 30 kN act on a cube of side 3m as shown. Replace the two forces by an equivalent wrench and determine the pitch and axis of wrench. Explain principle of transmissibility of force and its limitation. [7+3]



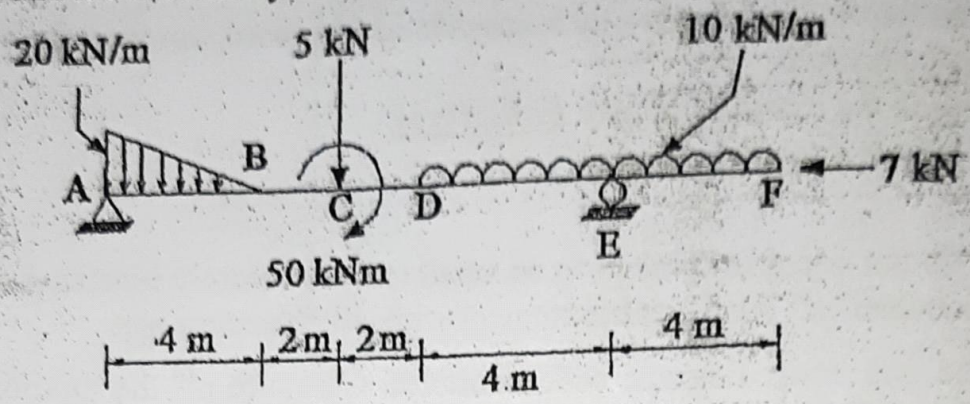
4. a) Determine by method of integration, the centroidal y-distance of a quarter circular area lying on first quadrant. [4]
   b) Calculate moment of inertia of the shaded section below about centroidal x-axis only. [8]



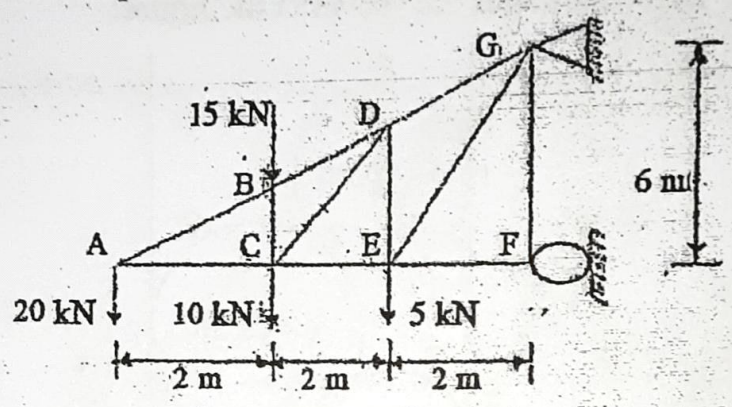
5

5. Show that angle of repose is always equal to angle of friction. Explain impending motion. [3+1]

6. Calculate axial force, shear force and bending moment at various points of overhanging beam and draw AFD, SFD and BMD showing salient features if any. Explain about static determinacy and indeterminacy of frame structure. [10+3]

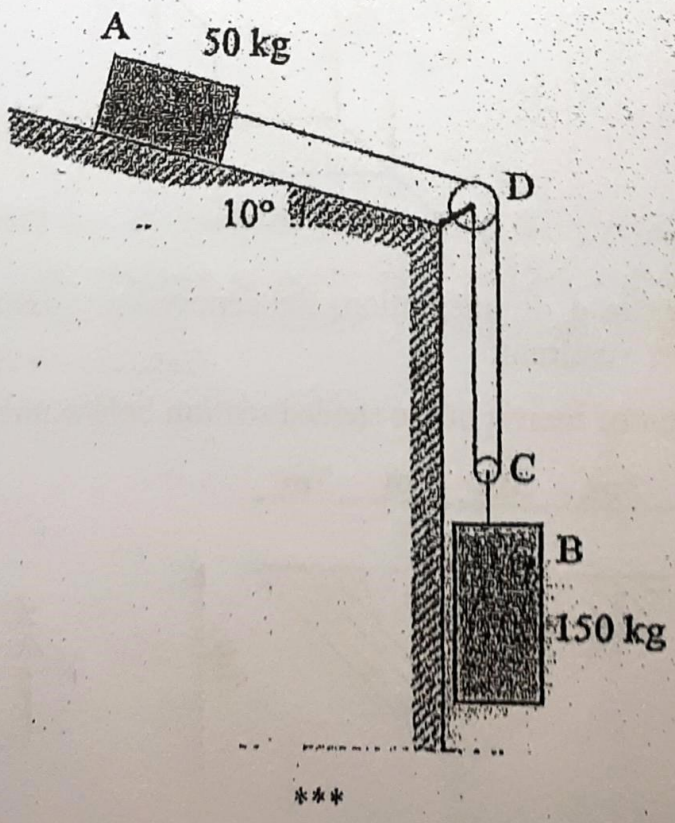


7. Determine the force developed in members BD, CD, EG and DE of the given truss. [8]



8. Derive an expression to determine motion of particle when acceleration is the given function of time. The motion of particle is defined by position vector $\vec{r} = 3t^2\,\vec{i} + 4t^3\,\vec{j} + 5t^4\,\vec{k}$ where $\vec{r}$ is in meter and t in seconds. At the instant $t = 4$ seconds, find the normal and tangential component of acceleration and radius of curvature. [3+7]

9. Two blocks shown in figure starts from rest. The pulleys are frictionless and have no mass. The kinetic co-efficient of friction between block A and inclined plane is 0.37. Determine the acceleration of each block and tension in each chord. What do you mean by dynamic equilibrium? [8+2]



***

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Poush

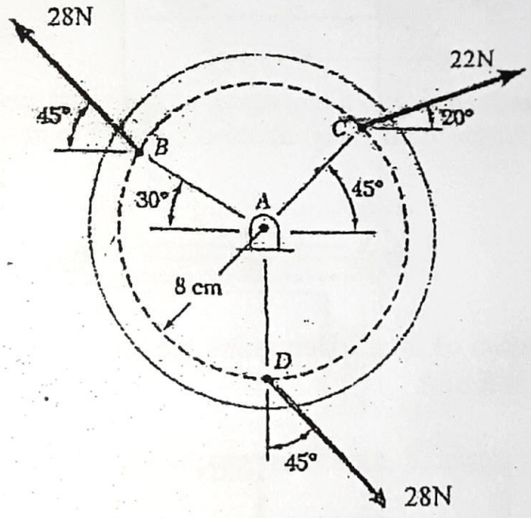
Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, BME, BGE, BCH	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Applied Mechanics *(CE 451)*

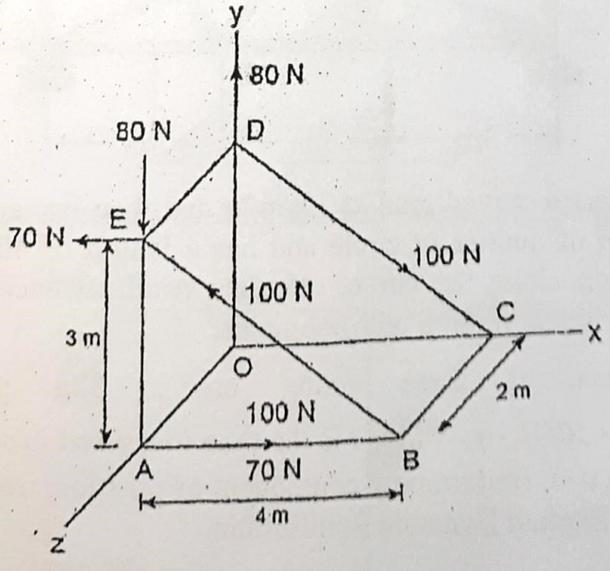
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt <u>All</u> questions.*
- ✓ *The figures in the margin indicate <u>Full Marks</u>.*
- ✓ *Assume suitable data if necessary.*

1. Define a particle and rigid body. Why it is necessary to assume a solid body as "Perfectly rigid" for our present study (ie. study of statics)? [2+2]

2. Three cables attached to a disk exerts on it the forces shown. [2+6]
   (i) Replace the three forces with an equivalent force couple system at A.
   (ii) Determine the single force which is equivalent to the force-couple system obtained in part (i) and specify its points of application on a line drawn through points A and D.

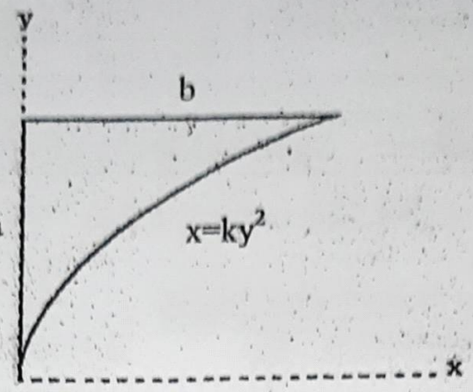


3. Explain the reduction of a system of forces to a wrench. Three pairs of couples are acted on the triangular block as shown in figure below. Determine the single resultant couple. [3+8]



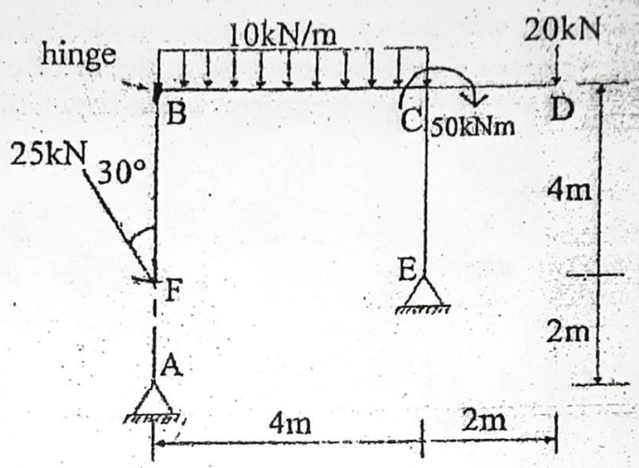
7

4. Explain moment of interia and radius of gyration. Determine moment of interia of the shaded region about its centroidal axes. [2+10]

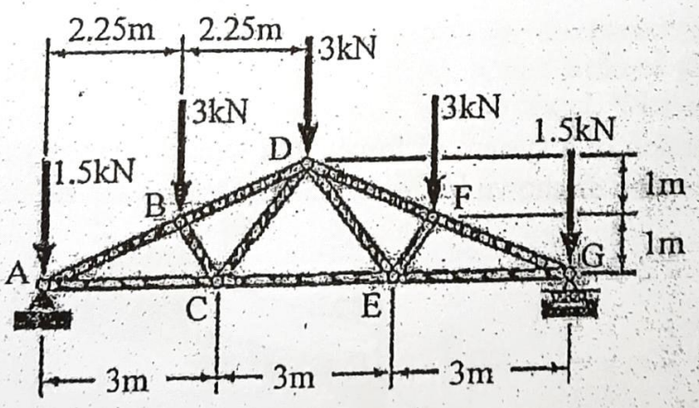


5. State laws of dry friction. Explain about condition of tipping but no sliding of a block. [2+2]

6. Draw axial force, Shear force and bending moment diagram of given loaded frame. Also indicate the salient feature (if any). [13]



7. What are the idealization of truss? Determine the forces in members BD, CD and CE of the roof truss shown in figure. [2+6]



8. An automobile enters a curved road at 30km/hr and then leaves at 48km/hr. The curved road is in the form of quarter of circle and has a length of 400m. If the car travels at constant acceleration along the curve, calculate resultant acceleration at both ends of curve. Explain curvilinear motion with examples. [8+2]

9. The resultant external force acting on a 3kg particle in space is $\vec{F} = (12t\hat{i} - 26t^2\hat{j} - 50t^3\hat{k})N$, where t is the time measured in seconds. The particle is at rest at origin, when t=0. Determine x component of position, velocity and acceleration at the instant of 5sec. Explain Dynamic Equilibrium. [8+2]

***

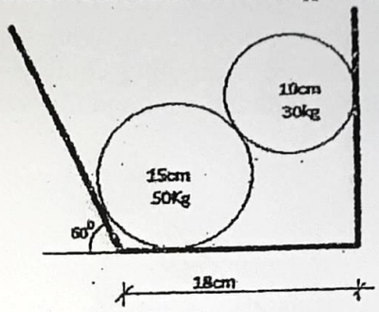
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Baishakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, BME, BGE	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

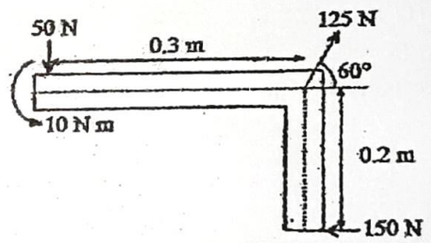
Subject: - Applied Mechanics *(CE 451)*

- ✓ 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.*

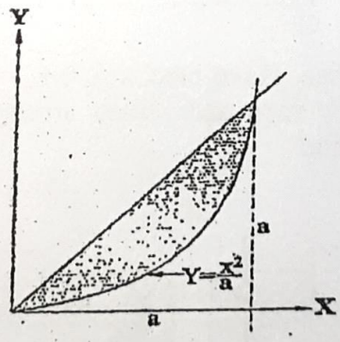
1. Explain rigid body and deformable body with example. State Newton's third law with example. [3]
2. Calculate the reactions in all contact surfaces. Given $R_A = 7.5$ cm and $R_B = 5$ cm. [8]



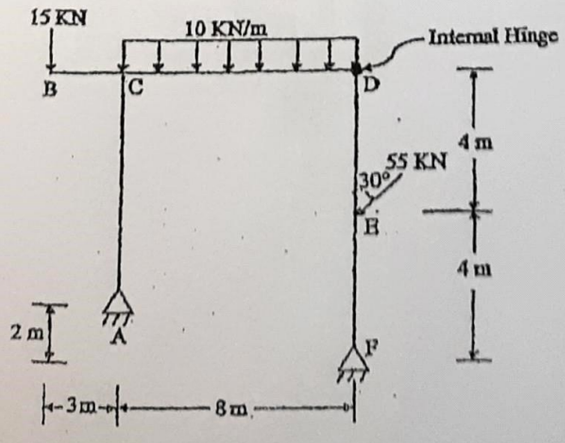
3. An angle bracket has been subjected to forces and a couple as shown in figure. Determine the resultant of this system of forces. Locate the position of resultant. Prove that couple is a free vector. [8+3]



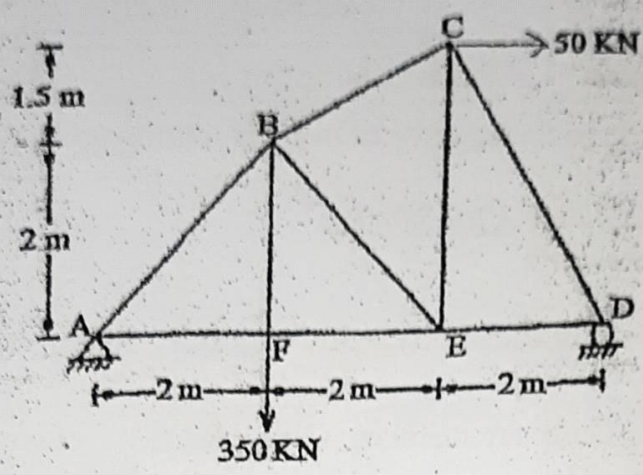
4. Determine the centroid for the shaded area as shown in figure below. State and prove parallel axis theorem. [8+4]



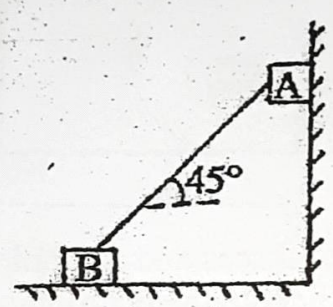
5. Draw axial force, shear force and bending moment diagram of the given frame. Indicate salient features if any. [13]



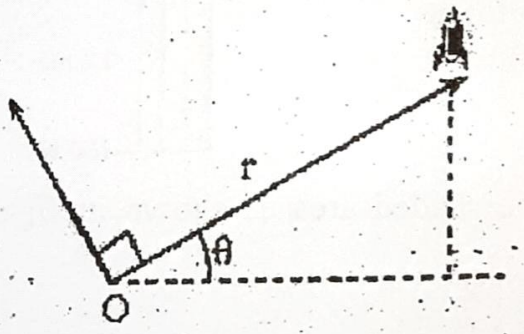
6. Determine the force developed in the members AB, AF, BC, BF, BE and EF of the truss loaded as shown in figure below. [8]



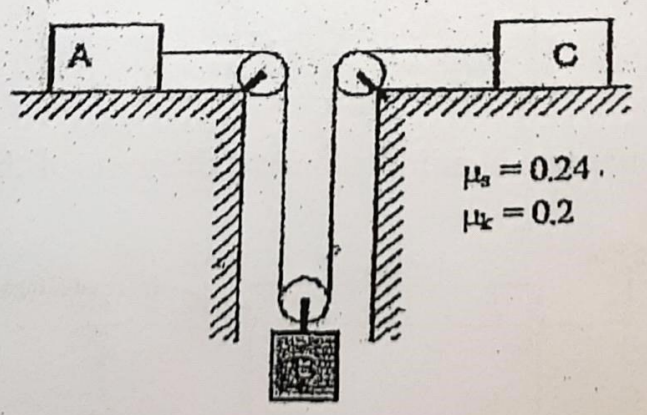
7. Two blocks A and B (which are identical) weighing W are supported by a rod inclined at 45° to the horizontal. If the blocks are in limiting equilibrium, find the coefficient of friction assuming it to be the same at both the floor and the wall. [5]



8. Explain Normal and tangential component of acceleration. A rocket is fired vertically and tracked by a radar station at 0 as shown in figure when $\theta = 30°$, it is found that $r = 9000$ m, $\dot{\theta} = 0.02$ rad/s and $\ddot{\theta} = 0.002$ rad/s^2. Determine velocity and acceleration of the rocket at the instant under consideration. [2+8]



9. Define dynamic equilibrium in brief. Three blocks A ($m_A = 5$ kg), B ($m_B = 10$ kg) and C($m_C = 10$ kg) are connected by rope and pulley arrangement as shown in figure. Neglecting mass of pulley, determine
   a) acceleration of each block
   b) tension in each cable [2+8]



***

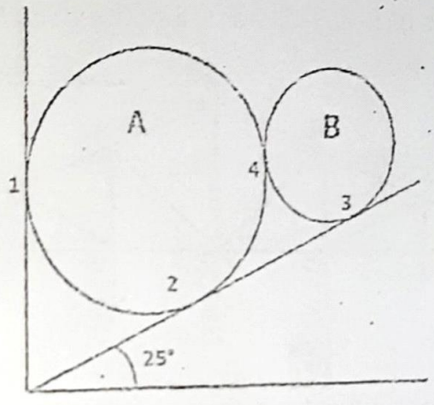
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2077 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BME, BGE, BCH	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

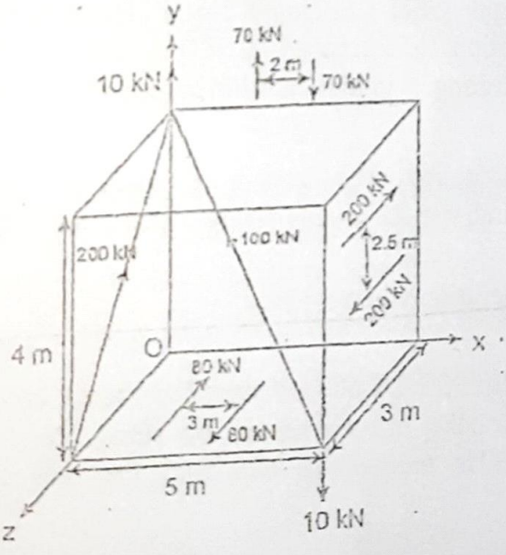
Subject: - Applied Mechanics *(CE 451)*

- ✓ 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.*

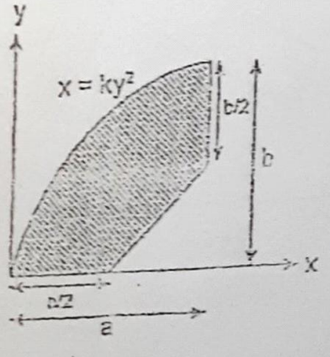
1. What do you understand by Free Body Diagram? Explain with sketches. [4]
2. The cylinder A and B rest in an inclined smooth surface which makes an angle of 25° with horizontal as shown in figure. Given, Weight of cylinder A = 200 N, Weight of cylinder B = 150 N, diameter of A = 90 mm, diameter of B = 60 mm. Determine all the contact forces. [8]



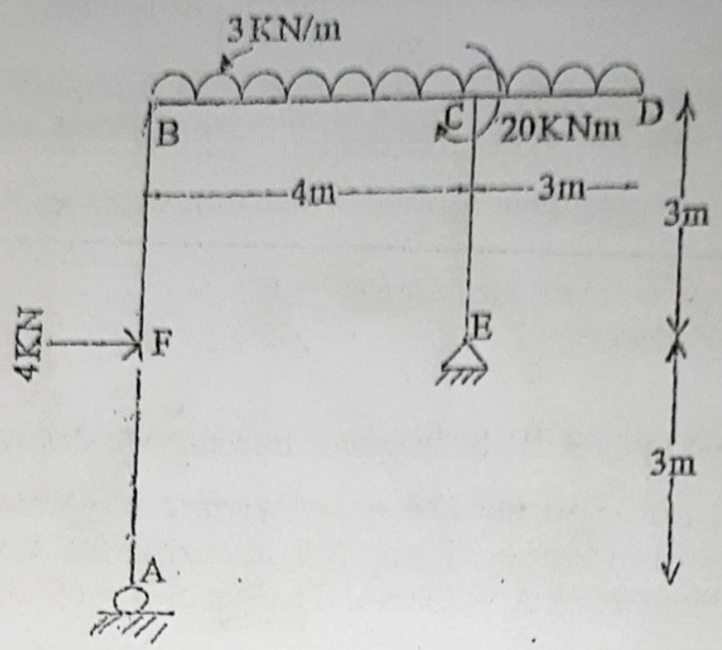
3. Determine the resultant force and moment about point O. [10]



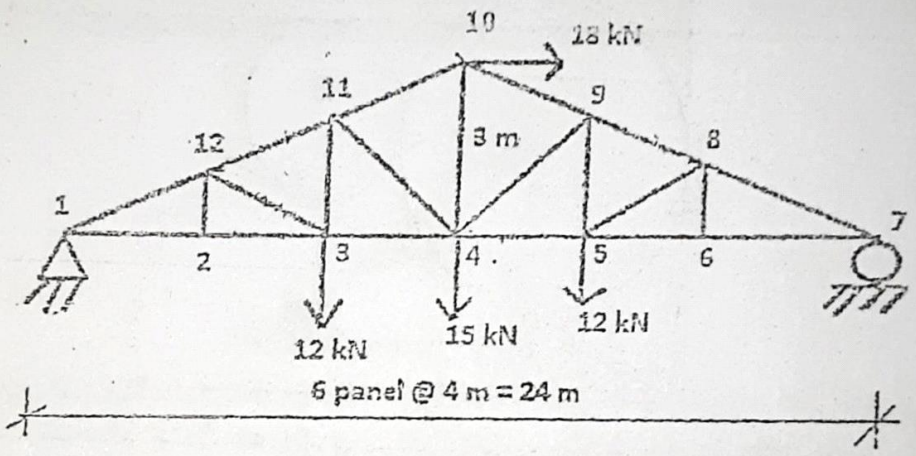
4. State and proof Parallel Axis theorem. Determine the centroid of the shaded area. [4+8]



5. Calculate and draw the axial force, shear force and bending moment diagram with its salient features for the given frame as shown in figure below. [13]



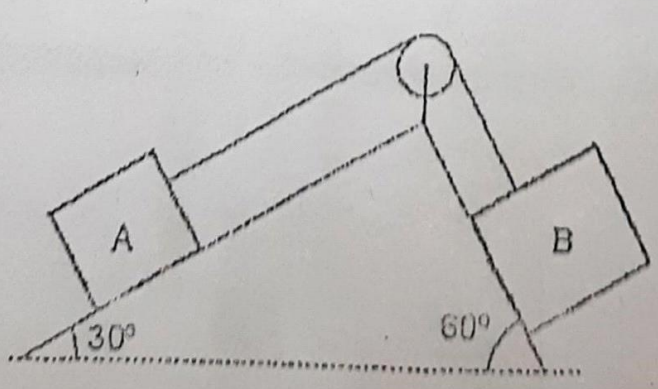
6. Calculate the member forces in 9-4, 9-5, 4-5, 5-8 of the given truss shown in figure. [8]



7. A uniform ladder of weight 250N and length 5m is placed against a vertical wall in a position where its inclination to horizontal is 60°. A man of weight 800N climbs the ladder. At what position along a ladder will he induce slippage? Take $\mu = 0.2$ for all surface. [5]

8. Explain about dependent motion. The motion of vibrating particle is defined by the equations $x = 100 \sin\pi t$ and $y = 25 \cos 2\pi t$ where x and y are expressed in mm and t in seconds. Determine
   a) The velocity and acceleration when $t = 1$ sec
   b) Path of particle [2+4+4]

9. Two rough plane inclined at 30° and 60° are placed as shown in figure. Mass of block A is 12kg and block B is 24kg are connected by string. If $\mu = 0.6$, find resulting acceleration. Define angular momentum and find the rate of change of angular momentum. [8+2]



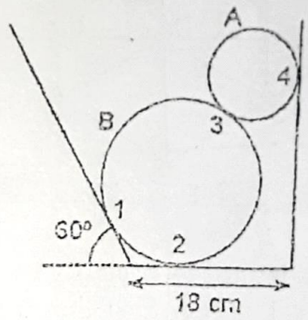
01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Baishakh

Exam.	[illegible]		
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Applied Mechanics *(CE 451)*

- ✓ 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. Differentiate between rigid body and deformable body. Mention Scope of applied Mechanics. [2+1]
2. Define FBD. Two cylinders A and B rest in a channel as shown in figure. The cylinder A has diameter of 10 cm and weighs 200 N whereas the cylinder B has diameter of 18 cm and weighs 500 N. Determine the reaction at all contact points. [2+8]



3. The direction cosines of the line of action of a force with magnitude 200 N passing through point A (2, -2, 2) is (0.5, 0.707, 0.5). Find moment of the force about point P (-2, 2, -2). Define a couple and show that couple is a free vector. [5+4]
4. a) Find the coordinate of center of gravity (CG) of the hatched area shown in Figure 1. [6]
   b) Find the moment of inertia of area in Figure 2 about given coordinate axes using integration technique. [6]

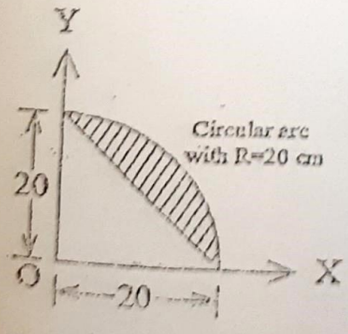


Figure-1

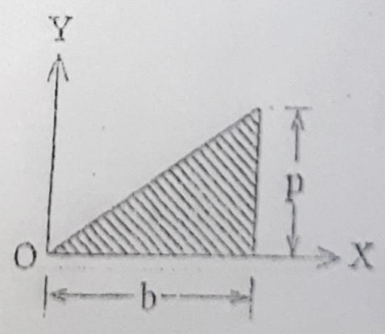
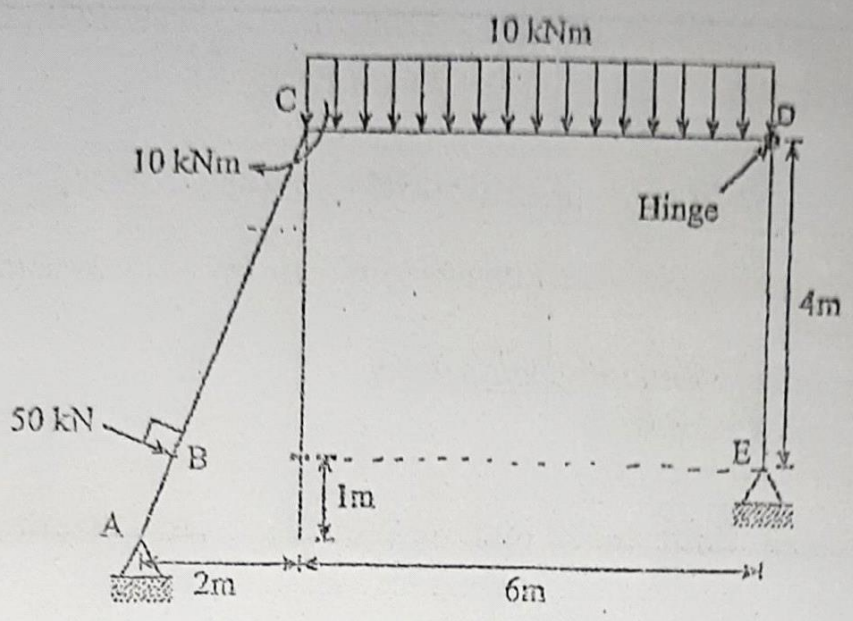


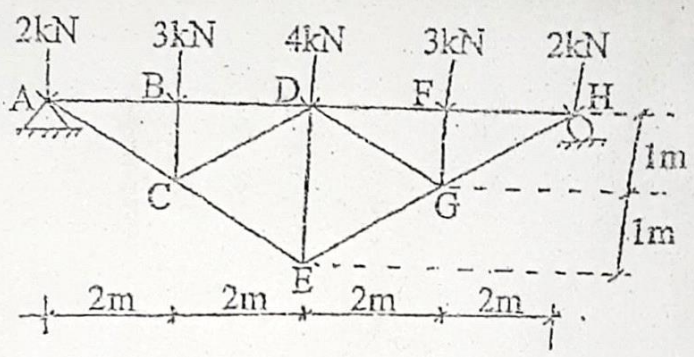
Figure-2

5. Explain the laws of static function. How can we assure the condition of sliding or overturning of a block? [2+2]

6. Calculate and draw the axial force, shear force and bending moment diagram; with its salient features for the given frame. [14]

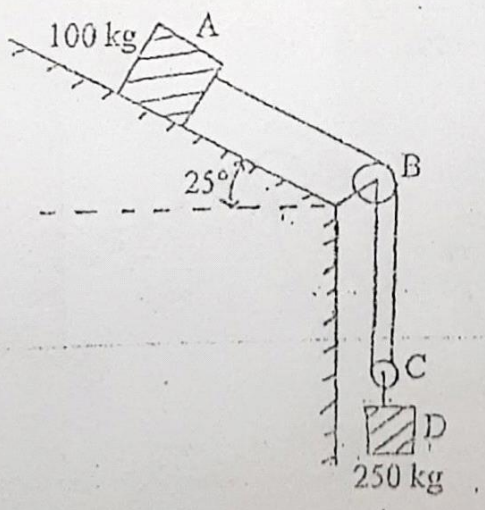


7. Determine the force in members DE, CD, AB and AC for the inverted roof truss shown in figure below. How can we check the determinancy and stability of plane truss? [6+2]



8. The acceleration of a particle is defined by a relation, $a = v^3$. It is known that at time $t = 0$, position is -2m and velocity is 1 m/sec. Find the displacement, position, velocity and acceleration at instant of 0.25 sec. What do you mean by dependent motion of particle? Explain with suitable example. [7+3]

9. What do you mean by dynamic equilibrium? Two blocks in figure starts from rest. The pulleys are Frictionless and having no mass. The kinetic co-efficient of friction between block A and inclined plane is 0.45. Determine the acceleration of each block and tension in each cord. [2+8]



***

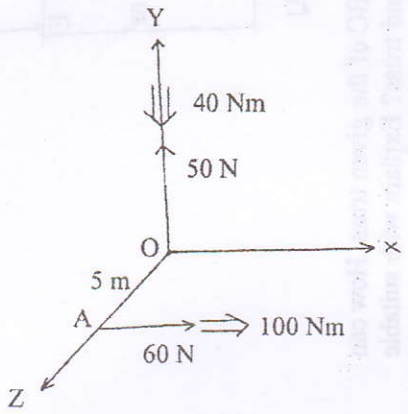
01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BME, BGE	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

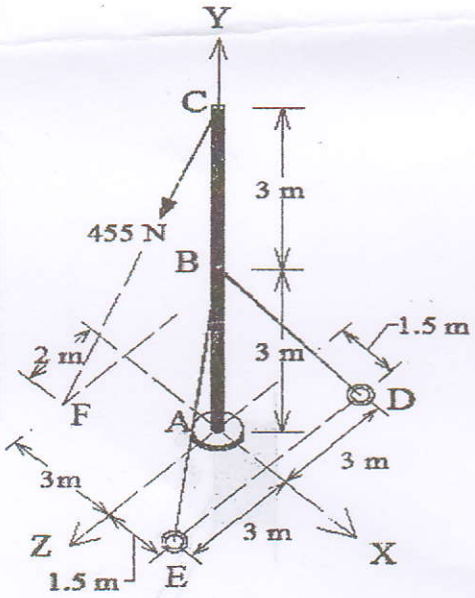
Subject: - Applied Mechanics *(CE451)*

- ✓ 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.*

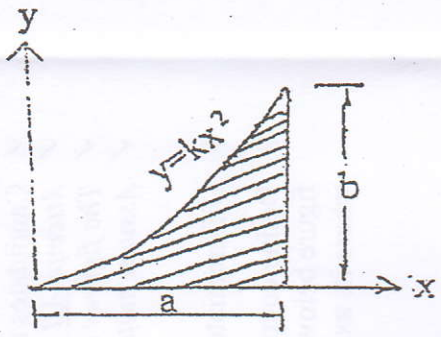
1. Differentiate between particle and rigid body. How can we draw a good FBD? [2+2]
2. Define couple and show that couple is free vector. Replace the two wrenches as shown in figure below by a single equivalent wrench and determine (a) Resultant force (b) the point where its axis intersects the XZ plane. [4+7]



3. The 6m pole ABC is acted upon by 455 N force as shown. The pole at A is supported by two cables BD and BE as shown in figure. Determine tension in each cable and the reaction at A. [7]

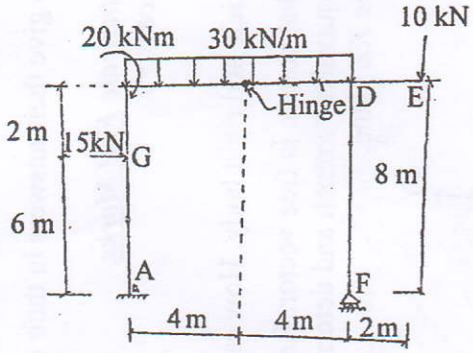


4. Determine the moment of inertia about centroidal axes of the shaded plane area by using direct integration method. Define the terms: Centroid, centre of gravity, radius of gyration and axes of symmetry. [8+4]

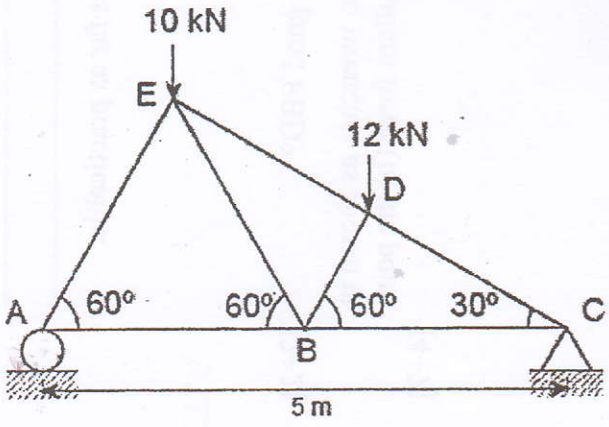


5. Explain the laws of dry friction. Define the terms: angle of friction and impending motion. [2+2]

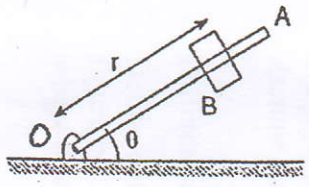
6. Draw the axial force, shear force and Bending moment diagram of the given Frame. Indicate also the salient features if any. [14]



7. Determine the force developed member ED, BD, AB and BC of the given truss. How can we check the determinancy and stability of beam, frame and truss? Explain with suitable examples. [5+3]

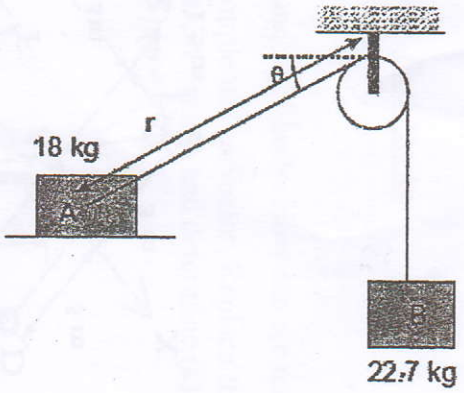


8. Define the uniformly rectilinear motion and the uniformly accelerated rectilinear motion? The rotation of the 0.9m arm OA about O is defined by the relation $\theta = 0.15t^2$ where θ is expressed in radians and t in seconds. Collar B slides along the arm in such a way that its distance from O is $r = 0.9\text{-}0.12t^2$, where r is expressed in meters and t in seconds. After the arm OA has rotated through $\theta = 25°$, determine (a) the total velocity of the collar, (b) the total acceleration of the collar, (c) the relative acceleration of the collar with respect to the arm. [2+8]



9. Explain the Principle of impulse and momentum. The velocity of the block A is 1.8 m/s to the right at the instant when $r = 0.73$ and $\theta = 30°$. Neglecting the mass of pulley and effect of friction, determine at this instant [2+8]

a) tension in the cable
b) acceleration of block A
c) acceleration of block B



***

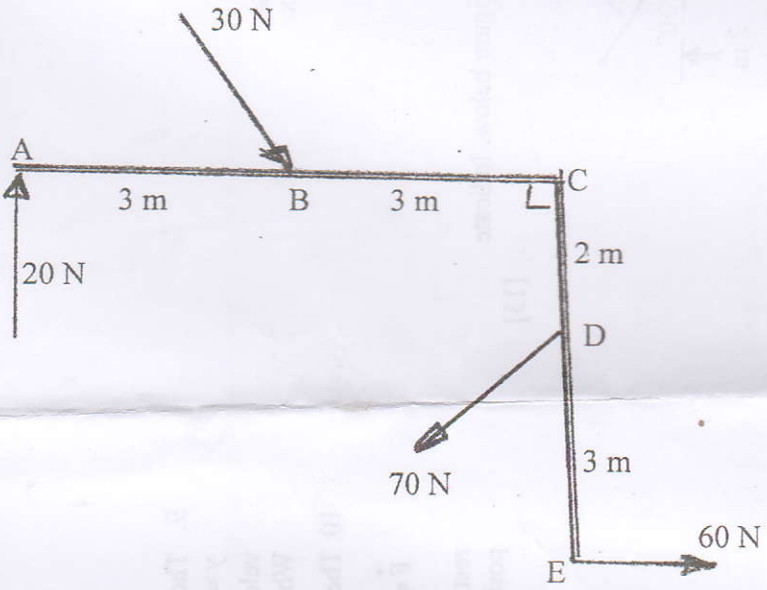
01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Baishakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

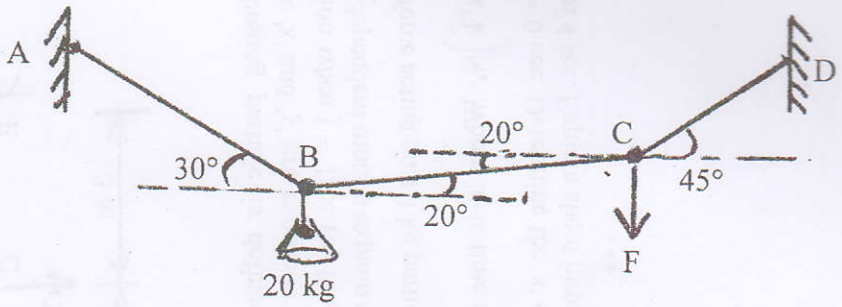
Subject: - Applied Mechanics *(CE451)*

- ✓ 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. What are the equations of Static Equilibrium for 2-D and 3-D analysis of particle and rigid body? [4]
2. Define particle, rigid body and free body diagram. Explain how can we reduce a force into a force and a couple. [3+2]
3. Determine magnitude, direction and line of action of the resultant of forces acting in the system as shown in figure below: [7]

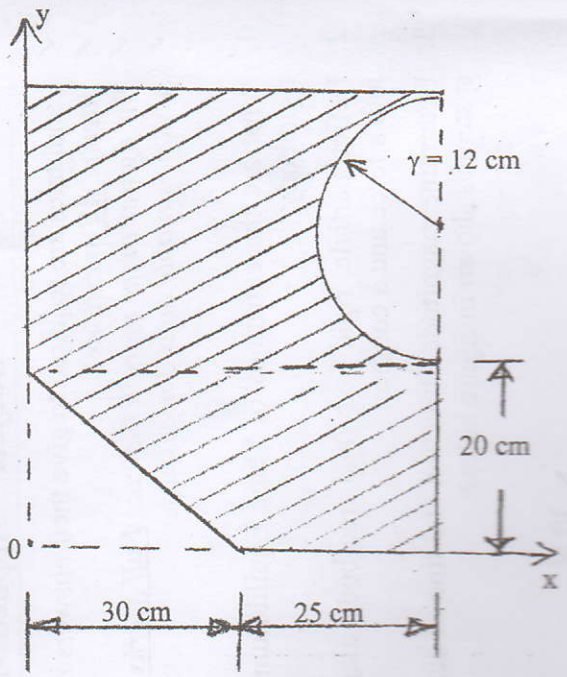


4. Determine the force in each cable and the force 'F' needed to hold the 20 kg lamp in the position shown in figure below: [6]

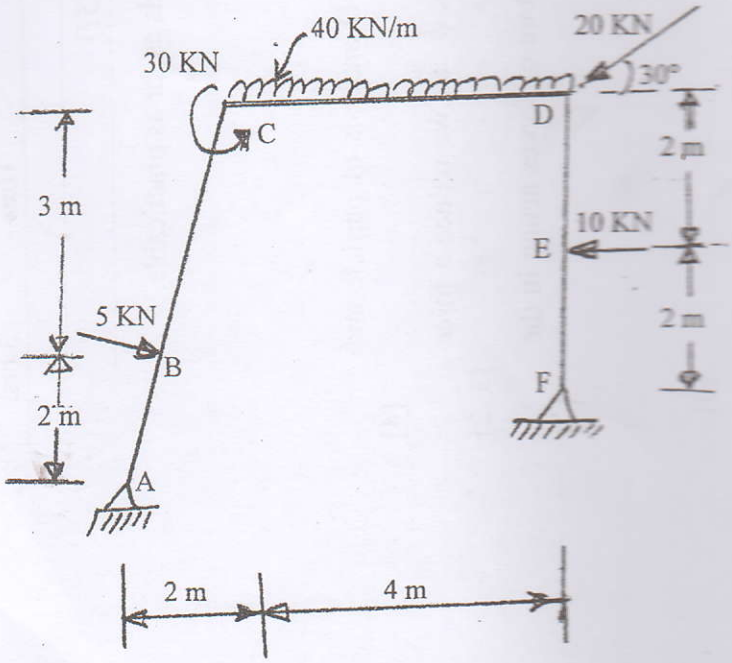


5. Define friction, angle of friction and explain how can we assure the condition of overturning or sliding of a block. [1+2+3]

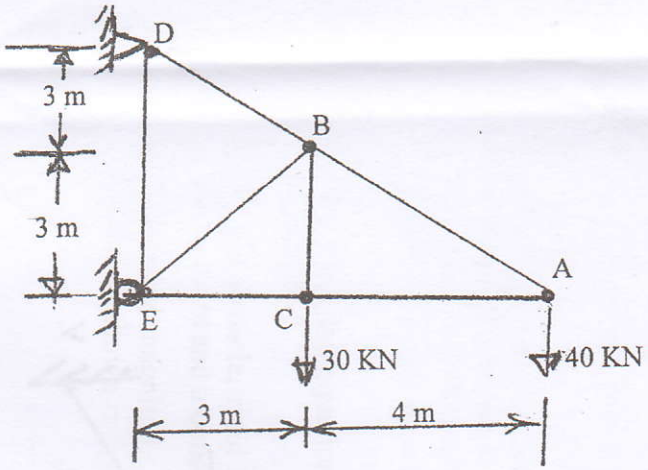
6. Define centroid, center of gravity and axis of symmetry. Calculate the moment of inertia of the figure below (shaded area) about centroidal X-X axis. [3+9]



7. Draw AFD, SFD and BMD of the given frame loaded as shown in figure below. Indicate the salient features if any. [13]



8. Determine the force developed in the members BC, BE, BD and CE of the truss loaded as shown in figure below. What are the assumptions of ideal truss? [5+2]



9. The motion of a vibrating particle is defined by the equation $x = 100 \sin \pi t$ and $y = 25 \cos 2\pi t$. Where 'x' and 'y' are expresses in mm and 't' in sec. (a) Determine the velocity and acceleration when t = 1sec (b) Find the nature of the path of the particle. What do you mean by dependent motion explain with example? [8+2]

10. The resultant external force acting on a 3 kg particle in space is

$\vec{F} = \left(12t\,\hat{i} - 24t^2\,\hat{j} - 40t^3\,\hat{k}\right)$N, Where 't' is time measured in seconds. The particle is at rest at origin, when t = 0 sec. Determine the 'x' component of acceleration, velocity and position at the instant of 4 sec. Explain about impulse momentum principle of the particle. [8+2]

***

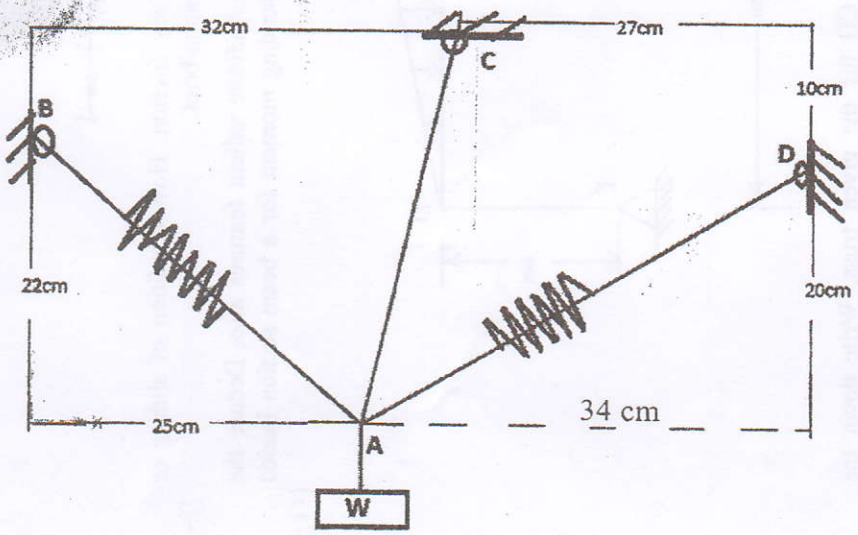
01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

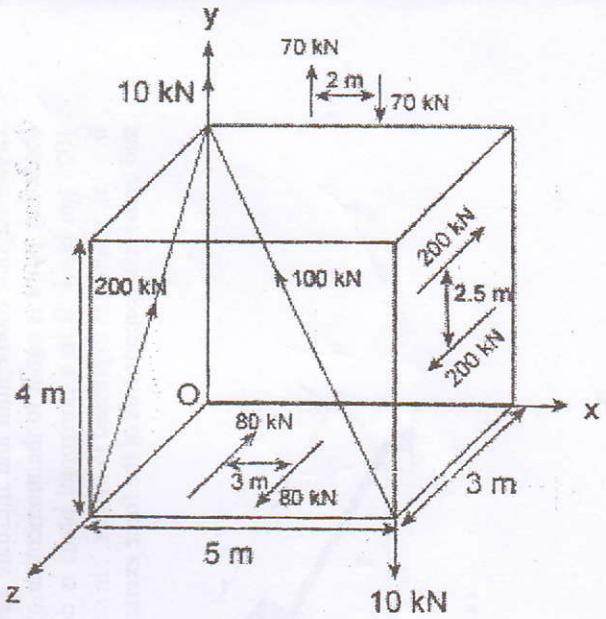
Subject: - Applied Mechanics *(CE451)*

- ✓ 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. What is Rigid body? Explain the transmissibility of force and its limitation. [1+3]
2. A block of weight W is suspended by a cord AC and two spring of which the unstretched length of 25 cm knowing that the constants of spring are AB = 10N/cm and AD = 3.5N/cm. Determine: [8]
   a) Tension in the cord AC
   b) Weight of the block

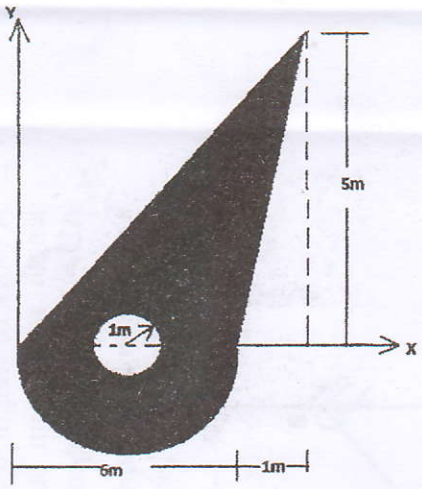


3. State and prove varignon's theorem. Determine the resultant force and moment about point O. [2+8]



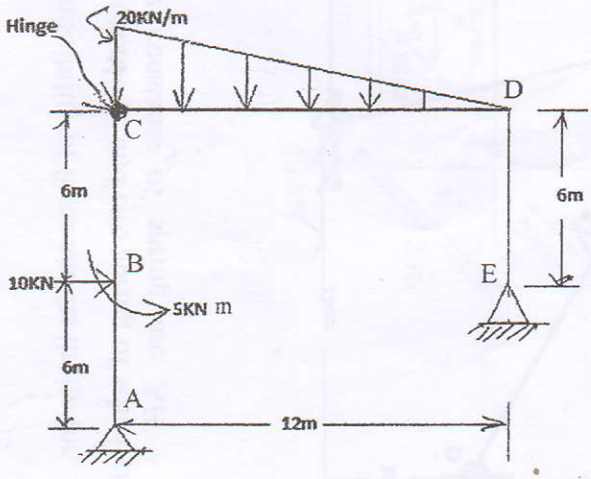
4. a) State and prove parallel axis theorem for moment of inertia. [4]

   b) Calculate moment of inertia of given shaded composite section about centrodial Y-Y axis. [8]

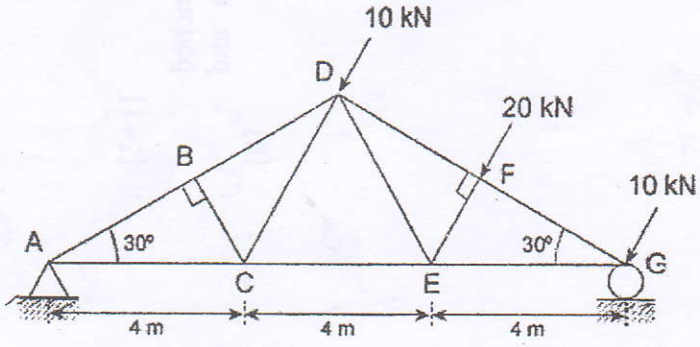


5. Define friction and explain about laws of dry friction. How condition of sliding or overturning can be decided for a block? Explain in brief. [2+2]

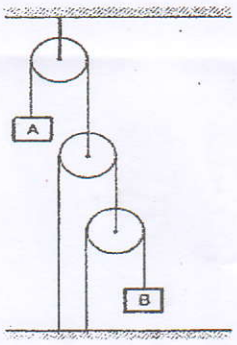
6. Draw AFD, SFD and BMD of given frame. Indicate salient features also. Deduce the relationship between load, shear force and bending moment for a beam section loaded uniformly with intensity of load w. [11+3]



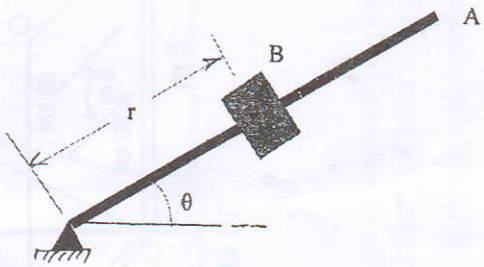
7. Find the member forces in BD, CE and CD for the given truss. Write down the assumptions of ideal truss. [6+2]



8. Define radial and transverse component of velocity and acceleration. Find the acceleration of block B if the acceleration of A is 4 m/s^2 (↓) for the following connection. Neglect the mass of blocks and pulleys. Assume that cords are inextensible and pulleys are friction less. [3+7]



9. Define angular momentum and illustrate that the rate of change of angular momentum about any point is equal to the momentum of the force about the point. The motion of a 1000 gm block B in a horizontal plane is defined by the relations $r = 3(1+\sin 2\pi t)$ and $\theta = 2\pi t$, where r is expressed in meters, t in seconds and θ in radians. Determine the radial and transverse components of the force exerted on the block when i) t = 0 and t = 0.5 sec. [3+7]



***

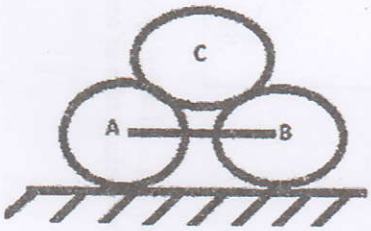
01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

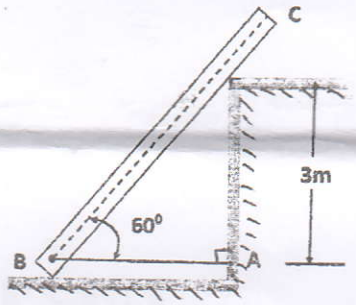
Subject: - Applied Mechanics *(CE451)*

- ✓ 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.*

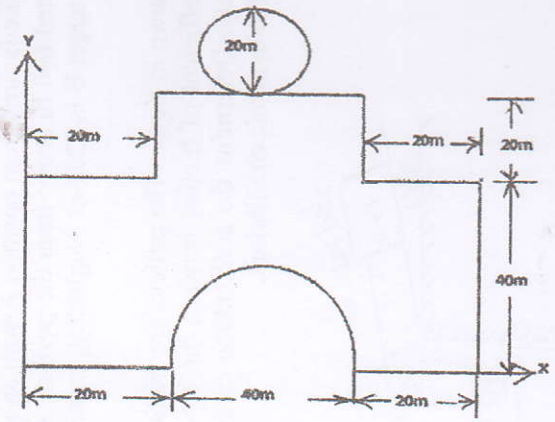
1. What is Mechanics? Define Rigid body and Deform body. [3]
2. Two smooth spheres of weight 100 kg each are connected at their centers by a string AB of length 40 cm, and supported third smooth sphere of weight 200 kg. Find the force in string AB and other contact surfaces. Radius of all spheres are 15cm. [8]



3. Define principle of transmissibility and explain about its drawback. Determine the tension in the cable AB which holds a post BC of 4m length from sliding. The post has a mass of 9 kg. Assume all the contact surfaces are smooth. [4+8]

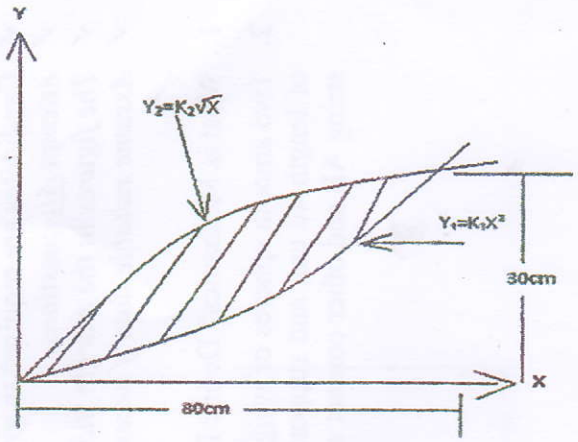


4. a) Locate the centroid of the given plane lamina. [6]

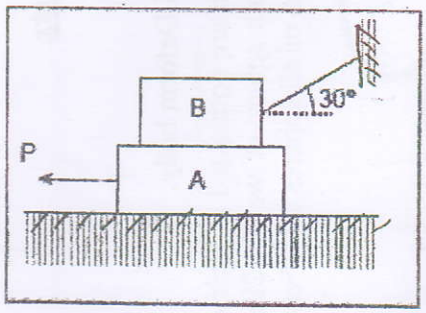


P.T.O

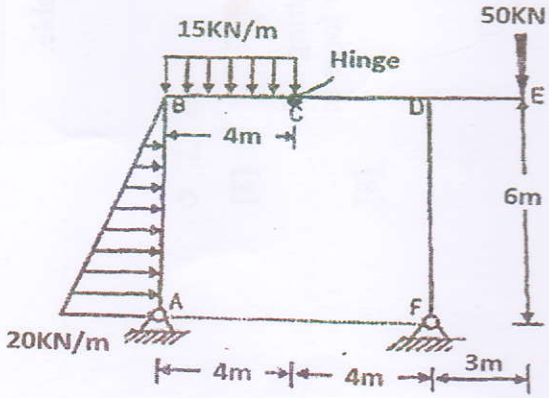
b) Find the moment of inertia of the given figure about centroidal X-X axis. [6]



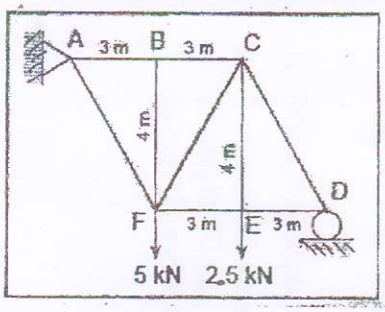
5. Two blocks A and B of 40 N and 20 N respectively are in equilibrium position as shown in figure. Calculate the force P required to move block A. Take $\mu_s = 0.3$ for all surface. [4]



6. Draw Axial force, Shear force and Bending Moment diagram for the given frame structure shown in figure below. Also indicate the salient features if any. [13]

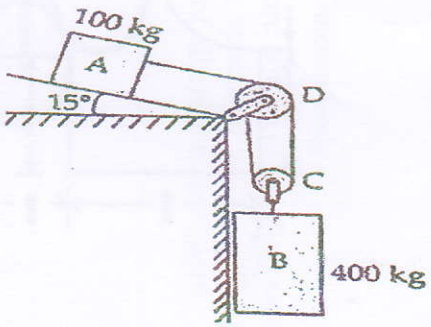


7. Determine the force developed in the members BC, BF, FE and FC of the given truss. [8]



8. Describe the Position, Velocity and Acceleration of particle when it follows straight line path. A projectile is fired from position A with an initial velocity of 245 m/sec at a target B in right located 600 m above from the position A and the horizontal distance between positions A to target B is 3200 m. Neglecting air resistance, determine the value of firing angle. [2+8]

9. Two blocks shown in figure. The pulleys are frictionless and having no mass. The static and kinetic coefficient of friction between the block A and inclined plane are 0.35 and 0.25 respectively. Determine the acceleration of each block and tension in each chord. Explain about the dynamic equilibrium. [8+2]



***

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Bhadra

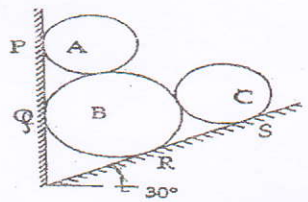
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Applied Mechanics *(CE451)*

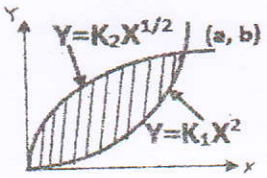
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. What is applied mechanics? Mention scope of applied mechanics in engineering. [1+2]
2. What is free body diagram? Determine the support reaction at contact point of given system. Assume contact surfaces are smooth. [1+7]

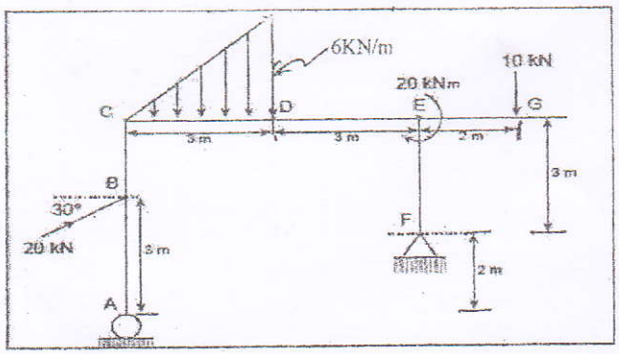
   Take,
   Weight of sphere A and C = 300N
   Weight of sphere B = 600N
   Diameter of A and C = 800mm
   Diameter of B = 1200mm



3. State and prove the parallel axis theorem for moment of inertia. Determine the moment of inertia about centroidal 'Y' axis of given shaded area. [4+8]



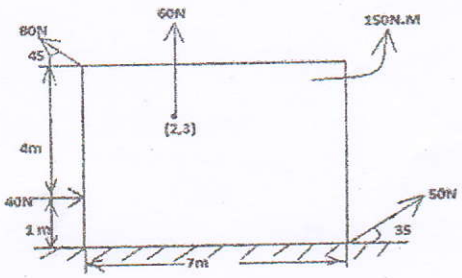
4. Define angle of friction, coefficient of friction. Why coefficient of static friction is greater than coefficient of kinetic friction. [1+1+2]
5. Draw axial force, shear force and bending moment diagram; and obtain salient features for the given frame Loaded as shown in figure. [13]



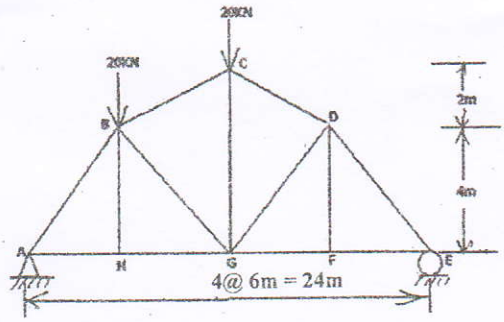
6. The acceleration of a particle is defined by the relation $a = 12x-28$ where a in m/s^2 and x in m. knowing that $v = 8m/s$ when $x = 0$; determine [8+2]

   a) the maximum value of x.
   b) the velocity when the particle has travelled a total distance of 3m.
   c) What do you mean by dependent motion of particle? Explain with suitable example.

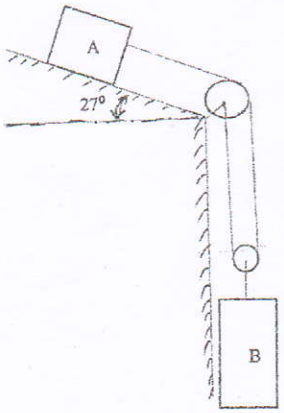
7. Explain free body diagram and its importance. Find the magnitude, direction of resultant force and locate two points on the edge of the plate where the resultant meet. [4+8]



8. Determine the member force in members BC, BG and DF. How can we check the determinacy and stability of the truss? Explain with suitable example. [5+3]



9. Derive the expression for angular momentum and rate of change. Two blocks, A of mass 150 kg and block B of mass 350 kg, shown starts from rest. The coefficient of friction between horizontal plane and the pulley is 0.2 and the pulleys assumed to be of negligible mass. Determine the acceleration of each block and tension in each chord. [2+8]



***

13

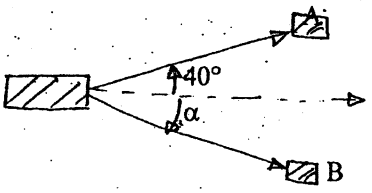
01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

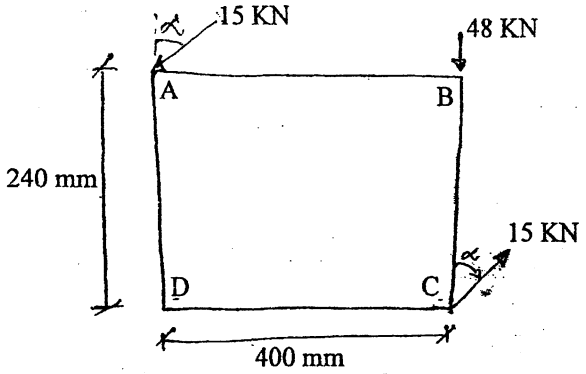
Subject: - Applied Mechanics *(CE451)*

- ✓ 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. How does deformable bodies differ from rigid body? What were the assumptions made regarding rigid body for our present study? [3+3]
2. A vehicle needs 50 KN to be moved forward by two pullers A and B. Puller A is at 40°to the axis of movement. Compute the value of angle 'α' for which puller B has to exert minimum force. Also compute the respective values of pull to be exerted. [3+3]

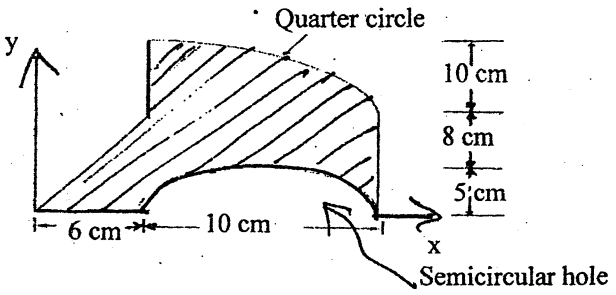


3. A rectangular plate is acted upon by the force and couple shown in figure below. The system is to be replaced by a signal equivalent force. [11]

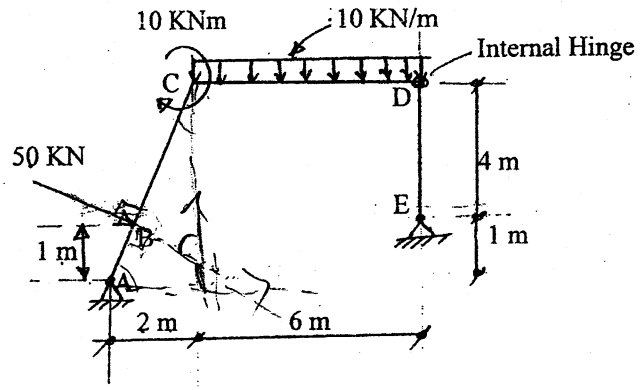


i) For α = 40°, specify the magnitude and the line of action of the equivalent force
ii) Specify the value of α, if the line of action of the equivalent force is to intersect line CD 300 mm to the right of D.

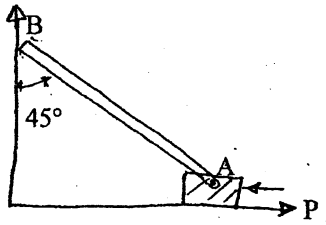
4. State and prove the parallel axis theorem for moment of inertia. Find the moments of inertia about the axes through centroid of given shaded area. [4+8]



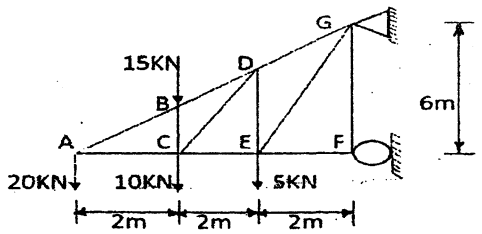
5. Calculate and draw the axial force, shear force and bending moment diagram; with its salient features for the given plane frame. [13]



6. A uniform bar AB having length 5 m and weighing 500 N is fastened by a frictionless pin to a block, weighing 200 N as shown in figure below. At the vertical wall, co-efficient of friction is 0.3 while under the block is 0.20. Determine the force P needed to start the motion to the left. [4]

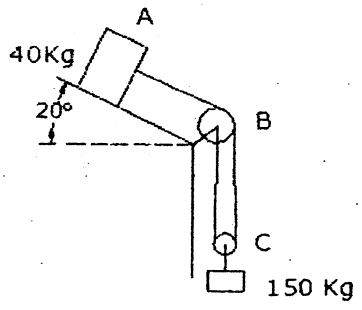


7. Determine the force developed in members BD, CD, EG and DE of given truss. [8]



8. The acceleration of a particle is given by the relation $a = 21-12x^2$, where a is expressed in m/s^2 and x is in meters. The particle starts with no initial velocity at origin. Determine: [10]
   i) The velocity when x = 1.5 m
   ii) The position where velocity is again zero
   iii) The position where velocity is maximum

9. a) Define dynamic equilibrium and impulse momentum principle for particle. [2]
   b) Two blocks in figure are start from rest. The pulleys are frictionless and having no mass. The kinetic coefficient of Friction between the blocks 'A' and the inclined plane is 0.4. Determine the acceleration of each block and tension in each chord. [8]



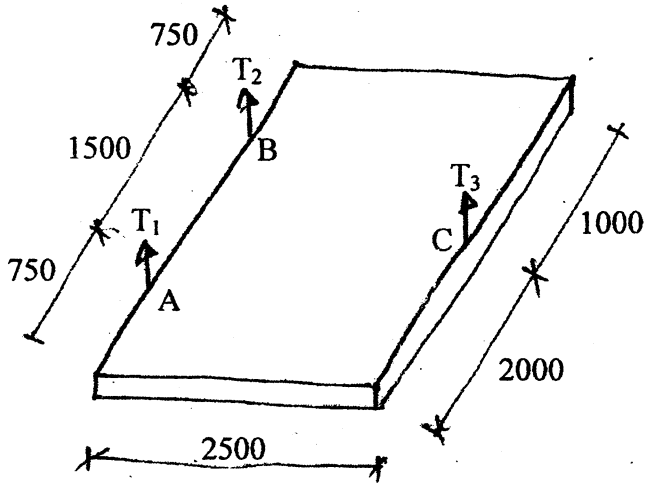
01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE, BME, BGE	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

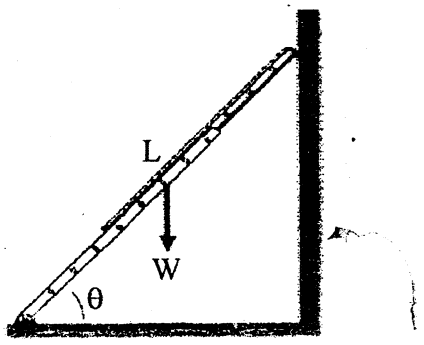
Subject: - Applied Mechanics *(CE451)*

- ✓ 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.*

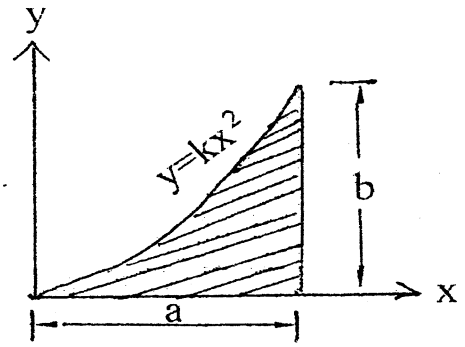
1. What is mechanics? Mention scope of Applied Mechanics in engineering.
2. Illustrate equilibrium condition of a rigid body and concept of free body diagram with suitable examples.
3. Three vertical wires as shown in figure support a plate of 50 kg. Determine the tension in each wire. All dimensions are in mm.



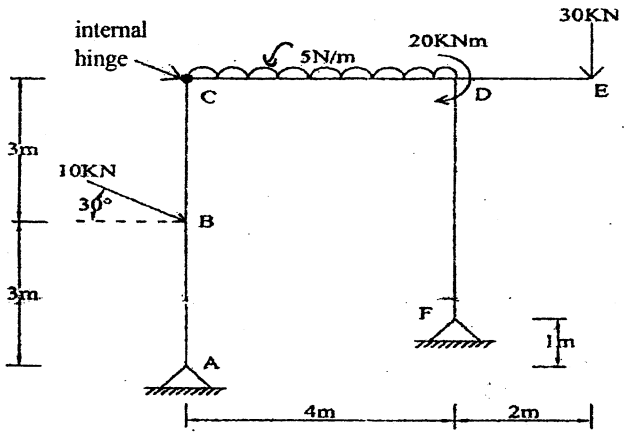
4. Force $\vec{F} = (3\hat{i} - 6\hat{j} + 4\hat{k})$N passes through point (6, 3, 2) m. Replace this force with an equivalent system, where the force $\vec{F}$ passes through point (2, 5, 10) m.
5. Determine the minimum angle θ (made by the ladder AB of length 'L' with the floor) at which a uniform ladder can be placed against a wall without slipping under its own weight (W). The coefficient of friction for all surfaces is 0.2.



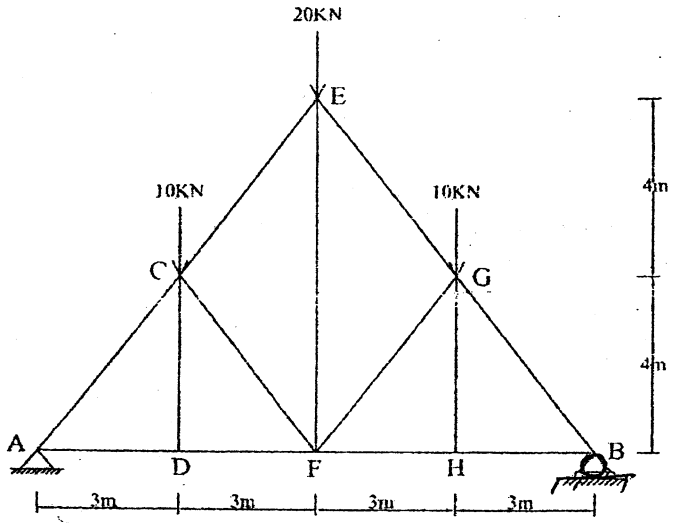
6. Determine the moment of inertia about centroidal axis of the shaded plane area by using Direct integration method. [12]



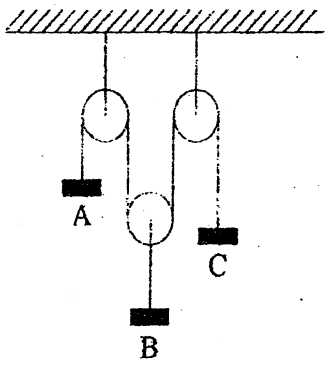
7. Draw the axial force, shear force and bending moment diagram of given frame. Indicate also the salient features if any. [14]



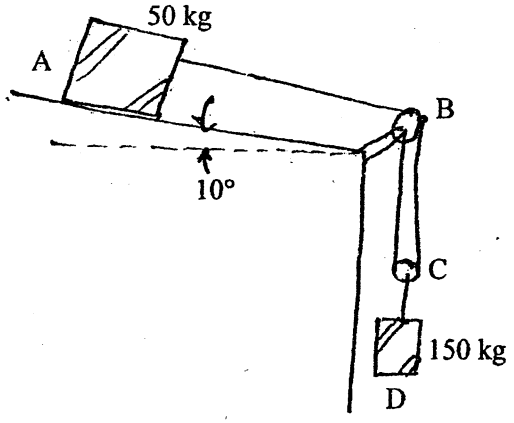
8. Determine the force developed in members CE, DF, EF, GH of given truss loaded as shown in figure. [8]



9. Define uniformly rectilinear motion and uniformly accelerated rectilinear motion. For the pulleys systems as shown in figure, calculate the velocity and acceleration of Block 'C'. If the velocities and acceleration of Block 'A' and 'B' are 3 m/s(↓), 2 m/s^2(↑), 4 m/s(↑) and 5 m/s^2(↓) respectively. [8]



10. Two blocks shown in figure starts from rest. The pulleys are frictionless and having no mass. The kinetic co-efficient of friction between block A and inclined plane is 0.37. Determine the acceleration of each block and tension in each cord. What do you mean by dynamic equilibrium? [8+2]



***

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Magh

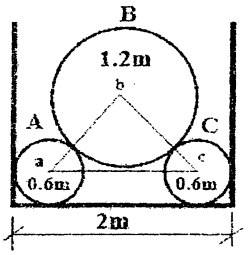
Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Applied Mechanics *(CE451)*

- ✓ 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.*

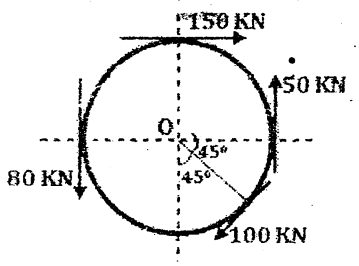
1. a) Describe the scope of applied mechanics. [3]

   b) The cylinders A and C weight 1000 N each and the weight of cylinder B is 2000 N. Determine the forces exerted at the contact points. [7]



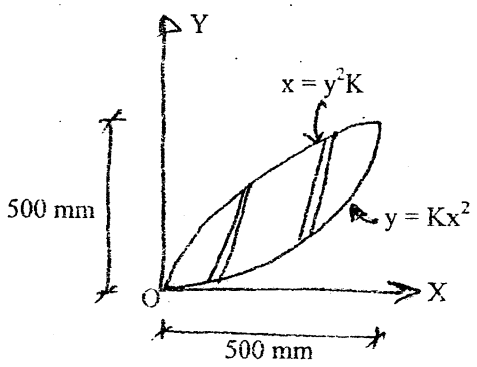
2. a) What is Free Body Diagram and why it is used during analysis of structure? [4]

   b) Determine the resultant of the forces acting tangentially to a circle of radius 3 m as shown in figure. What will be the location of the resultant with respect to centre of the circle? [8]

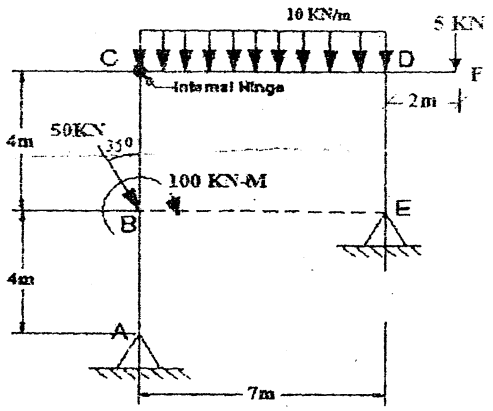


3. Explain the laws of static friction. Also define the limiting friction and angle of friction with suitable example. [2+1+1]

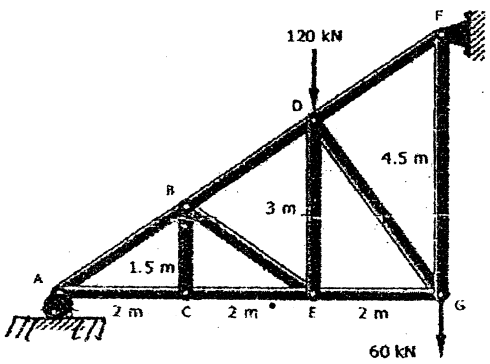
4. Determine the centroid of the hatched area by Direct Integration Method. State and prove the parallel axis theorem for moment of inertia. [8+4]



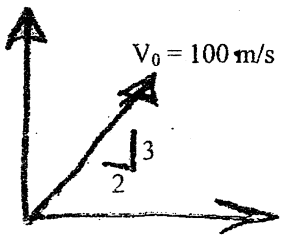
5. Draw the Axial Force, Shear Force and Bending Moment diagram of the given frame. Also show the salient features. [14]



6. Write down the ideal assumptions of truss. Determine the member forces BC, DG and EG for given truss. [2+6]



7. A particle starting from origin is subjected to acceleration such that $a_x = -4$ m/s^2 and $a_y = -8$ m/s^2. If the initial velocity is 100 m/s directed at a slope of 2:3. Compute the radius of curvature of the path after 5 sec. Also calculate the position at the end of 5 sec. What are the possible equations of motion for a particle in terms of kinetics? [7+3]



8. a) Define the dynamic equilibrium and impulse momentum principle for particle. [4]

   b) A particle moves along a curved path defined by $r = 5\theta$ and $\theta = t^2 / 3$ where r is in meters and t is in seconds. Determine the velocity and acceleration of the particle when $\theta = 90°$. [6]

***

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

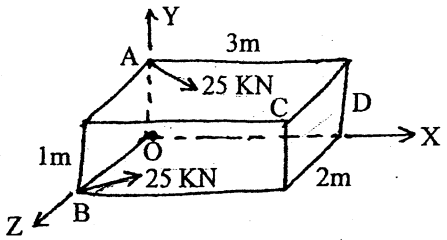
2070 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

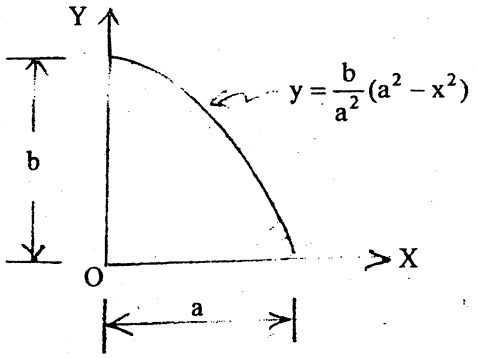
Subject: - Applied Mechanics *(CE451)*

- ✓ 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.*

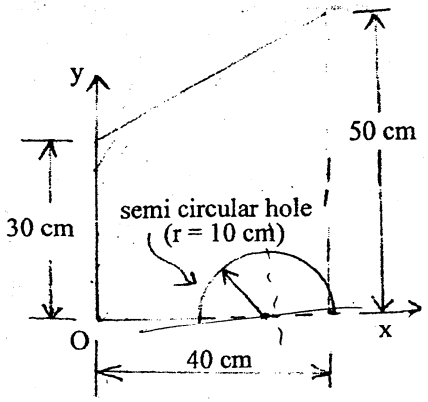
1. What do you mean by rigid body? Why it is necessary to assume a body as "perfectly rigid" for the study of statics. [1+2]
2. What is free body diagram? Why is it necessary to draw free body diagram in solving any structural problems? Also describe equation of equilibrium in two dimension. [2+3+3]
3. If two forces of same magnitude 25 kN act at points A and B as shown in figure and force at A passes through C and force at B passes through D. (a) Find equivalent force-couple system at 'O' (b) Find equivalent wrench and give pitch and axis of wrench. [12]



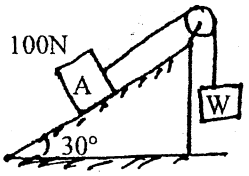
4. Locate the centroid of the area bounded by the curve as shown in figure, by the method of integration. [6]



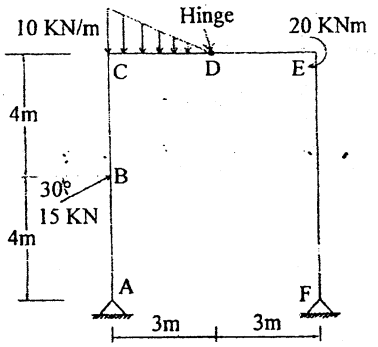
5. Calculate the moment of inertia of the composite area as shown in figure, about x-axis. [6]



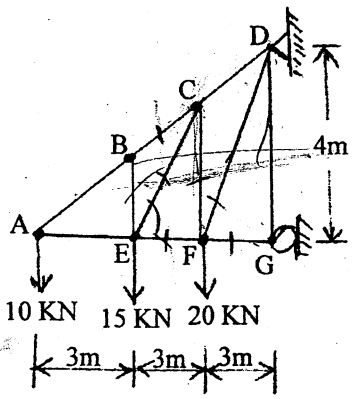
6. A block 'A' of weight 100 N rests on an inclined plane and another weight w is attached to the first weight through a string as shown in figure. If the coefficient of friction between the block and plane is 0.3, determine the maximum value of W so that equilibrium can exist. [5]



7. Draw axial force, shear force, bending moment diagram for the loaded frame shown in figure. Indicate also the salient features if any. [12]

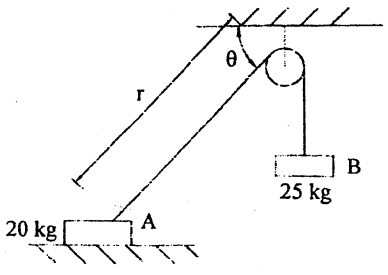


8. Calculate the force developed in members BC, EC, EF, FC, FD and FG of the cantilever truss loaded as shown in figure. [8]



9. Deduce the relationship of radial and transverse components of velocity and acceleration for a particle moving along the curve path. The acceleration of a particle is defined by the relation, $a = kt^2$, knowing that velocity is –32 m/sec when time is zero second and again velocity is +32 m/sec when time is 4 sec. (a) Determine, the value of the constant K, (b) Write the equations of motion knowing also that position of the particle is zero at the instant of 4 sec. [4+6]

10. The velocity of block 'A' is 2 m/s to the right at the instant when r = 0.8 and θ = 30°. Neglecting the mass of pulleys, and the effect of friction in the pulley, and between block 'A' and the horizontal surfaces. Determine at this instant (a) the tension in the cable (b) the acceleration of the block A (c) the acceleration of the block B. [10]



***

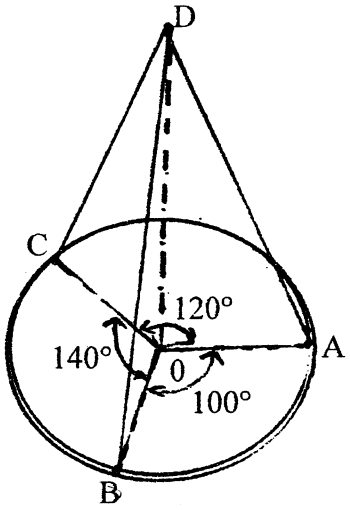
01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

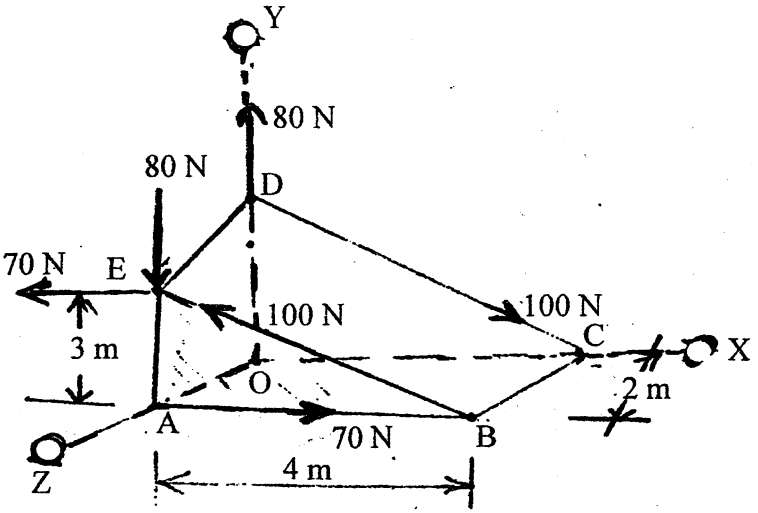
Subject: - Applied Mechanics *(CE451)*

- ✓ 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.*

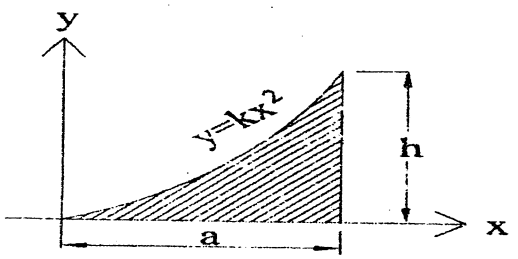
1. Differentiate between rigid body and deformable body. [3]
2. Explain about the physical meaning of equilibrium. Define free body diagram and concept of particle. [3+2+2]
3. A homogeneous circular plate of mass 50 kg is supported by three wires. The angular distance between the points of attachment on the circumference of the plate w.r.t center of the plate makes an angle of 100° while other two angular distances are 120° and 140° as shown in figure below. The three wires are attached to a single point on the ceiling which is 5 m vertically above the centroid of the plate. The plate has diameter of 1 m. Calculate the force developed in each wires. [8]



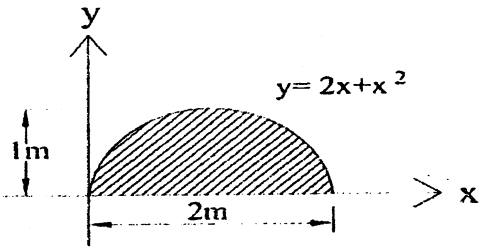
4. Three pairs of couples are acted on the triangular block as shown in figure below. Determine the resultant of them. [4]



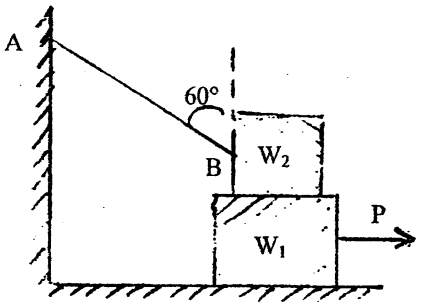
5. Determine the centroidal X and Y coordinate of the shaded area. [6]



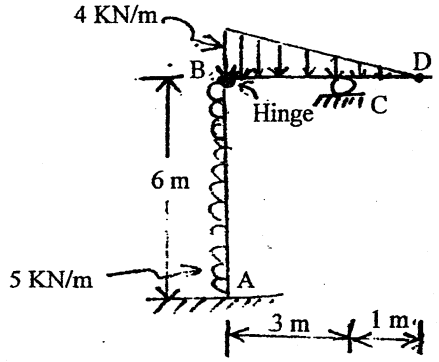
6. Determine the moment of inertia area about X-axis. [5]



7. A block of weight W_1 = 1800 N rests on a horizontal surface and supports on the top of it another block of weight W_2 = 1000 N as shown in figure below. The block W_2 is attached to a vertical wall by the inclined string AB. find the magnitude of the horizontal force P, applied to the lower block as shown, that will be necessary to cause sliding to impend. The coefficient of static friction for all contact surfaces is 0.4. [6]

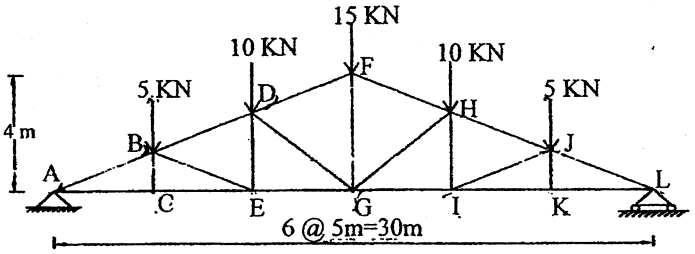


8. Deduce the relationship between load, shear force and bending moment for a beam section loaded uniformly with intensity of load W. Draw AFD, SFD and BMD of the given frame loaded as shown in figure below. Indicate also the salient features if any. [4+9]



6]

9. Determine the member forces in member CE, FH, GH, GI of given truss. [8]



[5]

10. Two ships A and B are at a distance of 4800 m apart B being south east of A. Speed of A is 2.6 m/s due east and B is travelling at speed of 4.47 m/s due north. Determine: (a) The relative velocity of B w.r.t A (b) The shortest distance between them (c) Time taken to reach the shortest distance. [10]

11. What do you mean by principle of impulse and momentum? The resultant external force acting on a 30 N particle in space is, $\vec{F} = (12t\,\hat{i} - 24t^2\,\hat{j} + 30t^3\,\hat{K})$ N, where t is the time measured in seconds. Initially, particle is at origin and at rest. Determine Y-component of acceleration, velocity and position at the instant of 5 sec. [3+7]

***

[6]

[4+9]

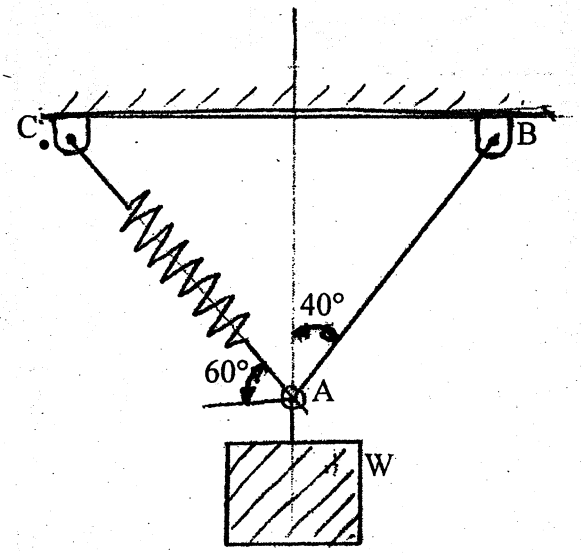
01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Bhadra

Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

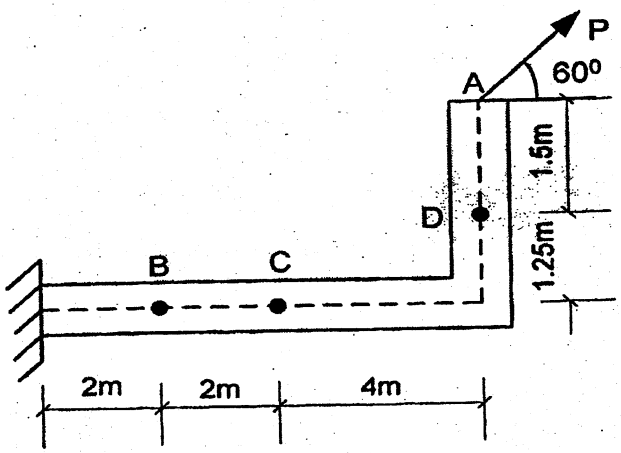
Subject: - Applied Mechanics *(CE 401)*

- ✓ 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.*

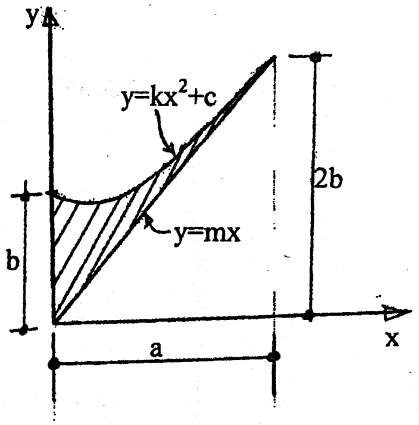
1. Differentiate between rigid body and deformable body. [3]
2. A container of weight W is subjected from ring A to which cable AB and spring AC are attached. The constant of spring is 100N/m and its unstretched length is 3m. Determine the tension in the cable; when (a) W = 120N (b) W = 160N. [8]



3. A 160N force P is applied at point A of a structural member. Replace P with (a) An equivalent force-couple system at C, (b) and equivalent system consisting of a vertical force at B and a second force at D. [12]

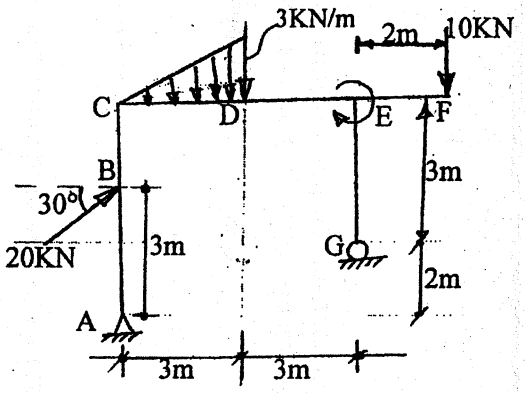


4. Determine the polar moment of inertia and the polar radius of gyration of the shaded area as shown in figure below with respect to centroid. [12]

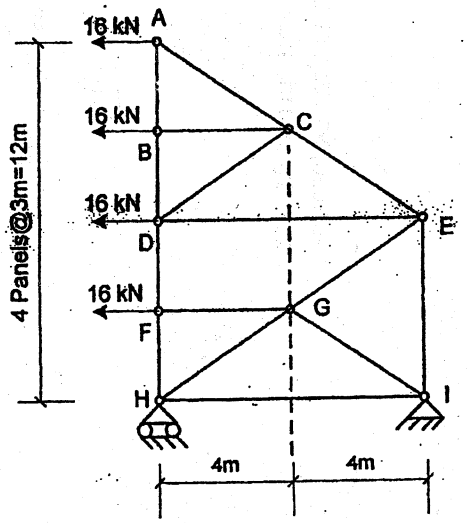


5. Define static friction. Explain why coefficient of static friction is always less than that of kinetic friction coefficient. Support your answer with relevant equations. [1+3]

6. Calculate and draw the axial force, Shear force and bending moment diagram with its salient features; for the given frame as shown in figure below. [13]



7. Use method of section to determine member forces DE, DF and GI for the given pin jointed truss and also indicate the nature of forces. [8]

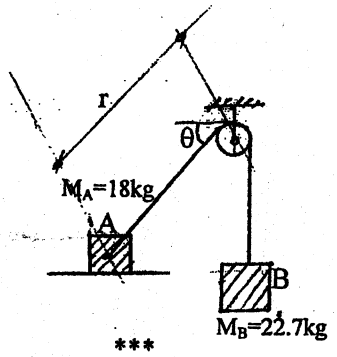


2069 Bhadra Applied Mechanics

8. A particle moving in a straight line has an acceleration, $a = \sqrt{V}$, its displacement and velocity at time t = 2 sec, are $\frac{128}{3}$m and 16m/s. Find the displacement velocity and acceleration at time t = 3 sec. [10]

9. The two blocks as shown in figure below are released from rest when r = 0.73m and θ=30°. Neglecting the mass of the pulley and the effect of the friction in the pulley and between block A and the horizontal surface. Determine:

   a) The initial tension in the cable
   b) Acceleration of the block 'A' and 'B' [10]



***

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Bhadra

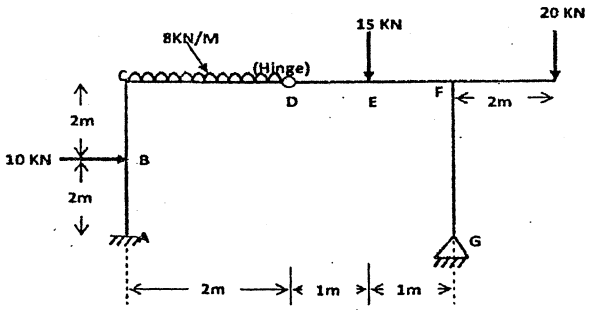
Exam.	**Regular**		
Level	BE	**Full Marks**	80
Programme	BCE, BME	**Pass Marks**	32
Year / Part	I / II	**Time**	3 hrs.

Subject: - Applied Mechanics

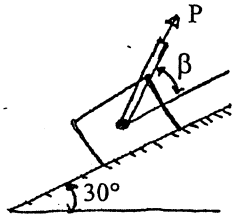
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Define the fundamental principles on which the study of mechanics rests. [3]

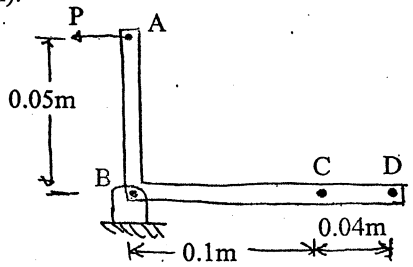
   b) Draw the axial force, shear force and bending moment diagram of the given frame. Also show the salient features. [13]



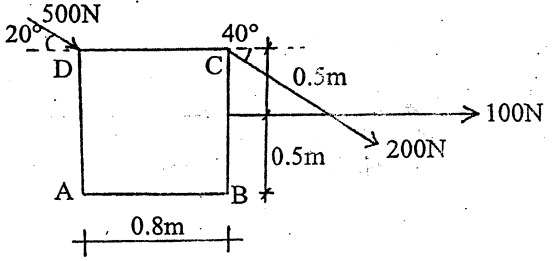
2. a) Knowing that the coeff. of friction between 25 kg block and the incline is $\mu_s = 0.25$. Determine (i) smallest value of P required. to start the block moving up the incline (ii) corresponding value of β. [4]



   b) The 80N horizontal force P act on a bell crank as shown in figure below. (i) Replace P with an equivalent force-couple system. (ii) Find two vertical forces at C and D that are equivalent to the couple formed in (i). [2+3]

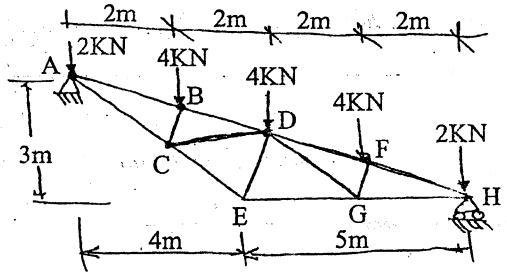


   c) Determine magnitude, direction and position of the resultant of forces acting on a block as shown in figure below. [7]

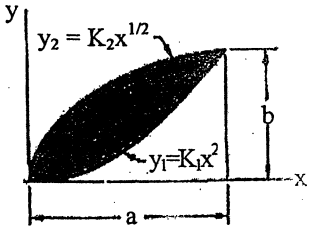


3. a) What is static equilibrium? What are the equations of static equilibrium in two dimension? Describe briefly the importance of them. [2+3+2]

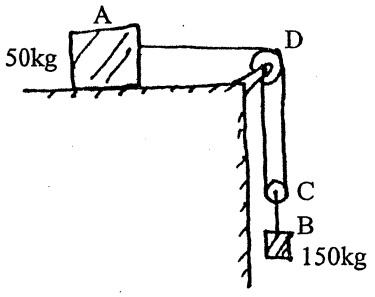
b) Determine the force in members DE, CD and AB for the inverted Howe Roof truss. State whether each member is in tension or compression. [8]



4. a) Determine the centroid of following enclosed (hatched) area with the curves $y_1 = K_1x^2$ and $y_2 = K_2x^{1/2}$, and also given that the extreme values of along X-axis and Y-axis are 'a' and 'b' respectively. Use direct integration method. [6]

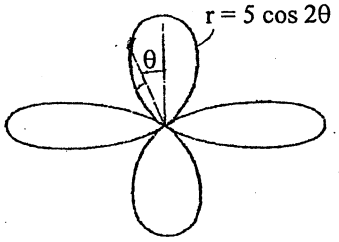


b) The two blocks shown in figure below start from rest. The horizontal plane and the pulley are frictionless and the mass of pulley is negligible. Determine the acceleration of each block and the tension in each cord. [10]

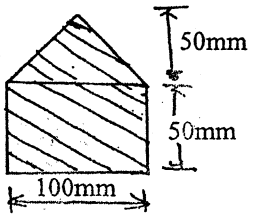


OR

b) The particle, having the position vector of $r = 5\cos(2\theta)$m, is travelled in a curvilinear path as shown in figure below, where $\theta = 3t^2$(rad/s). Find the velocity and acceleration of the motion of the particle at $\theta = 30°$. [10]



5. a) Determine moment of inertia about the centroidal x-axis of the shaded area shown in figure below. [6]



b) A projectile is fired from the edge of a 250m cliff with an initial velocity of 360m/s at an angle of 45° with the horizontal. Neglecting air resistance, find (i) The greatest elevation above the ground reached by the projectile (ii) The horizontal distance from the gun to the point where the projectile strikes the ground. [10]

***

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2067 Mangsir

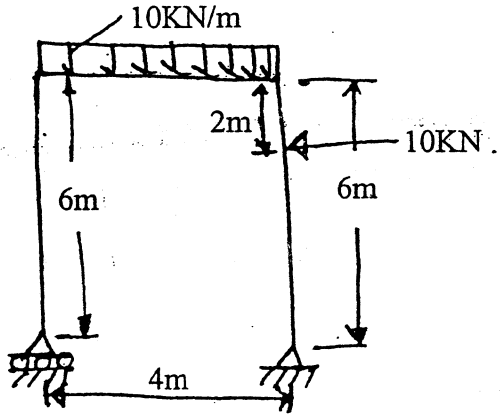
Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Applied Mechanics

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

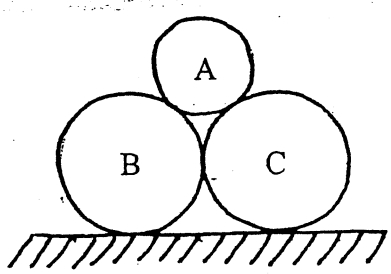
1. a) Write principle of transmissibility and define couples with suitable examples. [4]

   b) Draw axial force, shear force and bending moment diagram for the frame shown in figure below. [12]



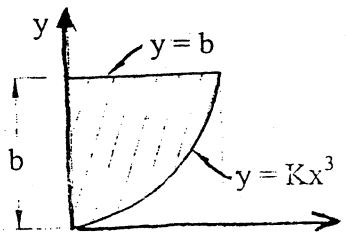
2. a) State and prove parallel axis-theorem for moment of inertia. [6]

   b) Find the contact forces of the three bodies as shown figure below. Body A has 20cm diameter and 60N weight and bodies B and C have 30cm diameter and 100N weight each. [10]



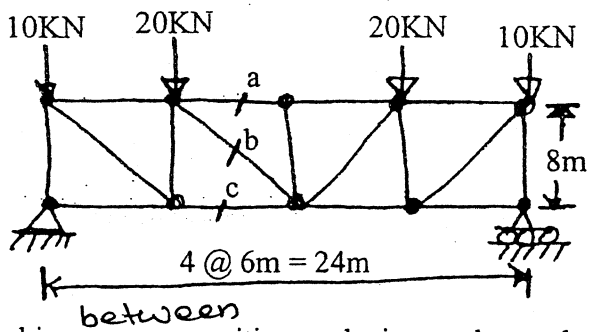
3. a) Define limiting friction, angle of friction and coefficient of static and dynamic friction. [6]

   b) Determine by direct integration the centroid of the shaded area as shown in figure below. [10]



4. a) Explain free body diagram with suitable examples. [6]

b) Find bar forces in members a, b and c in truss as indicated in figure below. Shown loads are vertical at the joints. [10]

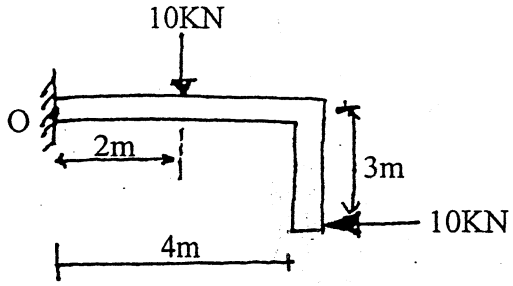


5. a) Explain relationship among position, velocity and acceleration of a particle in rectilinear motion. [6]

b) A ball is thrown vertically upward with a velocity of 25 m/sec. After 2 sec another ball is thrown with the same velocity. Find the height at which the two ball pass each other. [10]

6. a) State Newton's second law of motion and derive relation between linear momentum and force. [6]

b) Resolve the force system as shown in figure below into equivalent force-couple system about O. [10]



***

02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2065 Chaitra

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCE, B.Agri.	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Applied Mechanics II

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

1. a) "Graphical solutions are useful to simplify the problems related to dynamics". Justify this statement. [7]

   b) A nozzle discharges a stream of water in the direction as shown in fig-1 with an initial velocity of 30 m/sec. Determine the radius of curvature of the stream (i) as it leaves the nozzle, (ii) after 1.5 sec and (iii) at the maximum height of the stream. [9]

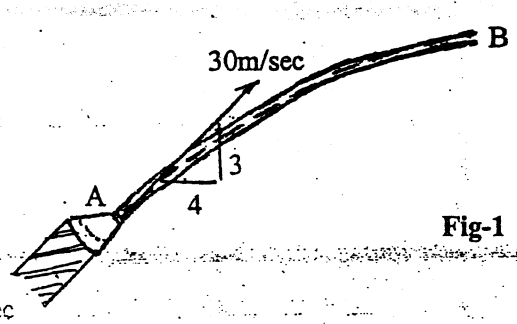


Fig-1

2. a) Obtain the expression for tangential and normal components of acceleration for a particle moving along a curve path. [7]

   b) A satellite is launched in a direction parallel to the surface of the earth with a velocity of 37,000 km/hr from an altitude of 500 km. Determine the altitude attained by it when it covers the angular distance equal to 15°. Also calculate the periodic time of the satellite. Take radius of earth, R = 6,370 km. [9]

3. a) Obtain the expression for trajectory of a particle moving under central force. [7]

   b) The magnitude and direction of the working of two identical smooth balls before they strike each other are as shown in fig-2. Assuming coefficient of restitution, e = 0.90, determine the magnitude and direction of the velocity of each ball after the impact. How much K.E. will be lost due to the impact? [9]

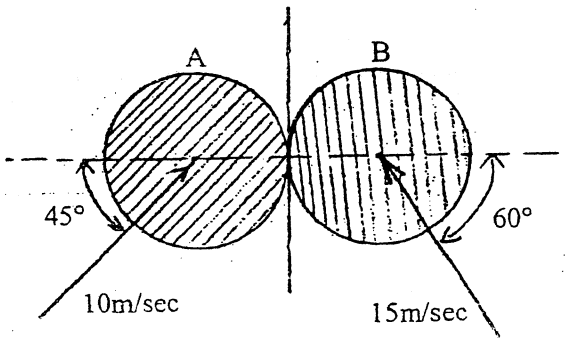


Fig-2

... for the expression for kinetic energy of system of particles while considering the centre of mass. [7]

b) A system of three masses is connected by massless rigid rods as shown in fig-3. If the three masses move 3m up the plane under the action of force $\vec{F}$, find the work done on the system. Assume F = 1.36 KN, $w_1 = w_2 = 2w_3 = 0.56$ KN, $\mu_d = 0.1$ and that the maximum frictional force is developed between each mass and the surface. [9]

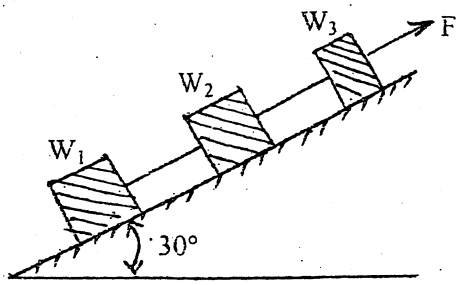


Fig-3

5. a) Explain what is general plane motion of a rigid body? Illustrate it suitable examples. [7]

b) The centre of the double gear has velocity of 2.4 m/sec and an acceleration of 6 m/sec^2 to the right as shown in fig-4. Recalling that lower rack is stationary, determine (i) the angular acceleration of the gear, (ii) the acceleration of points B, C and D of the gear. [9]

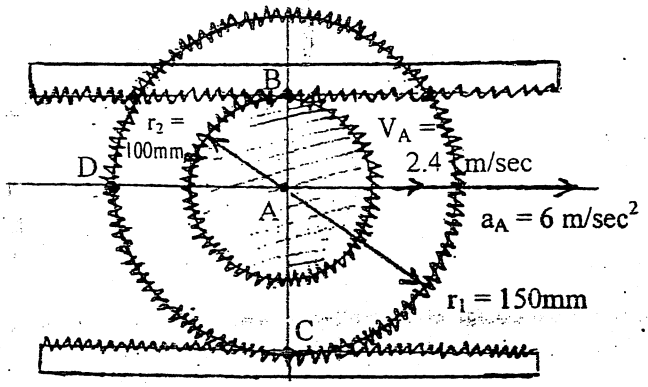


Fig-4

6. a) Explain what is free vibration of a rigid body? How the effective length of vibrating plate can be obtained while dealing with the free vibration of a rigid body? [7]

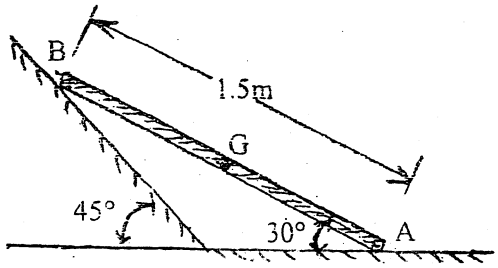


Fig-5

b) The extremities of a 1.5m rod of mass 30 kg moves freely with no friction along two straight tracks as shown in fig-5. If the rod is released with no initial velocity from the position shown, determine the angular acceleration of the rod. [9]

***