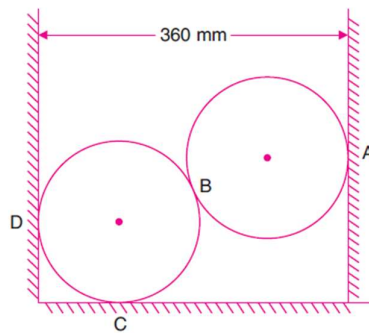
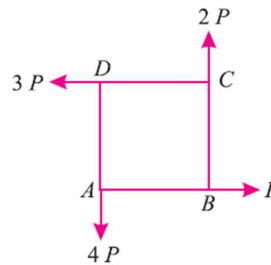


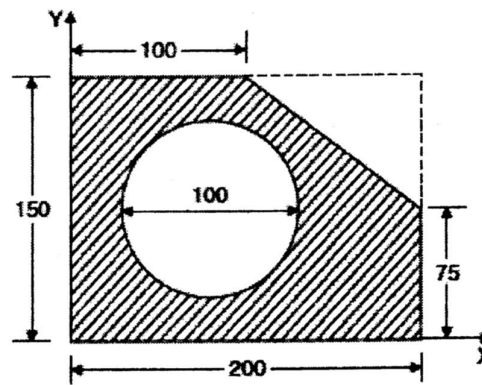
Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

	(Level/CO)	Marks
Q.1 Solve Any Two of the following.		12
A) Explain following with Diagram:	Remember	6
a) Equilibrium of Bodies		
b) Free Body Diagram		
c) Lami's Theorem		
B) Four forces equal to P, 2P, 3P and 4P are respectively acting along the four sides of square ABCD taken in order. Find the magnitude, direction, and position of the resultant force.	CO 1	6
C) Two smooth spheres each of radius 100 mm and weighing 100 N, rest in a horizontal channel having vertical walls, the distance between which is 360 mm. Find the reactions at the points of contact A, B, C and D as shown in figure.	CO 2	6
Q.2 Solve Any Two of the following.		12
A) State Laws of Friction.	Remember	6

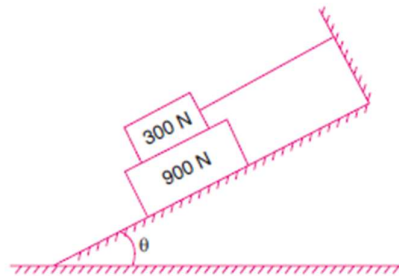


- B) Determine the coordinates X_c , and Y_c of the centre of a 100 mm diameter circular hole cut in a thin plate so that this point will be the centroid of the remaining shaded area shown in figure (All dimensions are in mm).



CO 3 6

- C) What should be the value of θ in Figure that will make the motion of 900 N block down the plane to impend? The coefficient of friction for all contact surfaces is $1/3$.



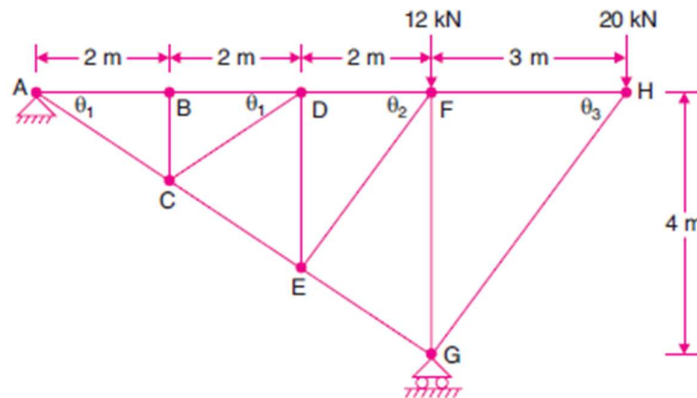
CO 2 6

Q.3 Solve Any Two of the following.

12

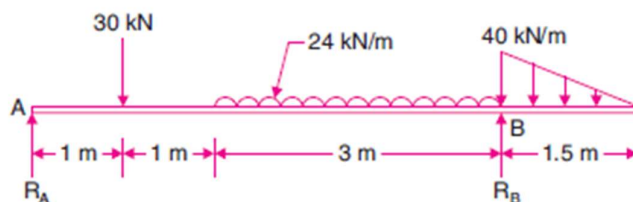
- A) Find the forces in all the members of the truss shown in figure.

CO 2 6



- B) Determine the reactions at supports A and B of the overhanging beam shown in figure.

CO 2 6



- C) State and Prove Varignon's Theorem.

Remember 6

Q.4 Solve Any Two of the following.

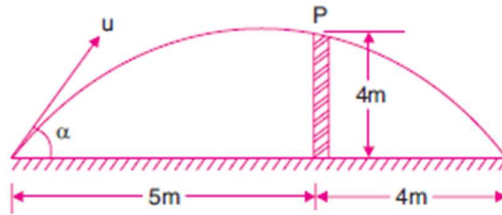
12

- A) Prove equations of motion of a body moving with constant acceleration.

Remember 6

- B)** A small steel ball is shot vertically upwards from the top of a building 25 m above the ground with an initial velocity of 18 m/sec. **CO 4** **6**
- a) In what time, it will reach the maximum height?
 - b) How high above the building will the ball rise?
 - c) Compute the velocity with which it will strike the ground and the total time it is in motion.

- C)** Find the least initial velocity with which a projectile is to be projected so that it clears a wall 4 m high located at a distance of 5 m and strikes the ground at a distance 4 m beyond the wall as shown in figure. The point of projection is at the same level as the foot of the wall. **CO 4** **6**



Q. 5 Solve Any Two of the following. **12**

- A)** The angular acceleration of a flywheel is given by $\alpha = 12 - t$, where, α is in rad/sec² and t is in seconds. If the angular velocity of the flywheel is 60 rad/sec at the end of 4 seconds, determine the angular velocity at the end of 6 seconds. How many revolutions take place in these 6 seconds? **CO 4** **6**
- B)** Direct central impact occurs between a 300 N body moving to the right with a velocity of 6 m/sec and 150 N body moving to the left with a velocity of 10 m/sec. Find the velocity of each body after impact if the coefficient of restitution is 0.8. **CO 5** **6**
- C)** Define following along with proper figure. **Remember** **6**
- a) Direct Impact
 - b) Oblique Impact
 - c) Eccentric Impact

*** End ***