| S.NO. | UNIT | QUESTION | MARK | YEAR | SESSION (Apr -May: Summer); (Nov-Dec: Winter) |
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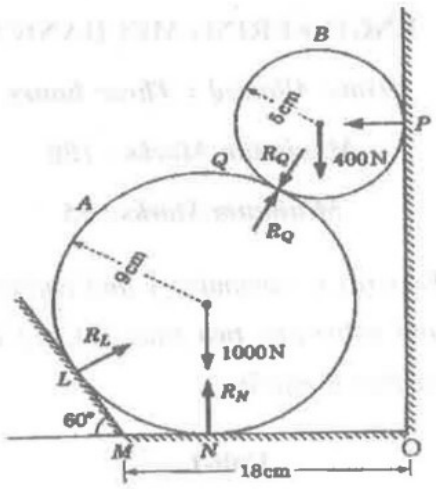
| 1 | Unit -1 | Define the free body diagram of a body in an equilibrium system, and explain its importance. Define free body diagram with neat sketch. Define Free Body Diagram. | 4,2,2 | 2021, 2019, 2018 | Winter, Winter, Summer |
| 2 | Unit -1 | What are the laws to add two forces and several concurrent, coplanar forces? Explain in detail. | 8 | 2021 | Winter |
| 3 | Unit -1 | Two cylinder A and B rest in a horizontal channel as shown in figure. The cylinder A has radius of 9 cm and weight 1000 N whereas the cylinder B has radius of 18 cm and weight 400 N. If the bottom width of the box is 18 cm with one side vertical and other at inclined at 60° with horizontal. Determine the reaction at points L,N and P.   | 8 | 2021 | Winter |

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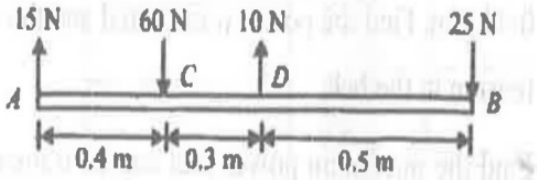
| 4 | Unit -1 | A rigid bar is subjected to a system of parallel forces as shown in figure. Reduce this system to (i) A single force system (ii) A single force moment system at A (iii) A single force moment system at B.<br>  <br> | 8 | 2021 | Winter |
| 5 | Unit -1 | Multiple choice question: **(A)** Which is the correct statement about law of polygon of forces? (a) If any number of forces acting at a point can be represented by the sides of a polygon taken in order, then the forces are in equilibrium. (b) If any number of forces acting at a point can be represented in direction and magnitude by the sides of a polygon, then the forces are in equilibrium. (c) If a polygon representing forces acting at point is closed then forces are in equilibrium. (d) If any number of forces acting at a point can be represented in direction and magnitude by the sides of polygon taken in order, then the forces are in equilibrium. **;(B)** The principle of transmissibility of forces states that, when a force acts upon body, its effect is: (a) Same at every point on its line of action. (b) Different at different points on its line of action. (c) Minimum, if it acts at the center of gravity of the body. (d) Maximum, if it acts at the center of gravity of the body. **;(C)** In order to determine the effects of a forces, acting on a body, we must know : (a) Magnitude of the force. (b) Line of action of the force. (c) Nature of the force i.e. whether the force is push or pull. (d) All of the above. **;(D)** In three forces acting in one plane upon a rigid body, keep it in equilibrium, then they must either: (a) Meet in apoint. (b) Be all parallel. (c) At least two of them must meet. (d) All of the above is correct. | 4 | 2020 | Winter |

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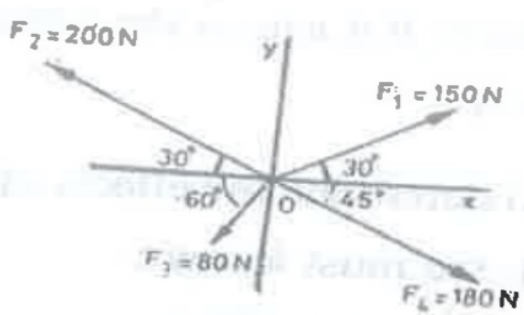
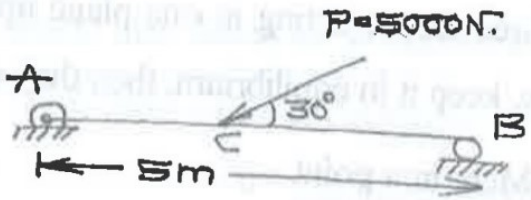
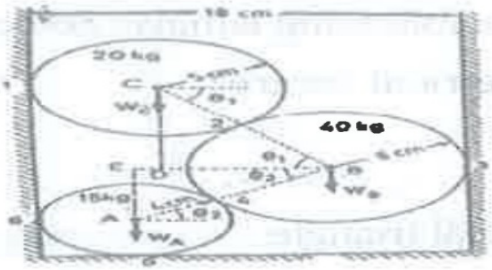
| 6 | Unit -1 | Find the Resultant of Coplanar Concurrent forces acting at the Point O. Refer Fig.-1.<br>  <br><br>Fig. - 1 | 8 | 2020 | Winter |
| 7 | Unit -1 | A force of P = 5000 N is applied at the centre C of the Beam AB of Length 5m. Find the reaction at the Hinge and roller supports. Refer Fig.- 2.<br>  <br><br>Fig. - 2 | 8 | 2020 | Winter |
| 8 | Unit -1 | Three cylinders are piled up in a rectangular channel as shown in Fig. Determine the Reaction R6 between the cylinder A and the vertical wall of the channel. Refer Fig. -3.<br>  <br><br>Fig. - 3 | 8 | 2020 | Winter |

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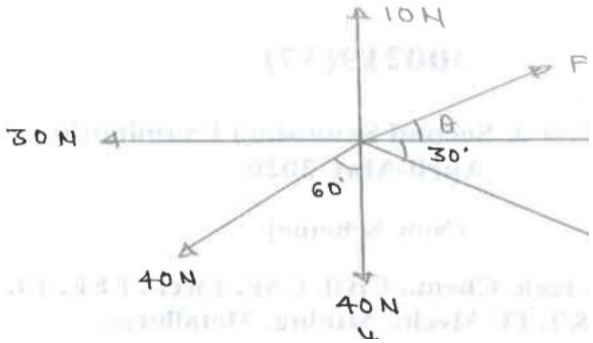
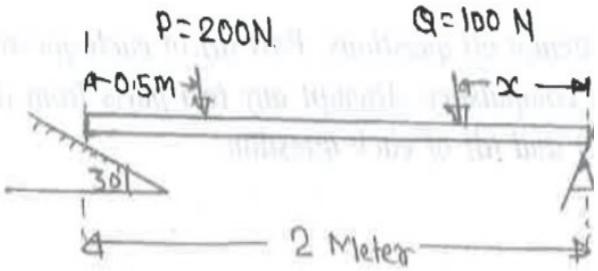
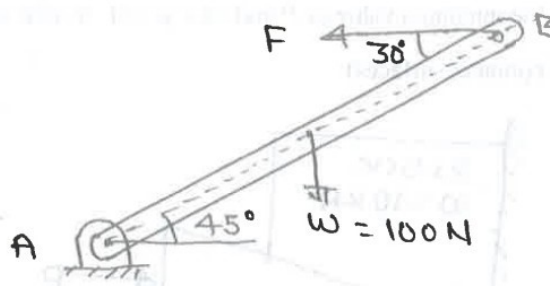
| 9 | Unit -1 | Explain Law of Transmissibility of forces.<br>Explain the principle of transmissibility of forces. | 2 | 2020, 2019 | Summer |
| 10 | Unit -1 | For the equilibrium of given force system, find the value of F and θ.<br>  | 7 | 2020 | Summer |
| 11 | Unit -1 | A bar 2m long and of negligible weight rests in horizontal position on two smooth inclined planes. Determine the distance x at which the load should be placed from point 13 to keep the bar horizontal.<br>  | 7 | 2020 | Summer |
| 12 | Unit -1 | A bar of weight w =100N is hinged at A and is pulled by a cable attatched at B by a force F. Find the force F and magnitude and direction of reaction at A if bar is in equilibrium condition as shown in figure.<br>  | 7 | 2020 | Summer |

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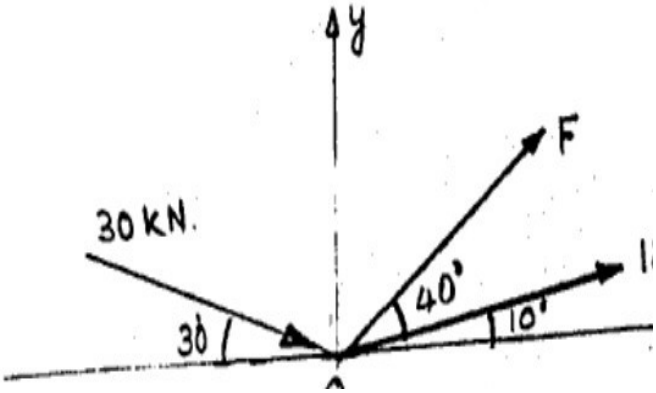
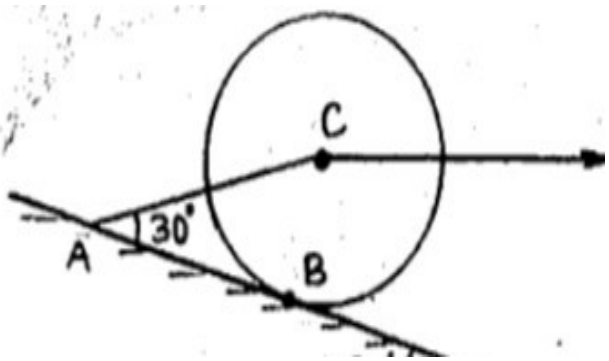
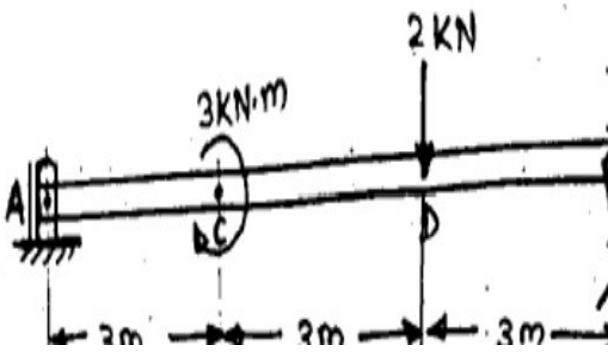
| 13 | Unit -1 | Three forces act on a particle 'O' as shown in figure. Determine the value of force F such that the resultant of these three forces is horizontal. Find the magnitude and direction of fourth force which, when acting along with the given three forces will keep particle 'O' in equilibrium.<br>  | 7 | 2019 | Winter |
| 14 | Unit -1 | A right circular roller of weight 5 kN rests on a smooth inclined plane and is held in position by a chord AC as shown in figure, horizontal force 1 kN acting at C. Find the reaction at B and tension in the chord.<br>  | 7 | 2019 | Winter |
| 15 | Unit -1 | Determine the reaction at A and B for the given force system.<br>  | 7 | 2019 | Winter |

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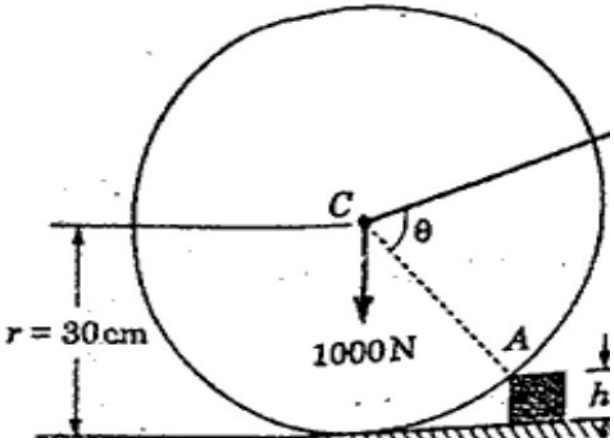
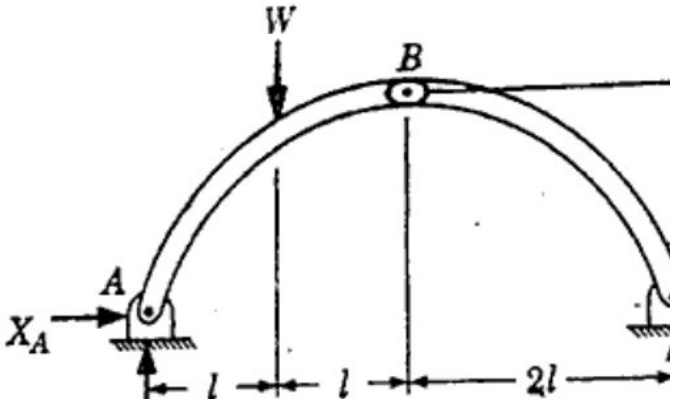
| 16 | Unit -1 | A uniform wheel of 60 cm diameter weighing 1000 N rests against a rectangular obstacle 15 cm high. Find the least force required which when acting through the centre of the wheel will just turn the wheel over the corner of block. Also find the angle 'θ' which this least force shall make with AC :<br>  | 7 | 2019 | Summer |
| 17 | Unit -1 | A three- hinged arch is loaded as shown in figure. Find the reactions $X_A$,$Y_A$,$X_C$, and $Y_C$ at the hinges:<br>  | 7 | 2019 | Summer |

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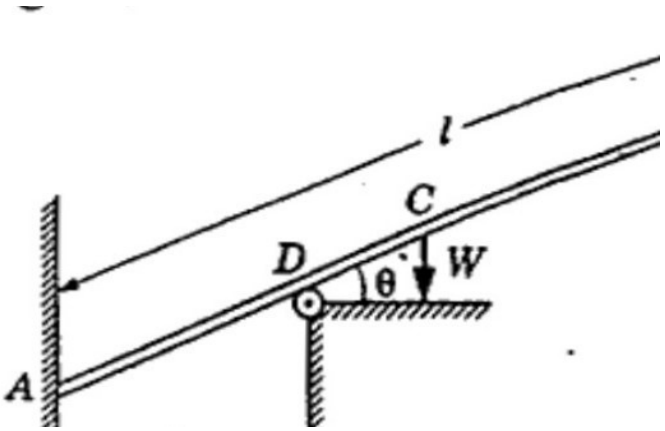
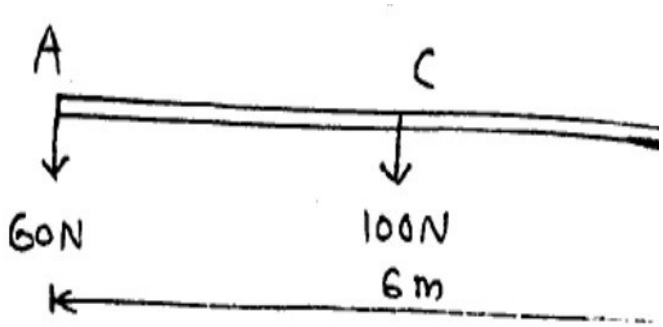
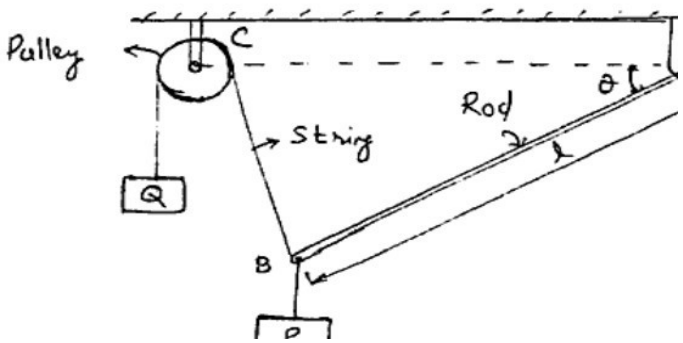
| 18 | Unit -1 | A prismatic bar AB of weight W is resting against a smooth vertical wall at A and is supported on a small roller at point D. If a vertical force F is applied at the end B, find the position of equilibrium as defined by the angle 'θ' :<br>  | 7 | 2019 | Summer |
| 19 | Unit -1 | What are the various characteristics of force? | 2 | 2018 | Winter |
| 20 | Unit -1 | A uniform beam AB of weight 100 and 6m long had two bodies of weight 60 N and 80 N suspended from its two ends as shown in fig. (1). At what point the beam should be suspended so that it may rest horizontally?<br>  | 4 | 2018 | Winter |
| 21 | Unit -1 | A uniform rod AB of negligible weight and length 'l' is hinged at the end 'A' and supported by a string as shown in fig. (2). What should be the inclination 'θ' of the rod if it is in a state of equilibrium? Take P = 2 Q.<br>  | 10 | 2018 | Winter |

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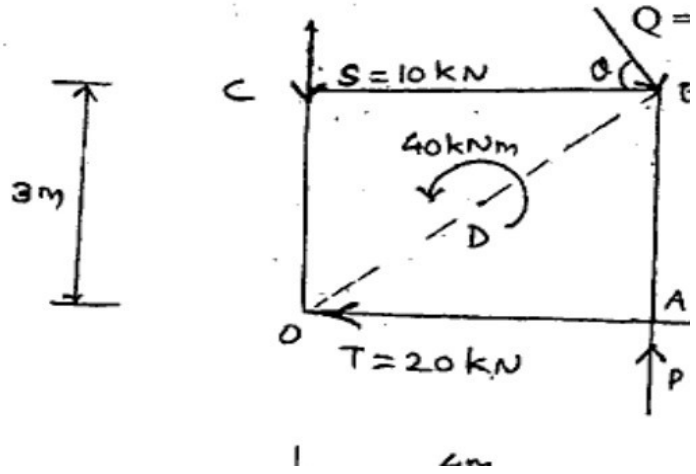
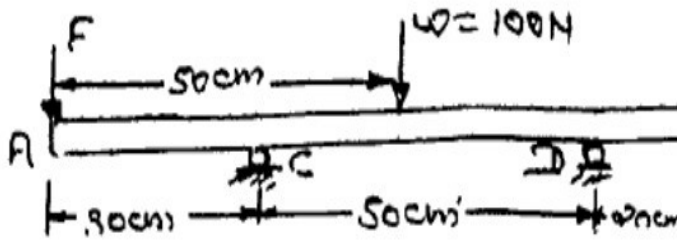
| 22 | Unit -1 | For the force system acting on a body OABC as shown in fig.(3), make calculations for the magnitude and direction of resultant force. Proceed to Determine: (i) the distance of resultant from Point 'O'. (ii) the points where the resultant meets the x-axis and y-axis.<br>  | 10 | 2018 | Winter |
| 23 | Unit -1 | A uniform beam AB of weight w= 100 N rests on two roller supports C and D as shown. If a force of 250 N is applied to the end B, find the range of valve of force F for beam for which it will remain in equilibrium.<br>  | 7 | 2018 | Summer |

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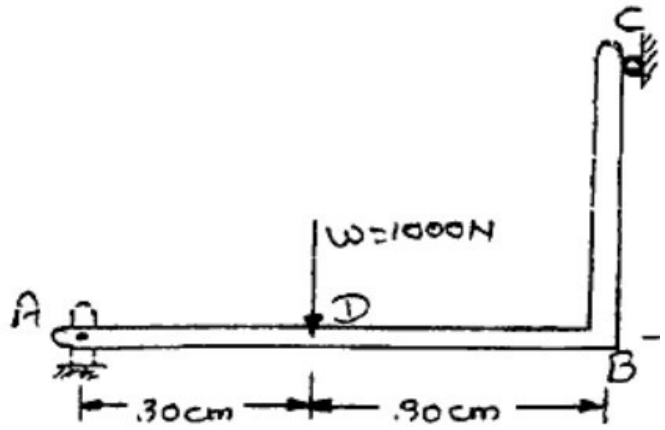
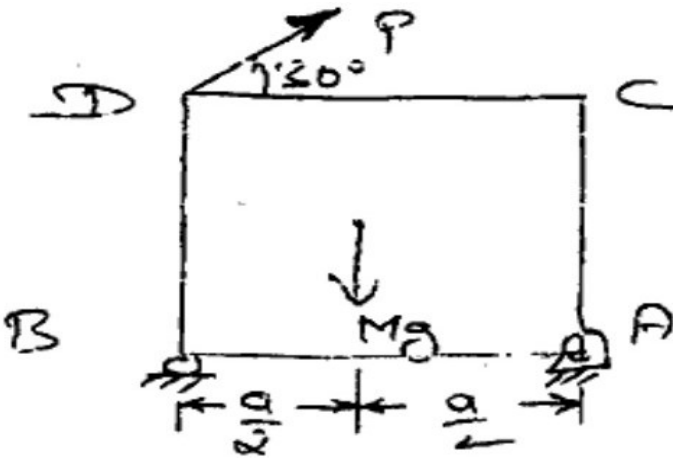
| 24 | Unit -1 | a corner plate AB is hinged to a fixed support at A and rests on a roller at C. If a force of w= 1000 N is acting as shown in figure 2, find the reaction at the supports.<br>  | 7 | 2018 | Summer |
| 25 | Unit -1 | A rigid square block of wood of mass M is hinged at A and rests on a roller at B. It is pulled by mean of a string attached at D and inclined at an angle 30 with horizontal. Determine the force P which should be applied to the string to just lift the block of the roller. Figure 3.<br>  | 7 | 2018 | Summer |
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| 1 | Unit -2 | Explain the phenomenon of friction by taking an example of a block placed on a rough surface. | 4 | 2021 | Winter |
| 2 | Unit -2 | A uniform ladder of weight 800 N and of length 7 m rests on a horizontal ground and leans against a smooth vertical wall. The angle made by the ladder with horizontal is 60°. When a man of weight 600 N stands on the ladder at a distance of 4 m from the top of the ladder, the ladder is at the point of sliding. Determine the coefficient of friction between the ladder and the floor. | 8 | 2021 | Winter |

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| 3 | Unit -2 | A belt 100 mm wide and 8.0 mm trick are transmitting power at a belt speed of 1600 m/minute. The angle of lap for smalletr pulley is 165° and coefficient of friction is 0.3. The maximum permissible stress is belt 2 $MN/m^2$ and mass of the belt is 0.9 kg/m. Find the power transmitted and the intial tension in the belt. Find the mnaximum power that can be transmitted and the corresponding belt speed. | 8 | 2021 | Winter |
| 4 | Unit -2 | Explain the principle of virtual work with their application. | 8 | 2021 | Winter |
| 5 | Unit -2 | Multiple Choice Questions:<br>**(A)** The ratio of the limiting force of friction (F) to the normal reaction (R) is known as: (a) Coefficient of friction. (b) Force of friction. (c) Angle of friction. (d) None of the above.<br>**(B)** What is β in the equation $T2= T1e^{\mu\beta}$ ? (a) Angle of the belt to surface contact in radians. (b) Angle of the belt to surface contact in degrees. (c) Angle of the belt in radians. (d) Angle of the belt in degrees.<br>**(C)** Which of the following laminas do not have centroid at its geometrical centre? (a) Circle. (b) Equilateral triangle. (c) Right angled triangle. (d) None of the above.<br>**(D)** What is the relation between tight side and slack side for a flat belt? (a) (Tight side × slack side)=eμβ. (b) (Tight side / slack side)=eμβ. (c) (Tight side + slack side)=eμβ. (d) None of the above. | 4 | 2020 | Winter |

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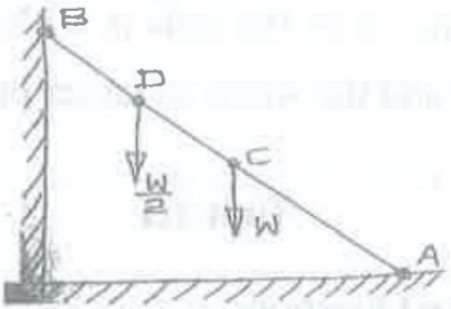
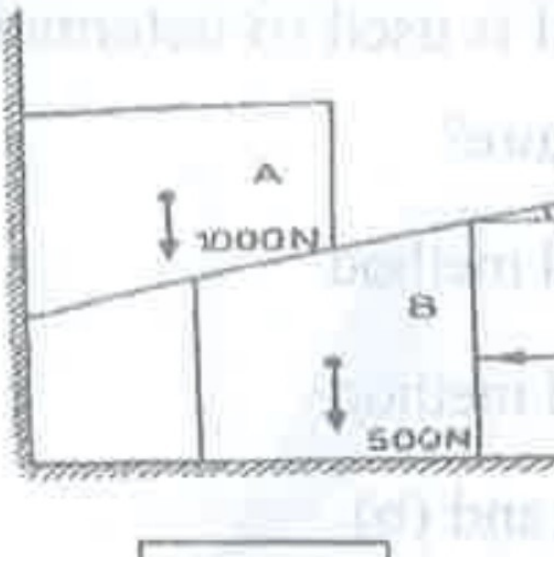
| 6 | Unit -2 | A uniform ladder AB of length l = 20 m and weight W is supported by the horizontal floor at A and by a vertical wall at B. It makes an angle 45º with the horizontal. If a man, whose weight is one-half that of the ladder, ascends the ladder, how much length x of the ladder he shall climb before the ladder slips. Assume, μβ= 1/3 and μA= 1/2. Refer Fig. -4.<br>  <br><br>Fig. - 4 | 8 | 2020 | Winter |
| 7 | Unit -2 | Block A weighing 1000N is to be raised by means of a 15° wedge B weighing 500N. Assuming the coefficient of friction between all contact surfaces to be 0.2, determine what minimum horizontal force P should be applied to raise the block refer Fig.-5.<br>  <br> | 8 | 2020 | Winter |

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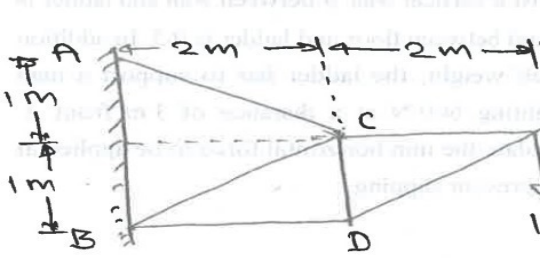
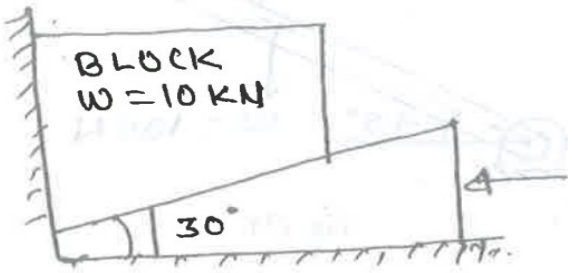
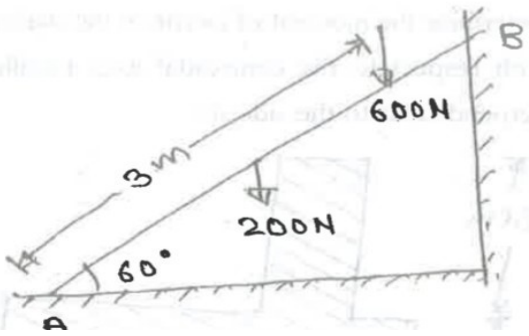
| 8 | Unit -2 | Find the power transmitted by a cross belt drive connecting two pulleys of 45.0cm and 20.0cm diameters which are 1.95m apart. The maximum permissible tension in the belt is 1kN. Coefficient of friction is 2.0 and the speed of larger pulleys is 100 rpm. | 8 | 2020 | Winter |
| 9 | Unit -2 | Define Angle of Friction. | 2 | 2020 | Summer |
| 10 | Unit -2 | A cantilever truss is loaded as shown in figure. Find the axial force in all the members.   | 7 | 2020 | Summer |
| 11 | Unit -2 | A block of weight 10 kN is to be raised by a wedge as shown by a horizontal force P in figure. Determine the minimum value of P and take μ = 0.36 (for all contact surfaces).   | 7 | 2020 | Summer |
| 12 | Unit -2 | A ladder of length 4 m weighing 200 N is placed against a vertical wall μ between wall and ladder is 0.2 and between floor and ladder is 0.3 . In addition to self weight, the ladder has to support a man weighing 600 N at a distance of 3m from A. Calculate the min. horizontal force to be applied at A to prevent slipping.   | 7 | 2020 | Summer |

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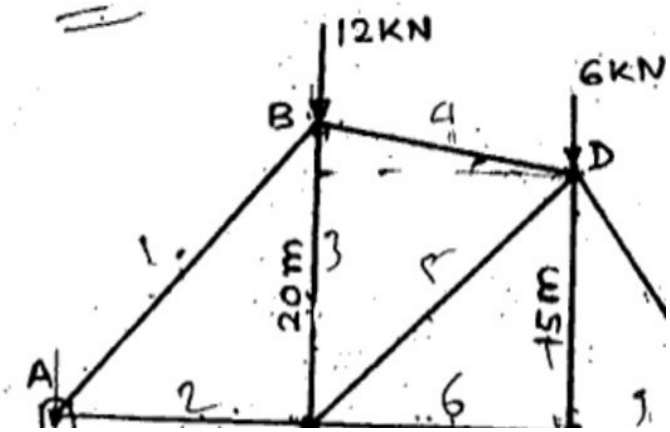
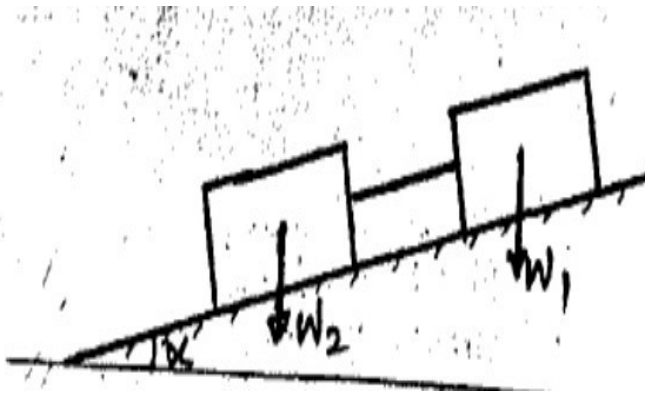
| 13 | Unit -2 | Define the perfect truss and give mathematical condition for perfect truss. | 2 | 2019 | Winter |
| 14 | Unit -2 | A plane truss is loaded and supported as shown in figure. Determine the axial forces in the members BD; CD and CE of truss shown in figure.   | 7 | 2019 | Winter |
| 15 | Unit -2 | Write short notes on any three: (not more than 50 words). (i) Basic assumption for perfect truss. (ii) Law of static friction (iii) Angle of friction (iv) Angle of Repose (v) Cone friction (vi) Wedge friction | 7 | 2019 | Winter |
| 16 | Unit -2 | Two blocks of weight $W_1$= 50 N and $W_2$= 50N rest on a rough inclined plane and connected by a string as shown in figure. The coefficient of friction between the inclined plane and weight $W_1$ and $W_2$ are $\mu_1$= 0.3 and $\mu_2$=0.2 respectively. Find the inclination of the plane to cause the motion to impend.   | 7 | 2019 | Winter |
| 17 | Unit -2 | Explain the term 'Coulomb friction'. | 2 | 2019 | Summer |

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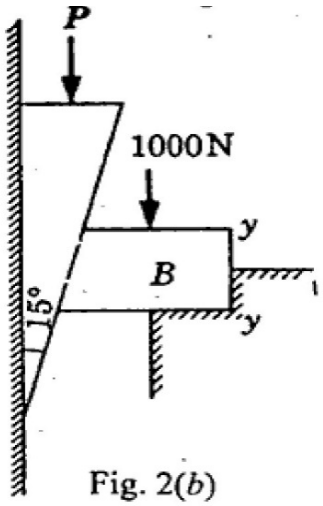
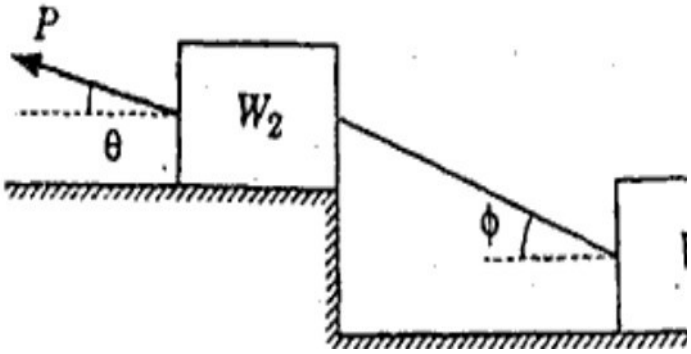
| 18 | Unit -2 | A 15° wedge of negligible weight is to be driven to tighten a body B which is supporting a vertical load of 1000N. If the coefficient of friction for all contacting surfaces be 0.25, find the minimum force P required to drive the wedge:<br>  <br><br>Fig. 2(*b*) | 7 | 2019 | Summer |
| 19 | Unit -2 | Two blocks of weights $W_1$ and $W_2$ are connected by a string and rest on horizontal plane as shown in figure. Find the magnitude and direction of the least force P that should be applied to the upper block to induce sliding. The coefficient of friction for each block is to be taken as μ:<br>  <br> | 7 | 2019 | Summer |

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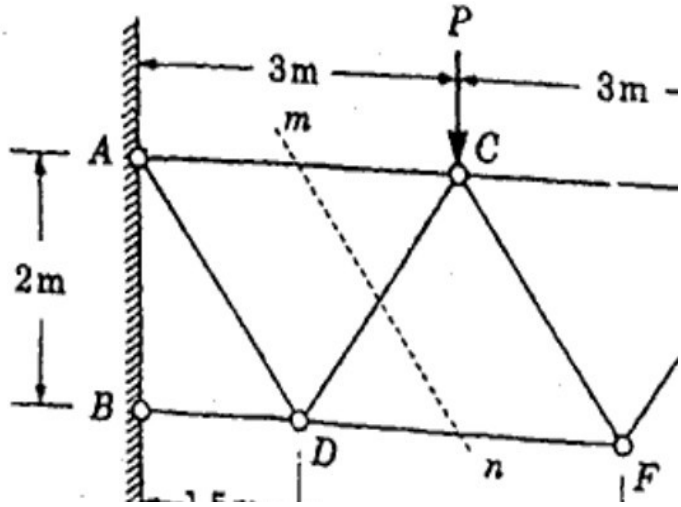
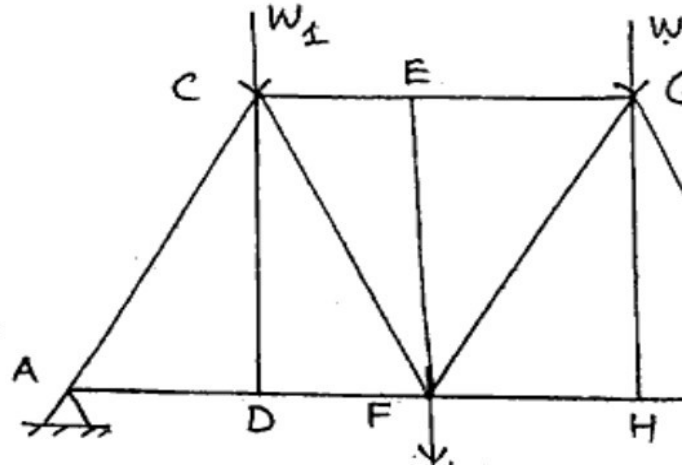
| 20 | Unit -2 | A cantilever truss is loaded and supported as shown in figure. Find the value of loads P which would produce an axial force of magnitude 3 kN in member AC:<br>  | 7 | 2019 | Summer |
| 21 | Unit -2 | Name the different methods of finding out the forces in the members of a perfect truss which one is used where and why? | 2 | 2018 | Winter |
| 22 | Unit -2 | With refrence to truss shown in fig.(4), identify the members which are not subjected to any force.<br>  | 4 | 2018 | Winter |

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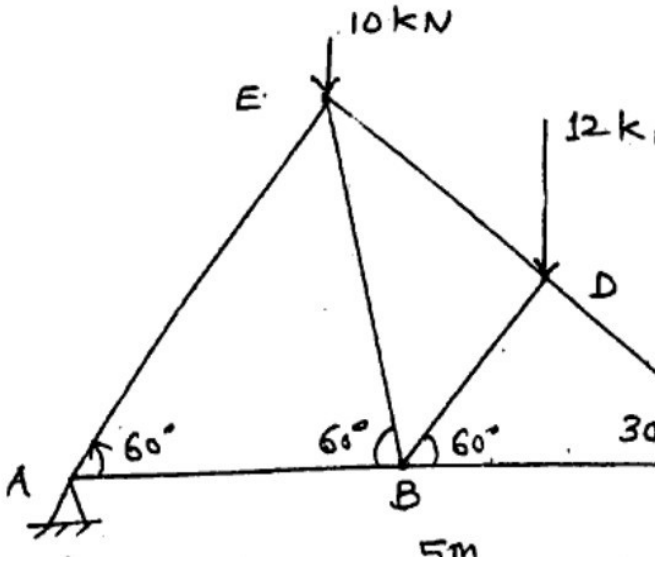
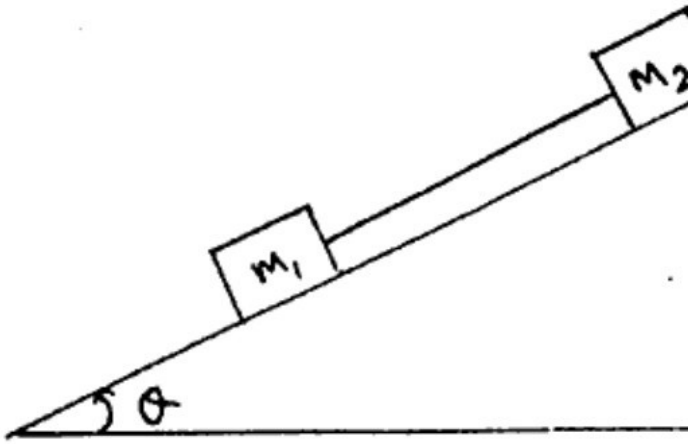
| 23 | Unit -2 | Determine the forces in all the members of the truss loaded and supported as shown in fig. (5).<br>  | 10 | 2018 | Winter |
| 24 | Unit -2 | Two masses $m_1$ = 22.5 kg and $m_2$ = 14 kg are tied together by a rope parallel to the inclined plane surface as shown in fig. (6). The coefficient of friction between $m_1$ and the plane is 0.25 while that of mass $m_2$ and the plane is 0.5.<br>Determine :<br>(i) the value of the incination of the plane surface θ for which the masses will just start sliding. downwards (ii) the tension in the rope.<br>  | 10 | 2018 | Winter |
| 25 | Unit -2 | Define coefficient of friction. | 2 | 2018 | Summer |

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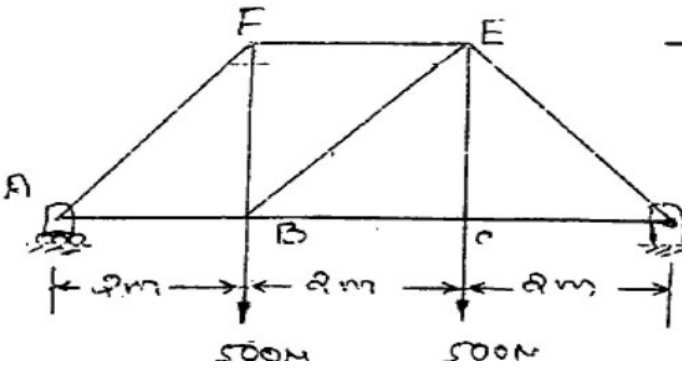
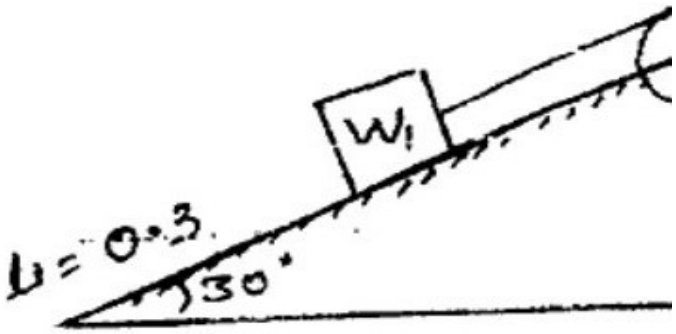
| 26 | Unit -2 | Determine the reaction and the forces in each member of a truss supporting two loads as shown in fig. 4.<br>  <br> | 7 | 2018 | Summer |
| | Unit -2 | A block of weight $w_1$ = 100 N rests on an inclined plane and another weight - $w_2$ attached to the first weight through a string as shown in figure 5. If the coefficient of friction between the block and plane 0.3, determine the maximum and minimum values of $w_2$ so that equilibrium can exist.<br>  <br> | 7 | 2018 | Summer |

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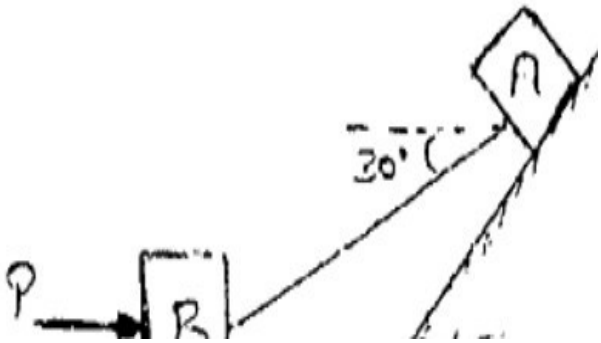
| | Unit -2 | Block A weighing 100 N rests on a rough inclined plane whose inclination to the horizontal is 45°. The block is connected to another block B weighing 300 N resting on a rough horizontal plane by a weightess rigid bar inclined at 30° to the horizontal. Find the horizontal force required to be applied to the block B to just move the block A in upward direction. Assume angle of limiting friction as 15° at all surfaces where there is a sliding Fig. 6.<br>  | 7 | 2018 | Summer |
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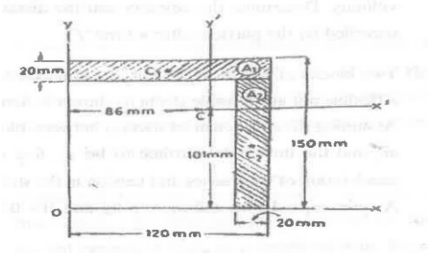
| 1 | Unit-3 | Differentiate between polar moment of inertia and product of inertia. | 4 | 2021 | Winter |
| 2 | Unit-3 | Find the coordinates of the centroid C of a circular sector of central angle 2a and radius r, by the method of integration. | 8 | 2021 | Winter |
| 3 | Unit-3 | Determine the moment of inertia of a traingle with respect to its base. | 8 | 2021 | Winter |
| 4 | Unit-3 | Find the moments of inertia of the area of the L section about x and y axis as shown in figure.<br>  | 8 | 2021 | Winter |

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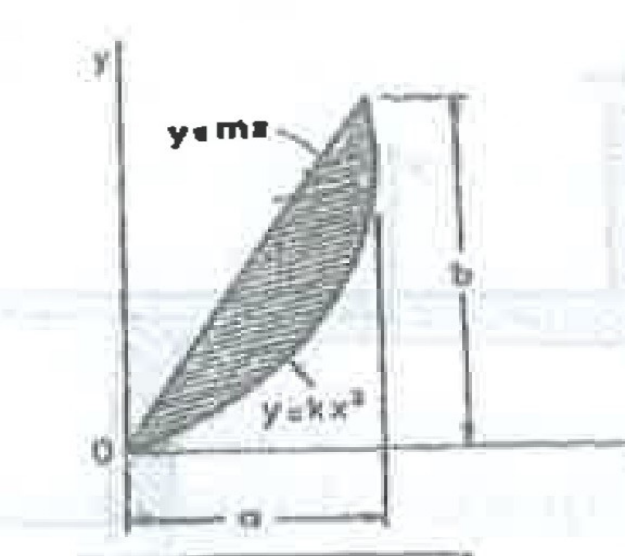
| 5 | Unit-3 | Multiple choice Questions :<br>**(A)** What is the centroidal distance of an equilateral triangle of side 2m? (a)0.866m, (b) 0.789m, (c) 1.000m, (d) 0.577m **(B)** What method is used to determine centroid of a composite figure? (a) Analytical method, (b) Graphical method, (c) Both (a) and (b), (d) None of the above **(C)** What is the formula of radius of gyration? (a) k2=I/A, (b) k2=I2/A, (c) k2=I2/A2, (d) k2=(I/A)21/2 **(D)** What is the formula of perpendicular axis? (a) lzz= lxx-lyy, (b) lzz=lxx+Ah2, (c) lzz-lxx=lyy, (d) None of the above | 4 | 2020 | Winter |
| 6 | Unit-3 | Determine by the direct integration the coordinates of the centroid of the shaded area formed by the intersection of a straight line and the curve $y=kx^2$. Refer Fig.-6.<br>  | 8 | 2020 | Winter |

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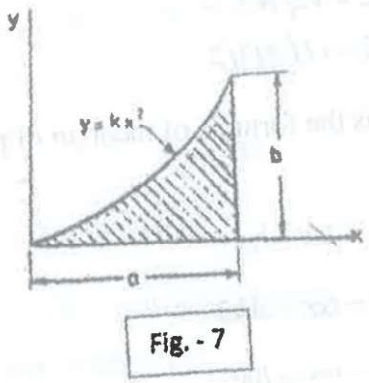
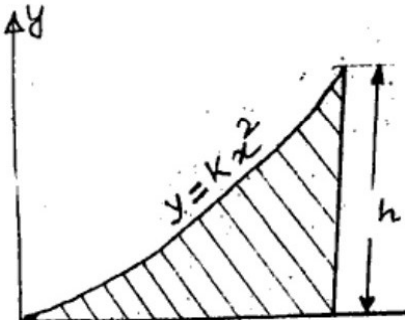
| 7 | Unit-3 | Determine the moments of inertia of the shaded area about the X-axis and the Y-axis. Refer Fig.-7. (2019) By direct integration<br>(2020) (2018)Determine the centroid of the Parabolic spandrels as shown in the figure. The equation of the parabola is given by $y= kx^2$.<br>  <br><br>Fig. - 7<br>  <br> | 8,7 | 2020, 2020, 2019, 2019, 2018 | Winter, Summer,Winter, Summer, Summer |

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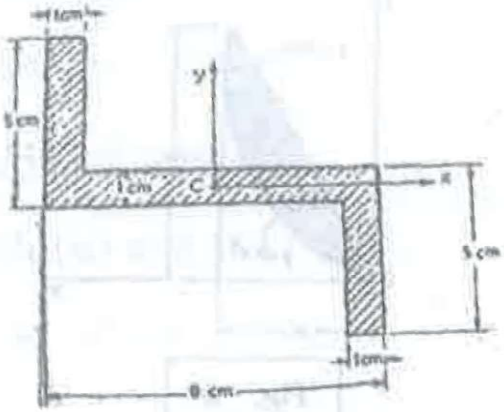
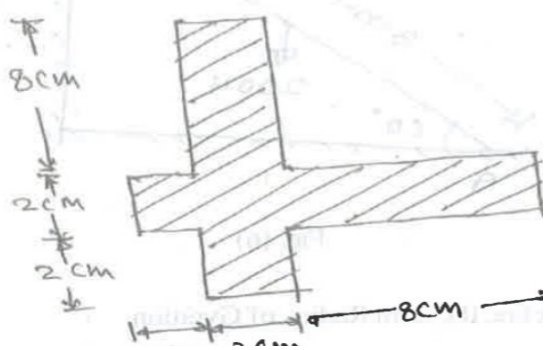
| 8 | Unit-3 | Finds the Product of inertia of the area shown with respect to the Centroidal x and y axes. Also find the angle θ defining the directions of principal axes through the Centroid and the principal Moments of Inertia. Refer Fig.-8.<br>  <br><br>Fig.- 8 | 8 | 2020 | Winter |
| 9 | Unit-3 | Define the term Radius of Gyration. | 2 | 2020 | Summer |
| 10 | Unit-3 | Determine the moment of inertia of the shaded area with respect to the centroidal axes parallel and perpendicular to the side AB.<br>  <br> | 7 | 2020 | Summer |

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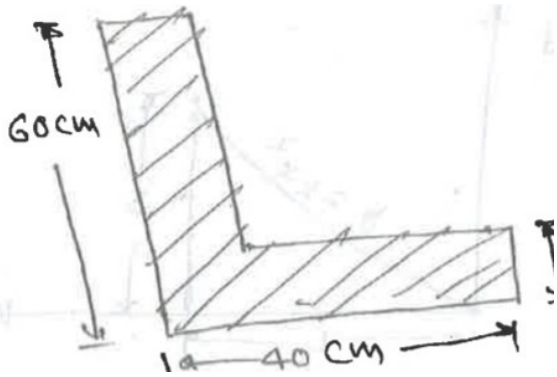
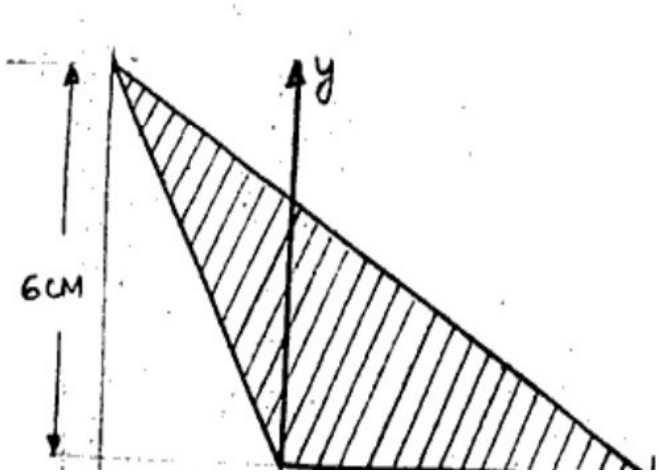
| 11 | Unit-3 | Determine the product of inertia of an unequal angle section in figure about its centroidal axes.<br>  | 7 | 2020 | Summer |
| 12 | Unit-3 | State the parallel axis theorem. | 2,2 | 2019, 2018 | Winter, Summer |
| 13 | Unit-3 | Determine the co-ordinates of centroid of the shaded area shown in figure. Calculate the second moment of area of the given shaded area with respect to centroidal axes.<br>  | 7 | 2019 | Winter |

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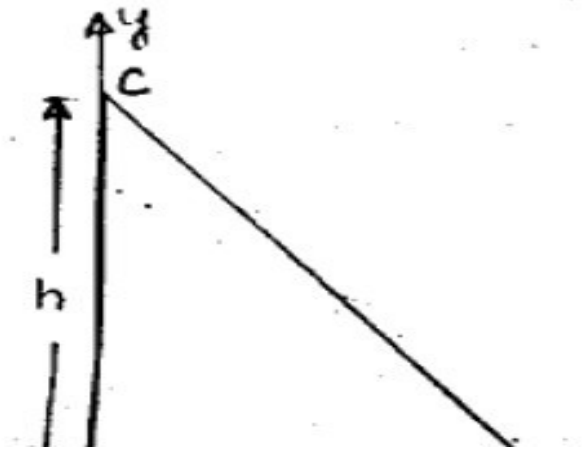
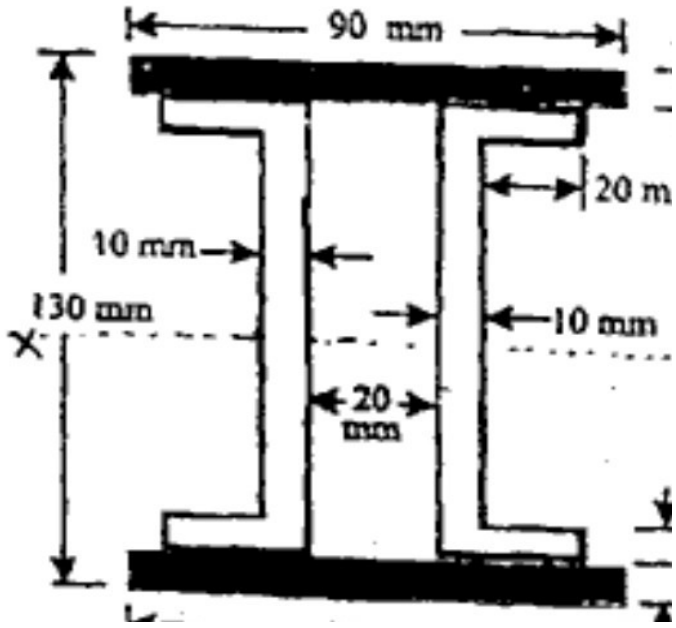
| 14 | Unit-3 | Determine the product of inertia of a right angle triangle: (i) with respect to x and y axis or '(2019) No diagram' (i) w.r.t to base axes (x and y axes passing through its perpendicular edges) (ii) with respect to centroidal axes parallel to 'x' and 'y' axes.<br>  | 7,7,10 | 2019, 2019, 2018 | Winter, Summer, Winter |
| 15 | Unit-3 | What is product of inertia ? | 2 | 2019 | Summer |
| 16 | Unit-3 | A built-up section is made by welding two plates and two channel sections as shown in figure. Determine the moment of inertia of built-up section about X-X axis passing through the centre of gravity of section:<br>  | 7 | 2019 | Summer |
| 17 | Unit-3 | What is meant by an axis of symmetry of a body in the context of centroid of bodies. | 2 | 2018 | Winter |

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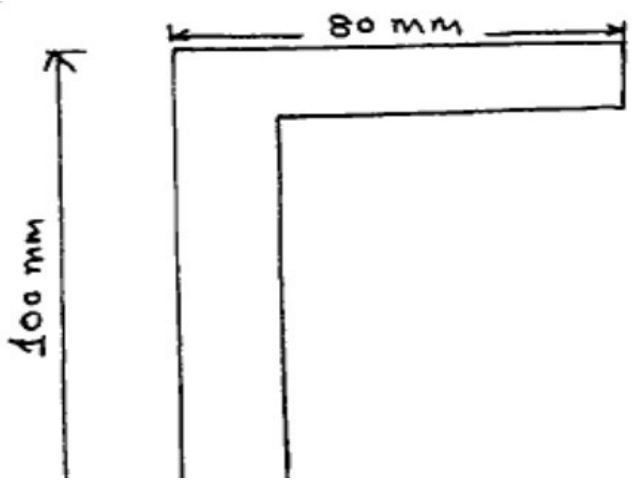
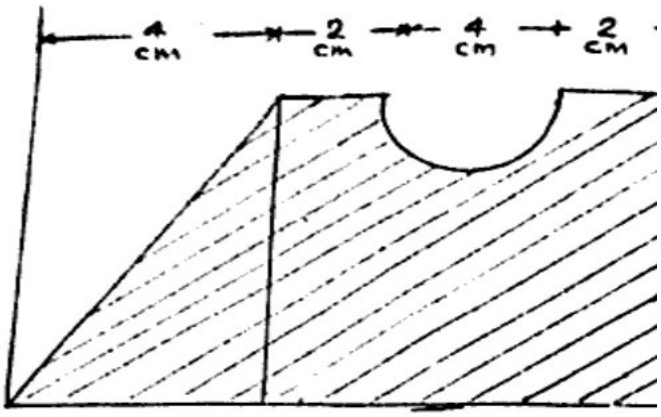
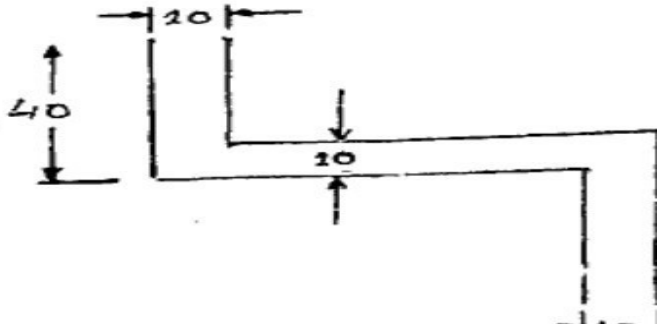
| 18 | Unit-3 | Determine the centroid of lamina shown in fig. (7).<br>  | 4 | 2018 | Winter |
| 19 | Unit-3 | Determine the moment of inertia of the plane area shown in fig. (8) about its centroidal axis.<br>  | 10 | 2018 | Winter |
| 20 | Unit-3 | Determine the moment of inertia about the x and y centroidal axis of a beam whose cross-section area is shown in figure.7. All dimensions are in cm.<br>  | 7 | 2018 | Summer |

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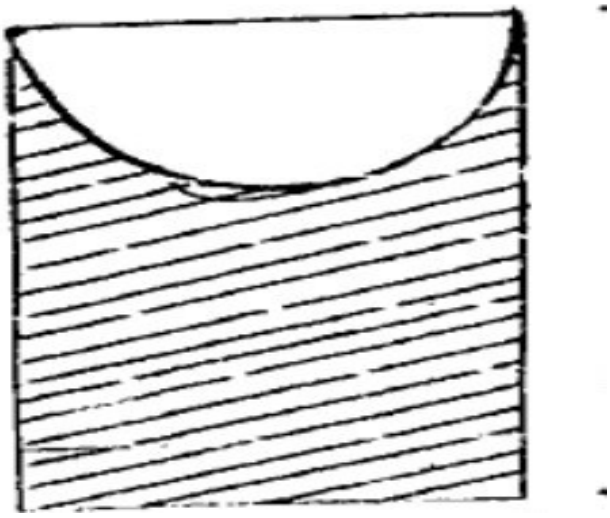
| 21 | Unit-3 | Find the moment of inertia of the section shown in fig. 8 about horizontal and vertical centroidal axis (all dimensio in mm).<br>  | 7 | 2018 | Summer |
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| 1 | Unit-4 | Discuss the difference between curvilinear and rectilinear motion. | 4 | 2021 | Winter |
| 2 | Unit-4 | A train start from rest and increase its speed from zero to v m/s with a constant acceleration of a1 $m/s^2$, runds at this speed for some time and finally comes to rest with a constant acceleration a1 $m/s^2$. If the total distance travelled is x meters, find the total time t required for this journey. | 8 | 2021 | Winter |
| 3 | Unit-4 | A particle of mass m falls vertically from rest in a medium whose resistance is proportional to the velocity. Determine the velocity and the distance travelled by the particle after a time't'. | 8 | 2021 | Winter |

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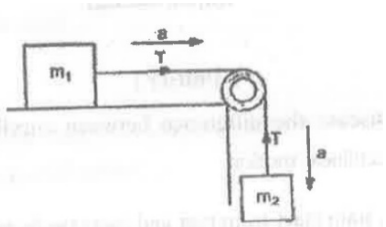
| 4 | Unit-4 | Two blocks of masses m1 and m2 are connected by a flexible but inextensible string as shown in figure. Assuming the coefficient of friction between block m1 and the horizontal surface to be μ, finfd the acceleration of the masses and tension in the string. Assume m1= 10 kg and m2= 5kg and μ= 0.25.<br>  <br> | 8 | 2021 | Winter |
| 5 | Unit-4 | Multiple Choice Questions:<br>**(A)** The rate of change……. With respect to time. (a) acceleration, (b) density, (c) displacement, (d) volume<br>**(B)** During undirectional motion, the displacement and distance travelled by a particle with uniform acceleration..... (a) different, (b) same, (c) variable, (d) none of the above<br>**(C)** What are the rectangular component of velocities in curvilinear motion? dx/dt and dy/dt, (b) dr/dt and d2r/dt, (c) d2x/dt2 and d2y/dt2, (d) none of the above<br>**(D)** The radius of curvature of trajectory for a profile is minimum, if..... (a) velocity is minimum, (b) acceleration is maximum, (c) both (a) and (b), (d) none of the above | 4 | 2020 | Winter |

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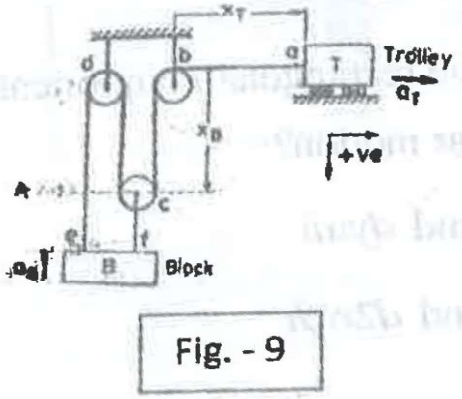
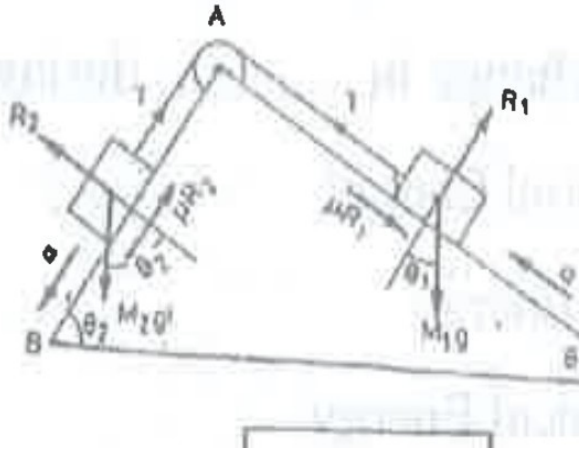
| 6 | Unit-4 | A trolley resting on horizontal plane starts from rest and is moved to the right with a constant acceleration of 0.18 m/s². Determine (a) acceleration of the block B connected to the trolley, (b) velocities of the trolley and the block after a time of 4 seconds and the distance moved by each of them, Refer Fig.-9.<br>  <br><br>Fig. - 9 | 8 | 2020 | Winter |
| 7 | Unit-4 | Two blocks of masses $M_1$ and $M_2$ are placed on two incline planes of elevartion $\theta_1$ and $\theta_2$ and are connected by a string as shown figure. Find the acceleration of the masses. The coefficient of friction between the blocks and the planes is $\mu$. RefernFig.-10.<br>  <br> | 8 | 2020 | Winter |
| 8 | Unit-4 | A car starts from rest on curved road of 250 m radius and accelerates at a constant tangential acceleration of 0.6 m/s². Determine distance and the time for which that car will travel before the magnitude of the total acceleration attained by it becomes 0.75 m/s². | 8 | 2020 | Winter |
| 9 | Unit-4 | State the principal of work-energy. | 2 | 2020 | Summer |

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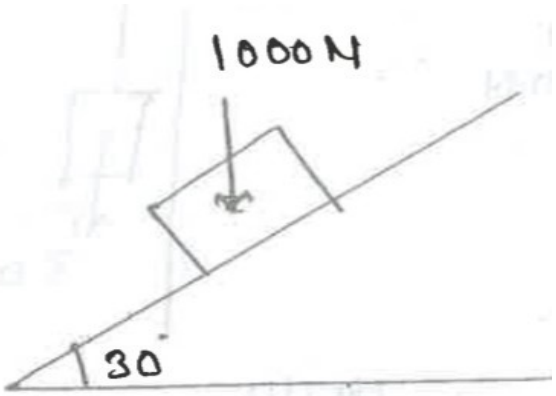
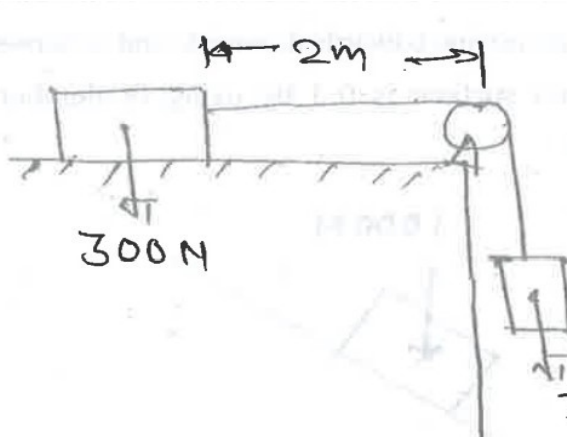
| 10 | Unit-4 | In the given figure find the acceleration of the block. If block in moving towards downside and N between block and surface is 0.3 by using D-alembert's principle.<br>  <br> | 7 | 2020 | Summer |
| 11 | Unit-4 | A blocks of 300 N is placed on a smooth table at 2m from its edge where the string connecting the block passes over a smooth pulley and carries a weight of 30 N at the other end.<br>Determine:<br>(i) Acceleration of the system<br>(ii) the tenson in the string<br>(iii) the time elapsed for the block to reach the edge of the table<br>  <br> | 7 | 2020 | Summer |
| 12 | Unit-4 | A machine gun bullet of mass 100 gm is fired with a velocity of 400 m/s. What is the kinetic energy of the bullet? If the bullet can penetrate 20 cm in a block of wood. What is the average resitance of the wood? What will be the exit velocity of the bullet if fired into similar block of wood 10 cm thick? | 7 | 2020 | Summer |

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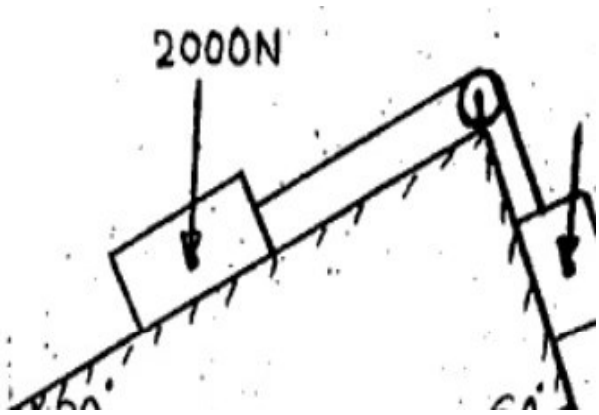
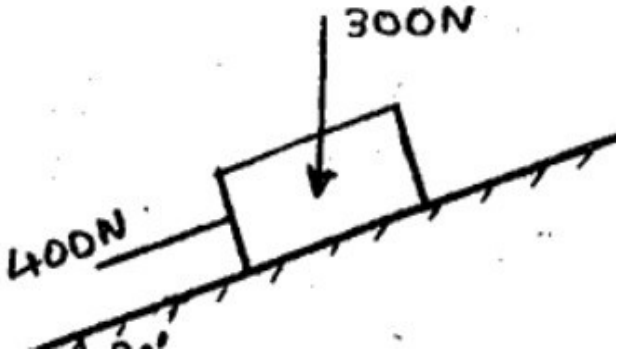
| 13 | Unit-4 | A person weighing 800 N stands in an elevator.<br>(i) If the elevator accelerates upward at a constant acceleration rate of 2 m/sec². What is the apparent weight of the person during this period of acceleration.<br>(ii) If elevator cage weighs 7000 N, find the cable tension, which corresponds to the case (i).<br>(iii) For what value of acceleration, the person would feel weighless. | 7 | 2019 | Winter |
| 14 | Unit-4 | Determine the time required for weights shown in figure to attain a velocity of 9.81 m/sec. What is the tension in the chord? Take μ= 0.2 for both planes.<br>  | 7 | 2019 | Winter |
| 15 | Unit-4 | A body weighing 300 N is pushed up a 30º plane by a 400 N force acting parallel to the plane. If the intial velocity of the body is 1.5 m/sec and coefficient of kinetic friction is μ= 0.2, what velocity will the body have after moving 6 m?<br>  | 7 | 2019 | Winter |
| 16 | Unit-4 | Explain principle of conservation of energy. | 2 | 2019 | Summer |

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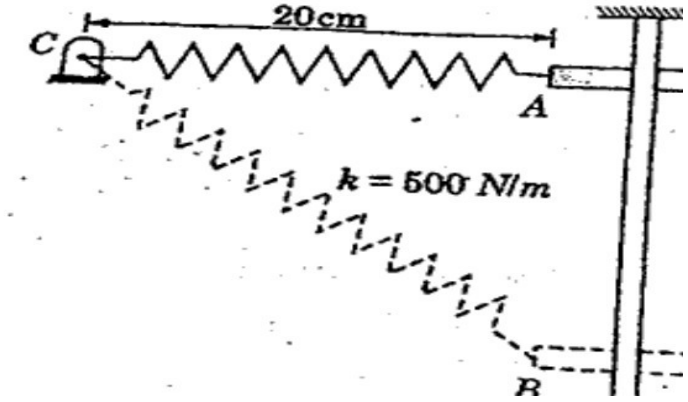
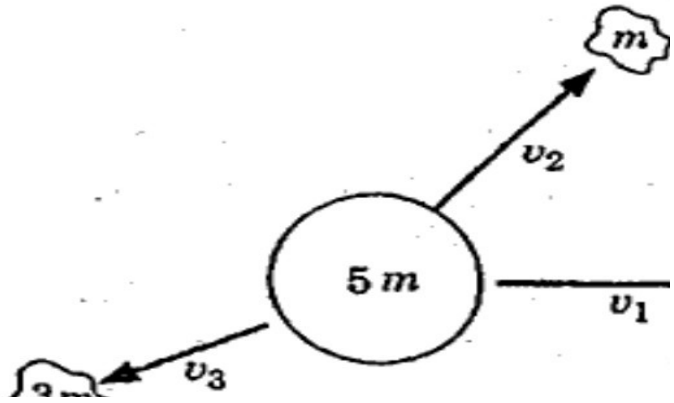
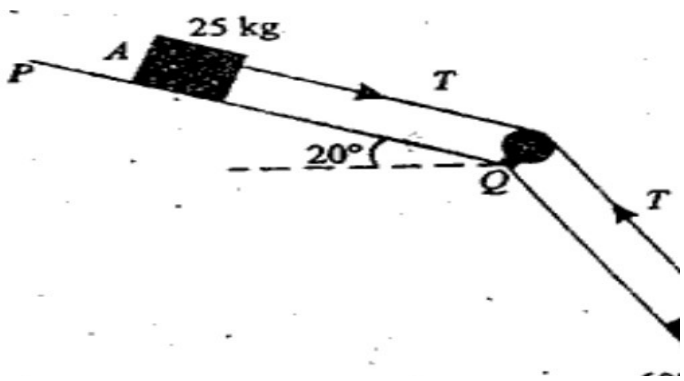
| 17 | Unit-4 | A collar of mass 5 kg can slide along a vertical bar as shown in figure. The spring attatched to the collar is in undeformed state of length 20 cm and stiffness 500 N/m. If the collar is suddenly released, find the velocity of the collar if it moves 15 cm down :<br>  | 7 | 2019 | Summer |
| 18 | Unit-4 | A bomb of mass 1 kg initially at rest explodes and breaks into 3 pieces of masses 1:1:3. The two pieces of equal mass fly off in the direction 60° to each other with a speed 30 m/s. What is the velocity of the heavier piece?<br>  | 7 | 2019 | Summer |
| 19 | Unit-4 | Two bodies A and B are connected by a light inextensible cord as shown in figure. If the bodies are released simultaneously, what distance do they move in 3 seconds? Neglect friction between the two bodies and inclined surfaces :<br>  | 7 | 2019 | Summer |

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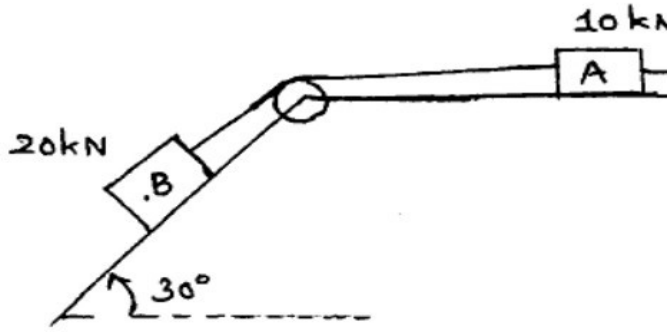
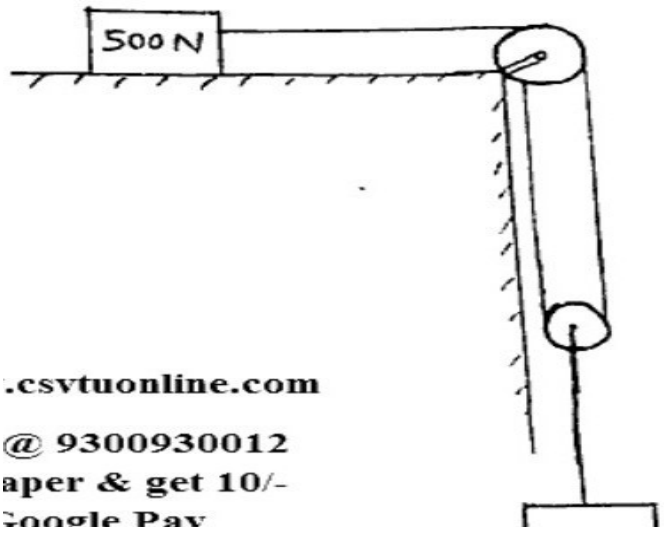
| 20 | Unit-4 | What is a conservative force? | 2 | 2018 | Winter |
| 21 | Unit-4 | Determine the acceleration produced in a body of 50 kg mass when it is acted upon by a force of 125 N. Use D'Almebert's principle. | 4 | 2018 | Winter |
| 22 | Unit-4 | Two blocks 'A' and 'B' are connected by a cable over a frictionless pulley as shown in fig. (9). The block 'B' is sliding down with velocity of 2 m/sec. What force 'P' applied over a period of 3 second will reverse its direction of motion   | 10 | 2018 | Winter |
| 23 | Unit-4 | The intial velocity of the 500 N block is 5 m/sec to the left. Determine the time 'T' using impulse-momentum equation at which the block has (i) no velocity (ii) a velocity of 5 m/sec to the right (fig.10).    | 10 | 2018 | Winter |
| 24 | Unit-4 | Explain the principle of impulse and momentum. | 2 | 2018 | Summer |

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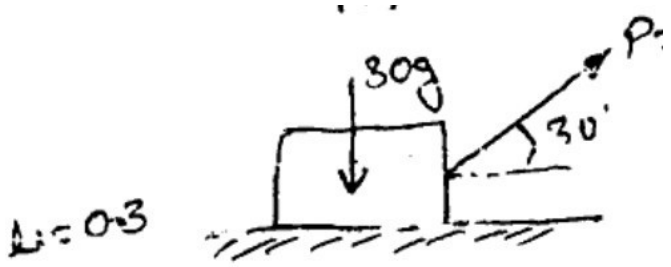
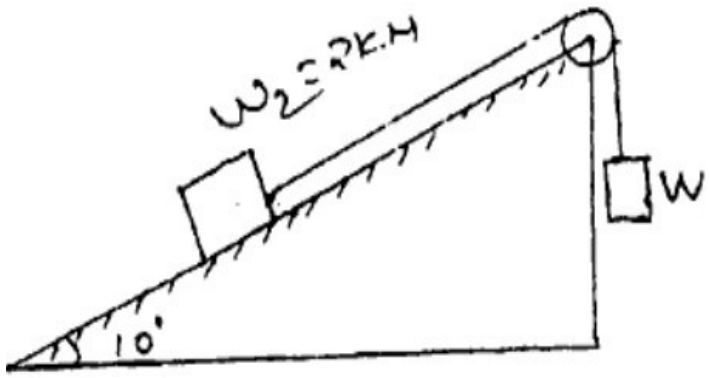
| 25 | Unit-4 | A block of mass 30 kg is dragged on the floor (μ= 0.3) with a force of 100 N by a string inclined to 30° to the horizontal, figure 10. What is the velocity attained after it has moved 4 m from rest and the time elapsed? If te string is now cut off how far the block moves before coming to rest?<br>  | 7 | 2018 | Summer |
| 26 | Unit-4 | A block weighing 2 kN rests on a rough inclined plane which makes an angle of 10° to the horizontal fig. 11. It is pulled by means of a light flexible rope running parallel to the plane and passing over a light frictionless pulley. The other end of the rope hangs vertically carrying a weight of 1 kN. If μ= 0.2 for the plane and block, determine :<br>(i) the tension in the rope<br>(ii) the acceleration of the block<br>(iii) the distance moved by the block in 5 seconds<br>  | 7 | 2018 | Summer |
| 27 | Unit-4 | A block of wood weighing 6 N is placed on a rough horizontal floor, the coefficient of friction between the block and the floor being 0.4. A bullet of weight 0.3 N is fixed with a velocity of 80 m/s into the block, determine : (i) the velocity with which the block and the bullet begin to move together after the impact.<br>(ii) the distance to which the block moves along the floor. | 7 | 2018 | Summer |
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| 1 | Unit-5 | State D' Alembert's principle. | 4,2 | 2021, 2019 | Winter |
| 2 | Unit-5 | A ball of mass m is dropped on to a spring of stiffness from a height h. Find the maximum deflection (δ) of the spring. Assume m= 5 kg, k=500 N/m and h =10 cm. | 8 | 2021 | Winter |
| 3 | Unit-5 | A gun of mass 3000 kg fires horizontally a shell of mass 50 kg with a velocity of 300 m/s. What is the velocity with which the gun will recoil? Also determine the uniform force required to stop the gun in 0.6 m. In how much time will it stop? | 8 | 2021 | Winter |
| 4 | Unit-5 | A glass ball is dropped on smooth horizontal floor from which it bounces to a height 9 m. On the second bounce it rises to a height of 6 m. From what height was the ball dropped and find the coefficient of restitution between the glass and the floor. | 8 | 2021 | Winter |
| 5 | Unit-5 | Multiple choice Questions :<br>**(A)** Which of the following is represented by the area under force-displacement diagram? (a) Impulse, (b) Momentum, (c) Power, (d) Work done<br>**(B)** According to work energy principle, a particle of mass m when subjected to unbalanced force system, the work done during displacement by all forces is equal to change in.... during displacement. (a) Gravitational Energy, (b) Kinetic Energy, (c) Mechanical Energy, (d) Potential Energy<br>**(C)** The force for which work done is independent of..... is called as conservative force. (a) distance, (b) path, (c) time, (d) all the above<br>**(D)** When the speed of an object is doubled, its momentum? (a) remains unchanged in accord with thr conservation of momentum, (b) doubles, (c) quadruples, (d) decreases | 4 | 2020 | Winter |

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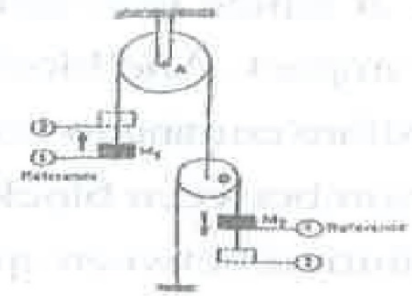
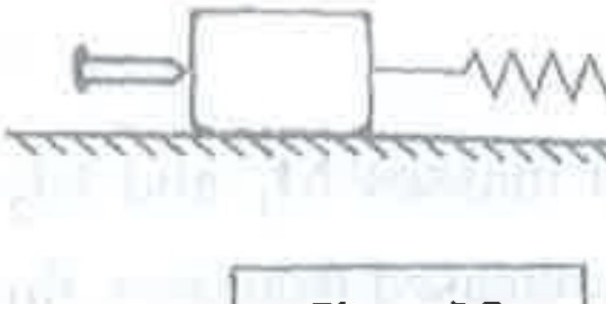
| 6 | Unit-5 | If a system of two masses $M_1$ and $M_2$ arranged as shown in Figure are released from rest, find the velocity of the mass $M_2$ after it has fallen a vertical distance of 2m. Neglect the inertia of the pulleys. Assume $M_1=M_2=$ 10 kg. Refer Fig. -11.<br>  <br>Fig. - 11 | 8 | 2020 | Winter |
| 7 | Unit-5 | A 20 gm bullet is fired horizontally into 300gm block, which rest on smooth surface. After the bullet penetrates into the block, the block moves to the right through 300mm before momentarily coming to rest. Determine speed of the bullet as it strikes the block. The spring is originally un-stretched and has a constant of 200N/m. Assume Plastic Impact. Refer Fig. -12.<br>  | 8 | 2020 | Winter |

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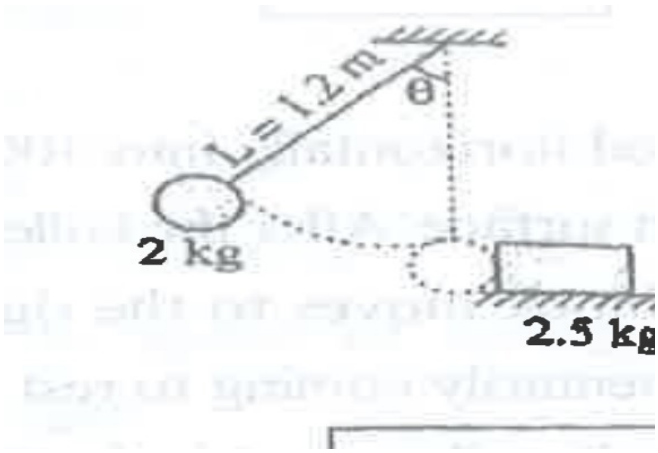
| 8 | Unit-5 | A 2 kg sphere is released from rest when θ=60°. It strikes 2.5 kg block B which is at rest. The velocity of sphere is zero after impact. And block moves through a distance of 1.5m before coming to rest. Determine : (a) Co-efficient of friction between block and surface. (b) Co-efficient of restitution between sphere and block. Refer Fig.-13.   | 8 | 2020 | Winter |
| 9 | Unit-5 | Define thermodynamic Equilibrium. | 2 | 2020, 2019 | Summer, Summer |
| 10 | Unit-5 | A mass of 1.5 kg of air is compressed in a quasistatic process from 0.1 Mpa to 0.7 Mpa for which PV= const. The intial density of air is 1.16 $kgm^{-3}$. Find the work done by piston to compress the air. | 7 | 2020 | Summer |
| 11 | Unit-5 | Prove that energy is A property of the system. | 7 | 2020 | Summer |
| 12 | Unit-5 | A blower handles 1 kg/s of air at 20° C and consumes a power of 15 kW. The inlet and outlet velocity of air are 100 m/s and 150 m/s. Find the exit air temperature assumign a diabiatic conditions. | 7 | 2020 | Summer |
| 13 | Unit-5 | Define the thermodynamic work transfer. | 2 | 2019 | Winter |
| 14 | Unit-5 | Write short notes on any two. (not more than 100 words)<br>(i) Thermodynamic system.<br>(ii) Zeroth law of thermodynamics (2018)<br>(iii) Thermodynamic equilibrium<br>(iv) First law of thermodynamics | 7,2 | 2019, 2018 | Winter, Summer |

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| 15 | Unit-5 | A cylinder contains 0.45 $m^3$ of gas at 1 Mpa and 80° C. The gas is compressed to the volume of 0.13 $m^3$, the final pressure being 5 Mpa.<br>Determine:<br>(i) The mass of the gas<br>(ii) The value of compression index n.<br>(iii) The increase in internal energy of the gas<br>(iv) The work required during compression.<br>Take r = 1.4 and R = 294.2 J/kg ºK. | 7 | 2019 | Winter |
| 16 | Unit-5 | At the inlet oa a nozzle, the enthalpy of the fluid passing is 3000 kJ/kg and the velocity is 60 m/sec. At the outlet, the enthalpy is 2762 kJ/kg. The nozzle is horizontal and negligible head loss from it. Find<br>(i) the velocity at the exit of the nozzle<br>(ii) the mass flow rate from nozzle, If the inlet area is 0.1 $m^3$ and the specific volume at the inlet is 0.187 $m^3$/kg.<br>(iii) The exist area of nozzle, if the specific volume at the nozzle exit is 0.498 $m^3$/kg. | 7 | 2019 | Winter |
| 17 | Unit-5 | Show that the internal energy is a property of the system. | 7 | 2019 | Summer |
| 18 | Unit-5 | A gas undergoes a thermodynamic cycle consisting of three processes beginning at an intial state where $P_1$ = 1 bar, $V_1$ = 1.5 $m^3$ and $U_1$ = 512 kJ.The processes are as follows :<br>(i) Process 1-2 : Compression with PV = constant to $P_2$ = 2 bar and $U_2$ = 690 kJ<br>(ii) Process 2-3 : $W_{23}$ = 0, $Q_{23}$ = -150 kJ<br>(iii) Process 3-1 : $W_{31}$ = +50 kJ Neglect KE and PE change. Determine the heat interactions $Q_{12}$ and $Q_{31}$. | 7 | 2019 | Summer |
| 19 | Unit-5 | At the inlet of certain nozzle, the enthalpy of the fluid passing is 3000 kJ/kg and the velocity is 60 m/sec. At the discharge end the enthalpy is 2757 kJ/kg. The nozzle is horizontal. The heat loss during the flow is negligible. (i) Find the velocity at the exit. (ii) If the inlet area is 0.1 $m^2$ and specific volume is 0.187 $m^3$/kg, find the mass flow rate. (iii) If the specific volume at the outlet is 0.498 $m^3$/kg, find the area at the exit of the nozzle. | 7 | 2019 | Summer |
| 20 | Unit-5 | Which non-flow compression process needs maximum work to be done. | 2 | 2018 | Winter |

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| 21 | Unit-5 | Air at 30° C and 1 bar is compressed reversibly and polytropically from 5 $m^3$ to 1 $m^3$. Calculate the final temperature and pressure of air. (n =1.4) $C_p$ = 1.005 kJ/kg K, $C_v$ = 0.718 kJ/kg K. | 4 | 2018 | Winter |
| 22 | Unit-5 | Steam is supplied to a fully loaded 1100 kW turbine at 15 bar with an internal energy of 2395 kJ/kg and specific volume of 0.16 $m^3$/kg and velocity 110 m/sec. Exhaust takes place at 0.05 bar with internal energy of 1885 kJ/kg and specific volume equal to 26 $m^3$/kg and velocity 300 m/sec. Heat loss from the steam in the turbine is 21 kJ/kg. Potential energy change is negligible. Determine : (i) Shaft work output per kg and (ii) Steam flow rate in kg/hr | 10 | 2018 | Winter |
| 23 | Unit-5 | 2.3 $m^3$ of a gas at 80 kPa and 180°C are heated at constant pressure until the volume is doubled. $C_p$ = 1.0006 kJ/kgK and $C_v$ = 0.7134 kJ/kgK. Determine the change in internal energy and the workdone doing the process. | 10 | 2018 | Winter |
| 24 | Unit-5 | Prove that heat transfer is a path function. | 7 | 2018 | Summer |
| 25 | Unit-5 | 3 kg of air kept at an absolute pressure of 100 kPa and temperature of 300 K is compressed polytropically until the pressure and temperature become 1500 kPa and 500 K respectively. Evaluate the polytropic index n, the final volume, the work done and the heat interaction. Take gas constant R = 2.87 kJ/kg K. | 7 | 2018 | Summer |
| 26 | Unit-5 | In a gas turbine the gas enters at the rate of 5 kg/s with a velocity of 50 m/s and enthalpy of 900 kJ/kg and leaves the turbine with a velocity of 150 m/s and enthalpy 400 kJ/kgK. The loss of heat from the gases to the surroundings is 25 kJ/kg. Assume for gas R= 0.285 kJ/kgK and $C_p$= 1.004 kJ/kgK and the inlet conditions to be at 100 kPa and 27°C . Determine the power output of the turbine and the diameter of the inlet pipe. | 7 | 2018 | Summer |