TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2076 Chaitra

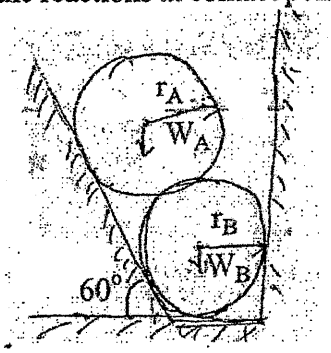
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BEI, BCT, BAM, BIE, BAG, BAR, BAS	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

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.*

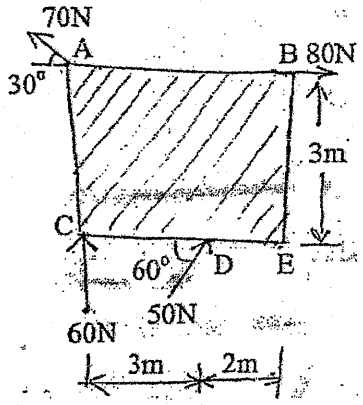
1. What are the equations of static equilibrium for 2D and 3D analysis of particle and rigid body? Define free body diagram with examples. [4+2]

2. Find the reactions at contact points of Ball A and Ball B. [7]

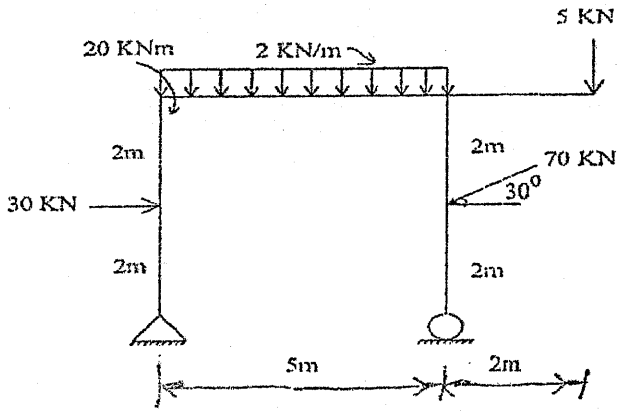


$W_A = 50N$, $W_B = 40N$
$r_A = 10cm$, $r_B = 8cm$

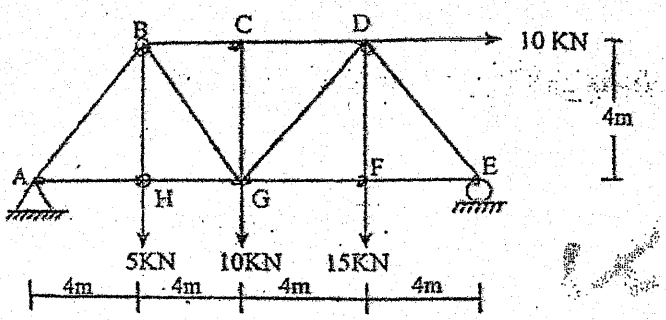
3. Define Applied Mechanics and concept of rigid & deformed body. Find the magnitude, direction and line of action of the resultant force as shown in figure below. [2+7]



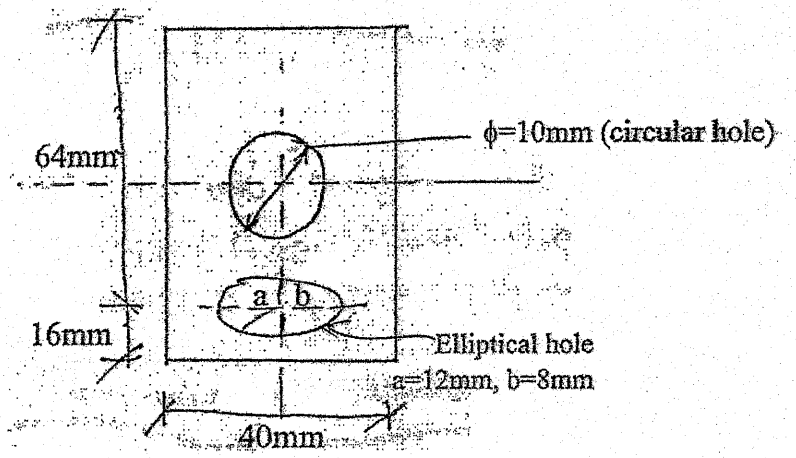
4. What do you mean by determinate and indeterminate structures? Draw AFD, SFD and BMD of the given frame loaded as shown in figure. Indicate the salient features if any. [2+12]



5. Calculate the force developed in member BC, BG, HG and GD of the truss loaded as shown in figure. Define determinate, stable, unstable structures. [5+2]



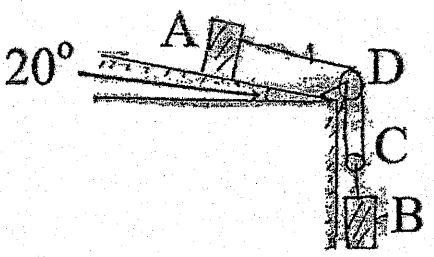
6. Find MOI about Centroidal XX and YY axes of the composite area. Define Centroid, Center of Gravity and axis of symmetry. [8+4]



7. What do you mean by friction? What are the laws of dry friction? Explain about static and kinetic friction. [1+2+2]

8. Define Kinematics and Kinetics of particle. A train runs at a speed of 120km/hr in a curved track of radius 900m the application of brake suddenly, causes the train to slow down at a constant rate. After 6 seconds the speed has been reduced to 72km/hr. Determine the acceleration immediately after the brakes is applied. [2+8]

9. Determine the acceleration of two block & tension in the wire when two blocks start form rest. There is no friction & no mass of pully. Coeff. of kinetic friction is 0.4 and m_A=100kg and m_B=300kg. What do you mean by impulse momentum principle and dynamic equilibrium? [7+3]



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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BAM, BIE, BAG, BAE, BAS	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Applied Mechanics *(CE 401)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt <u>All</u> questions.*
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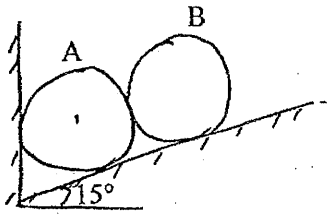
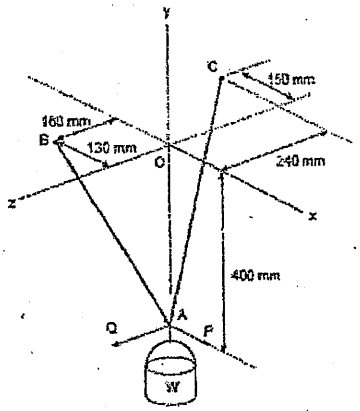
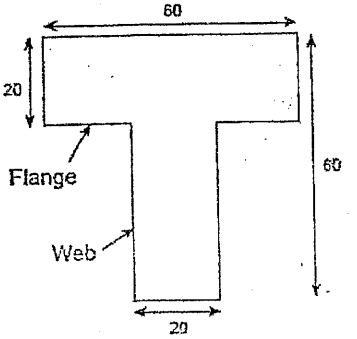
1. Differentiate between particle and rigid body. [2]
2. Determine the forces developed on the contact surfaces of the following body. Neglect the effect of friction. Given: Mass of body A = Mass of body B = 100 kg
   Dimensions of body A = Dimension of body B [9]



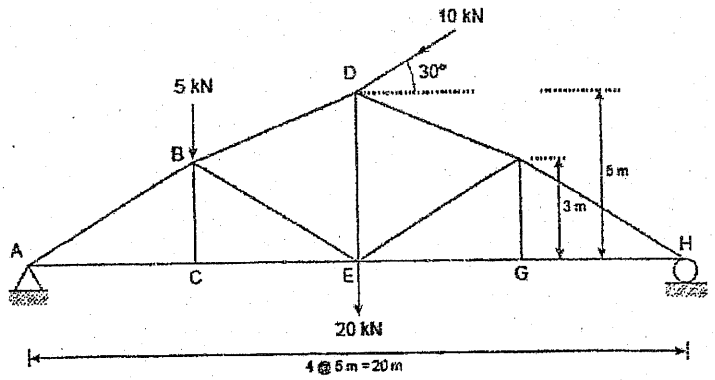
3. A container of weight W is suspended from ring A. Cable BAC passes through the ring and is attached to fixed supports at B and C. Two forces P = Pi and Q = Qk are applied to the ring to maintain the container in the position shown. Knowing that W = 376 N, determine P and Q. [7]



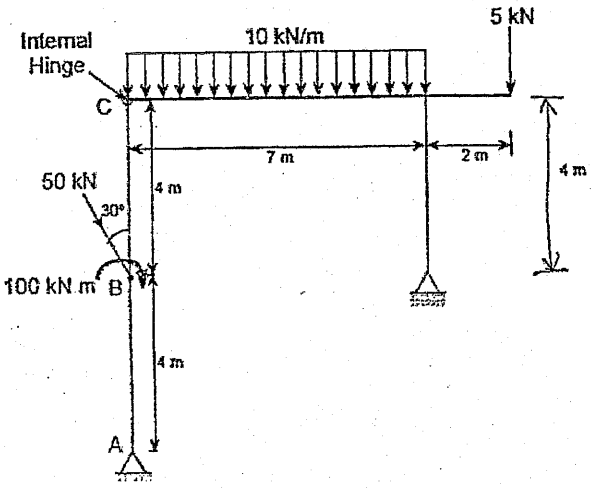
4. State and prove varignon's theorem. [4]
5. Define the angle of friction, impending motion and condition of tipping and sliding of block. [4]
6. Calculate the MOI about centroidal axes. All dimensions in cm. [10]



7. Determine the member force in AB, CE, BE, ED and BD for given truss. [10]



8. Draw AFD, SFD and BMD for the beam loaded as shown in figure. Also show the salient point (if any). [14]

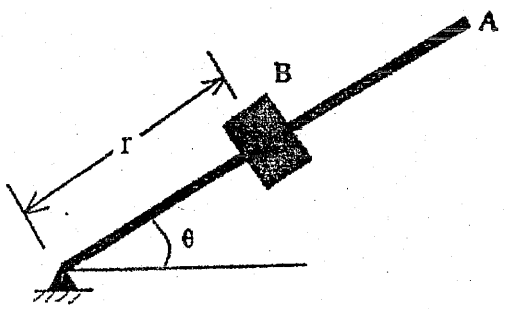


9. Define tangential and normal component of acceleration. The motion of particle is given by the relation $v_x = 2 \cos t$ and $v_y = \sin t$. It is known that initially both x and y coordinate are zero. Determine

   a) Total acceleration at the instant of 2 sec
   b) The equation of path [2+8]

10. What do you mean by the principle of impulse and momentum? 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 metres, t in seconds and θ in radians. Determine the radial and transverse components of the force exerted on the block when [2+8]

    a) $t = 0$ and
    b) $t = 0.5$ sec.



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Examination Control Division
2076 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
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Subject: - Applied Mechanics *(CE 401)*

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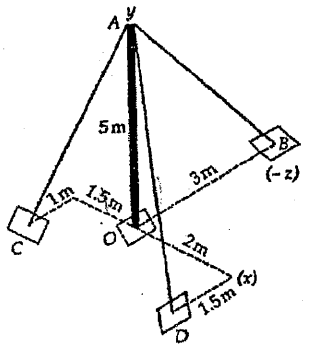
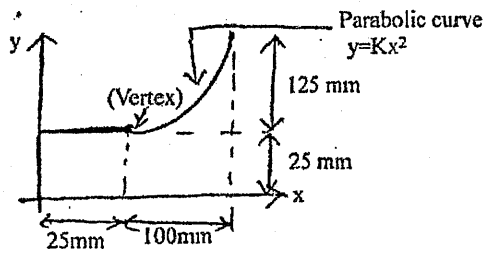
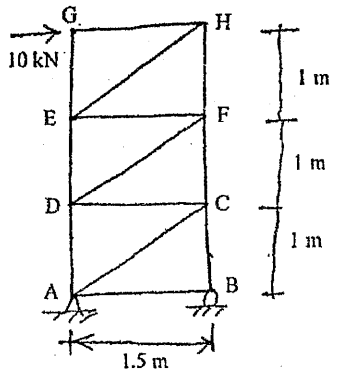
1. Define the terms Rigid body and particles. [2]
2. What do you understand by Free Body Diagram? Explain with sketches. What is the physical significance of static equilibrium? [4+4+2]
3. In the system shown in figure, a 5m long pole is held in vertical position by three guy wires AB, AC and AD. If the tension of 600 N is induced in AD and the resultant force at A is to be vertical, determine the tension in cables AB and AC. [8]



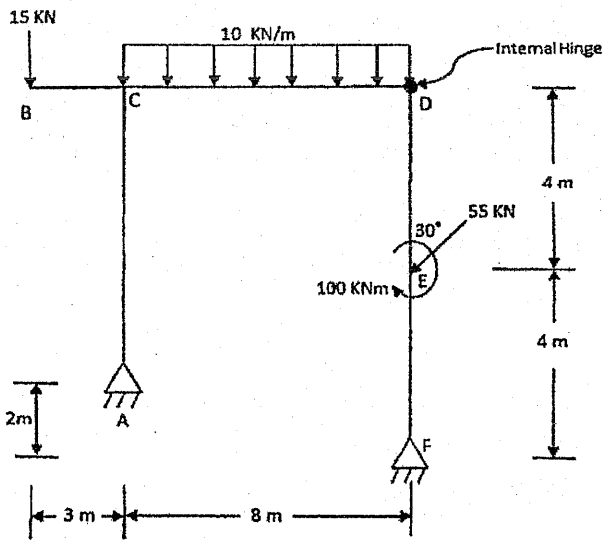
4. What are the characteristics of couple? [4]
5. What are the uses of friction in engineering field? [2]
6. Determine the centroid of the following composite figure. [10]



7. Analyze the following pin-jointed frame regarding the members AD, DC, DF, ED and FC, using Method of Moment. [10]



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

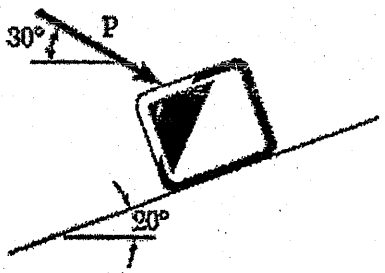


9. What do you mean by dependent motion, explain with example? [2+8]

A projectile is fired from the top of a 30 m high building with an initial velocity of 45 m/s at an angle of 35° with the horizontal. Neglecting air resistance, find

a) the greatest elevation above the ground,
b) the horizontal distance from the point of projection to the point where the projectile strikes the ground
c) the velocity with which it strikes

10. Define principle of impulse momentum for particle. A 20-kg package is at rest on an incline when a force P is applied to it. Determine the magnitude of P if 10 s is required for the package to travel 5 m up the incline. The kinetic coefficients of friction between the package and the incline is equal to 0.3. [2+8]



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11 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2074 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BAME, BIE, B.Agri, B. Arch.	Pass Marks	32
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Subject: - Applied Mechanics *(CE401)*

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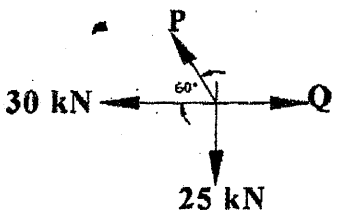
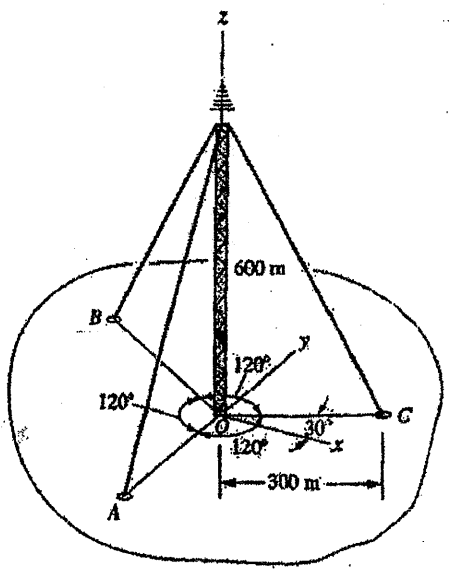
1. Explain in brief about fundamental concepts and principles of mechanics. [3]
2. What do you understand by Free Body Diagram? Explain with sketches. Also state Varigon's Theorem and prove it. [4+4]
3. Determine the values of the unknown forces P and Q for the system of forces to be in equilibrium. [4]

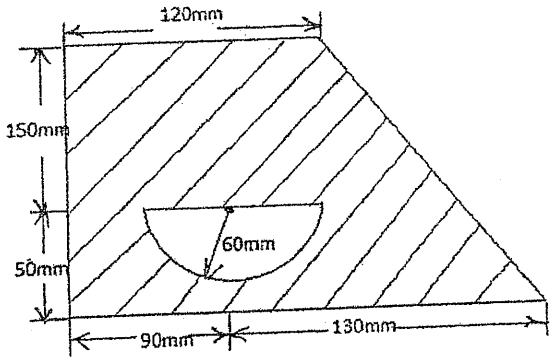


4. Three gay wires are used in the support system for a television transmission tower that is 600m tall. Wire A and B are tightened to a tension of 60KN, whereas wire C has only 30 KN of tension. What is the moment of wire forces about the base O of the tower? The Y axis is collinear with AO. [7]



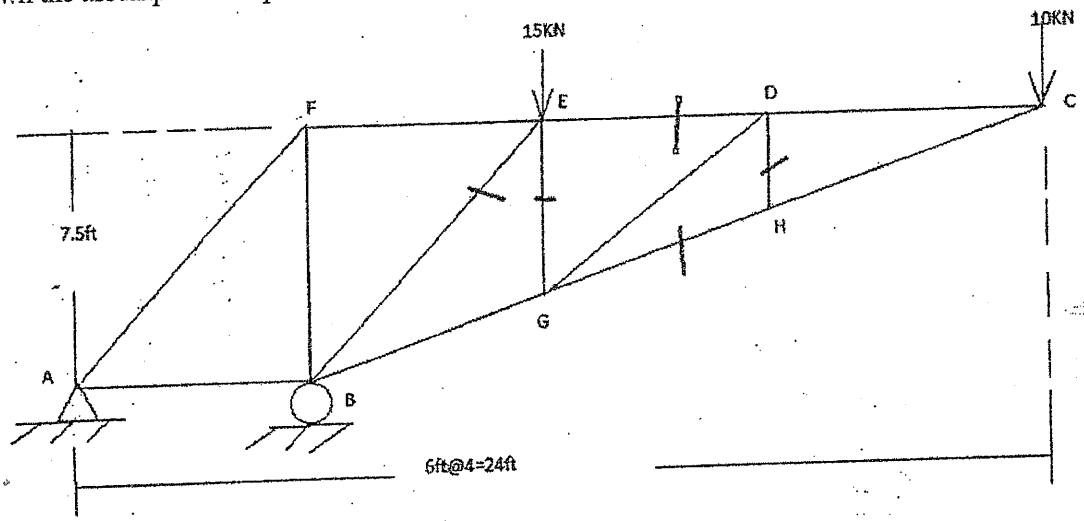
P.T.O

5. State and proof parallel axis theorem for moment if inertia. Determine moment if inertia about centroidal axes of the plane figure shown in below. [4+8]

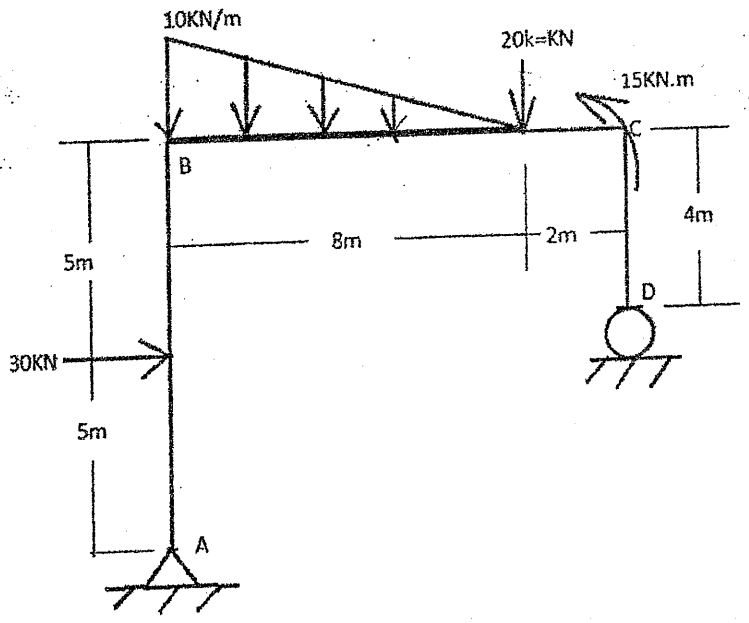


6. Define limiting friction, angle of friction and coefficient of the static and dynamic friction. [4]

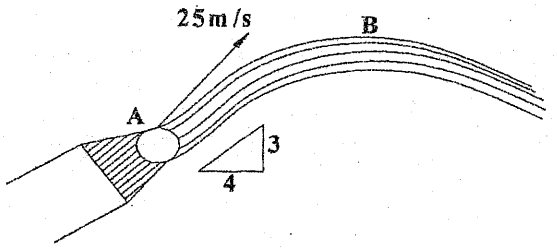
7. Find the member forces of indicated members of the truss shown in figure below. Write down the assumptions of perfect truss. [5+4]



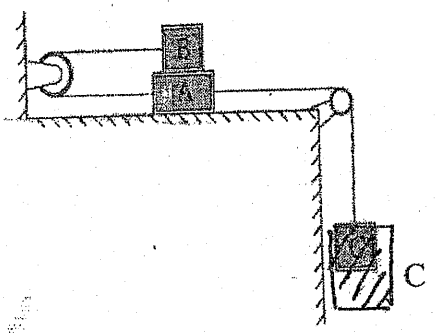
8. Draw axial forces, shear force and bending moment diagram and indicate the salient features if any for the given frame loaded as shown in figure below. [13]



9. Derive the relationship for normal and tangential components of acceleration for a particle moving in a curvilinear path. A nozzle discharge a stream of water in direction as shown in figure below with an initial velocity of 25m/sec. Determine the radius of curvature of the stream (i) as it leaves the nozzel (ii) at the maximum height of the stream. [4+6]



10. Determine the acceleration of block "A" for the system, if the system starts from rest. Coefficient of friction between block "A" and table is 0.25 and that between blocks "A" and "B" is 0.35. Where weight of block A, B and C are 100 N, 50 N and 500 N respectively. [10]



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2075 Ashwin

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Subject: - Applied Mechanics *(CE401)*

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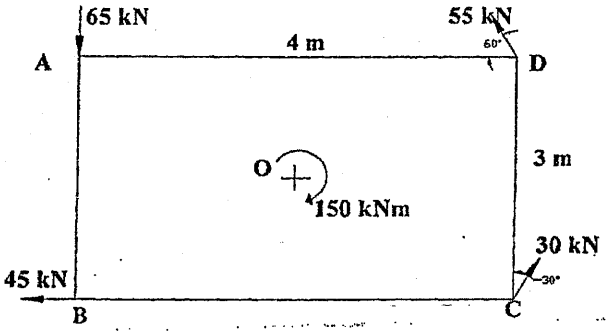
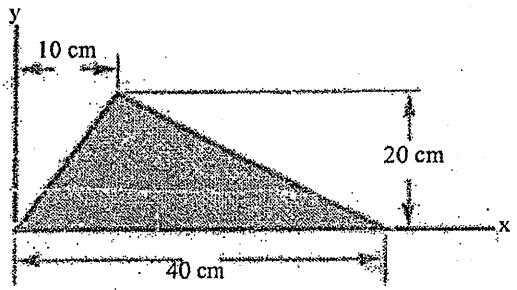
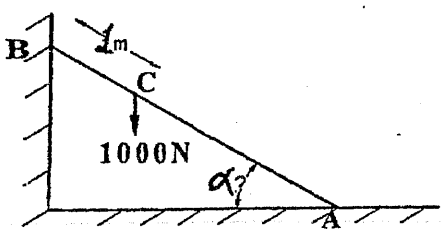
1. **Define rigid** body. Explain about the principles of Mechanics? [1+2]
2. **It is very** important to draw free body diagram for the analysis of problem in statics, **Explain.** Describe about the equations of static equilibrium for 2-D and 3-D analysis of a **particle and** a rigid body. [3+3]
3. **State principle** of transmissibility with its limitations. Explain, couple is a free vector. [2+2]
4. **Determine** the magnitude; direction and position with respect to center 'O' of the resultant **of the forces** acting on the resultant plate ABCD as shown in the figure below. [8]



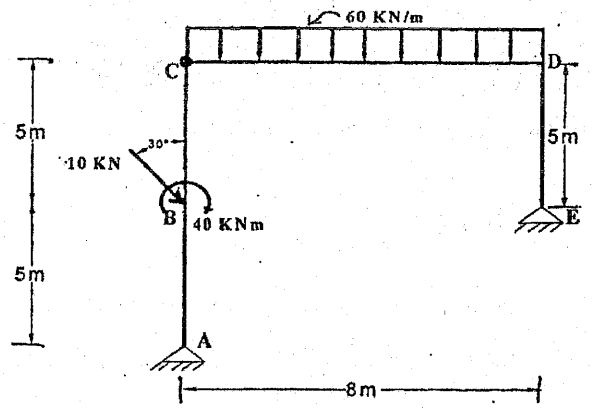
5. **Define** centroid, centre of gravity and axis of symmetry. Find I_{xx} and I_{yy} for the given **triangle about** it's centroidal axes. [3+9]



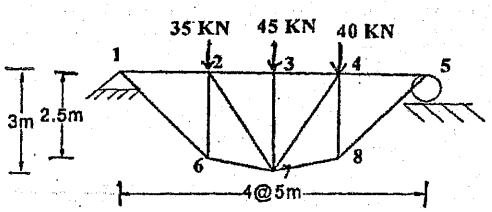
6. A ladder shown in figure is 4m long and is supported by a horizontal floor and a vertical wall. The co-efficient of friction at the wall is 0.3 and at the floor is 0.45. The weight of the ladder is 300N. The ladder supports a vertical load of 1000N at C. Determine the reactions at A, B and C and compute the least value of α at which ladder may be placed without slipping to right. [5]



7. Draw AFD, SFD and BMD for the following structure. Also show salient features, if any. [13]



8. Determine the member forces in the members 26,23,27,67,37. How can we check the determinancy and stability of the plane truss? Explain with examples. [5+4]



9. Define average and instantaneous velocity. Two cars A and E travel along the same straight route. At any time t their distance x_a and x_e from the starting point are given by: [2+8]

$x_a = 2.5t+1.2t^2$

$x_e = 3t^2-0.25t^3$

Where t in seconds and x_a and x_e are in meters.

a) Which car is ahead just after they leave the straight point?
b) At what time are the cars at the same point?
c) At what time is the distance between A and E neither increasing nor decreasing?
d) At what time do A and E have the same acceleration?

10. The resultant of the force applied on a 3kg particle is given by the relation; $\vec{F} = \left(12t\,\hat{i} - 24t^2\,\hat{j} - 40t^3\,\hat{k}\right)$N. The particle is initially at origin at rest. Determine the y-component of acceleration, velocity and position at the instant of 3 sec. What do you mean by dynamic equilibrium for a particle? [7+3]

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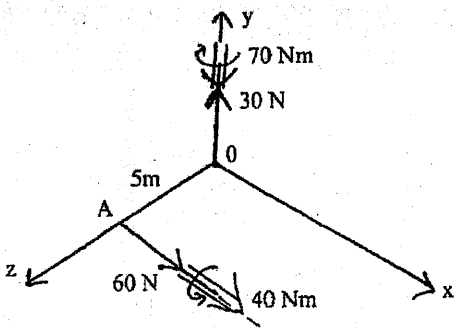
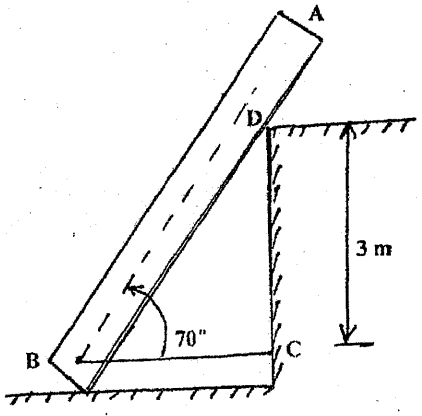
1. Define Equilibrium and its essence. What are the equations of static equilibrium for 2D and 3D analysis of particle and Rigid Body? [6]
2. Replace the two wrenches as shown in figure below by a single equivalent wrench and determine the point where its axis intersects the XZ plane. [8]

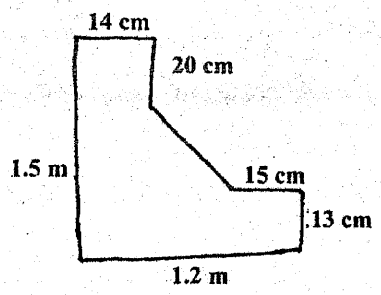


3. Determine the tension in the cable BC which holds a part AB of length 4m length from sliding. The past has a mass of 10 kg. Assume all the contact surfaces are smooth. [6]



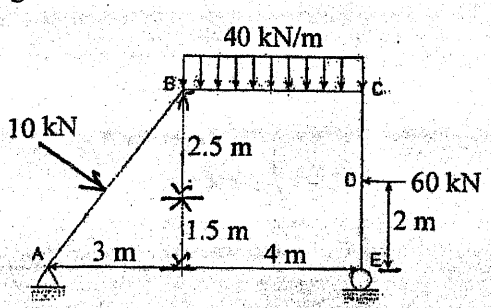
4. Illustrates the conditions of no friction, no motion, impending motion and motion with necessary sketches. How can you assure condition of sliding or overturning of the block? [3+2]

5. Determine moment of inertia about centroidal XX and XY axes of the plane figure shown in figure below. Define centroid, centre of gravity and axes of symmetry. [9+3]

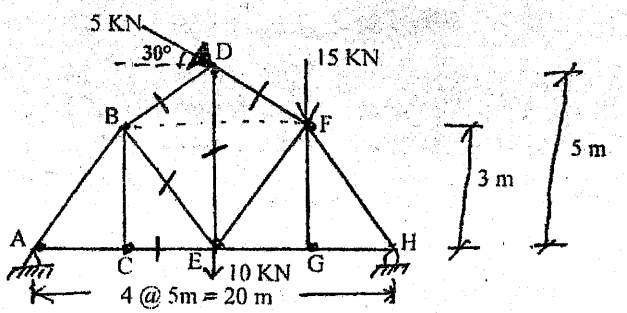


6. a) How can you check the determinacy and stability of the frame? Explain with examples. [3]

   b) Calculate and draw the axial force, shear force and bending moment diagram; with its salient features for the given frame. [12]



7. Find the member force in the indicated members of the truss shown below. [8]



8. Explain about relative motion of particle with example. A projectile is fired from position A with an initial velocity of 200 m/sec at a target B on right located 500m above from the position A. The horizontal distance between A and B is 3000 m. Determine the firing angle neglecting air resistance. [2+8]

9. The resultant external force acting on a 2 kg particle in space is $\vec{F} = \left(12t\,\hat{i} - 24t^2\,\hat{j} - 40t^3\,\hat{k}\right)$ N, where t is the time measured in seconds. The particle is at rest at the origin when t = 0. Determine the acceleration component a_y, the velocity component V_y, and the coordinate y of the particle at the instant of 4 sec. What do you mean by principle of impulse and momentum? [8+2]

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21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2073 Chaitra

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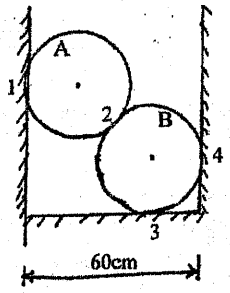
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BAME, BCT, BIE, B.Agri., B.Arch.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Applied Mechanics *(CE401)*

- ✓ 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.*

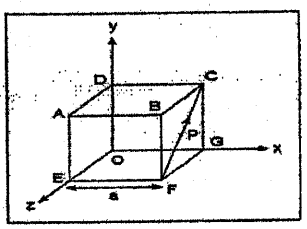
1. Enlist the fundamental principles of Applied Mechanics. Define rigid body. [3+1]

2. Two smooth spheres of weight 200N each are kept inside a channel shown in figure. The radius of each sphere is 20cm. Determine reactions at contact surfaces. [6]

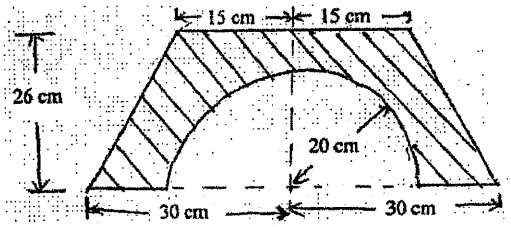


3. Define couple and show that couple is a free vector. How will you reduce a system of forces to a wrench? A cube of side a = 4m is acted upon by a force P = 20kN as shown. Determine the moment of force P. [2+3+6]

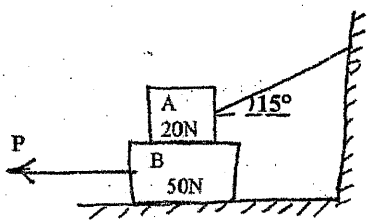
   a) about A
   b) about edge AB
   c) about diagonal AG of cube



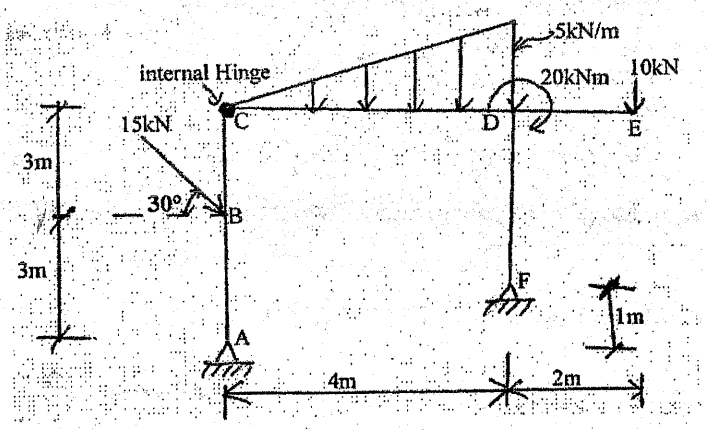
4. State parallel axis theorem and radius of gyration. Calculate the moment of inertia of the given shaded area about it's centroidal axes. [3+9]



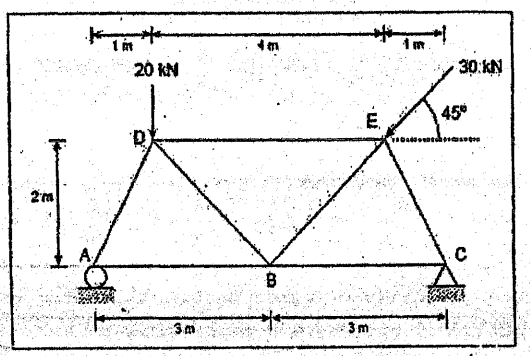
5. Determine the force required for just motion of the block B shown in figure below. Take $\mu_s = 0.25$ for all surfaces. [5]



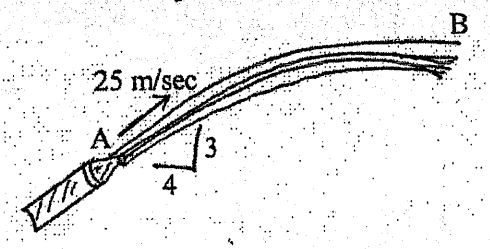
6. Draw the axial force, shear force and bending moment diagram for the given frame shown in figure below. Also show the salient features. [14]



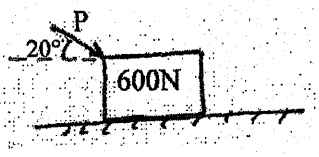
7. Determine the force developed in the members of the given truss. What are the assumptions of perfect truss? [6+2]



8. A nozzle discharges a stream of water in the direction shown below with an initial velocity of 25 m/sec. Determine the radius of curvature of the stream (a) as it leaves the nozzle, (b) at the maximum height of the stream. What do you mean by dependent motion of particle? Explain with suitable example. [8+2]



9. A 600N block rests on a horizontal plane. Find the magnitude of P required to produce the block an acceleration of $2m/s^2$ to the right. The coefficient of friction is 0.25. What do you mean by dynamic equilibrium? [8+2]



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21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

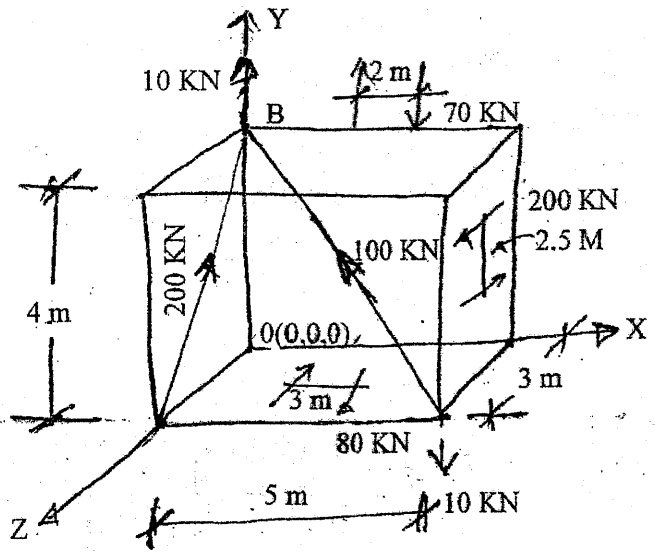
2073 Shrawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BAME, BIE, B. Agri. B. Arch.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

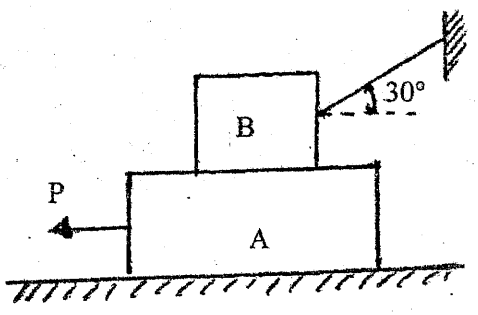
Subject: - Applied Mechanics *(CE401)*

- ✓ 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.*

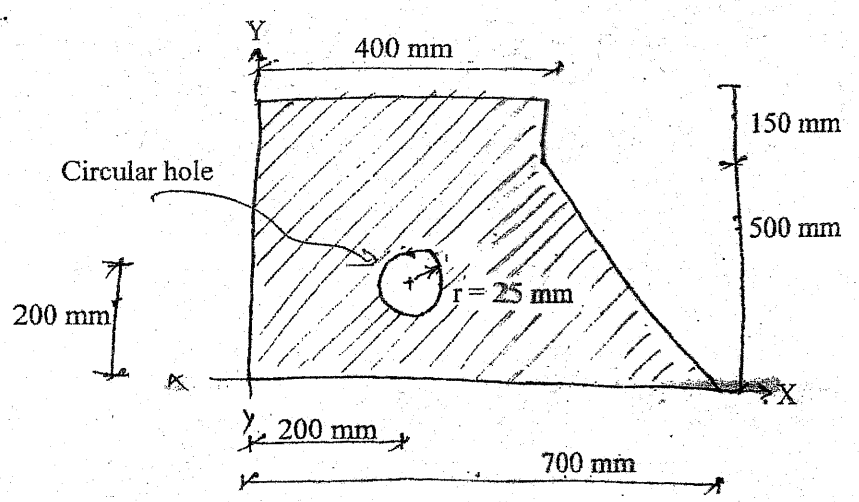
1. What do you understand by a Rigid Body? Why it is necessary to assume a body as 'perfectly rigid' for your present study? [3]
2. Write down the concept of rigid bodies and deformable bodies. What is Free Body Diagram and why it is used during analysis of structure? [8]
3. Determine the resultant force and moment of the following system about the point 'O' as shown in figure below. [10]



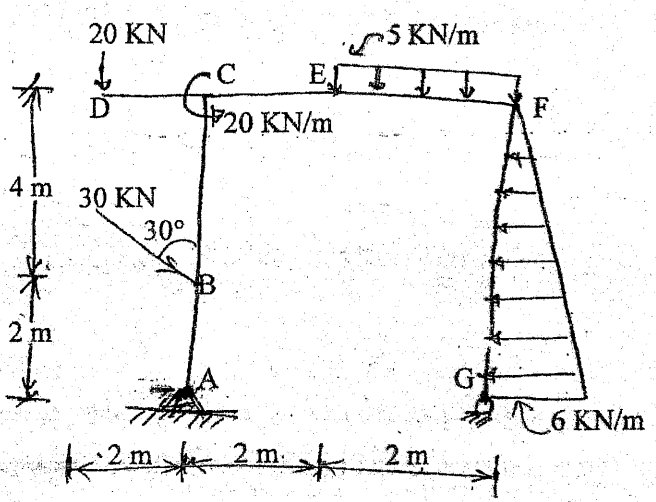
4. Two blocks A and B of 40 N and 20 N respectively are in equilibrium position as shown in figure below. Calculate the force P required to move block A. Take $\mu = 0.3$ for all surface. [5]



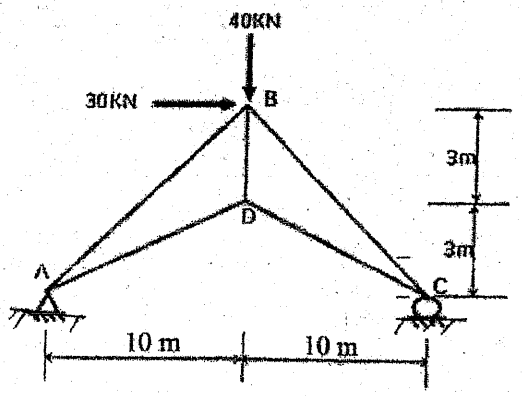
5. Calculate the moment of inertia of the composite area as shown in figure about it's centrorial axes. Define centroid, center of gravity, axis of symmetry and radius of gyration. [8+4]



6. Draw AFD, SFD and BMD for the given frame and loading. Indicate salient points, if any. [14]



7. Write down the ideal assumptions of Truss. Calculate the member forces in all members of the truss loaded as shown in figure below by using suitable method. [2+6]



8. Define the uniformly rectilinear motion and the uniformly accelerated rectilinear motion. A projectile is fired with an initial velocity of 244m/s at a target B located 610m above the gun A and at a horizontal distance of 3658m. Neglect air resistance, determine the value of the firing angle α. [2+8]
9. The motion of a 1000 gm block B in a horizontal plane is defined by radius, $r = 2(1+\cos 2\pi t)$ and $\theta = 2\pi t$ where 'r' is expressed in meters and t in seconds. Determine the radial and transverse components of the force exerted on the block B at 0.8 sec. Explain about principle of impulse and momentum. [8+2]

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Morning. 081

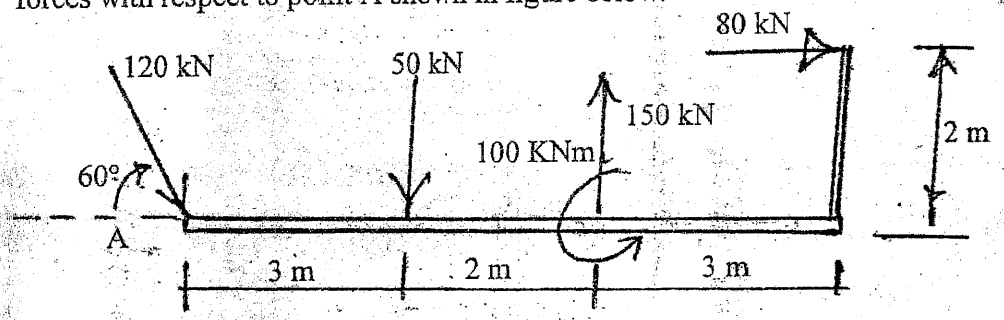
21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B. Agri., B.Arch.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

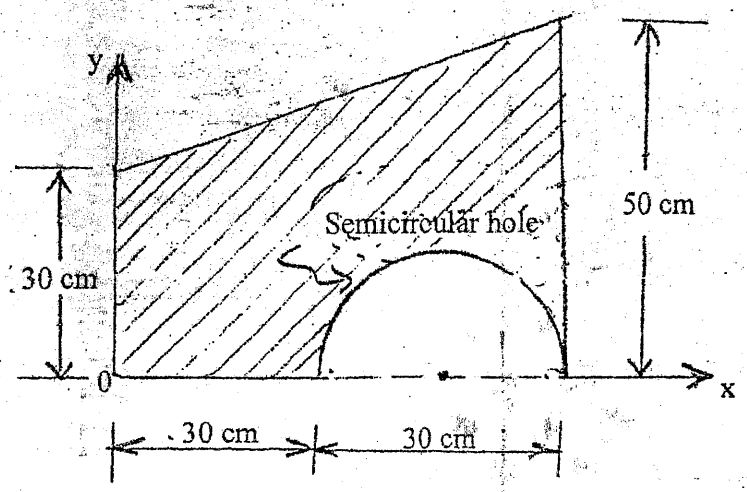
Subject: - Applied Mechanics *(CE401)*

- ✓ 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 physical meaning of equilibrium and its application in structural engineering. [4]
2. a) Differentiate between rigid body and deformable body. Also explain the free body diagram. [2+2]
   b) Determine the magnitude, direction and position of the resultant of the system of forces with respect to point A shown in figure below. [12]



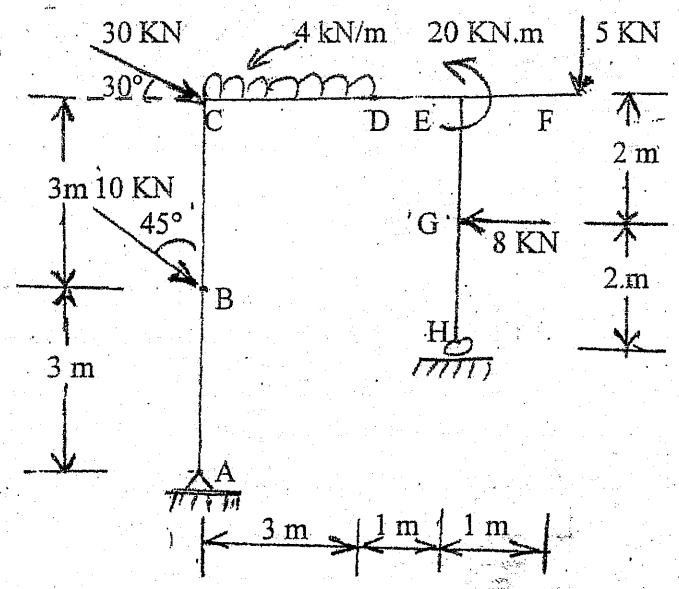
3. State and prove the parallel axis theorem for moment of inertia. Determine the moment of inertia of the given composite area as shown in figure below about it's centroidal X-X axis. [4+8]



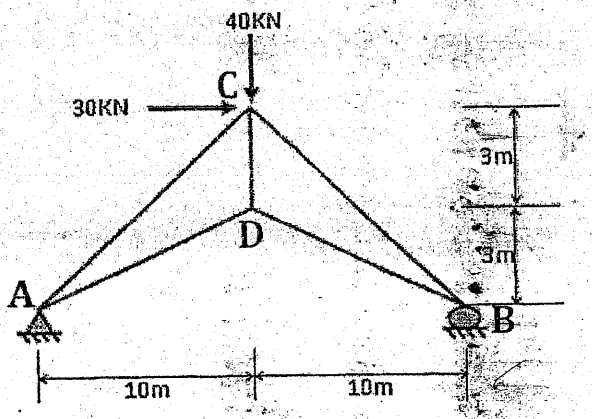
4. Define friction force and explain condition of tipping and sliding of a block. [1+3]

03

5. Draw AFD, SFD and BMD of the given frame loaded as shown in figure below. Indicate also the salient features if any. [14]



6. Write down the ideal assumption of truss. Calculate the force developed in all members of the truss loaded as shown in figure by using suitable methods. [2+8]



7. What do you mean by dependent motion of particles? Illustrate it with suitable example. A particle starting from origin is subjected to acceleration such that $a_x = -2m/sec^2$ and $a_y = -5\ m/sec^2$. The initial velocity is 60 m/sec directed at a slope of 30° w.r.t. horizontal. Compute the radius of curvature at the end of 3 sec. Also determine its position at the end of 3 sec. [3+7]

8. Show that, "rate of change of angular momentum about a point is equal to moment of the force about the same point." The resultant external force acting on a 5 kg particle in space is $\vec{F} = (12t\hat{i} - 24t^2\hat{j} + 40t^3\hat{k})$ N, where t is seconds. The particle is initially at rest at origin. Determine the x component of acceleration, velocity and position at the instant of 5 sec. [4+6]

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21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

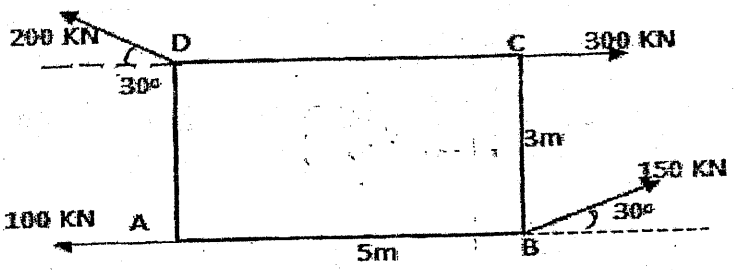
2072 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BAME, BIE, B. Agri. B. Arch.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

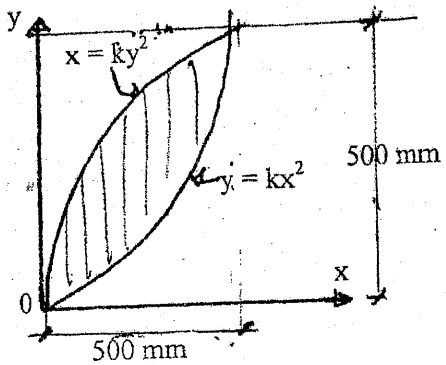
Subject: - Applied Mechanics *(CE401)*

- ✓ 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.*

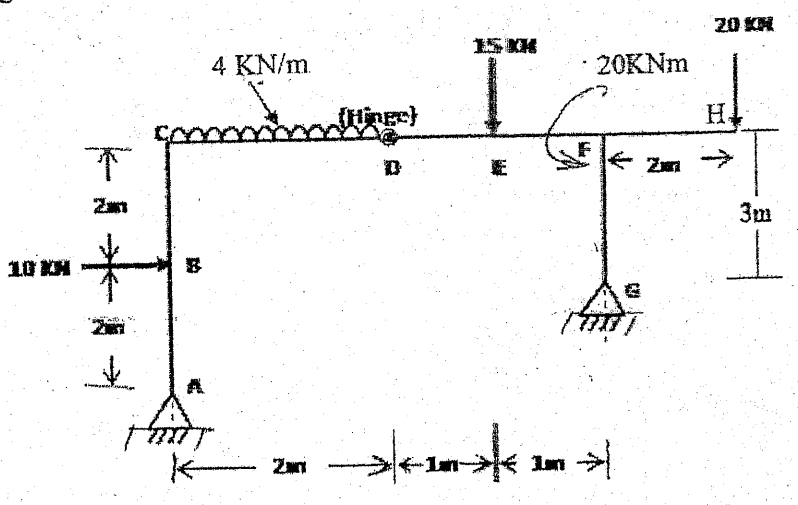
1. Describe about the fundamental principle of applied mechanics. [3]
2. Write down the steps to be considered while drawing a free body diagram. Illustrate equilibrium condition of particle and rigid body in two and three dimensional analysis. [8]
3. Find the magnitude, direction and Position of resultant force of the following system as shown in figure. [10]



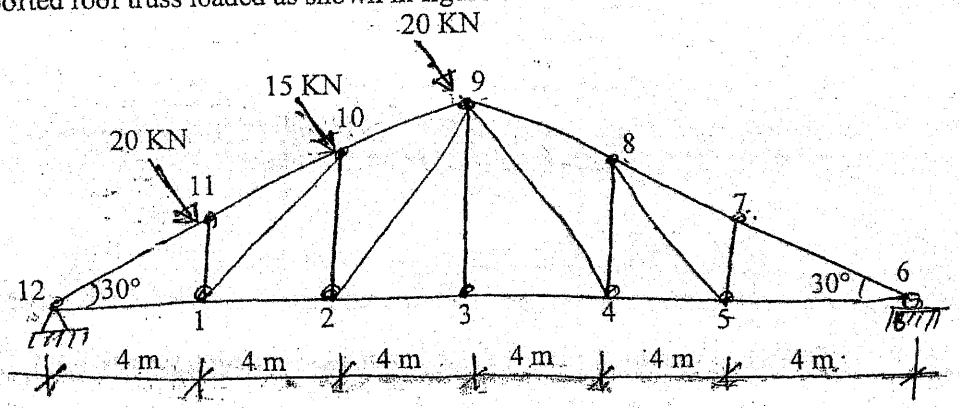
4. Describe the condition illustrating No friction, No motion, Impending motion and motion with proper sketches. How can we assure condition of sliding and over turning of a block? Explain with suitable figure. [3+2]
5. State and prove parallel axes theorem for moment of inertia. Determine centroid of the given plane in figure below. [4+8]



6. Draw the Axial Force, Shear Force and Bending Moment diagram for the given frame shown in figure below. Also show the salient features. [14]



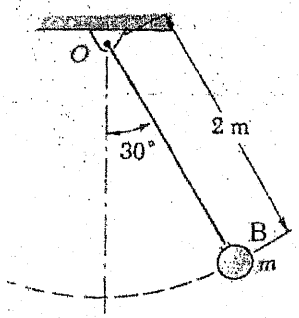
7. Find the member force of members 1-11, 1-10, 1-2 ,2-10 and 10-11 of the simply supported roof truss loaded as shown in figure below. [8]



8. A ball is tossed with velocity of 10 m/s directed vertically upward from a window located 20 m above the ground. Knowing that the acceleration of the ball is constant and equal to 9.81 m/s^2 downward, determine: [8+2]

   i) The velocity 'v' and the elevation 'y' of the ball above the ground at any time 't'.
   ii) The highest elevation reached by the ball and the corresponding value of 't'.
   iii) The time when the ball will hit the ground and the corresponding velocity.
   What do you mean by dependent motion? Explain with example.

9. Define the linear momentum and angular momentum. Find the velocity and the acceleration of the bob in the given position. The bob of a 2 m pendulum describes an arc of a circle in a vertical plane, which is shown in figure below. If the tension in the cord is 2.5 times the weight of the bob for the position shown. [2+8]



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140

21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

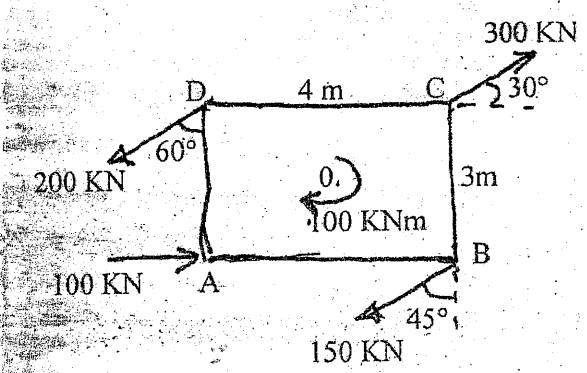
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri, B. Arch.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Applied Mechanics *(CE401)*

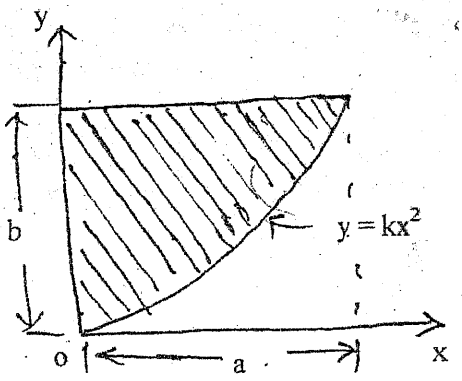
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

BCT, BEX, BEL

1. Explain about the principles of Applied Mechanics. Why it is necessary to assume a solid body as 'perfectly rigid' for the study of statics? [3+3]
2. Define Free Body Diagram with example and explain about equations of static equilibrium for 2-D and 3-D analysis of a particle and a rigid body. [2+4]
3. Describe the principle of transmissibility. Determine the magnitude, direction and position with respect to center 'O' of the resultant of the forces acting on the rectangular plate ABCD as shown in figure below. [3+8]

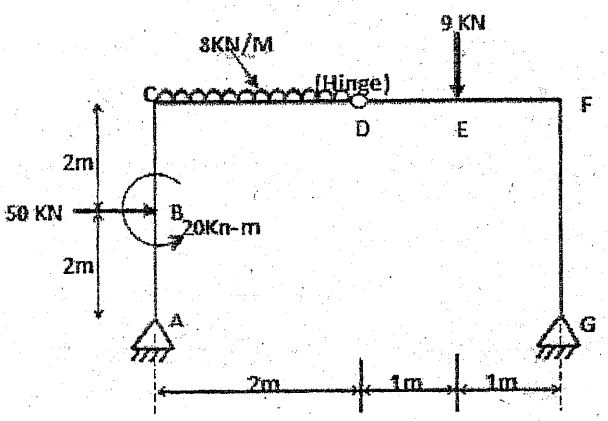


4. Explain radius of gyration. Determine the centroid of the shaded area shown in figure below, Using direct integration method. [3+8]

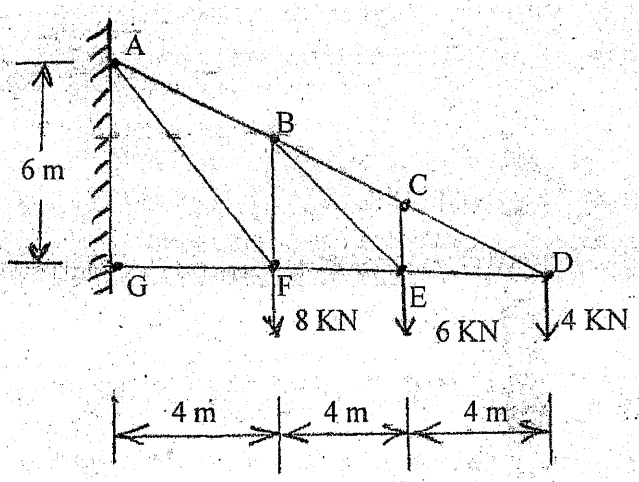


5. What are the advantages and disadvantages of friction? Also explain the working principles of high tension friction grip bots. [2+2]

6. A frame is loaded as shown in figure below. Draw the AFD, SFD and BMD and also show the salient features of each diagram. [14]



7. Describe the use of trusses in engineering. Determine the force developed in BC, BE, EF, AB, AF and BF members of cantilever truss loaded as shown in figure below. [2+6]



8. a) What is uniformly accelerated rectilinear motion? Also define the angular momentum and its rate of change. [2+2]

   b) Motion of a particle is defined by a relation $x = \frac{t^3}{3} - 3t^2 + 8t + 15$. Determine the position of particle when velocity is 2.5m/sec. Also determine the position of particle when acceleration is 3.6 m/sec^2. [6]

9. a) What are tangential and normal components of velocity? Explain with examples. [4]

   b) A particle moves along a curved path defined by $r = 4\theta^2$ and $\theta = \frac{t^2}{2}$ where r is in meters and t in seconds. Determine the velocity and acceleration of the particle when $\theta = 80°$. [6]

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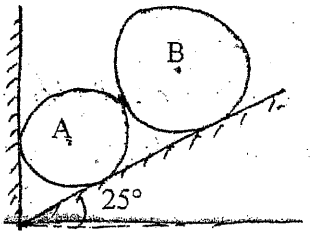
21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE,B.Agri,B.Arch	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

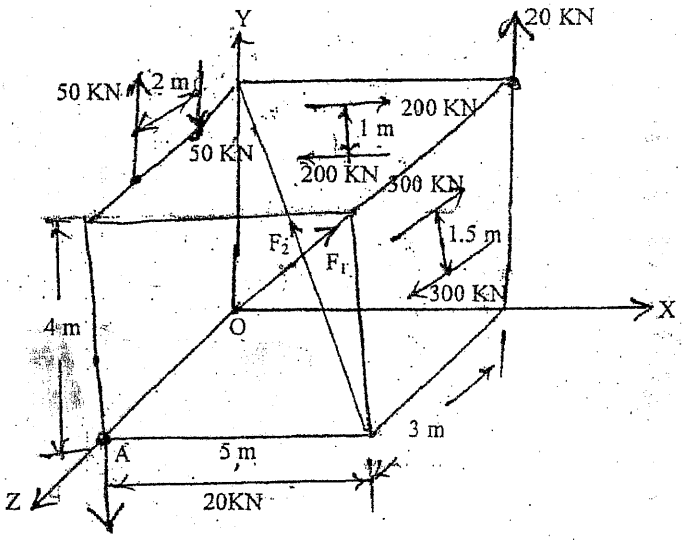
Subject: - Applied Mechanics *(CE401)*

- ✓ 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.*

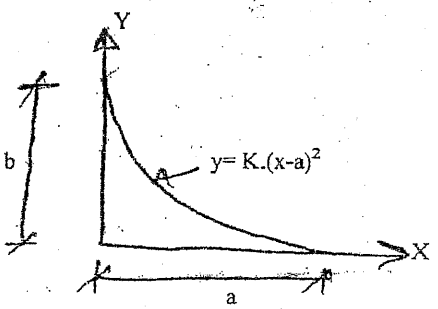
1. Why it is necessary to assume a solid body as a perfectly rigid in the Engineering study. [3]
2. What is free body diagram? The cylinder A and B rest in an inclined surface which makes an angle of 25° with horizontal as shown in figure below. Determine reaction at contact points. Take: [2+6]
   Weight of cylinder A (W_A) = 100 N
   Weight of cylinder B (W_B) = 200 N
   Diameter of cylinder A (r_A) = 60 mm
   Diameter of cylinder B (r_B) = 90



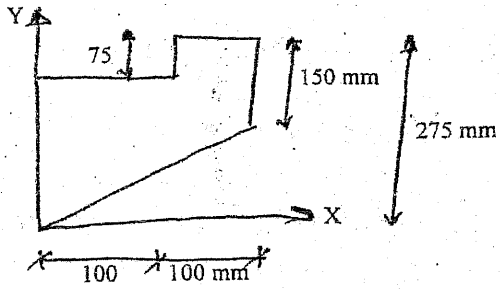
3. Find the resultant of force couple system at point 'A' as shown in figure below. Take F_1 = 100 KN, F_2 = 300 KN. Define a couple and show that couple is a free vector. [8+3]



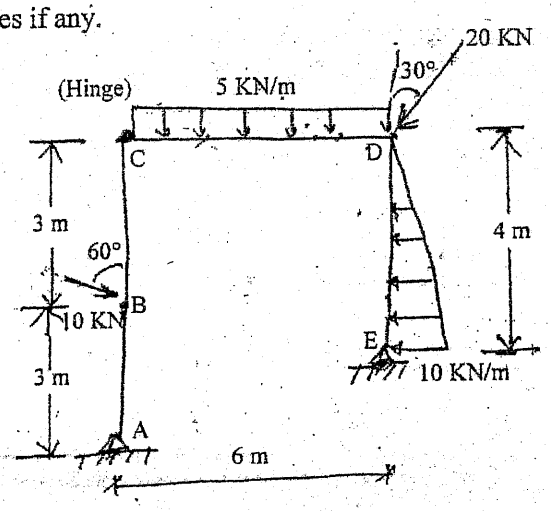
4. Determine by direct integration method, the centroid of the area shown in figure below: [5]



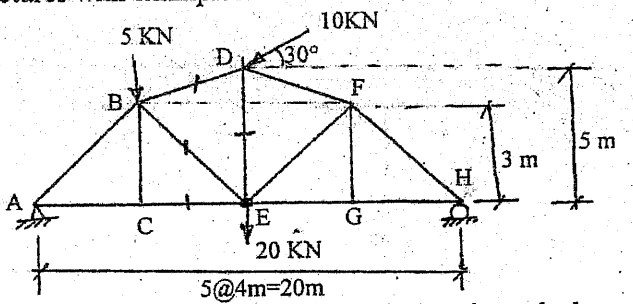
5. Calculate the moment of inertia of the composite area about Y-axis. [6]



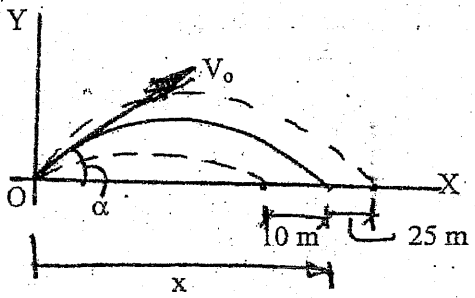
6. State laws of dry friction. How can we assume the condition of overturning and sliding of a block? Explain with suitable example. [2+3]
7. Draw axial force shear force and bending moment diagram for the given frame. Also indicate salient features if any. [14]



8. Find the member forces in CE, BE, BD and DE for the given truss. Define stability and determinacy of structures with examples. [5+3]



9. A projectile is aimed at a marked on the horizontal plan through the point of projection and falls 10 shorts when the angle of projection is 15° while overshoots the mark by 25 m when the inclination is 40°. Calculate the distance of the target and required angle of projection, if the velocity remains constant. Neglecting air resistance. Define dependent motion of particle with example. [8+2]



10. Define the dynamic equilibrium. Determine the velocity and acceleration of the particle, if it 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. Given that the instant angle is $\theta = \pi/2$. [2+8]

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BEX, BEL, BCT - I/I

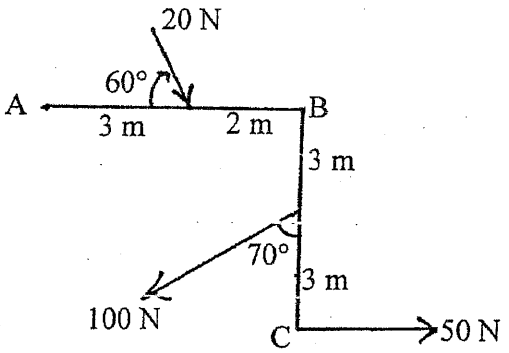
21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Ashad

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri, B.Arch	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

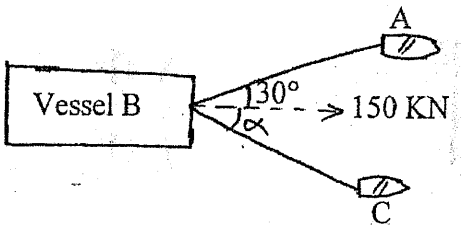
Subject: - Applied Mechanics *(CE401)*

- ✓ 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.*

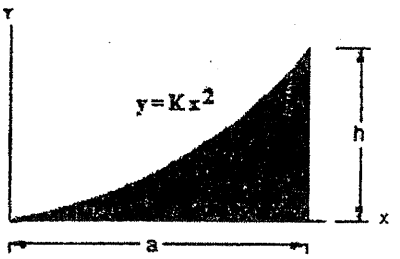
1. Describe the scope of applied mechanics in engineering. [3]
2. What is the physical meaning of equilibrium and why it is important in structure? How can we draw good Free Body Diagram? Explain with suitable examples. [4+4]
3. Determine magnitude, direction and line of action of the resultant of forces acting in the system shown in figure below. [8]



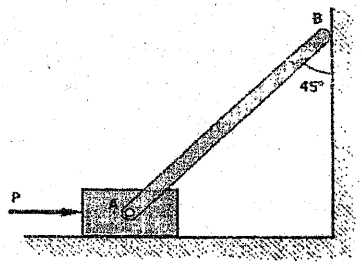
4. A commercial vessel is being pulled into larbour for unloading by two tugboats as shown in figure knowing the vessel requires 150 KN along its axis to move it steadily. Compute the tensions in rope AB and BC when $\alpha = 40°$. [4]



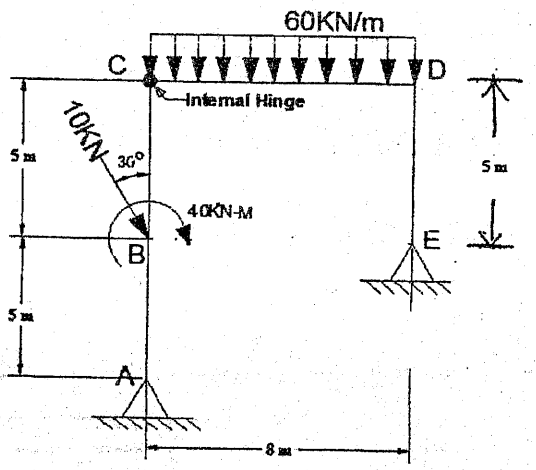
5. State and prove parallel axis theorem. Also determine the centroidal X and Y coordinate of the hatched area. [3+8]



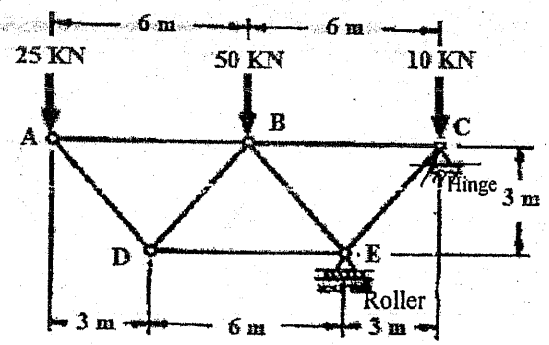
6. A uniform bar AB, weighing 424 N, is fastened by a frictionless pin to a block weighing 200 N as shown in figure. At the vertical wall, $\mu = 0.268$ while under the block, $\mu = 0.20$. Determine the force P needed to start motion to the right. [5]



7. Draw the Axial Force, Shear force and Bending Moment diagram of the given frame. Also show the salient features if any. [13]

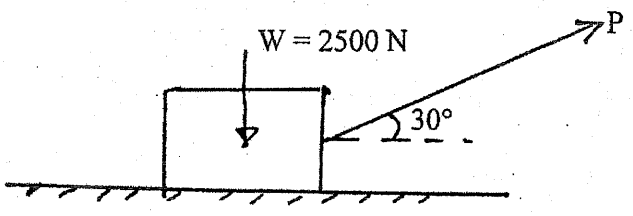


8. Determine the member forces for given truss loaded as shown in figure below. [8]



9. The motion of a 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 sec. [10]
   a) Determine the velocity and acceleration when t = 1 sec
   b) Find the nature of path of the particle

10. Determine the magnitude of force P required to give the block an acceleration of 10 m/s^2. Coefficient of friction between the block and the floor is 0.25. [10]



21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

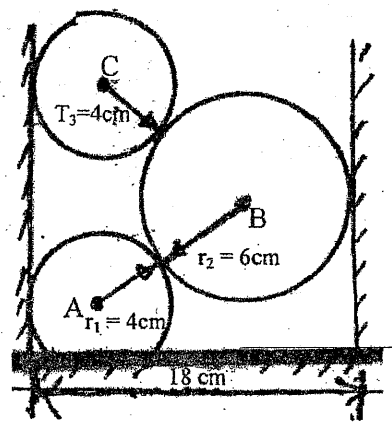
2070 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE B.Agri, B.Arch	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

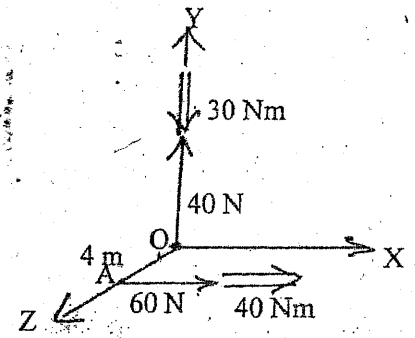
Subject: - Applied Mechanics *(CE401)*

- ✓ 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.*

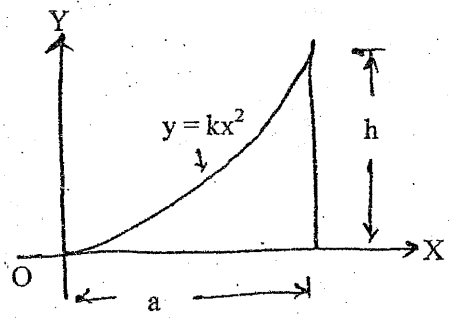
1. Describe the scope and importance of applied mechanics in engineering study. Define free body diagram with examples. [2+2]
2. Determine the reactions at the contact points, if three cylinders are piled in a rectangular ditch as shown in figure. Given that the weight of the cylinders are: $W_A = 2$ KN $W_B = 5$ KN $W_C = 3$ KN [8]



3. How can you reduce a force into a force and couple? Obtain the resultant of the two pairs of wrench shown in the figure. Indicate it's line of action. [3+8]

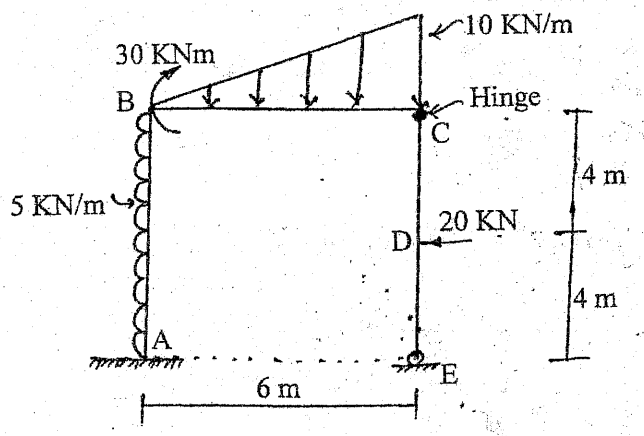


4. Determine centroid of the given plane figure. State and prove parallel axes theorem for moment of inertia. Define centroid and center of gravity. [7+3+2]

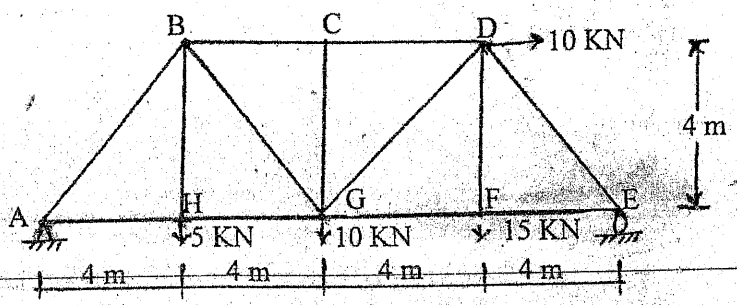


5. Define the angle of friction and also write the laws of static friction. [4]

6. Draw axial force, shear force and bending moment diagram for the loaded frame as shown in figure below. Also indicate the salient featutes if any. [13]

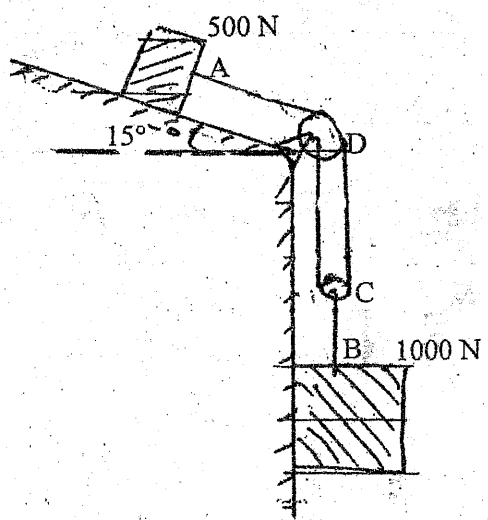


7. Determine the total degree of internal, external indeterminacy of given truss. Also determine the member forces in members BC, BG, HG and GD. [2+6]



8. The acceleration of a partial is given by a relation $a = v^3$. It is known that at time $t = 0$, position is -2m and velocity is 2m/sec. Find the displacement, position, velocity and acceleration at instant of ½ sec. What do you mean by projectile and obtain the equations for projectile motion. [7+3]

9. What do you mean by impulse momentum principle? Two blocks A and B having respective weights 500 N and 1000 N start form rest. The pulley is frictionless and also practically mass less. The kinetic coefficient of friction between the block A and the inclined surface is 0.35. Determine the acceleration of each block and tension in the cord. [2+8]



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21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING

Examination Control Division

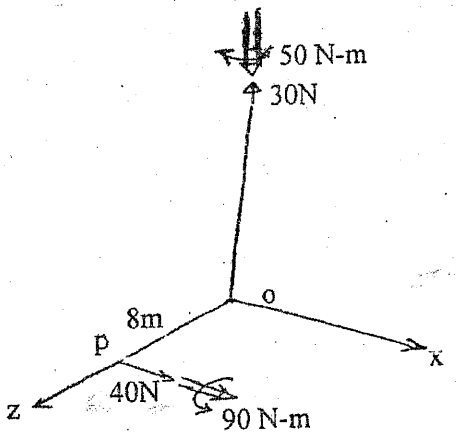
2069 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri. B.Arch.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

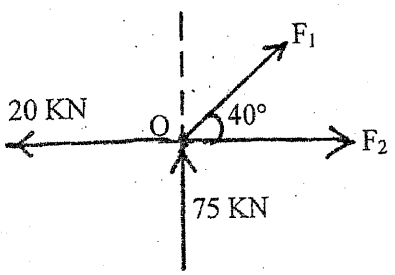
Subject: - Applied Mechanics *(CE401)*

- ✓ 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.*

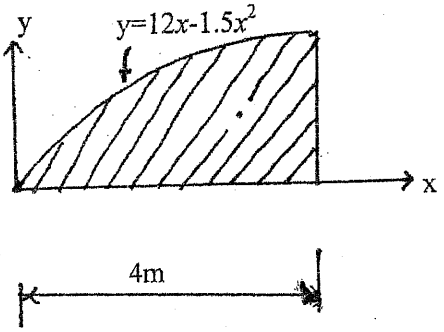
1. Describe briefly the concept of particle, rigid body and deformable body. [3]
2. Describe Free Body Diagram and physical meaning of equilibrium. Also describe the importance of Free Body Diagram and equilibrium in structural analysis. [2+2+2+2]
3. Replace the two wrenches as shown in figure by a single equivalent wrench and determine (a) the resultant force, (b) indicate it's line of action. [8]



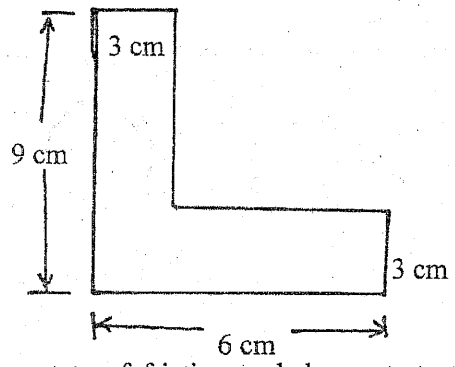
4. Determine the value of F1 and F2 if the forces shown in figure below are in equilibrium. [4]



5. Determine centroidal x coordinate of the shaded area shown in figure below. [4]

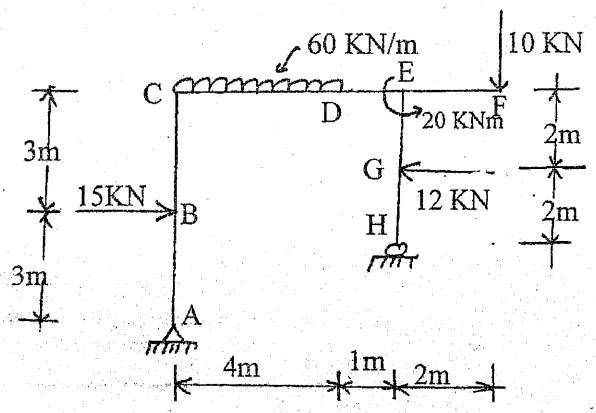


6. Determine radius of gyration (r_x) of the angle section shown in figure below about centrodal x-axis. [8]

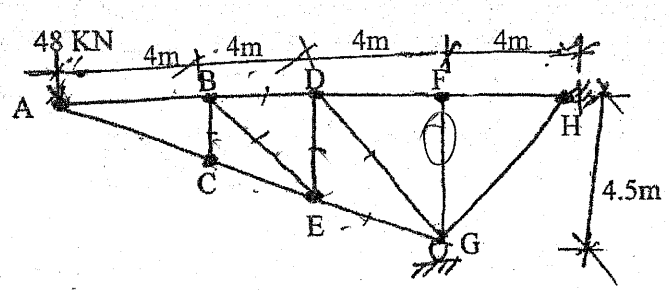


7. Illustrate impending motion state of friction and demonstrate the change in frictional force for different motion stages using relevant figure. [4]

8. Draw AFD, SFD and BMD of the given frame loaded as shown in figure below. Indicate the salient feature if any. [14]

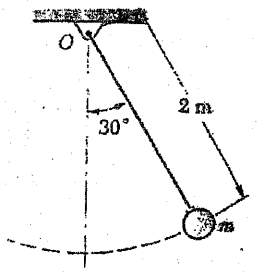


9. Compute the force developed in the member BC, BD, BE, DE, DG and EG of the given truss loaded as shown in figure. [7]



10. Define uniformly rectilinear motion and uniformly accelerated rectilinear motion. A projectile is fired with an initial velocity of 244m/s at a target B located 610m above the level of gun A and at a horizontal distance of 3658m. Neglecting air resistance, determine the value of the firing angle. [2+8]

11. Define the linear momentum and angular momentum. Find the velocity and acceleration of the bob in the given position. The bob of a 2m pendulum describes an arc of a circle in a vertical plane. Tension in the cord is 2.5 times the weight of the bob for the position shown. [2+8]



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01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Bhadra

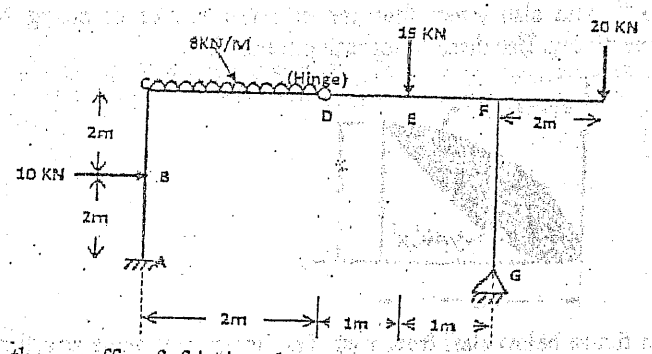
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BME	Pass Marks	32
Year / Part	I / [illegible]	Time	3 hrs.

Subject: - Applied Mechanics

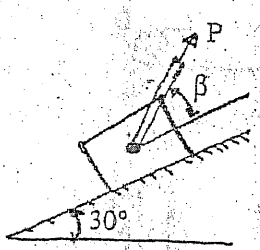
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

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

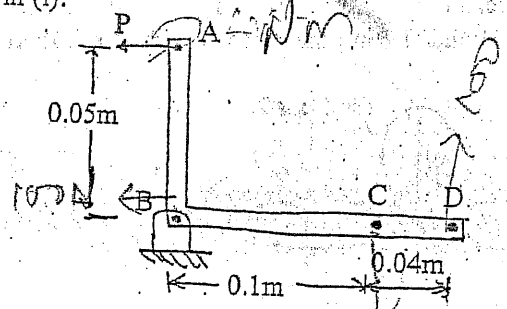
   b) Draw the axial force, shear force and bending moment diagram of the given frame. Also show the salient features. [13]



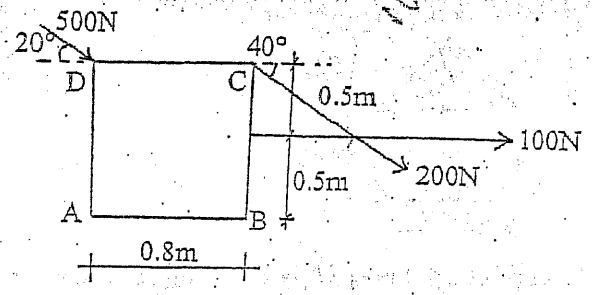
2. a) Knowing that the coeff. of friction between 25 kg block and the incline is $\mu_s = 0.25$. Determine (i) smallest value of P required. to start the block moving up the incline (ii) corresponding value of β. [4]



   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]

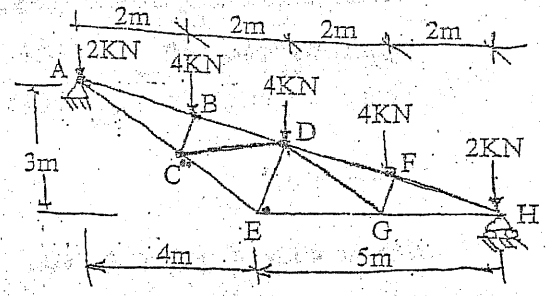


   c) Determine magnitude, direction and position of the resultant of forces acting on a block as shown in figure below. [7]

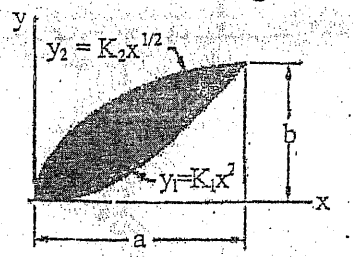


3. a) What is static equilibrium? What are the equations of static equilibrium in two dimension? Describe briefly the importance of them. [2+3+3]

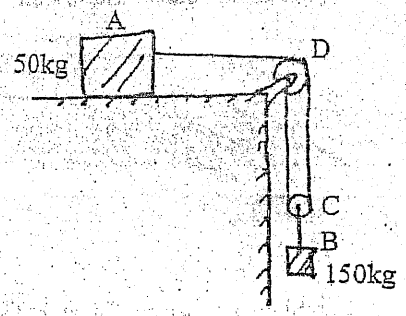
b) Determine the force in members DE, CD and AB for the inverted Howe Roof truss. State whether each member is in tension or compression. [8]



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]

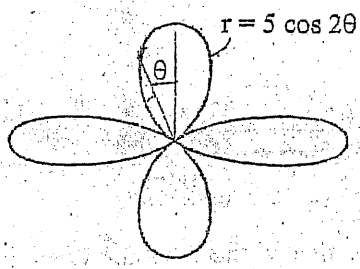


b) The two blocks shown in figure below start from rest. The horizontal plane and the pulley are frictionless and the mass of pulley is negligible. Determine the acceleration of each block and the tension in each cord. [10]

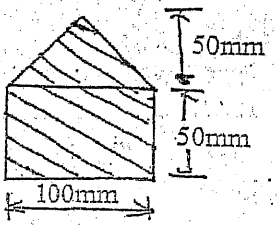


OR

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]

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21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2068 Baishakh

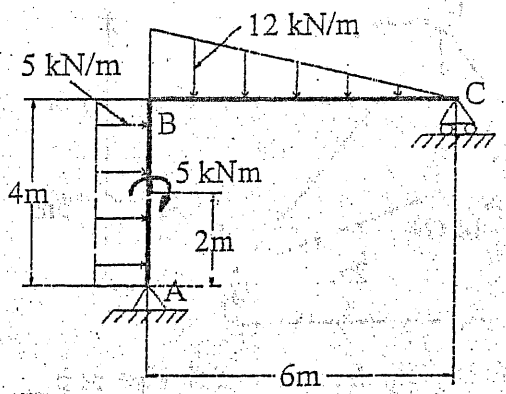
Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BIE, B.Agri., B.Arch.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

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.*

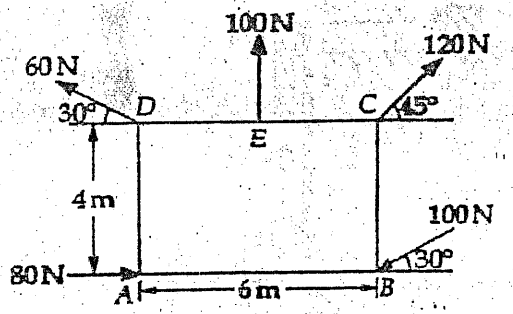
1. a) Derive the relationship between load, shear force and bending moment. [4]

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



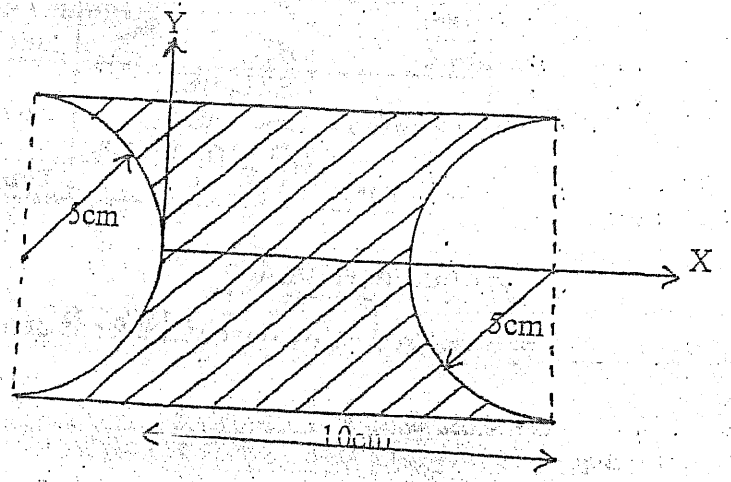
2. a) What is the equilibrium of a body? Write the conditions of equilibrium of a particle. [4]

   b) A plate of size 6m × 4m is acted upon by a set of forces in its plane as shown in figure below. Determine the magnitude, direction and position of resultant force. [12]



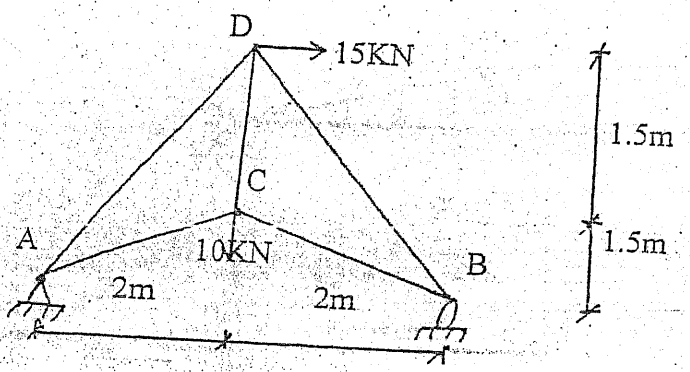
3. a) Determine the centroid of right angle triangle by method of integration. [6]

b) Find the moment of inertia and radius of gyration about X-Y axis of the figure shown below. [10]



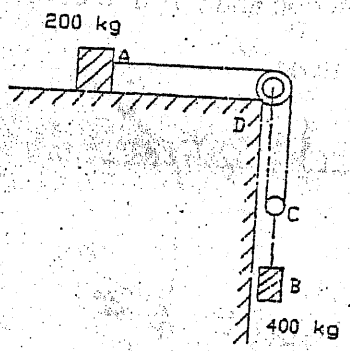
4. a) What is the angle of friction? Explain about tipping and sliding of block? [6]

b) Determine the support reactions and forces in all member in the given pin jointed truss as shown in figure below. [10]



5. a) What is the linear momentum? Explain about rate of change of it. [4]

b) Two blocks shown in figure below start from rest. The horizontal plane and the pulleys are frictionless, and the pulley is assumed to be of negligible mass. Determine the acceleration of each block and the tension in each rod. [12]



6. a) Mention the types of support on structures and support reactions with its free body diagram. [6]

b) For a particular body moving rectilinearly, $a = -10x^{-2}$, where a is the acceleration in m/sec^2 and x is in meter units. It is known that when $t = 2$ sec, $x = 8m$ and $v = 3m/sec$. Determine its acceleration when $t = 3$ sec. [10]

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