Problems Based on Force Concept

2005–2006 (Sem. I) (TME101)

1. Principal of transmissibility of a force.
2. Necessary and sufficient conditions of equilibrium of a system of coplanar force system.
3. Two smooth spheres each of weight W and each of radius r are in equilibrium in a horizontal channel of width b ($b < 4r$) and vertical sides as shown in diagram. Find the three reactions from the sides of channel which are all smooth. Also find the force exerted by each sphere on the other.

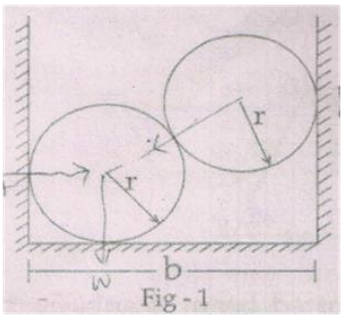
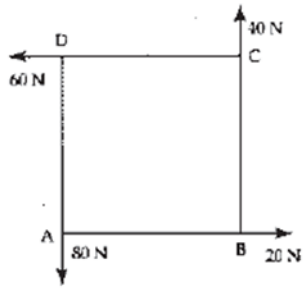


Fig - 1

2005–2006 (Sem. II) (TME201)

1. Enumerate different laws of motion, discussing the significance of each of them. What do you understand by transfer of force to parallel position? Also explain Varignon's Theorem of moments, in brief.
2. What do you understand by Resultant of a Force system and which are the methods used for determining the resultant of coplanar concurrent force systems? Four forces having magnitudes of 20 N, 40 N, 60 N and 80 N respectively, are acting along the four sides (1 m each), of a square *ABCD*, taken in order, as shown in figure. Determine the magnitude and direction of the resultant force.



2006–2007 (Sem. II) (TME201)

1. Necessary and sufficient conditions of equilibrium of a system of coplanar concurrent forces.
2. Concept of free body diagram with the help of suitable examples.
3. A plate measuring (4 × 4) m² is acted upon by 5 forces in its plane as shown in fig. Determine the magnitude and direction of the resistance force.

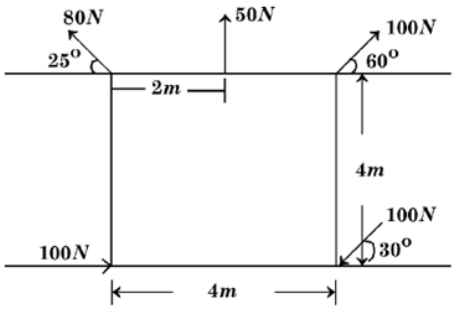
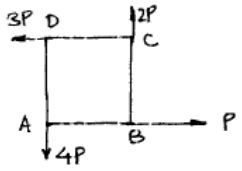


Fig. 1

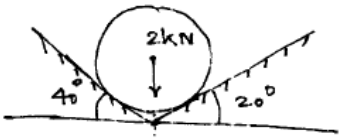
2006–2007 (Sem. II) (ME202)

1. Explain the law of transmissibility of forces.
2. A particle is acted by following forces.
   200 N inclined 30° with east towards north
   250 N towards the north
   300 N towards the north west
   350 N inclined at 40° with west towards south
   Find the resultant of all forces and its direction.

3. Four forces equal to P, $2P$, $3P$ and $4P$ are acting along the four sides of a square $ABCD$ as shown in figure. Find the magnitude, direction and position of resultant forces.



4. A smooth circular cylinder of radius 2 m is lying in a triangular groove, one side of which makes 20° and other side makes 40° angle with the horizontal. Find the reaction at the surfaces of contact, if there is no friction and the cylinder weighs 2 kN.



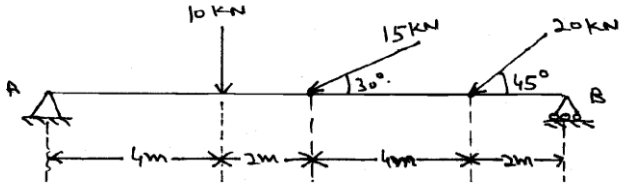
5. Briefly explain the Varignon's Principle.

2006–2007 (Sem. I & II) (TME101/TME201) [SCOP]

1. $ABCD$ is a regular Hexagon. Forces 90 N, P, Q, 240 N and 180 N act along AB, CA, AD, AE and FA respectively. Find the forces P and Q for the condition of equilibrium of the system.

2. State Lam's theorem.

3. The beam AB of span 12 m shown in fig is hinged at A and is on rollers at B. Determine the reactions at A and B for the loading shown.



2007–2008 (Sem. I) (TME101)

1. Principle of transmissibility of forces.

2. Parallelogram law of forces.

3. Obtain the resultant of 5 forces; 10 kN, 15 kN, 7 20 kN, 40 kN and 80 kN which are acting at one of the angular points of a regular hexagon towards five other angular points respectively.

4. Two rollers of mass 20 kg and 10 kg rest on a horizontal beam as shown in fig. 1 with a massless wire fixing the two centers. Determine the distance x of the load 20 kg, from the support A, if the reaction R_A is twice of the support reaction R_B. The length of the beam is 2 m and the length of the connecting wire is 0.5 m. Neglect weight of beam. Assume the rollers to he point masses neglecting its dimensions.

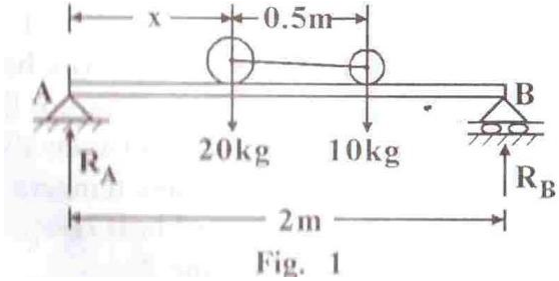


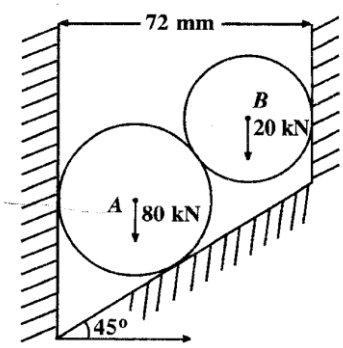
Fig. 1

2007–2008 (Sem. II) (TME201)

1. General condition of equilibrium of a system of coplanar concurrent forces.
2. Moment of a couple. Show that a force acting at a point is equivalent to a force - couple system at another point.
3. Forces 7, 1, 1 and 3 kN act at one of the angular points of a regular pentagon towards four other angular points taken in order. Obtain the resultant of this force system. What is its direction?

2008–2009 (Sem. I) (EME102)

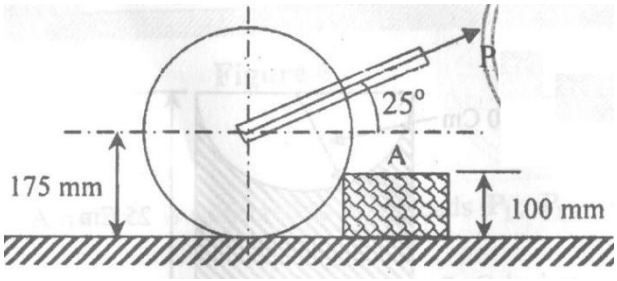
1. Two cylinders *A* and *B* of diameters 3 cm and 6 cm weighing 20 kN and 80 kN respectively are placed as shown in figure Assuming all the contact surfaces to be smooth, find the reactions at the walls.



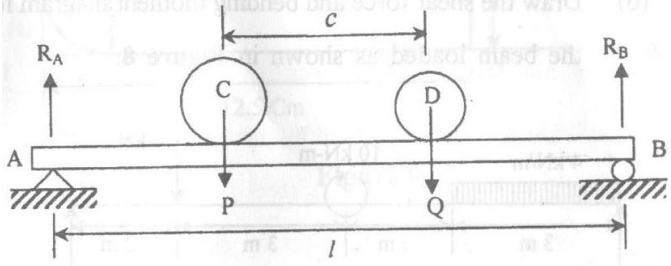
2. Explain the following :
   (i) Lami's theorem.
   (ii) Principle of transmissibility of forces.
   (iii) Conditions of equilibrium for coplanar forces and concurrent forces.

2008–2009 (Sem. II) (EME202)

1. A roller shown in Figure 1 is of mass 150 kg. What force *P* is necessary to start the roller over the block *A*?



2. What is a free body diagram? Explain with suitable example.
3. Two rollers *C* and *D* produce vertical forces *P* and *Q* on the horizontal beam *AB*, as shown in Figure 6 Determine the distance *x* of the load *P* from the support *A* if the reaction at *A* is twice as great as the reaction at *B*. The weight of the beam is to be neglected. Given: $P = 18$ kN, $Q = 9$ kN, $l = 3.6$ m, $c = 0.9$ m



2009–2010 (Sem. I) (EME102)

1. Three cylinders *A*, *B* and *C* each weighing 100 N and diameter 80 mm are placed in a channel of 180 mm width as shown in Fig. 1. Determine the pressure exerted by the cylinder *A* and *B* at the point of contact.

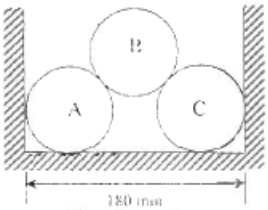


Fig. 1.

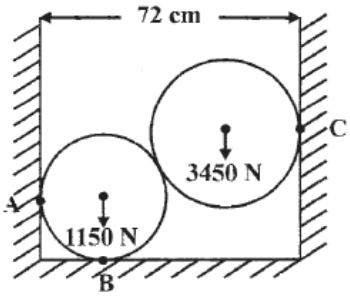
2. Explain the theorem of transmissibility of a force. What are its limitations?

2009–2010 (Sem. I) (TME101) [COP]

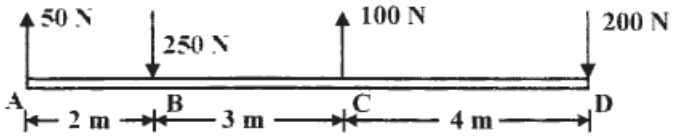
1. Parallelogram law of forces.

2. Lami's theorem.

3. Two spherical balls rest between two vertical walls as shown in figure. The radius of smaller ball is 16 cm and weight is 1150 N. The radius of the larger ball is 24 cm and its weight is 3450 N. The distance between the walls is 72 cm. Assuming the contact surfaces to be smooth, determine the reactions at *A*, *B* and *C*.



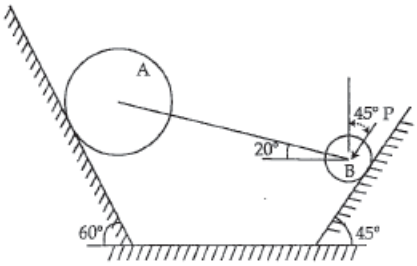
4. A system of parallel forces acting on a rigid bar *ABCD* is shown in figure. Reduce this system to (i) a single force and a couple at *A*, (ii) a single force. 50 N



2009–2010 (Sem. II) (EME202)

1. State and prove Varignon's theorem.

2. Two cylinders *A* and *B* weighing 4 kN and 3 kN, respectively, rest on smooth inclined plane as shown in Figure 1. They are connected by a bar of negligible weight hinged to each cylinder at its geometric centre by smooth pins. Find the force *P* to be applied to the smaller cylinder at 45° to the vertical to hold the system in the given position.

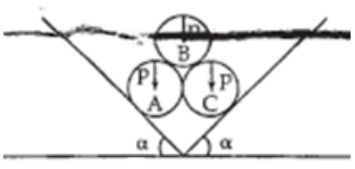


2009–2010 (Sem. II) (TME201) [COP]

1. Parallelogram law of forces.

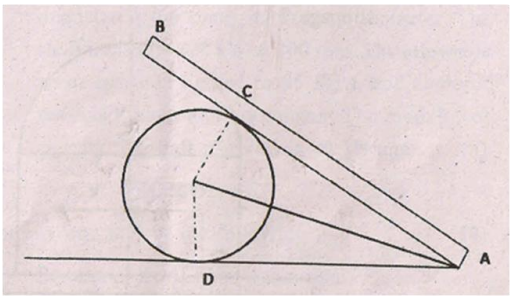
2. Conditions of equilibrium for coplanar forces and concurrent forces.

3. In figure, three smooth right circular cylinders, each of radius *r* and weight *P*, are arranged on smooth inclined surfaces as shown. Determine the least value of angle α that will prevent the arrangement from slipping.



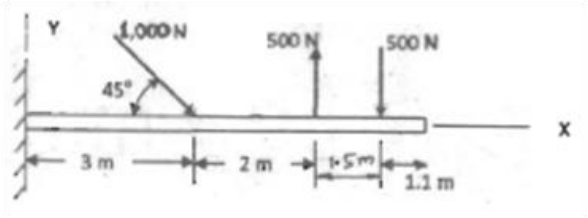
2010–2011 (Sem. I) (EME102)

1. A smooth weightless cylinder of radius 600 mm rests on a horizontal plane and is kept from rolling by an inclined string of length 1000 mm. A bar *AB* of length 1500 mm and weight 1200 N is hinged at *A* and placed against the cylinder of negligible weight. Determine tension in the string.



2. State and prove Lami's theorem.

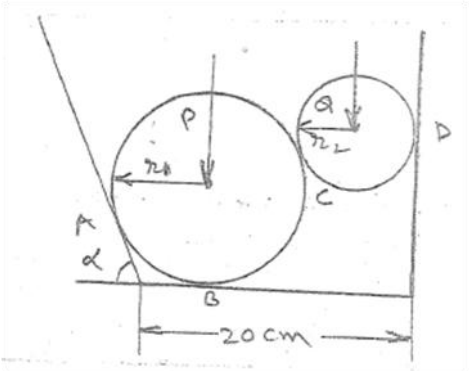
3. A system of forces acting on a cantilever beam is shown in figure. Reduce this system to a single force system and find the point of application of this force on the beam.



2010–2011 (Sem. I) (TME101) [COP]

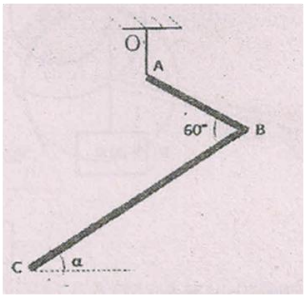
1. Concept of free body diagram.

2. Two smooth cylinders of weight *P* and *Q*, respectively, rest in a horizontal channel having one inclined wall and one vertical wall, the distance between them at the bottom is 20 cm (see fig). Find the pressures exerted on the walls and floor at the points of contact *A*, *B* and *D*. The following numerical data are given: P = 2000 N and Q = 800 N; r_1 = 10 cm, r_2 = 5 cm and $\alpha = 60°$.

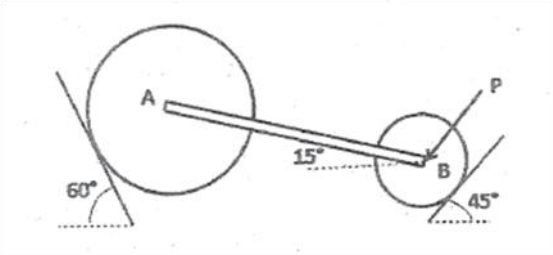


2010–2011 (Sem. II) (EME202)

1. Two prismatic bars *AB* and *BC* of length 0.5 m and 1.0 m respectively, are joined rigidly at *B* and suspended by a string *OA* as shown. Determine the value of α for equilibrium of the arrangement.

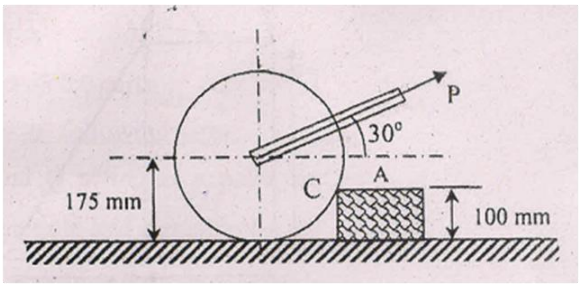


2. Two cylinders of mass 100 kg and 500 kg are connected by a rigid bar of negligible weight hinged at each cylinder. Determine the magnitude of force *P*, acting parallel to the 45° plane, for equilibrium.



2010–2011 (Sem. II) (EME202) (MTU)

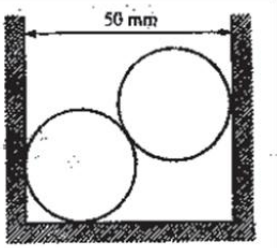
1. A roller shown in Fig. 1 is of mass 20 kN. What force *P* is necessary to start the roller over the block *A* and reaction at the contact point *C*.



2. Varignon's theorem.

3. Types of force systems.

4. What is a free body diagram? Explain with suitable example. Two smooth balls each of radius 15 cm and weighing 400 N are lying in a vertical cylinder of diameter 50 cm (Figure). Determine the pressure exerted on the balls and base of the cylinder by the balls.



2010–2011 (Sem. II) (TME201) [COP]

1. Necessary and sufficient condition of equilibrium of a system of coplanar concurrent forces.

2. Concept of free body diagram with the help of suitable examples.

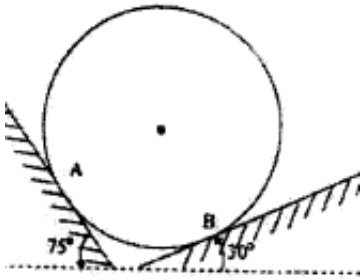
3. *ABCD* is a regular Hexagon. Forces 90 N, *P*, *Q*, 240 and 180 N act along *AB*, *CA*, *AD*, *AE* and *FA* respectively. Find the forces *P* and *Q* so that the system is in equilibrium.

2011–2012 (Sem. I) (EME102)

1. If the resultant of two forces of magnitude *P* has the magnitude *P*, then determine the angle between the forces,

2. Explain the law of equilibrium for a body under three only Forces.

3. A 20 kg homogeneous smooth sphere rests on two inclined planes as shown in Fig. 5. Determine the contact forces at *A* and *B*.



4. Determine the force *P* required to hold a mass of mass 10 kg in equilibrium utilizing the system of pulleys as shown in Fig. 1. Assume that each pulley is of 3 kg.

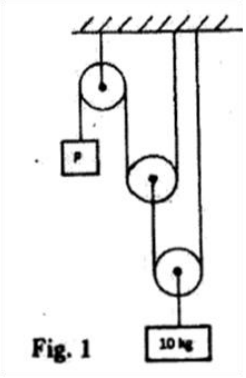


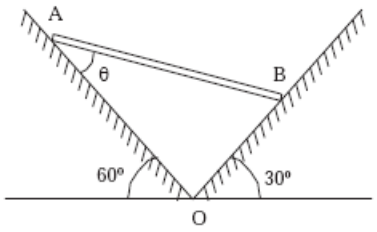
Fig. 1

2011–2012 (Sem. I) (EME102) (MTU)

1. Define the law of parallelogram law of forces. What is the use of this law?
2. Classification of two-dimensional force system.

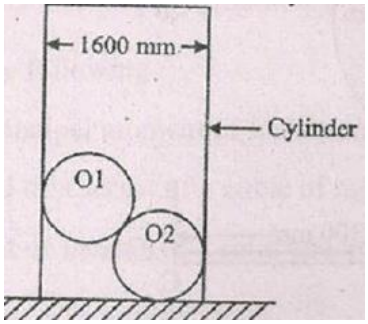
2011–2012 (Sem. II) (EME202)

1. Define the principle of transmissibility of forces.
2. Describe the equilibrium of a body if it is acted upon by only three forces.
3. State and prove Varignon's theorem.
4. A uniform bar *AB* of length *L* and weight *W* lies in a vertical plane with its ends resting on two smooth surfaces on *O*A and *OB*, find angle '*θ*' for equilibrium of bar. Refer Fig.

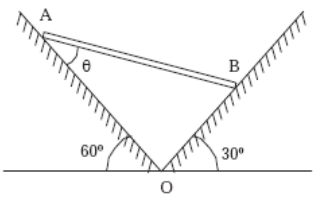


2011–2012 (Sem. II) (EME202) (MTU)

1. What is equilibrium? State the necessary and sufficient conditions for a system of coplanar forces to be in equilibrium.
2. State Varignon's theorem.
3. A hollow right circular cylinder of radius 800 mm is open at both ends and rests on a smooth horizontal plane as shown in Fig. Inside the cylinder there are two spheres having weights 1 kN and 3 kN and radius 400 mm and 600 mm respectively. The lower sphere also rests on the horizontal plane. Neglecting friction find the minimum weight *W* of the cylinder for which it will pot tip over.



4. A uniform bar *AB* of length *L* and weight *W* lien in a vertical plane with its end resting on two smooth on *OA* and find angle *θ* for the equilibrium of bar as shown in Fig.



5. Classify and explain the various force systems.

2012–2013 (Sem. I) (EME102)

1. Two forces P and Q are inclined at angle of 75°. Magnitude of their resultant is 100 N. The angle between the resultant and P is 45°. Determine the magnitude of P.

2. A sphere of radius 20 cm and mass 20 kg is resting on a vertical smooth wall with the help of a chain of length 30 cm tied to wall as shown in Fig. 1. Determine the reaction of the wall and Tension in the chain.

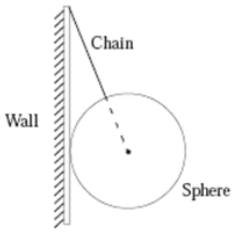
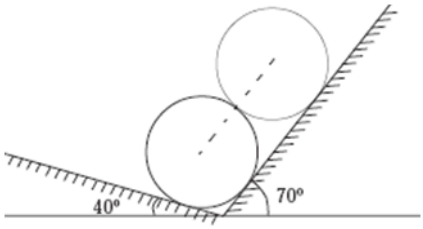
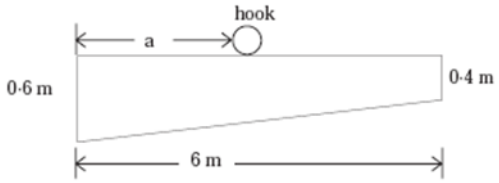


Fig. 1

3. Two identical rollers each of weight 5000 N rest on smooth inclined planes as shown in Fig. 6. Find the Reactions of the planes on rollers.



4. Where must a lifting hook be placed in a tapered beam shown in Fig. 12, so that the beam always stays horizontal when lifted?



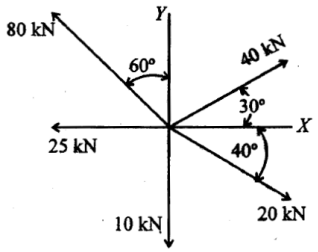
2012–2013 (Sem. I) (ME101) (MTU)

1. Explain coplanar forces, and Concurrent forces.

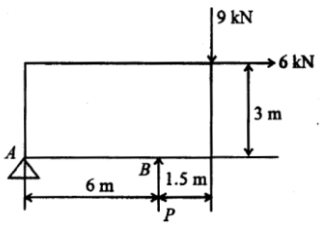
2. Explain free body diagram with example.

3. State Varignon's theorem.

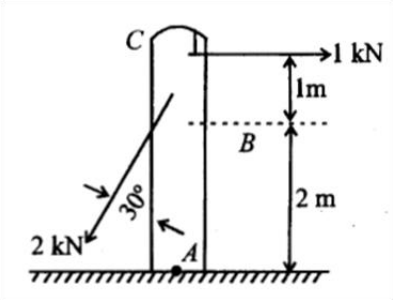
4. A system of concurrent force is as shown in Fig. 1. Find the net components along X and Y directions.



5. A block is supported on a hinge at A and subjected to three forces, 9 kN, 6 kN and P as shown in Fig. 2. Neglecting the weight of the block determine the force P and the reaction at the hinge.

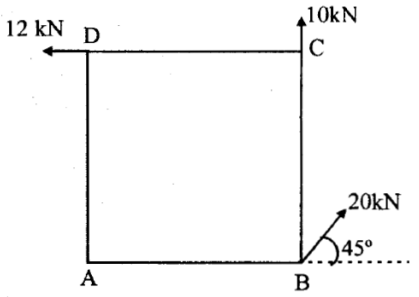


6. State the Newton's laws of motion.
7. Explain the principle of transmissibility in detail.
8. Find the moment of sum of forces shown in Fig. 6 about point *A*.



2012–2013 (Sem. I) (EME102) (MTU) [COP]

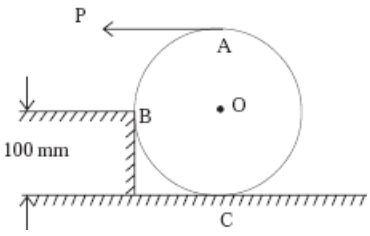
1. With the help of neat sketch explain the principle of transmissibility.
2. What are the different types of parallel forces? Explain in brief.
3. State Varignon's theorem with mathematical equation.
4. State and prove Varignon's theorem.
5. Determine the magnitude, direction and position of resultant force for a system of forces acting on 5 m square lamina as shown in Fig. 1.



6. The resultant of two forces when they act at an angle 60° is 14 N. If the same forces are acting at right angles their resultant is √136 N (square root). Determine the magnitude of the two forces.

2012–2013 (Sem. I) (TME101) [COP]

1. A roller of radius 200 mm and weight 1732 N is to be pulled over a curb of height 100 mm by a horizontal force *P* applied to the end of string wound tightly around the circumference of the roller. Find the magnitude of *P* required to start the roller move over the curb. Also find the least pull through the centre *O* the wheel to just turn the roller over the curb. Fig.



2012–2013 (Sem. II) (ME201) (MTU)

1. State the principle of transmissibility of forces.
2. Write the general conditions for equilibrium of a particle.
3. State Varignon's theorem.
4. Two concurrent forces of 12 N and 18 N are acting at an angle of 60°. Find the resultant force,
5. Three coplanar concurrent forces are acting at a point as shown in Fig. 1. Determine the resultant in magnitude and direction.

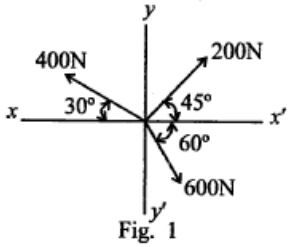


Fig. 1

6. An electric light fixture weighing 150 N hangs from a point *C*, by two strings *AC* and *BC* as shown in Fig. 5. Determine the forces in the strings *AC* and *BC*.

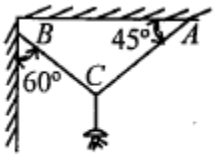
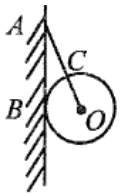


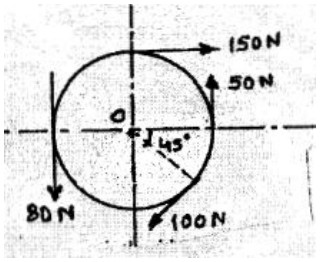
Fig. 5

7. A smooth sphere of weight W 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 Fig. If the length of the string AC is equal to the radius of the sphere, find the tension in the string and reaction of the wall.



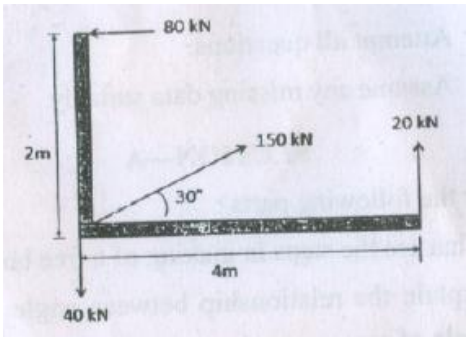
2012–2013 (Sem. II) (TME201) [COP]

1. Explain Lami's Theorem.
2. Explain equations of equilibrium.
3. Explain concept of free body diagram.
4. Determine the resultant of the forces acting tangential to the circle of radius 3 m as shown in fig. What will be the location w.r.t. the centre of the circle?

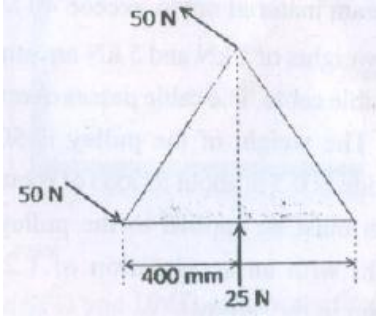


2013–14 (Sem. I) (NME102)

1. What are the steps in making of a free body diagram?
2. The force system applied to an angle bracket is shown in figure. Determine the magnitude, direction and line of action of the resultant force.

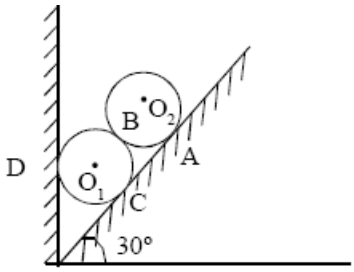


3. Discuss the law of parallelogram of forces. Two forces equal to P and $2P$ act on a rigid body. When the first force is increased by 100 N and the second force is doubled, the direction of the resultant remains unchanged. Determine the value of P.
4. An equilateral triangle ABC of side 800 mm is subjected to a force and a couple as shown in figure. Replace the force and couple by an equivalent force system considering three forces acting along the three sides of equilateral triangle.

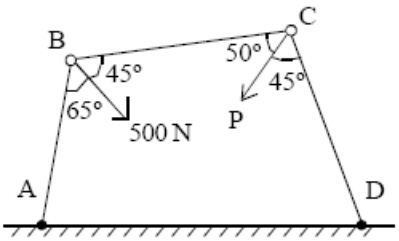


2013–14 (Sem. I) (EME102) [COP]

1. Write the equilibrium equations for concurrent force system and non-concurrent force system.
2. State and prove Lami's theorem.
3. Two identical rollers, each of weights 100 N are supported by an inclined plane and a vertical wall as shown in Fig. (4). Assume smooth surfaces, find the reactions induced at the points of supports *A*, *B*, *C* and *D*.

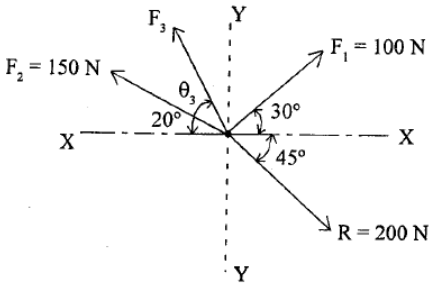


4. Three bars hinged at *A* and *D* and pinned at *B* and *C* as shown in Fig. (5) form a four linked mechanism. Determine the value of *P* that will prevent movement of bars.

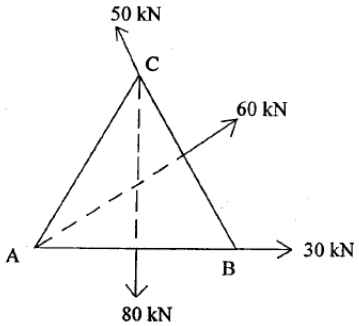


2013–14 (Sem. I) (ME101) [COP]

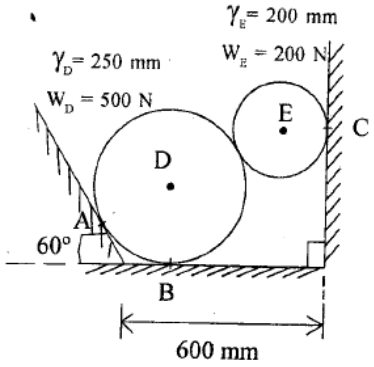
1. State and explain law of forces.
2. State Varignon's theorem.
3. What is the equilibrium? Write the equations of equilibrium for non concurrent force system.
4. Explain principle of transmissibility of forces.
5. Find the unknown force F_3 in the system of forces as shown in figure 1, if F_1 = 100 N, F_2 = 150N and the resultant of these three forces (F_1, F_2 and F_3) is 200 N.



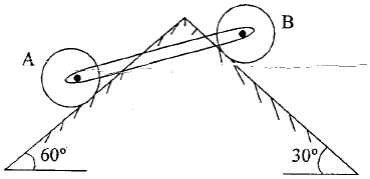
6. An equilateral triangular plate of sides 200 mm is acted upon by four forces as shown in figure-2. Determine the magnitude and direction of the resultant of this system of forces and its position from *A*.



7. Two sphere rest in a smooth surface as shown in figure-5. Find forces at points of contacts.



8. Two rollers of weights A = 60 N and B = 100 N are connected by a rod in figure-6. Find the tension induced in the rod and the angle that make with the horizontal when the system is in equilibrium.

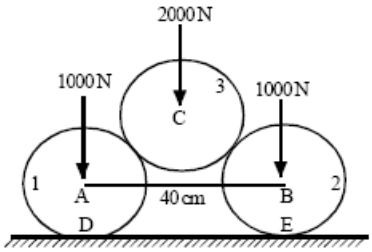


2013–14 (Sem. I) (TME101) [COP]

1. State Varignon's theorem. How it can help on determination of moments? In what condition is it used?

2. Two equal forces are acting at a point with an angle 60° between them. If the resultant force is equal to 20 N, find magnitude of each force.

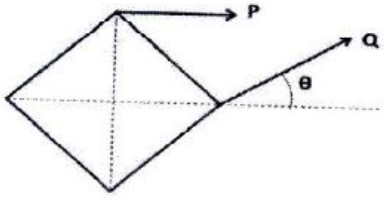
3. Two smooth circular cylinders, each of weight W = 1000 N and radius 15 cm are connected at their centres by a string AB of length = 40 cm and rest upon a horizontal plane, supporting above them a third cylinder of weight = 2000 N and radius 15 cm as shown in fig. Find the Tension S in the string AB and the pressure produced on the floor at the points of contact D and E.



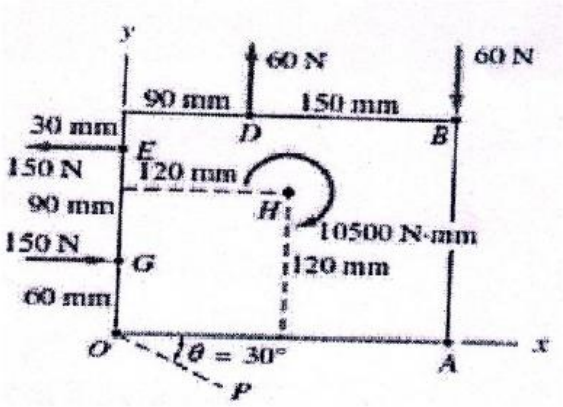
2013–14 (Sem. II) (NME202)

1. The resultant of two forces $3P$ and $2P$ is R. If the first force is doubled the resultant is also doubled, determine the angle between the two forces.

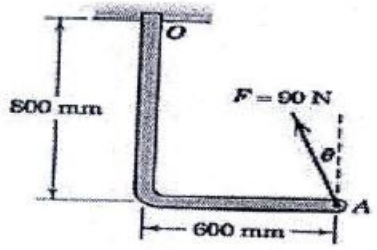
2. Two forces P and Q are applied to the corners of a 100 mm^2 square plate as shown in figure. Find forces P, Q and angle θ if resultant of two forces has a magnitude of 140 N, passing through the centroid of the plate and making an angle of 30° with positive x-axis.



3. Figure shows a plate acted upon by three couples. Replace the three couples with (i) a couple vector, (ii) two forces, one acting alone line OP and the other acting at point A and (iii) smallest pair of forces with one force acting at O other acting at A.



4. Calculate the moment of 90 N force about point O for the condition $\theta = 15°$. Also, determine the value of θ for which the moment about O is zero.

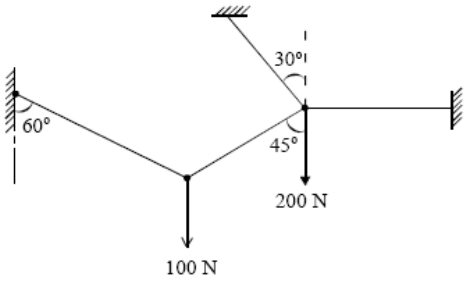


2013–14 (Sem. II) (EME202) [COP]

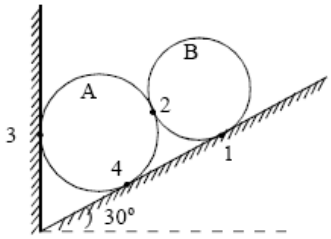
1. If the square of the resultant of two equal forces is equal to three times of their product, find the angle between the forces.

2. Define and explain coplanar and non-coplanar force system.

3. Calculate the tensions in various segments of cable:



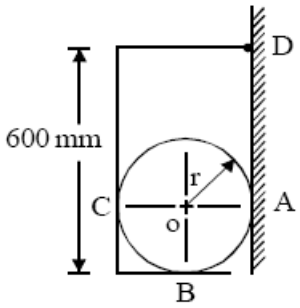
4. Refer to the system of cylinders arranged as shown in figure. Determine the forces exerted at all the contact points if diameter of each cylinder is 200 mm. W_A = 300 N, W_B = 300 N



2013–14 (Sem. II) (ME201) [COP]

1. Write the equilibrium condition for co-planer non-concurrent force system.

2. Define the terms: Free vector, Fixed vector and Sliding vector. Give one example for each.
3. Show that moment about a point is two times the area of triangle formed by the force and that point.
4. Explain Law of Polygon.
5. State and prove principle of transmissibility of a force.
6. Two forces one of which is double the other has resultant of 260 N. If the direction of the larger force is reversed and other remains unaltered, the resultant reduces to 200 N. Determine the magnitude of the forces and angle between them.
7. A 800 N cylinder is supported by the frame *BCD* as shown in diagram. The frame is hinged at *D*. Determine the reactions at *A*, *B*, C and *D*. (Figure-1). Take r = 150 mm.



8. Find the reactions at contact points *A*, *B*, *C* and *D* for following system (Figure 6), if W_2 = 5 kN, W_1 = 2 kN, r_1 = 1 m and r_2 = 1.5 m.

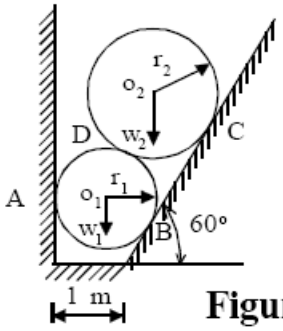
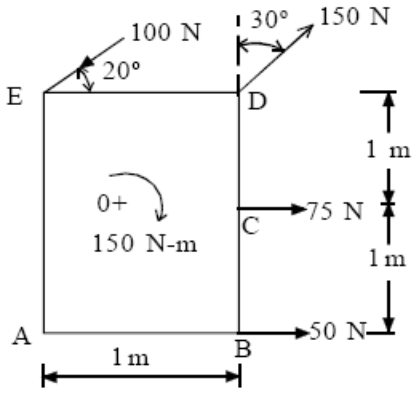


Figure-6

9. Four forces and a couple are acting on a rectangular plate as shown in figure-7. Find their resultant and its position from corner '*A*'.

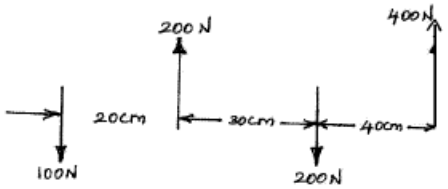


2014–15 (Sem. I) (NME102)

1. Principle of Transmissibility
2. A Particle is in equilibrium under the influence of forces as shown in Fig 1. Find the unknown forces using the Lami's theorem.

3. Write short notes on free body diagram with an example.

4. Determine the resultant action of a coplanar parallel force system in the given figure.



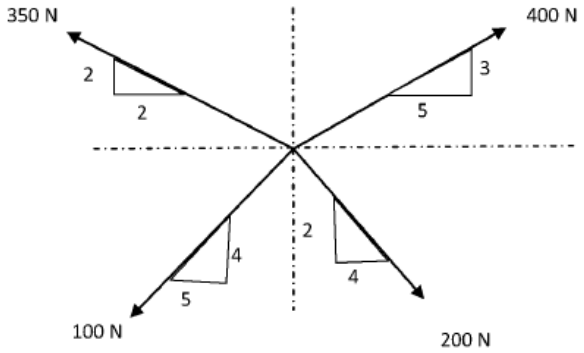
2014–15 (Sem. I) (EME102) [COP]

1. State Newton's second law of motion and establish mathematical relationship.

2. Define static equilibrium of a body.

3. State the principle of transmissibility of a force.

4. Determine the resultant of four forces concurrent at the origin as shown in figure.



5. Two forces equal to $2P$ and P act on a particle. If the first force be doubled and the second force is increased by 12 kN, direction of their resultant remain unaltered. Find the value of P.

2014–15 (Sem. I) (ME101) [COP]

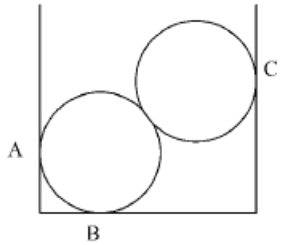
1. State and prove Law of parallelogram of forces.

2. Write the difference between collinear and concurrent force system.

3. Find the resultant in magnitude and direction of forces P and Q respectively, acting at right angles to each other.

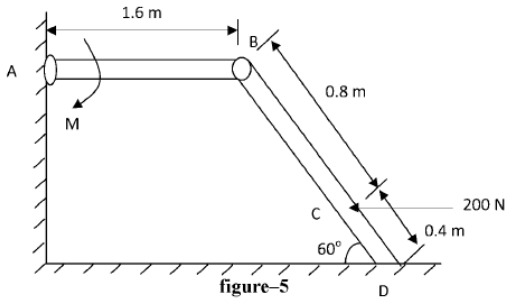
4. Two forces of magnitude 20 N and 40 N are acting on a particle such that the angle between two is 135°. If both these forces are acting away from the particle, calculate their resultant and find its direction.

5. Two spheres, each of weight 1 kN and 25 cm rest in a horizontal channel of width 90 cm as shown in figure 4. Find the reactions on the points of contact A, B and C.



6. A horizontal force 200 N is applied to the sloping bar BCD whose bottom rests on a horizontal plane, as shown in figure 5. Its upper end is pinned at B to the horizontal bar AB which has a pinned support at A. What couple M must be applied to AB to

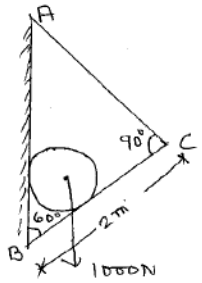
hold the system in equilibrium? What is the magnitude of the pin reaction at *B*? Assume the bars to be weightless and pins at *A* and *B* to be smooth.



figure–5

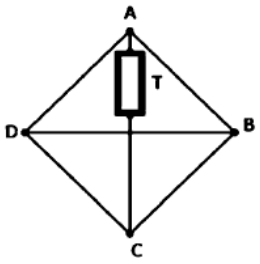
2014–15 (Sem. II) (NME202)

1. How do you find the resultant of non coplaner concurrent force system?
2. A cylinder of weight 1000 N and radius 40 cm is in equilibrium as shown in fig 2. Find the tension in the rope *AC*. Length of *BC* is 2 mtr.

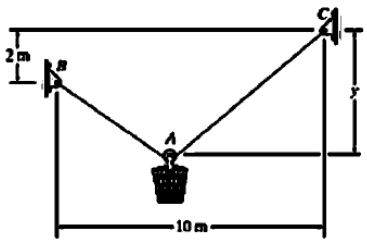


2014–15 (Sem. II) (EME202) [COP]

1. State Varignon's theorem and its importance in finding the resultant of a coplanar force system.
2. A force of 5 kN inclined upward at an angle of 62° with horizontal axis acts at a point (1 m, 3 m). Find the moment of the force about the origin.
3. A tensile force of $T = 1000$ N is produced using a turnbuckle in one of the radial bars of regular square in which all joints are hinged, as shown in figure. Determine the forces produced in other bars.



4. The bucket and its contents shown in figure have a mass of 60 kg. If the cable *BAC* is 15 m long, determine the distance *y* to the pulley at *A* for equilibrium. Neglect the size of the pulley.

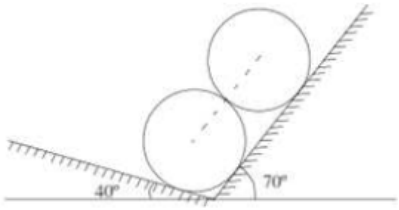


2014–15 (Sem. II) (ME201) [COP]

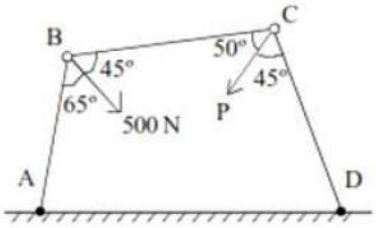
1. What is equilibrium? State the necessary and sufficient conditions for a system of coplanar forces to be in equilibrium.

2. State Varignon's theorem and its importance in finding the resultant of a coplanar force system.

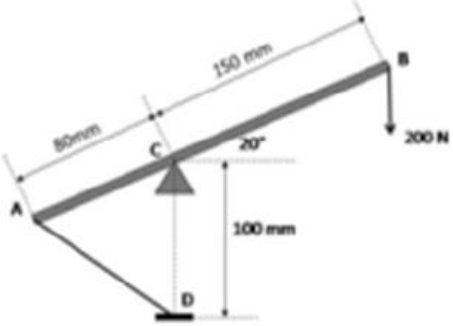
3. Two identical rollers each of weight 5000 N rest on smooth inclined planes as shown in figure. Find the Reactions of the planes on rollers.



4. Three bars hinged at *A* and *D* and pinned at *B* and *C* as shown in figure form a four linked mechanism. Determine the value of *P* that will prevent movement of bars.



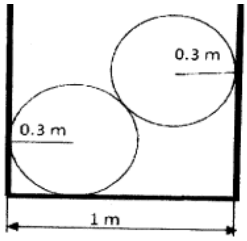
5. A lever *AB* is hinged at *C* and attached to a control cable at A as shown in figure. Determine (i) tension in the cable and (ii) the reaction at hinge *C*.



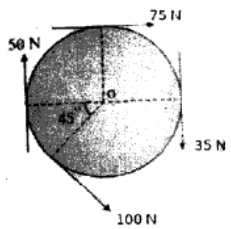
2014–15 (NME202/NME102/EME202/EME102) [SCOP]

1. Define a force system and list various types of force systems.

2. The two cylindrical rollers of weight 50 N each are placed inside a cup as shown in figure (5). Find the reactions at points of contact.

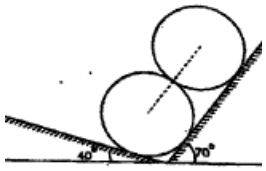


3. Four forces act tangentially to a circle of radius 2 m as shown in figure (1). Find the magnitude, inclination & distance of the resultant from centre of circle.



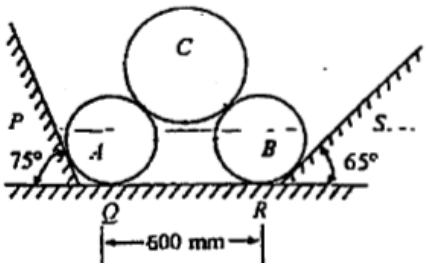
2015–16 (Sem. I) (NME102)

1. What is static equilibrium? Write down sufficient condition of static equilibrium for a Coplanar concurrent and non-concurrent force system.
2. Two identical rollers, each of weights 1000 N are supported by an inclined plane as shown in fig. 1. Assuming smooth surfaces, find the reactions induced at the points of supports.

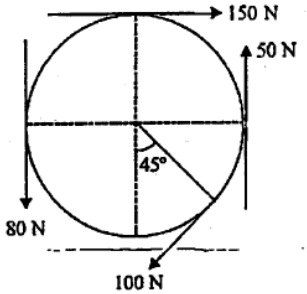


2015–16 (Sem. I) (EME102) [COP]

1. Two forces 60 kN and 20 kN act at a point *O*. The included angle between them is 50°. Find the magnitude and direction of the resultant?
2. Define force couple system.
3. Three sphere *A*, *B* and *C* having their diameter 500 mm, 500 mm and 800 mm respectively are placed in a trench with smooth side walls and floor as shown in figure 1. The center to center distance of spheres *A* and *B* is 600 mm. The weights of the cylinders *A*, *B* and *C* are 4 kN, 4 kN and 8 kN respectively. Determine the reactions at *P*, *Q*, *R*, and *S*.



4. Determine the resultant of four forces tangent to the circle of radius 3 m shown in Fig. 6. What will be its location with respect to the center of the circle.



2015–16 (Sem. I) (ME101) [COP]

1. State the Lami's theorem.
2. With the help of neat sketch explain the principle of transmissibility.
3. Name various types of force system.
4. State prove the Varignon's theorem.
5. Explain and prove the Parallelogram law of forces.
6. A uniform wheel weighing 20 kN and 600 mm diameter rests against 150 mm thick rigid block as shown in fig. Considering all surfaces to be smooth, determine (a) the least pull through the centre of wheel to just turn the wheel over the corner of the block, (b) Reaction of the block as shown in fig 3.

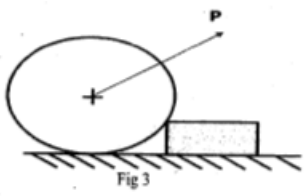


Fig 3

7. Find the resultant and position of the resultant of a set of coplanar forces acting on a lamina as shown in Fig. 2. Each square has side of 10 mm.

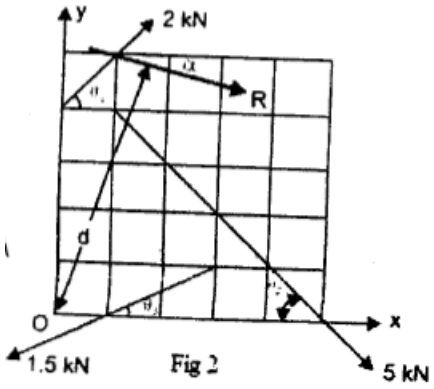
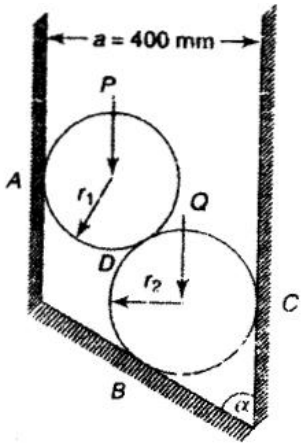


Fig 2

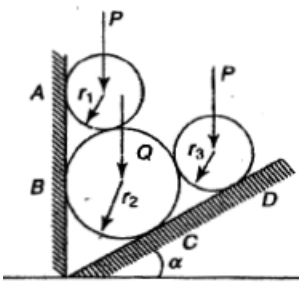
2015–16 (Sem. II) (NME202)

1. State the Varignon's theorem. In what conditions it is used?
2. Explain law of transmissibility of forces.
3. Two smooth cylinders of weight P and Q are placed in a smooth channel as shown in figure. Determine the reactions at contact surfaces A, B & C. The following numerical data are given: P = 200 N, Q = 800 N, r_1 = 100 mm, r_2 = 200 mm, and a = 400 mm, α = 45°.



2015–16 (Sem. II) (EME202) [COP]

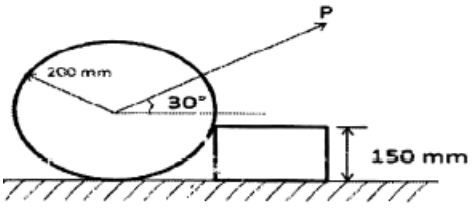
1. Classify the force system and explain parallel force system.
2. Explain the principal of transmissibility.
3. Explain varignon's theorem, and its importance.
4. Define couple, in what way it is different from moment.
5. Three smooth spheres of weight P, P, Q are placed in a smooth trench as shown in fig. find the support reactions at point of contact A, B, C, D. The following numerical data are given: P = 300 N, Q = 600 N, r_1 = 400 mm, r_2 = 600 mm, r_3 = 400 mm and α = 30°.



2015–16 (Sem. II) (ME201) [COP]

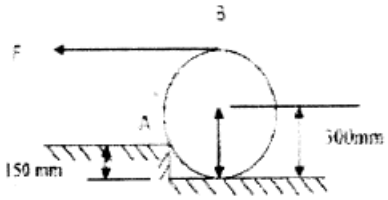
1. Write the equations of equilibrium for concurrent and non concurrent force system.

2. Explain the principle of transmissibility.
3. Explain Lamis' theorem, also write down the limitations of Lamis' theorem.
4. Find the force to pull the roller over the hurdle as shown in the figure. Radius of roller is 200 mm.



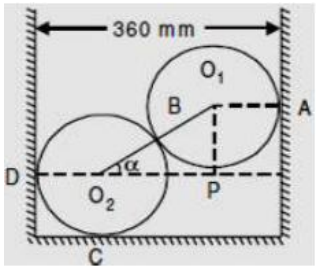
2016–17 (Sem. I) (RME101)

1. State Varignon's theorem of moments.
2. A roller of radius r = 300 mm and weighing 2000 N is to be pulled over a curb of height 150 mm [fig.] by horizontal force F applied to the end of a string wound tightly around the circumference of the roller. Find the magnitude of F required to start the roller move over the curb. What is the least F through the center of the roller to just turn it over the curb?



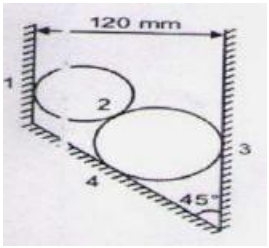
2016–17 (Sem. II) (RME201)

1. Define the principle of transmissibility.
2. Explain free body diagram with example.
3. Define parallelogram law of forces.
4. Two forces P and Q are inclined at an angle of 75°, magnitude of their resultant is 100 N. The angle between the resultant and the force P is 45°. Determine the magnitude of P and Q.
5. Two smooth spheres each of radius 100 mm and weight 100 N, rest in a horizontal channel having vertical walls, the distance between which is 360 mm. Find the reactions at the points of contacts A, B, C and D shown in Fig. below.



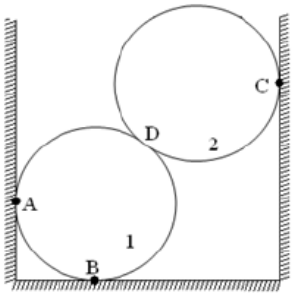
2016–17 (Sem. II) (NME202/EME202/ME201) [COP]

1. Explain coplanar concurrent forces.
2. Explain Polygon law of forces.
3. The sum of two concurrent forces P and Q is 500 N and their resultant is 400 N. If the resultant is perpendicular to P, find P, Q and angle between P and Q.
4. Two cylinders of diameters 100 mm and 50 mm, weighing 200 N and 50 N, respectively are placed in a trough as shown in Fig. 2. Neglecting friction, find the reactions at contact surfaces 1, 2, 3 and 4.



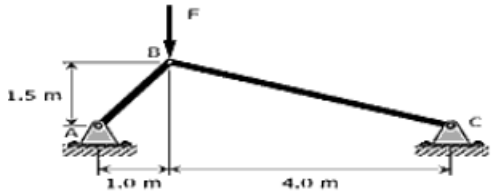
2017–18 (Sem. I) (RME101)

1. Write down the equations of equilibrium for a body subjected to coplanar concurrent force system.
2. Two spheres, each of weight 1000 N and of radius 25 cm rest in a horizontal channel of weight 90 cm as shown in Fig-1. Find the reaction on the points of contacts *A*, *B* and *C*.

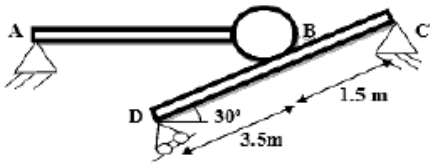


2017–18 (Sem. I) (NME102/EME102) [COP]

1. State and prove Varignon's theorem.
2. If the force *F* shown in figure is resolved into components parallel to the bars *AB* and *BC*, the magnitude of the component parallel to bar *BC* is 4 kN. What are the magnitudes of *F* and its component parallel to *AB*?

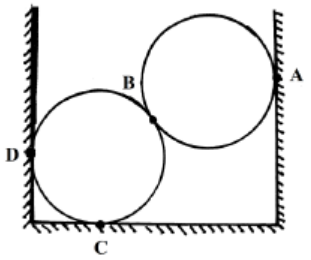


3. A 1000 N cylinder supported by a horizontal rod *AB* and a smooth uniform rod *CD* which weighs 500 N as shown in figure. Assuming *A*, *B*, *C* and *D* to be pin jointed and weight of *AB* is negligible, Find reactions at *C* and *D*.



2017–18 (Sem. II) (RME201)

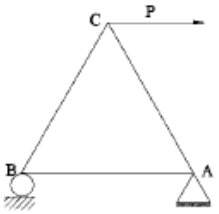
1. Explain conditions of equilibrium of coplanar concurrent and non-concurrent forces.
2. Two smooth spheres *P* and *Q* each of radius 25 cm and weight 500 N, rest in a horizontal channel having vertical walls, the distance between the walls is 90 cm. Find the reactions at the points of contacts *A*, *B*, *C* and *D* shown in figure 1.



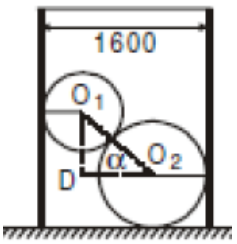
2017–18 (Sem. II) (NME202) [COP]

1. What do you mean by equilibrium of the body? Explain with suitable examples.
2. State polygon law and triangle law of forces.
3. State and prove Varignon's theorem.

4. The cross-section of a block is an equilateral triangle as shown in figure 1. It is hinged at *A* and rests on a roller at *B*. It is pulled by means of a string attached at *C*. If the weight of the block is *W* and the string is horizontal, determine the force *P* which should be applied through string to just lift the block of the roller.



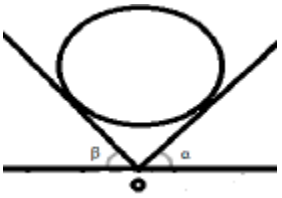
5. A hollow right circular cylinder of radius 800 mm is open at both ends and rests on a smooth horizontal plane as shown in Figure 4. Inside the cylinder there are two spheres having weights 1 kN and 3 kN and radii 400 mm and 600 mm, respectively. The lower sphere also rests on the horizontal plane. Neglecting friction find the minimum weight *W* of the cylinder for which it will not tip over.



2017–18 (Sem. II) (EME202) [COP]

1. Explain how you will reduce the system of coplanar non-concurrent forces to a force and a couple.

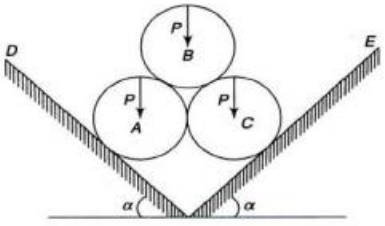
2. A heavy spherical ball of weight *W* rest in a V-shaped through whose sides are inclined at α and β to the horizontal. Determine the pressure exerted on each side. Neglect friction. Subsequently a similar spherical ball is placed on the side of inclination α and it is made to rest on the first ball. Work out the force exerted by the lower ball on the side inclined at β.



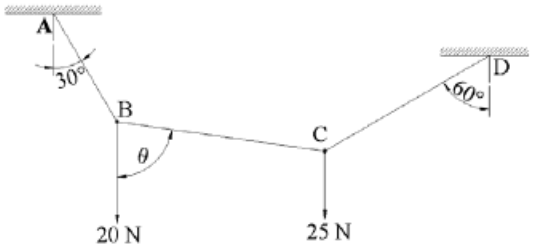
2018–19 (Sem. I) (RME101)

1. Explain the term moment and couple of forces.

2. Three smooth right circular cylinders each of radius *r* and weight *P* are arranged in smooth inclined surfaces as shown in fig below determine the least value of angle α that will prevent the arrangement from slipping.

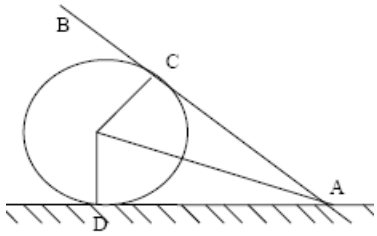


3. A wire is fixed at two points *A* & *D* as shown in following figure 6. Two weights 20 N, 25 N are supported at *B* & *C*, respectively, when equilibrium is reached it is found that inclination of *AB* is 300 and that of *CD* is 600 to the vertical. Determine the tension in the segments *AB*, *BC* and *CD* of the rope and also the inclination of *BC* to the vertical.

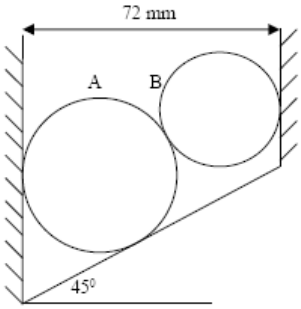


2018–19 (Sem. I) (NME102/EME102) [COP]

1. Define force and it's elements.
2. State Lami's theorem.
3. State and prove Varignon's theorem.
4. A smooth weightless cylinder of radius 600 mm rests on a horizontal plane and is kept from rolling by an inclined string of 1000 mm length. A bar *AB* of length 1500 mm and weight 1200 N is hinged at *A* and placed against the cylinder. Determine tension in the string.

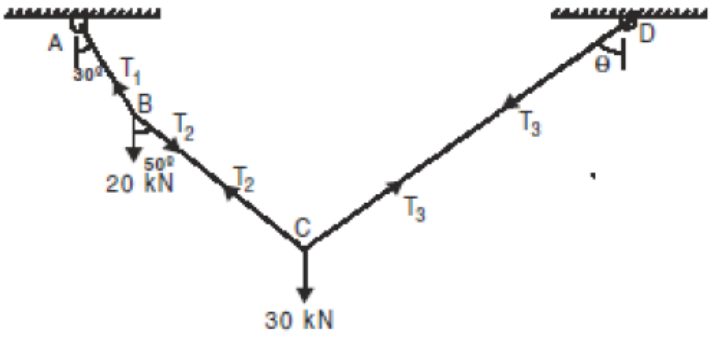


5. Two cylinders *A* & *B* of diameters 60 mm and 30 mm weighing 80 kN and 20 kN respectively are placed in a channel. Find out reactions at all the contact points.

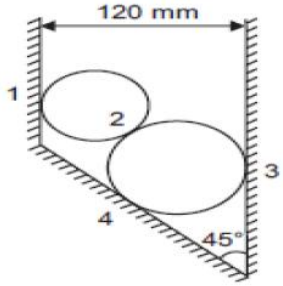


2018–19 (Sem. II) (RME201)

1. Differentiate between concurrent and non- concurrent force system.
2. A wire rope is fixed at two points *A* and *D* as shown in Fig. 1. Two weights 20 kN and 30 kN are attached to it at *B* and *C*, respectively. The weights rest with portions *AB* and *BC* inclined at angles 30° and 50° respectively, to the vertical as shown in figure. Find the tension in the wire in segments *AB*, *BC* and *CD* and also the inclination of the segments *CD* to the vertical.

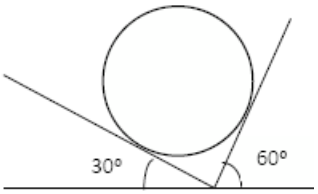


3. Two cylinder of diameters 100 mm and 50 mm, weighing 200 N and 50 N, respectively are placed in a trough as shown in Fig. 5. Neglecting friction, find the reactions at contact surfaces 1, 2, 3 and 4.

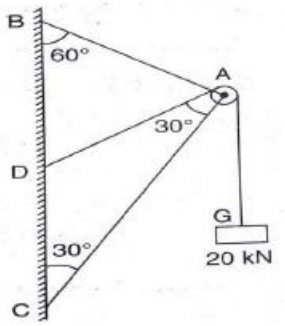


2018–19 (Sem. II) (NME202/EME202) [COP]

1. State and prove parallelogram law of forces.
2. List the characteristics of force. Give the necessary and sufficient conditions for equilibrium of 'non-concurrent' force system.
3. A ball of weight 120 N rests in a right angled groove, as shown in fig. 1. The sides of the groove are inclined to an angle of 30° and 60° to the horizontal. If all the surfaces are smooth, then determine the reactions at the point of contact.

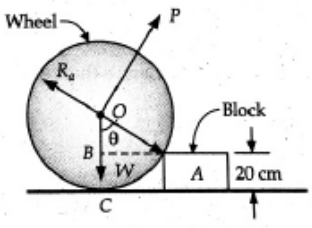


4. The frictionless pulley *A* shown in fig. 3 is supported by a two bars *AB* and *AC* which are hinged at *B* and *C* to a vertical wall. The flexible cable *DG* hinged at *D* goes over the pulley and support a load of 20 kN at *G*. The angles between various members are shown in figure. Determine the forces in *AB* and *AC*. Neglect the size of the pulley.



2019–20 (Sem. I) (RME101)

1. State varignon's theorem.
2. A uniform wheel of 50 cm diameter and 1 kN weight rests against a rigid rectangular block of thickness 20 cm. Considering all surfaces smooth; determine the least pull to be applied through the centre of wheel to just turn it over the corner of the block and reaction of the block.



2019–20 (Sem. I) (NME102/EME102) [COP]

1. Explain coplanar concurrent forces.
2. Explain Polygon law of forces.
3. A ball of weight 120 N rests in a right angled groove, as shown in fig. 1. The sides of the groove are inclined to an angle of 30° and 60° to the horizontal. If all the surfaces are smooth, then determine the reactions at the point of contact.