ENGINEERING MECHANICS
SAMPLE QUESTIONS

1. Two equal forces act on a particle such that the square of their resultant is equal to the three times of their product. Find the angle between the forces.

2. State the parallelogram law of forces.

3. Define angle of repose, angle of friction, coefficient of friction.

4. State the laws of solid friction.

5. State perpendicular axis theorem.

6. A car starts from rest and attains a velocity of 24 m/s in 30 seconds. Find its acceleration and distance covered during this time.

7. What are impulse and recoil of gun?

8. Draw a neat line diagram of differential wheel and axle.

9. Give the expressions for mechanical advantage of first system of pulleys, second system of pulleys, and third system of pulleys.

10. Write any three differences between machine and mechanism.

11. A lamp weighing 5 N is suspended from the ceiling by means of a wire. It is pulled to one side by a horizontal cord, until the wire makes an angle Of 60° with the ceiling. Find the tension in the wire and cord.

12. (a) Two forces of 100 N and 60 N act at a point. If the angle between the lines of action of the two forces is 60°. Determine the magnitude and direction of the resultant.

(b) Find the MI of rectangular lamina of 30 mm wide and 70 mm deep about its centroidal x-axis and least radius of gyration.

13. A body resting on a rough horizontal plane required a pull of 150 N inclined at 30° to the plane just to move it. It was found that a push of 200 N inclined at 30° to the plane just moved the body. Determine the Weight of the body and the coefficient of friction.

14. Find the amplitude and time period of a particle moving with SHM, which has a velocity of 9 m/s and 4 m/s at the distances of 2 m and 3 m Respectively from the center.

15. a) Write the law of the machine with effort versus load diagram.

b) A simple machine applied an effort of 280 N to lift a load of 1400 N. Find effort lost in friction and load equivalent to friction.

16. a) Derive an expression for velocity ratio of wheel and axle with the help of a neat sketch.

b) Explain the slider crank mechanism with a neat line diagram.

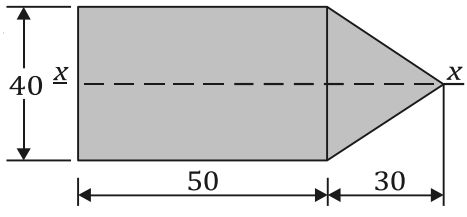
ENGINEERING MECHANICS

SAMPLE QUESTIONS

1. The resultant of two given forces is equal to each of the forces. Find the angle between the forces.
2. Define equilibrium and equilibrant.
3. Prove that the angle of repose is equal to angle of friction at the limiting fiction.
4. State the laws of static friction.
5. Define Center of gravity and Radius of gyration.
6. A body moving with SHM has amplitude of 0·8 m and period of complete oscillation is 2 seconds. Determine the maximum velocity and maximum acceleration.
7. State the law of conservation of momentum.
8. What is self locking? Mention the condition for self locking.
9. In a simple lifting machine, an effort of 500 N raised a load of 12·5 kN. If the machine has an efficiency of 65%, determine the mechanical advantage and velocity ratio.
10. *(a)* Three forces acting on a particle are in equilibrium. Angle between first two forces is 90º and that between second and third is 120º. Find the ratio of the forces.

    (b) Define a couple. List out any three practical applications of a couple.
11. *(a)* Define moment of a force. State VARIGNON'S principle.

    (b) Locate the centroid of the following section.



12. A body resting on a rough horizontal plane required a pull of 180 N inclined at 30º to the plane just to move it. It was found that a push of 220 N inclined at 30º to the plane just moved the body. Determine The weight of the body and the coefficient of friction

13. Find MI about centroidal axis parallel to base for a symmetrical I-section with the following dimensions : Top and Bottom flanges : 160 mm × 10 mm ; Web : 180 mm × 10 mm.

14. A bullet of mass 0·03 kg is fired with a velocity of 500 m/s. What is the kinetic energy of the bullet? If the bullet penetrates into a block of wood 300 mm deep, what is the resistance offered by wood to the bullet? What is the exit velocity, if the same bullet is fired into a 150 mm thick wood?

15. *(a)* An elevator lifting a weight of 4450 N starts to move upwards with a uniform acceleration of 0·6 m/s^2. Find the tension in the cable during upward motion.

(b) A wheel rotating about a fixed axis at 20 rpm is uniformly accelerated for 70 seconds, during which time it makes 50 revolutions. Find the angular velocity at the end of this interval.

16. In a differential wheel and axle, the difference between axle diameters is 50 mm and the diameter of the effort wheel is 750 mm. If a load of 2500 N is lifted by an effort of 175 N and a load of 3250 N is lifted by an effort of 210 N, determine : *(a)* law of the machine, *(b)* load lifted by an effort of 225 N, *(c)* mechanical advantage, *(d)* velocity ratio and *(e)* efficiency.

17. *(a)* Draw the following line diagrams of simple pulleys, second system of pulleys, third system machines of pulleys.

(b) Explain Ackermann Steering Gear mechanism with a neat line diagram.

ENGINEERING MECHANICS
SAMPLE QUESTIONS

1. Define and classify the system of forces.

2. Two forces of 100 N and 60 N act at a point. If the angle between the lines of action of the two forces is 60°, determine the magnitude and direction of the resultant.

3. State the laws of solid friction.

4. A body of weight 100 N is placed on a horizontal plane. Determine the coefficient of friction, if a horizontal force of 60 N just causes the body to slide over the plane.

5. Define *(a)* centre of gravity and *(b)* moment of inertia.

6. A body moving with SHM has amplitude of 0·8 m and period of complete oscillation is 2 seconds. Determine the maximum velocity and maximum acceleration.

7. State the law of conservation of momentum.

8. What is self-locking? Mention the condition for self-locking.

9. In a simple lifting machine, an effort of 500 N raised a load of 12·5 kN. If the machine has an efficiency of 65%, determine the mechanical advantage and velocity ratio.

10. The following forces act at a point :

    (i) 30 kN inclined at 35° towards North of East

    (ii) 22 kN towards North

    (iii) 30 kN inclined at 30° towards North of West

    (iv) 35 kN inclined at 25° towards South of West

    Find the magnitude and direction of the resultant force.

11. An effort of 1960 N is required to just to move a certain body up to inclined plane of angle 15°. This effort is acting parallel to the inclined plane. If the angle of inclination of the plane is made 20°, the effort required is found to be 2254 N. In this case also, the effort is parallel to the inclined plane. Find *(a)* weight of the body and *(b)* coefficient of friction.

12. An I-section is made up of a top flange 80 mm × 20 mm, web 120 mm × 20 mm and bottom flange 100 mm × 20 mm. Determine the

moment of inertia of the I-section about its centroidal axes.

13. In a differential wheel and axle, the difference between axle diameters is 40 mm and the diameter of the effort wheel is 600 mm. If a load of 2600 N is lifted by a load of 150 N and a load of 3200 N is lifted by an effort of 200 N, determine *(a)* law of the machine, *(b)* velocity ratio, *(c)* load lifted by an effort of 250 N, *(d)* mechanical advantage, *(e)* efficiency and *(f)* effort wasted in friction.

14. *(a)* What is a lever? Illustrate the types of lever with examples.

(b) Explain Whitworth quick return mechanism with a neat diagram.

15. (a) What is couple? Discuss about the classification and characteristics of a couple.

(b) Find the moment of inertia of a rectangular lamina of 40 mm wide and 80 mm deep. Also determine the least radius of gyration.

16. A particle is moving with its acceleration directed to and proportional to its distance from a fixed point. When the distance of the particle from equilibrium position has values 1·3 m and 1·8 m, the corresponding velocities are 5 m/s and 2 m/s. Determine the (a) amplitude, (b) maximum velocity, (c) maximum acceleration and (d) time period.

17. (a) A stone is dropped from a tower and strikes the ground after 4 seconds. Find the velocity of stone at the end of 4 seconds and height of the tower.

(b) A bullet of mass 30 g is fired into a target with a velocity of 420 m/s. It penetrates into a plank through 3 cm. Find the resistance offered by the plank.

ENGINEERING MECHANICS
SAMPLE QUESTIONS

1. State the Lami's theorem and write the relevant formula.

2. Two forces 10 N and 12 N act simultaneously at a point. Find the resultant force if the angle between them is 60°.

3. Define the following terms :

(a) Angle of friction

(b) Angle of repose

4. State any three laws of solid friction.

5. Define the following terms :

(a) Moment of inertia

(b) Radius of gyration

6. Define centrifugal force. Give two examples where this force comes into play.

7. State the Alembert's principle.

8. Define the following terms:

(a) Velocity ratio

(b) Mechanical advantage

9. Write the difference between a reversible machine and self- lock machine.

10. List out any three names of inversions of four bar chain.

11. The following forces act at a point:

a. 30 N towards East

b. 25 N towards North

c. 35 N towards West

d. 45 N towards south

Find the magnitude and direction of resultant force

12. A body resting on a rough horizontal plane required a pull of 90 N inclined at 30° to the plane just to move it. It was also found thata push of 110 N inclined at 30° to the plane just moved the body. Determine weight of the body and the coefficient of friction.

13. *(a)* The resultant of two equal forces acting at a point with an angle of 60° between them is 17·32 N. Find the magnitude of each force.

(b) Find the moment of inertia of rectangular lamina of 30 mm wide and 70 mm deep about its centroidal axes. Also find its least radius of gyration.

14. Find the moment of inertia about centroidal axes for the given I-section. The dimensions are as follows :

Top flange : 100 mm × 20 mm

Web : 20 mm × 100 mm

Bottom flange : 120 mm × 30 mm

15. A bullet of mass 0·1 kg is fired into a target with a velocity of 350 m/s. The mass of the target is 10 kg and it is free to move. Find the loss of kinetic energy.

16. A wheel rotating about a fixed axis at 45 r.p.m is uniformly accelerated for 60 seconds during which it makes 50 revolutions. Find :

(a) Angular velocity at the end of this interval and

(b) Time required for the speed to reach 90 r.p.m.

17. An effort of 303·8 N is required to lift 9800 N and effort of 597·8 N is required to lift 19600 N using a simple machine. Find the load lifted using an effort of 156·8 N on that machine.

18. *(a)* Draw the line diagram of second system of pulleys and write the formula for its velocity ratio.

(b) Explain the Pantograph mechanism with a neat sketch.

TH4 ENGINEERING MECHANICS
SAMPLE QUESTIONS

1.
   a. Define coplanar forces.
   b. DefinePrinciple of Transmissibility.
   c. Define couple.
   d. What is the centre of gravity of a semicircle from its base along its vertical radius?

   e. State angle of repose.
   f. Define centre of gravity & centroid.
   g. Define coefficient of friction.
   h. Write the formula for MI of hollow rectangular section.
   i. Define velocity ratio.
   j. State Newtons second law of motion.

2.
   a. State and prove Lamis theorm.

   b. State laws of friction.
   c. State & prove perpendicular axis theorm.

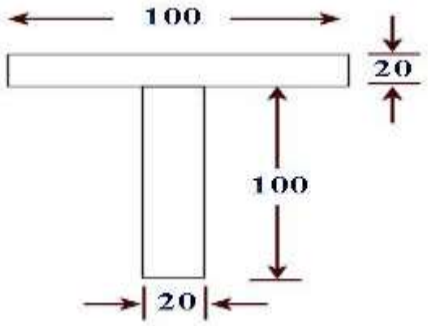
   d. A lifting machine whose velocity ratio is 50, an effort of 100N is Required to lift a load of 4KN is the machine reversible?
   e. State the relationship between Efficiency, M.A & V.R of lifting machine.
   f. A scooter starts from rest moves with a constant acceleration of 1.2 m/s2. Determine its velocity , after it has travelled for 60meters.

   g. State & Prove Lami's theorem.

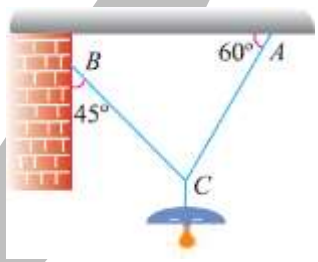
3 A body which weighs 300 N rests on a horizontal plane having a co-efficient as 0.3. Find the magnitude of force, which can move the body , while acting at an angle of 25° to the horizontal.

4 What is parallelogram law and how it is used to find out Resultant and its direction.

5 Find the C.G of a T-section.



6 An electric fixture weighing 15N hangs from appoint C, by two string AC and BC. The string AC is inclined at 60 to the horizontal BC at 45 to the horizontal as shown in fig



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7. Explain the working principle of screw jack & find the V.R of screw jack.

TH4 ENGINEERING MECHANICS
SAMPLE QUESTIONS

1.

a. Define system forces.
b. Define recoil of gun.
c. Define arm of a couple.
d. What is the center of gravity of a semicircle from its base along its vertical radius?

e. State Triangle law of forces.
f. Define center of gravity & centroid.
g. Define coefficient of friction.
h. Write the formula for MI of hollow rectangular section.
i. Define velocity ratio.
j. State Newton's first law of motion.

2.

a. State and prove Lami's theorm.
b. State laws of friction.
c. State & prove perpendicular axis theorm.

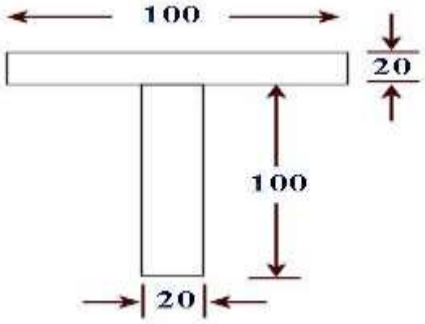
d. A lifting machine whose velocity ratio is 50, an effort of 100N is Required to lift a load of 4KN is the machine reversible?

e. State the relationship between Efficiency, M.A & V.R of lifting machine.
f. Find the moment of inertia of a hollow rectangular section about its center of gravity if the external dimensions are breadth 60mm, depth 80mm and internal dimensions are breadth 30mm and depth 40mm respectively.

g. State the laws of friction.

3. A body which weighs 300 N rests on a horizontal plane having a co-efficient as 0.3. Find the magnitude of force, which can move the body , while acting at an angle of 25° to the horizontal.

4. What is parallelogram law and how it is used to find out Resultant and its direction.
5. Find the C.G of a T-section.



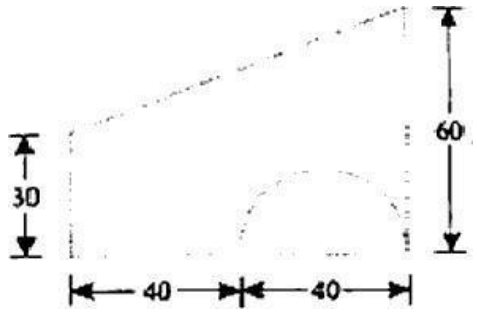
6. A vehicle of mass 500kg ,is moving with a velocity of 25m/sec. A force Of 200N act on it for 2 minutes. Find the velocity of the vehicle:

   (a) When the force acts in the direction of motion,and
   (b) When the force acts in the opposite direction of motion.

7. Explain the working principle of screw jack & find the V.R of screw jack.

ENGINEERING MECHANICS
SAMPLE QUESTIONS

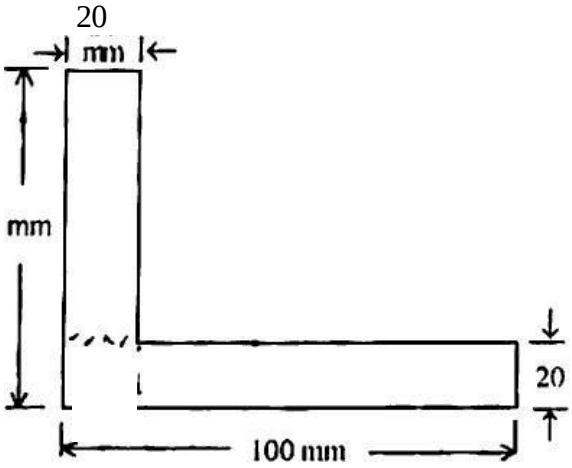
1. State and prove Lami's theorem.
2. The resultant of two concurrent forces is perpendicular to the smaller force and angle between the forces is 120º.if the bigger force is 60 N, find the smaller one?
3. State the laws of static friction?
4. A certain weightlifting machine of velocity ratio 40canlifta load of2000N, with the help of I5O N effort. Determine the efficiency of the machine?
5. A smooth circular cylinder of radius 1.5 meter is lying in a triangular groove, one side of which makes I5º angle and the other 40º angle with the horizontal. Find the reactions at the surfaces of contact, if there is no friction and the cylinder weights 100 N.
6. A semicircular area is removed from a trapezium as shown in Fig-(dimensions in mm). Determine the centroid of the remaining area (shown hatched).



7. A body of mass 40 kg is moving with a constant velocity of 2.5 m/s. Now a force of 100 N is applied on the body in its direction of motion. What will be its velocity after 2 second?
8. What is reversible machine? State the condition of reversibility.
9. What load can be lifted by an effort of 120 N, if the velocity ratio is 18 and efficiency of the machine at this load is 60% ? Determine the law of the machine, If It is observed that an effort of 200 N is required to lift a load of 2600 N.
10. Define Collision state the law of conservation of linear momentum.
11. The resultant of two concurrent forces is perpendicular to the smaller force and angle between the forces is 120 º. If the bigger force is 60N. Find the smaller one
12. State the Laws of friction.
13. Define gear train? Derive the velocity ratio of a compound gear train.
14. A ball of mass2kg moving with a velocity of 2m/shits directly on a ball of mass4kg at rest. The first ball, after impinging, comes to rest. Find the velocity of the second ball after the impact and the coefficient of restitution.
15. State and prove Lami's theorem.
16. A single purchase crab winch has 300mm long handle and 120mm diameter drum. Number of teeth on the pinion is25 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 .
17. Explain principles of transmissibility and superposition.

18. Derive the condition for reversibility of a machine.
19. Derive velocity ratio of a compound gear train.

20. A body of weight 50 N is pulled along a rough horizontal plane by a force of 18 N acting at an angle of 14^0 with the horizontal. Find the coefficient or friction.
21. Find the position of Centroid of an **L** section as shown in the figure below.



mm

22. State and prove Perpendicular axis theorem.

ENGINEERING MECHANICS
SAMPLE QUESTIONS

1. Define force and state its unit.
2. State the principle of transmissibility.
3. Define Couple and write its unit.
4. Define angle of repose.
5. Define co efficient of friction.
6. Differentiate between Centroid and Centre of Gravity.
7. Define Mechanical advantage and Velocity ratio by considering a lifting machine.
8. Define momentum and impulse.
9. Define coefficient of restitution.
10. State Triangle's law of forces.
11. Define angle of Repose.
12. State Perpendicular Axis Theorem.
13. Inaweightliftingmachinehavingavelocityratio20isabletoliftaweightof1KNby an effort of 80N. Show that the machine can work in the reverse direction if the effort is removed.
14. Define power Write its S.I unit
15. Explain (i) coplanar forces (ii) concurrent forces
16. Define free body diagram with an eat sketch.
17. Explain conservation of energy.
18. Define moment of a force Classify the moments according to the direction of rotation.
19. State polygon law of forces.
20. State the condition of equilibrium.
21. Define angle of friction.
22. State any two disadvantages of friction.
23. State the relation between M.A, VR and efficiency of a simple lifting machine.
24. State law of machine.
25. Define power and write down its S.I unit. (J)State Newton's 2^{nd} law of motion.
26. State and explain D'Alembert's principle.
27. State and explain law of conservation of energy.
28. State Varignon’s theorem.
29. State reversible machine.
30. State parallel axis theorem.
31. Express the formula for velocity ratio of a single purchase crab winch.
32. Illustrate self locking machine.

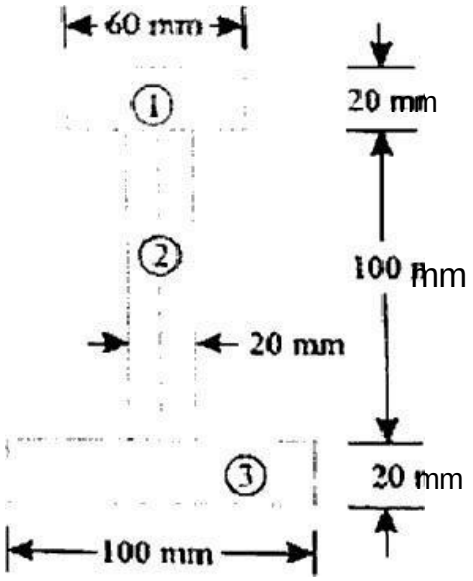
ENGINEERING MECHANICS
SAMPLE QUESTIONS

1. The following forces act at a point:
   (i) 20Ninclinedat30' towards North of East,
   (ii) 25Ntowards North.
   (iii) 30Ntowards North West, and
   (iv) 35Ninclinedat40ºtowardsSouthofwest.

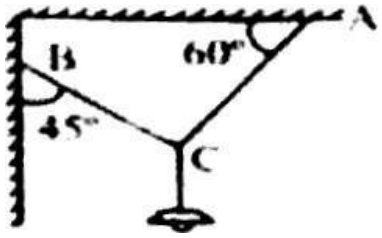
Find the magnitude and direction of the resultant force

2. A uniform ladder of length 3.25 m and weighing 250 N is placed against a smooth vertical wall with its lower end 1.25 m from the wall. The coefficient Of friction between the ladder and floor is 0.3. What is the frictional force acting on the ladder at the point of contact between the ladder and the floor? Show that the ladder will remain in equilibrium in this position.

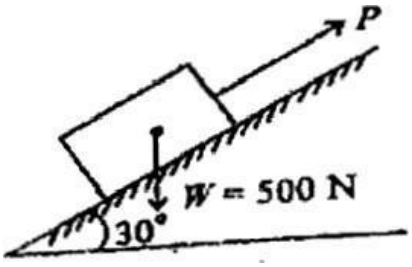
3. An I-section is made up of three rectangles as shown in Fig. Find the moment of inertia of the section about the horizontal axis passing through the centre of gravity of the section.



4. An electric light fixture weighs 15N hangs from a10 point by two Strings AC and BC. The string is inclined at 600 to the horizontal and BC is at 45^0 to the horizontal as shown in the figure below. Determine the forces on string AC and BC.

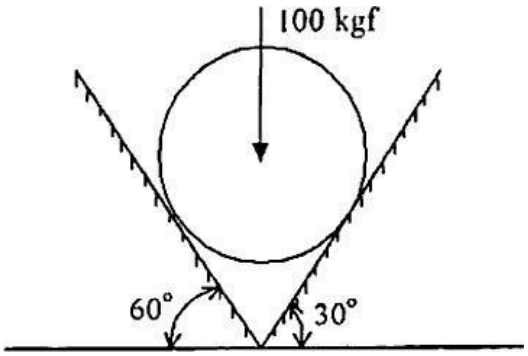


5. A body of weight 5OO N is lying on a plane inclined at an angle 30º. It is supported by an effort parallel to the plane as shown in figure. Determine the minimum & maximum values of P for which equilibrium can exist. Take the coefficient of friction as 0.35.



6. Find law of the machine in which an effort of 19.5 N raised a load of 90N and another effort of 15.5 N raised a load of 70 N. Find what effort is required to lift a load of 100 N.

7. State and explain Newton's laws of motion equation of motion
8. A spherical ball of weight 100 kg rests on two smooth inclined planes as shown in the figure. Find the reaction of each inclined plane on the ball.



9. A ladder 5 meter long rests on a horizontal ground and leans against a smooth vertical wall at an angle of 70ºwiththe horizontal. The weight of the ladder is900 N and acts at its middle. The ladder is at the point or sliding, when a man weighing 750 N stands on a ring m from the bottom of the ladder. Calculate the co-efficient of friction between ladder and floor.

10. A ball is dropped from a height of 1mon a smooth floor. Knowing that the height of the first bounce is = 81 cm determine
    (a) Coefficient of restitution
    (b) Expected height of second bounce.