DPP – 1 FROCE

1. Define the following:

a) Rigid body

b) Point of action of force

c) Line of action of force

d) Principle of transmissibility of force

2. Name four bodies which can be called rigid bodies for practical purposes.

3. Under what condition a body describes a motion of

a) Translation **b)** Rotation

4. What do you understand by the term moment of force?

5. State two factors, which determine the moment of force?

6. State one way of a) reducing moment of force, b) increasing moment of force for a given force acting on a body capable of turning around a fixed point.

7. State the law of moments.

8. What do you understand by the terms a) positive moments, b) negative moments?

9. State the absolute units of the moment of force in a) CGS system, b) SI system.

10. What do you understand by the following terms?

a) Couple **c)** Moment of couple

b) Arm of couple

11. State the absolute units of the moment of force in a) CGS system, b) SI system.

12. Give four examples of couple in everyday life.

13. State the mathematical expression for the moment of a couple.

14. Explain the following :

a) Jack screw provided with the long arm.

b) It is easier to open a door by handling it from its edge.

c) A small boy can balance a stout man on a see – saw.

d) The handle of a hand flour grinder is provided near its rim.

e) It is easier to turn a steering wheel of larger diameter than a steering wheel of smaller diameter.

f) A wrench or a spanner has a long handle.

15. What do you understand by the term equilibrium of a body?

16. State a condition when a body is in

a) Static equilibrium. **c)** Support your answer with one example each.

b) Dynamic equilibrium.

17. A body is acted upon by number of forces acting in different directions. State two conditions for a body to be in equilibrium.

DPP – 2 FORCE

1. What do you understand by the term center of gravity?

2. State the position of CG in case of the following regular bodies.

- **a)** a triangular lamina
- **b)** a rectangular lamina
- **c)** a circular lamina
- **d)** a cylinder
- **e)** a sphere
- **f)** a square lamina

3. Is it possible to have a body whose center of gravity is outside the body? If so, explain.

4. How will you determine the centre of gravity of an irregular piece of a cardboard?

5. A flat triangular cardboard equatorial in shape is suspended by passing a common pin through a narrow hole at its corner. Draw a diagram to show its position in the state of rest. In the diagram mark the position of suspension by the letter A and center of mass (center of gravity) by the letter B.

6. A stone of mass 'm' is rotated in a circular path with uniform speed by tying a strong string with the help of your hand. Answer the following questions.

- **a)** Is the stone moving with a uniform or variable speed?
- **b)** Is the stone moving with a uniform acceleration? What is the effect of acceleration? In which direction does the acceleration act?
- **c)** What kind of force acts on the stone and state its direction?
- **d)** What kind of force acts on the hand and state its direction?

7. State whether following statements are true or false:

- **a)** On deformation of a body, the position of center of gravity does not change.
- **b)** The center of gravity of a freely suspended body is always vertically below the point of suspension.

8. Define or explain (i) circular motion (ii) centripetal force (iii) centrifugal force.

9. Give an example of a body moving with a uniform speed, but has an accelerated motion.

10. Compare uniform circular motion and uniform linear motion.

11. Explain the motion of moon around the earth.

12. With reference to magnitude of force and its direction, how does centripetal force differ from centrifugal force?

DPP – 3 FORCES

1. Write SI unit of the torque. Is torque a vector or scalar quantity?

2. State the factors on which moment of force depends.

3. What is clockwise and anticlockwise moment of force? When is it taken positive and when negative?

4. You and your father are sifting on either side of a sea-saw. Who has to sit near the fulcrum to balance the sea-saw? Assume your father has more weight than you.

5. A rigid body free to rotate about a fixed point is stationary although number of forces act on the body at different points in the body. Why?

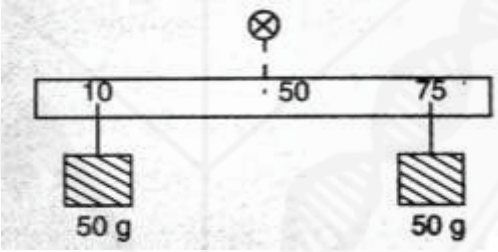
6. A meter scale is pivoted from 0 cm mark and is free to rotate in vertical plane. A 50 g weight is suspended from the 20 cm mark on the scale. Calculate moment of force in

(i) *gf x cm*

(ii) *Nm.*

Draw a diagram to explain whether this moment of force is positive or negative.

7. As shown in the figure a meter scale is fixed from 50 cm mark and is free to rotate in vertical plane. Two 50 g weights are suspended from 10 cm and 75 cm marks. What is the resulting moment of force of the arrangement?



8. The iron door of a building is 2.4 m broad. It can be opened by applying a force of 10 kgf at the middle of the door. What is the least force required to open the door? Where the force should be applied?

9. A boy of weight 40 kgf is sitting 1.2 m away from the fulcrum of a sea-saw. Where should another boy of weight 60 kgf sit to keep the plank horizontal?

10. A torque of 10 kgf x m is required to open a bolt. Calculate the amount of force to be applied on the spanner at length 25 cm away from the bolt.

11. A uniform metre scale is suspended from a thread at 60 cm mark. Which end of the scale should have a 20 g mass to balance the scale? What is the mass of the scale?

12. A uniform metre scale is suspended from the 50 cm mark on the scale and it stays horizontal. Two weights of 20 g and 50 g are suspended on either side of this point of suspension. If the 20 g weight is placed on 12 cm mark what is the position of the 50 g weight?

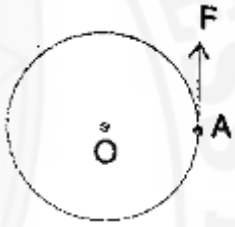
13. A uniform metre scale of mass 70 g is suspended from the 65 cm mark on the scale. Where on the scale a 50 g mass be suspended to keep the scale in horizontal position?

14. A uniform horizontal rod of length 1.5 m is pivoted from the middle such that it can rotate freely in vertical plane. Two forces each of 100 N are applied at the two ends of the rod in vertically upward and downward directions. What is the magnitude of couple acting on this system?

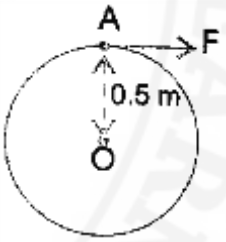
15. A nut can be opened by applying a moment at force 90 Nm. If a mechanic can apply maximum force of 150 N, what should be the length of lever to open the nut?

Assignment – 4 Force

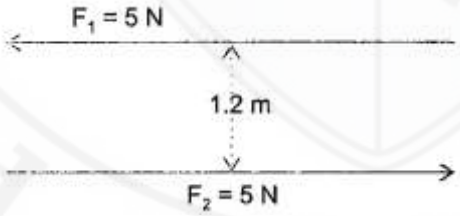
1. A force of 50 dynes acts on a rigid body, such that the perpendicular distance between the fulcrum and the point of application of force is 75 cm. Calculate the moment of force.
2. The perpendicular distance between the point of application of force and the turning point is 1.75m, when a force of 80 N acts on a rigid body. Calculate the moment of force.
3. A force of 50 N produces a moment of force of 10 N-m in a rigid body. Calculate the perpendicular distance between the point of application of force and the turning point.
4. Calculate the force which will produce a moment of force of 1575 dyne-cm, when the perpendicular distance between point of application of force and turning point is 45 cm.
5. A couple of 15 N force acts on a rigid body, such that the arm of couple is 85 cm. Calculate the moment of couple in SI system.
6. Calculate the length of the arm of couple, if a force of 13 N produces a moment of couple of 14.3 N-m.
7. Two forces each of magnitude 2 N act vertically upward and downward respectively on two ends of a uniform rod of length 1 m, freely pivoted at its centre. Determine the resultant moment of forces about the mid-point of the rod.



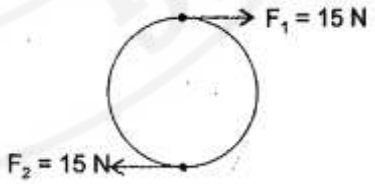
8. The diagram alongside shows a force F = 5 N acting at point A produces a moment of force of 6 Nm about point O. What is the diameter of the wheel?
9. The diagram alongside shows a force F acting at point A, such that it produces a moment of force of 20 Nm in clockwise direction. Calculate the magnitude of force F.



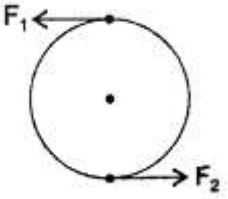
10. Study the diagram alongside and calculate the moment of couple.



11. Two forces F_1 and F_2 are applied on a circular body such that moment of couple is 9 Nm in a CWD. Calculate radius of circular body.



12. Two forces $F_1 = F_2$ are applied on a wheel of radius 1.5 m, such that moment of couple is 30 Nm. Calculate the magnitude of each of the force.



13. A uniform metre scale is balanced at 60 cm mark, when weights of 5 gf and 40 gf are suspended at 10 cm mark and 80 cm mark respectively. Calculate the weight of the metre scale.

14. A uniform metre scale is balanced at 20 cm mark, when a weight of 100 gf is suspended from one end. Where the weight must be suspended? Calculate the weight of the metre scale.

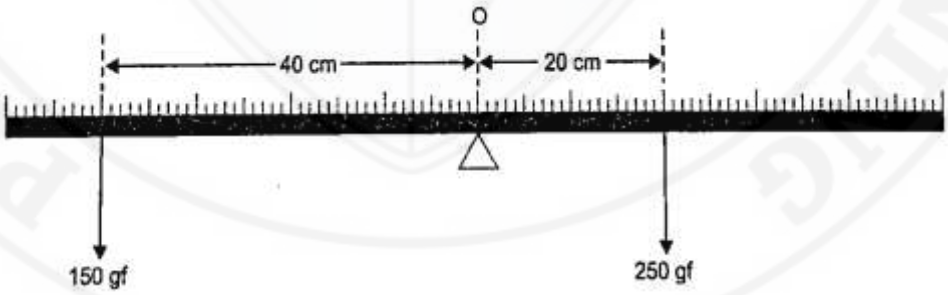
15. A uniform metre scale balances horizontally on a knife edge placed at 55 cm mark, when a mass of 25 g is supported from one end. Draw the diagram of the arrangement. Calculate mass of the scale.

16. A uniform metre scale of weight 50 gf is balanced at the 40 cm mark, when a weight of 100 gf is suspended at the 5 cm mark. Where a weight of 80 gf must be suspended to balance the metre scale?

17. A see-saw 8 m long is balanced in the middle. Two children of mass 30 kgf and 40 kgf are sitting on the same side of the fulcrum at a distance of 1.5 m and 3.5 m from the fulcrum respectively. Where must a lady weighing 60 kgf sit from the fulcrum, so as to balance the see-saw?

18. A uniform wooden beam AB, 80 cm long and weighing 250 gf, is supported on a wedge as shown in the figure. Calculate the greatest weight which can be placed on end A without causing the beam to tilt.

19. Figure shows a uniform metre rule weighing 100 gf, pivoted at its centre ‘O’. Two weights of 150 gf and 250 gf hang from the metre rule as shown. Calculate



(i) Total C.W. moment about 'O'.

(ii) Total A.C.W. moment about 'O',

(iii) Difference of C.W. and A.C.W. moments.

(iv) The distance from 'O' where a 100 gf weight should be suspended to balance the metre scale.