

MODEL QUESTION

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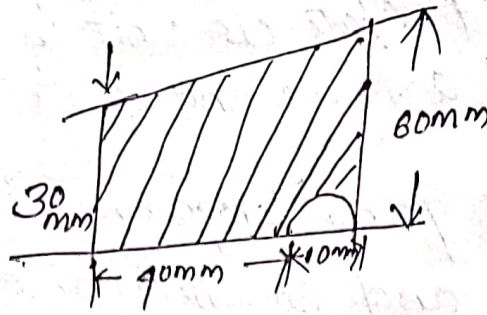
2x10

- (1)(a) Define force and state its unit in S.I system
- (b) Define moment of a force and state its unit in S.I system
- (c) State the law of parallelogram of forces.
- (d) Define friction and co-efficient of friction
- (e) Define Centroid of a plane figure.
- (f) Define a simple lifting machine.
- (g) State Newton's law of collision of two bodies.
- (h) What is resultant force?
- (i) State Varignon's theorem.
- (j) State the condition of equilibrium for non-concurrent forces.

5x6

- (2)(a) Find the magnitude and direction of force, which when combine with a 8N vertical force, will give 6N horizontal force.
- (b) Explain principle of transmissibility and super position.
- (c) State and explain Varignon's theorem
- (d) State and prove Lami's theorem
- (e) Find the expression for Centroid of a semi-circle.
- (f) A ball of mass '1kg' moves with a velocity of 2m/sec impinges directly on a ball of mass '2kg' at rest. The 1st ball after impinging comes to rest. Find the velocity of the second ball after impact and coefficient of restitution.

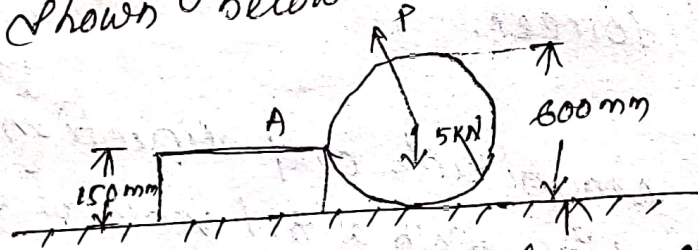
- (g) explain laws of friction.
 (h) Find the centroid of the figure shown notched (2)
 as below



ANSWER ANY THREE

- (3) Two forces act at angle of 120° . The bigger force is 90 N and the resultant is perpendicular to the smaller one. Find the smaller force. 10

- (4) A uniform wheel 600 mm diameter weighing 5 kN rests against a right rectangular block of 150 mm height as shown below 10



Find the least pull force through the center of the wheel required just to turn the wheel over the corner A of block (assume surface to be smooth)

- (5) An electric light fixture weighs 15 N hangs from a point (c) by two strings AC and BC. The string is inclined at 60° to the horizontal and BC is at 45° to the horizontal as shown in the figure below. Determine the forces on string AC and BC using Lami's theorem. 10

MODEL QUESTION

3

(1)(a) Define limiting angle of friction.

2x10

(b) State parallel axis theorem

(c) What is reversible machine

(d) Define impulse

(e) Define triangle law of forces

(f) State law of moment.

(g) State Lamie's theorem

(h) What do you mean by Centroid?

(i) State law of Conservation of linear momentum

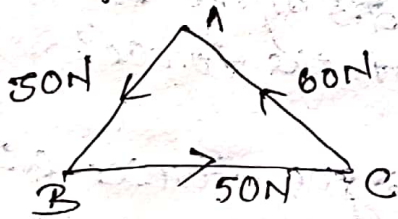
(j) What is lifting machine?

5x6

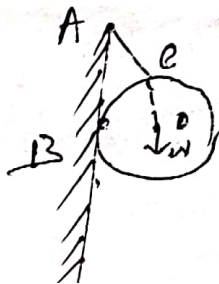
(2)(a) Find velocity ratio of a compound gear train

(b) State and explain d'Alembert's principle.

(c) Forces of 30N, 50N and 60N are acting along the sides of an equilateral triangle ABC of side 50 cm as shown in figure - 1. Find the magnitude, direction and position of resultant force.

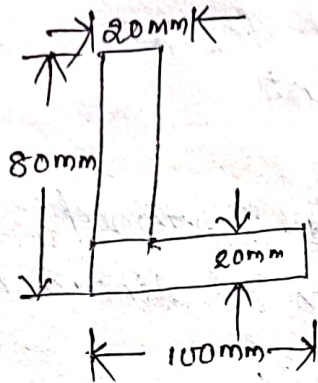


(d) A smooth sphere of weight 1000N is supported by a string fastened to a point A on the smooth vertical wall, the other end is in contact with point B on the wall as shown in it the length of string AC is equal to the radius of the sphere, find the tension in the string and reaction of the wall.



(e) A body of weight 50 N is pulled along a rough horizontal plane by a force of 18 N acting at an angle of 19° with the horizontal. Find the co-efficient of friction.

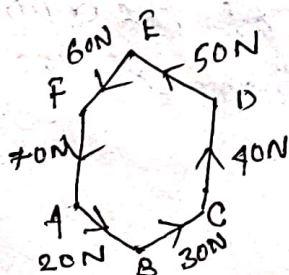
(f) Find the position of centroid of a L section as shown



(g) In a cutting machine, an effort of 50 N is required to lift a load W . The distance moved by the load and effort are 20 mm and 500 mm respectively. Determine the magnitude of the load W if the efficiency of the machine is 80% .

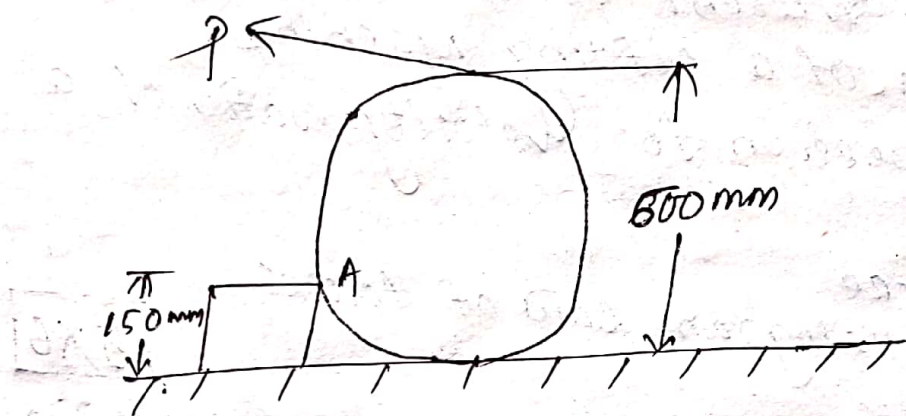
(h) A constant force acting on a body of mass 20 kg changes its speed from 2.5 m/sec to 10 m/s in 15 seconds . What is the magnitude of the force?

(3) ABCDEF is a regular hexagon. Forces of 20 N , 30 N , 40 N , 50 N , 60 N and 70 N are acting along the sides AB, BC, CD, DE, EF and FA respectively as shown. Find the magnitude and direction of resultant force. 10



(4) A uniform wheel of 600 mm diameter, weighing 10 kN rests against a rigid rectangular block of 150 mm height as shown in. Find the least pull required at the top of the wheel just to turn the wheel over the corner 'A' of the block. Also find the reaction at 'A' (assume all the surfaces to be smooth)

10



MODEL QUESTION

6

1(a) Define couple.

2 X 10

(b) What is free body diagram

(c) What do you mean by reversibility of a lifting machine.

(d) Define Co-efficient of restitution

(e) State Lamé's theorem

(f) Define Co-efficient of friction

(g) Define M.A of a lifting machine

(h) State expression for velocity ratio of a screw jack

(i) Define force

(j) State parallelogram law of forces.

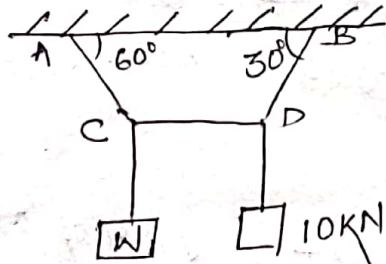
5 X 6

2(a) A constant force acting on a body of mass 20 kg changes its speed from 2.5 m/sec to 10 m/sec in 15 seconds. What is the magnitude of the force

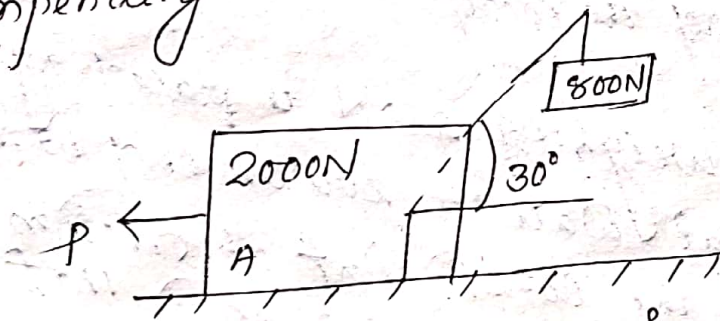
(b) Two forces one of which is double the other, has resultant of 260 N. If the direction of the larger force is reversed and the other remains unaltered, the resultant reduces to 180 N. Determine the magnitude of the forces and the angle bet'n them.

(c) ABCD is rectangle, in which AB = CD = 25 cm and BC = DA = 45 cm. Forces of 150 N each act along AB and CD and forces of 200 N each act along BC and DA. Find the resultant moment of two couple

(d) A cord supported at A and B carries a load of 10kN at 'D' and load W at 'C' as shown in figure. Find the value of W so that CD remains horizontal. (7)



(e) The block 'A' as shown in figure weighs 2000N. The cord attached to 'A' passes over a frictionless pulley and supports a weight equal to 800N. The value of the coefficient of friction between A and the horizontal plane is 0.35. Find the value of P, if motion is impending towards left.



(f) State and prove parallel axis theorem

(g) What do you mean by reversibility of a lifting machine? Derive the condition of reversible machine

(h) A bullet weighs 0.5N and moving with a velocity of 400 m/sec hits centrally a 30N block of wood moving away at 15 m/s and gets embedded in it. Find the velocity of the bullet and block after impact.

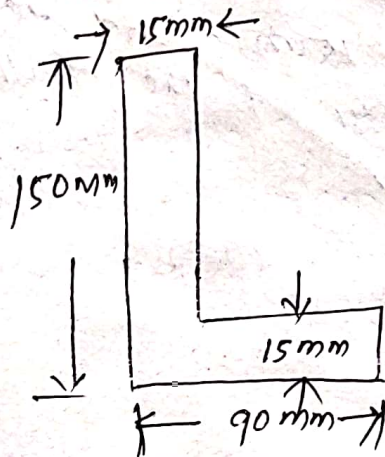
(3) A single purchase crab winch has 300mm long handle and 120mm diameter drum. Number of teeth on the pinion are 25 and that on wheel 130. If an effort of 20N lifts a load of 300N, find the MA, VR and efficiency of the crab winch. [10]

(4) A motorist travelling at a speed of 70 km/hr suddenly applies brakes and comes to a stop after skidding 50m. Determine

- (i) time required to stop the car
- (ii) the co-efficient of friction between the tyres and the road [10]

(5) A 4m ladder weighing 250N is placed against a smooth vertical wall its lower end 1.5m away from the wall. If the co-efficient of friction between the ladder and the floor is 0.3. Show that the ladder will remain in equilibrium in this position. [10]

(6) Find the M.I. of a L-section as shown in fig about the centroidal horizontal axis and vertical axis. [10]



MODEL QUESTION

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(1a) Define couple

2X10

(b) What is co-planar concurrent forces.

(c) Define Centre of gravity

(d) What is law of machine

(e) What is self locking machine

(f) Define co-efficient of friction

(g) State Lami's theorem

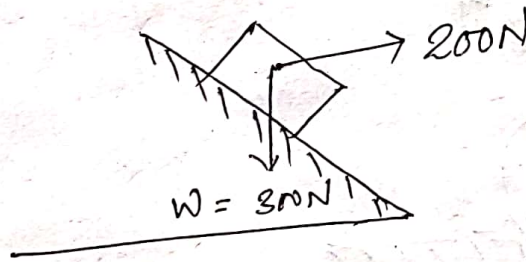
(h) Define m.A of a lifting machine

(i) What is position of centroid of a semicircular section from the base.

(j) State the law of parallelogram of forces

5X6

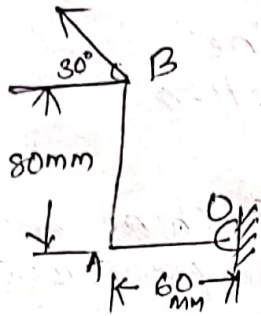
(2)(a) A body weighing 300N rests on an inclined plane making an angle of 30° with the horizontal. A horizontal force of 200N is acting on the body as shown in figure. Find the total force in the direction parallel to the plane and perpendicular to the plane.



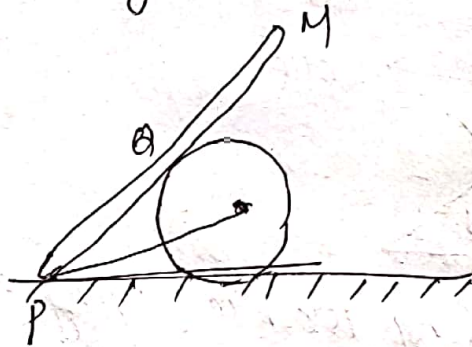
(b) A rectangular block weighing 150N is lying on an inclined plane, whose inclination with horizontal is 45° . The block is tied up by a horizontal string, as shown on fig, which has a tension of 50N. Find

- the frictional force on the block
- normal reaction of the inclined plane.
- co-efficient of friction betⁿ the surface of contact

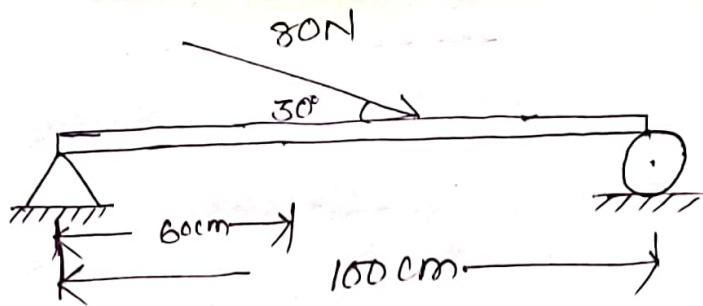
(c) A force of 200 N is acting on a bracket OAB hinged at 'O' as shown in fig. Find the moment of the force about 'O' (10)



(d) A smooth right circular cylinder of radius 16 cm rests on horizontal plane and is prevented from rolling by an inclined string PC of length 32 cm as shown in fig. A prismatic bar PQM of length 48 cm and weight 580 N is hinged at P and leans against the cylinder. Find the tension in the string.



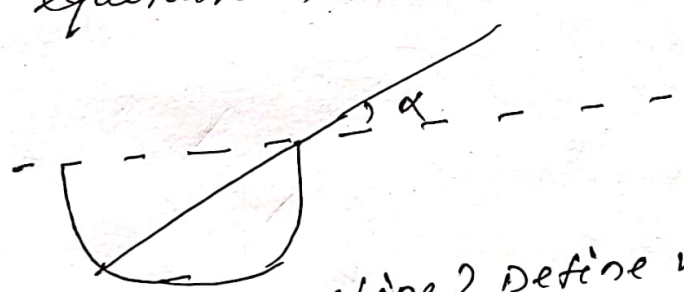
(e) A beam of length 1 m is hinged at one end A and rests on a roller supporter at other end B shown in fig. The beam is acted upon by an inclined force of 80 N at a distance of 60 cm from A. Find the reaction at A and B



(11)

- (f) Find the moment of inertia of a square section of side 80 mm about its diagonal.
- (g) Explain worm and worm wheel. Derive its velocity ratio.
- (h) An elevator is moving upward with an acceleration of 1 m/sec^2 . Find the pressure exerted by the mass of man.

(3) A prismatic bar of length 2.1 m and weight 365 N rests within a hemispherical bowl of radius 0.7 m as shown. Determine the angle α for the position of equilibrium. 10



(4) What is lifting machine? Define velocity ratio, mechanical advantage and efficiency of lifting machine. Explain law of lifting machine. 10

(5) A triangular section is cut out from a quarter circular section as shown. Find the position of the centroid of the cut out section. 10

