

# University of Mumbai

Program: All

Curriculum Scheme: Rev2019/2016/2012

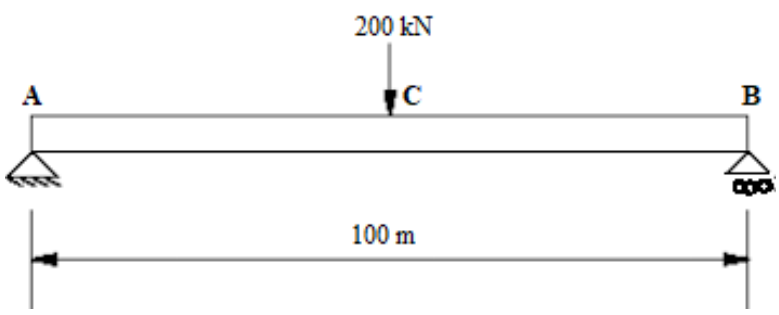
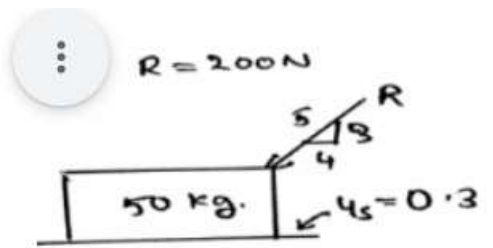
Examination: FE

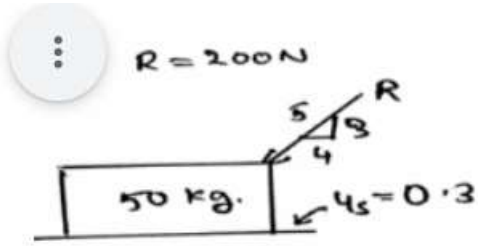
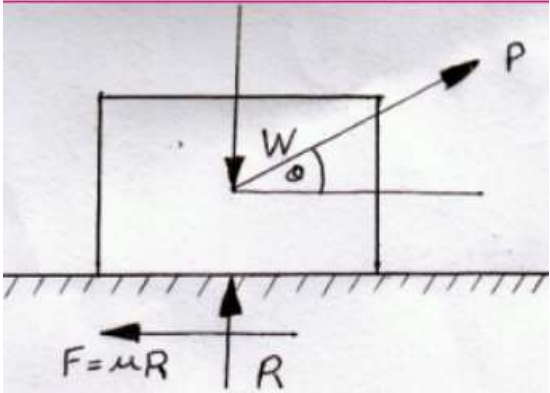
Semester I

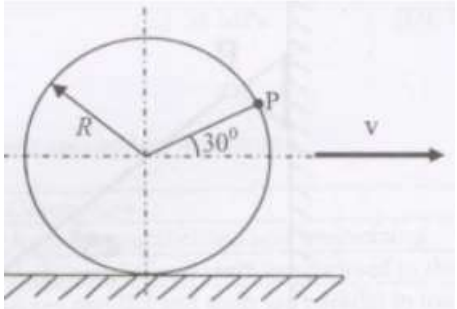
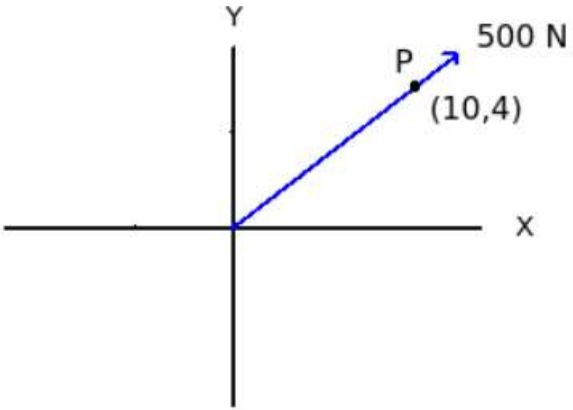
Course Code: 104 and Course Name: EM

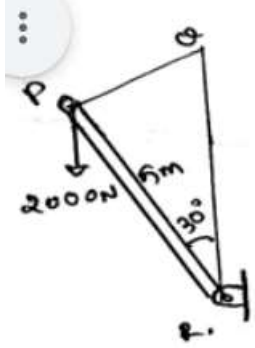
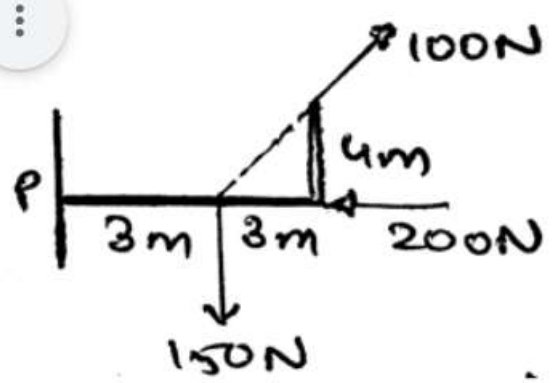
Time: 2-hour

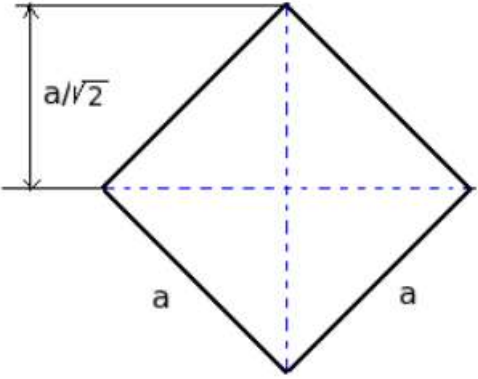
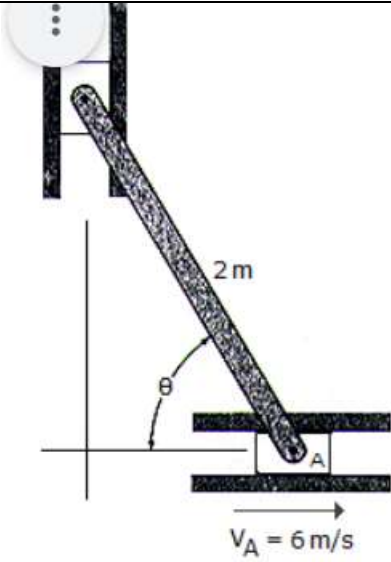
Max. Marks: 80

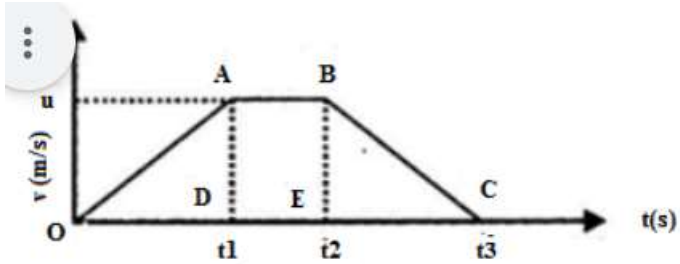
<b>Q1.</b>	<b>Choose the correct option for following questions. All the Questions are compulsory and carry equal marks</b>
1.	<p>Find support reaction at point B of transversely loaded beams shown below, AC=BC:</p> 
Option A:	100 N
Option B:	100000 N
Option C:	50 kN
Option D:	200 kN
2.	<p>Calculate the product of normal force and the coefficient of friction between the body and the surface.</p> 
Option A:	183 N
Option B:	116 N
Option C:	100 N
Option D:	180 N

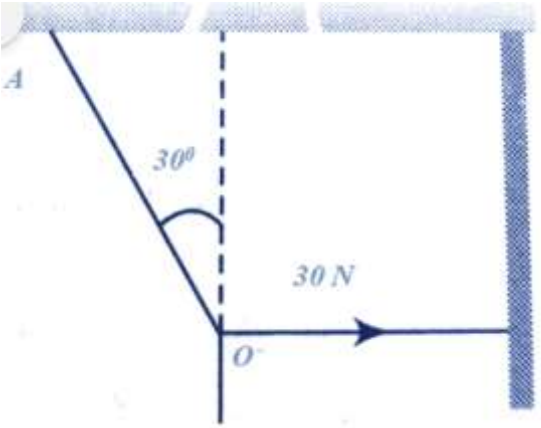
3.	<p>Calculate the frictional force developed between the body and the surface.</p> 
Option A:	180 N
Option B:	16 N
Option C:	10 N
Option D:	160 N
4.	<p>The value of Normal reaction (R) for the following figure is [Where, W = Weight of block, P = Applied force, <math>\mu</math> = Coefficient of friction, <math>\theta</math> = Angle]:</p> 
Option A:	$W - P \sin \theta$
Option B:	$W + P \sin \theta$
Option C:	$P - W \sin \theta$
Option D:	$P + W \sin \theta$
5.	On a ladder resting on smooth ground and leaning against vertical wall, the force of friction will be
Option A:	Towards the wall at its upper end
Option B:	Away from the wall at its upper end

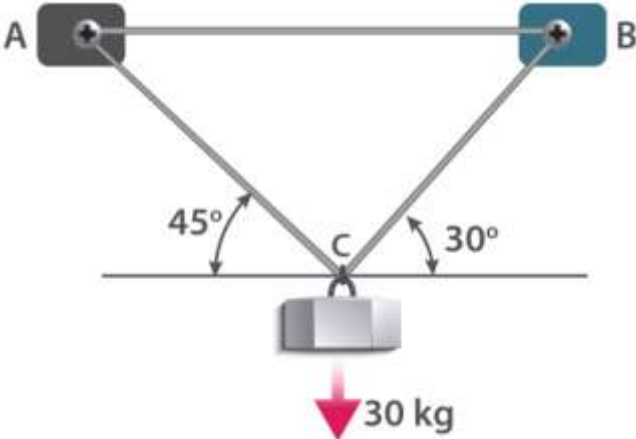
Option C:	Upwards at its upper end
Option D:	Downwards at its upper end
6.	<p>A circular disk of radius <math>R</math> rolls without slipping at a velocity <math>v</math>. The magnitude of the velocity at point <math>P</math> is _____</p> 
Option A:	$3\sqrt{3}v$
Option B:	$3\sqrt{v/23}v/2$
Option C:	$v/2\sqrt{2}$
Option D:	$2v/3\sqrt{2}v/3$
7.	<p>What are the X and Y components of point P for the force system shown below?</p> 
Option A:	$X = 186.00 \text{ N}, Y = 464 \text{ N}$
Option B:	$X = 464.23 \text{ N}, Y = 185 \text{ N}$
Option C:	$X = 466.12 \text{ N}, Y = -180 \text{ N}$
Option D:	$X=366 \text{ N}, Y = 80 \text{ N}$

8.	<p>Find the moment of the force about the point R.</p> 
Option A:	5000 N-m
Option B:	5550 N-m
Option C:	6000 N-m
Option D:	7000 N-m
9.	<p>Find the total resultant force acting vertically in the given figure below consisting of a beam of 'L' shape</p> 
Option A:	180 N
Option B:	18 N
Option C:	10 N
Option D:	100 N

10.	<p>What is the distance of centroid with respect to diagonal shown in diagram below?</p>	
Option A:	$a/\sqrt{3}$	
Option B:	$a/\sqrt{2}$	
Option C:	$a/\sqrt{18}$	
Option D:	$3a/\sqrt{2}$	
11.	<p>The 2-m-long bar is confined to move in the horizontal and vertical slots A and B. If the velocity of the slider block at A is 6 m/s, determine the bar's angular velocity and the velocity of block B at the instant <math>\theta = 60^\circ</math>.</p>	
Option A:	$\omega_{AB} = 3.46 \text{ rad/s}$ , $v_B = 3.46 \text{ m/s}$	
Option B:	$\omega_{AB} = 3.00 \text{ rad/s}$ , $v_B = 3.00 \text{ m/s}$	
Option C:	$\omega_{AB} = 3.00 \text{ rad/s}$ , $v_B = 6.00 \text{ m/s}$	
Option D:	$\omega_{AB} = 6.00 \text{ rad/s}$ , $v_B = 10.39 \text{ m/s}$	
12.	<p>What is the acceleration if the body starts from rest and travels a distance of 's' m in 2 seconds?</p>	

Option A:	$(2/3)s \text{ m/s}^2$
Option B:	$(3/2)s \text{ m/s}^2$
Option C:	$(1/3)s \text{ m/s}^2$
Option D:	$(s/2) \text{ m/s}^2$
13.	<p>Given here is a velocity-time graph of the motion of a body. What is the distance travelled by the body during the motion?</p> 
Option A:	$1/2(OA+AB) \times BC$
Option B:	$1/2(OA+BC) \times OC$
Option C:	$1/2(OC+AB) \times AD$
Option D:	$1/2(AD+BE) \times OC$
14.	An airplane flying 490 m above ground level at 100 m/s, releases a block. How far on the ground will it strike?
Option A:	2 km
Option B:	0.1 km
Option C:	1 km
Option D:	0.2 km
15.	A block is displaced by 3 m when a force of 200 N is applied on it on a smooth inclined surface which is at an angle of 50 degrees with the horizontal. What is the work done?
Option A:	385.67 Nm
Option B:	459.62 Nm

Option C:	933.00 Nm
Option D:	960 Nm
16.	What is the magnitude of the resultant force when $F_1 = 60j + 80k$ and $F_2 = 50i - 100j + 100k$ ?
Option A:	188unit
Option B:	191unit
Option C:	181unit
Option D:	120 unit
17.	A metal ball falls from a height of 32 metres on a steel plate. If the coefficient of restriction is 0.5 to what height will the ball rise after the second bounce
Option A:	4 m
Option B:	8 m
Option C:	2 m
Option D:	16 m
18.	<p>In the given figure, the tension in the horizontal cord is 30 N. What is the weight <math>W</math> and tension in the string <math>OA</math> in newton?</p> 
Option A:	$30\sqrt{3}, 30$
Option B:	$60\sqrt{3}, 30$
Option C:	$30\sqrt{3}, 60$
Option D:	$60\sqrt{3}, 60$

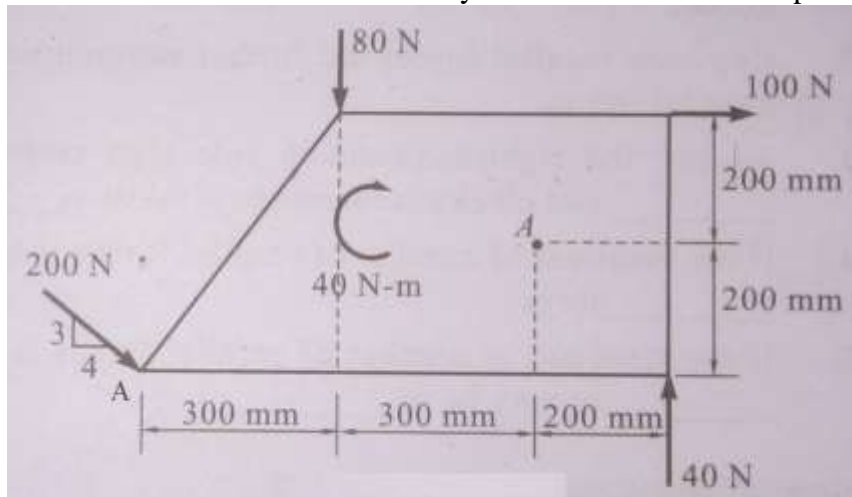
19.	<p>A 30 kg iron block is suspended using supports A and B as shown in the figure. What is the tension in both ropes?</p> 
Option A:	263.566 N and 215.2 N
Option B:	463.566 N and 415.2 N
Option C:	663.566 N and 615.2 N
Option D:	863.566 N and 815.2 N
20.	A man stands on a weighing machine in the lift. When the lift is stationary his weight is recorded as 40 kg. If the lift accelerates upwards with an acceleration of 2 m/s <sup>2</sup> what weight will the machine show?
Option A:	40 kg
Option B:	48 kg
Option C:	42 kg
Option D:	32 kg



**Q2****Solve any Four out of Six****5 marks each**

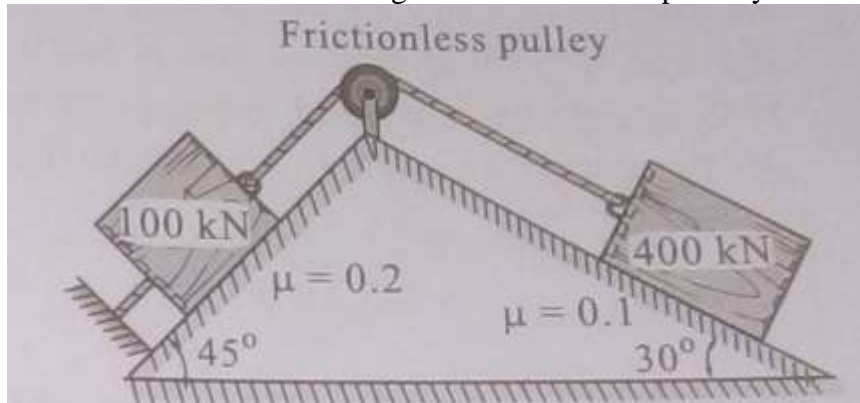
A

Determine the Resultant of Force System and Locate it w.r.t. point A.



B

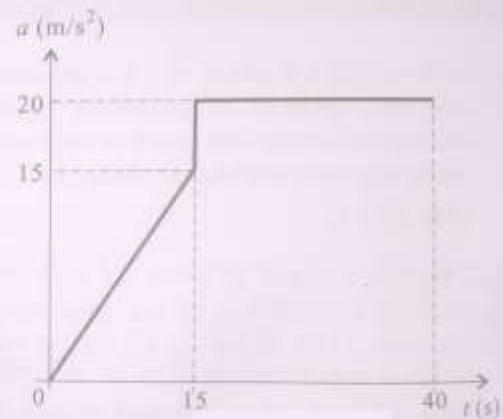
Find the tensions in the cords given in the inclined plane system below.

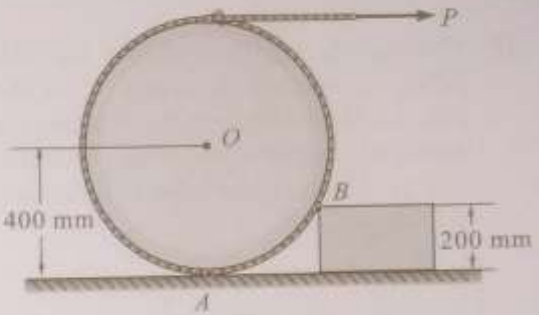
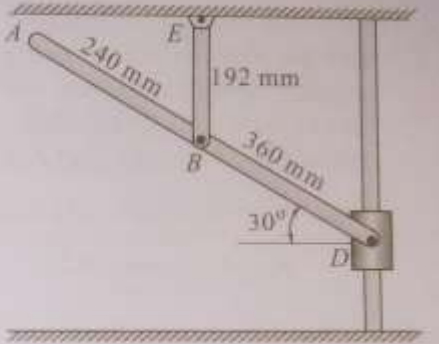


C

A two-stage rocket is fired vertically from rest with acceleration as shown in. After 15 s the first stage *A* burns out and the second stage *B* ignites. Calculate the following:

- (a) Velocity of the rocket at  $t = 15$  s,  
 (b) Distance travelled by the rocket at  $t = 15$  s,  
 (c) Velocity of the rocket at  $t = 40$  s and

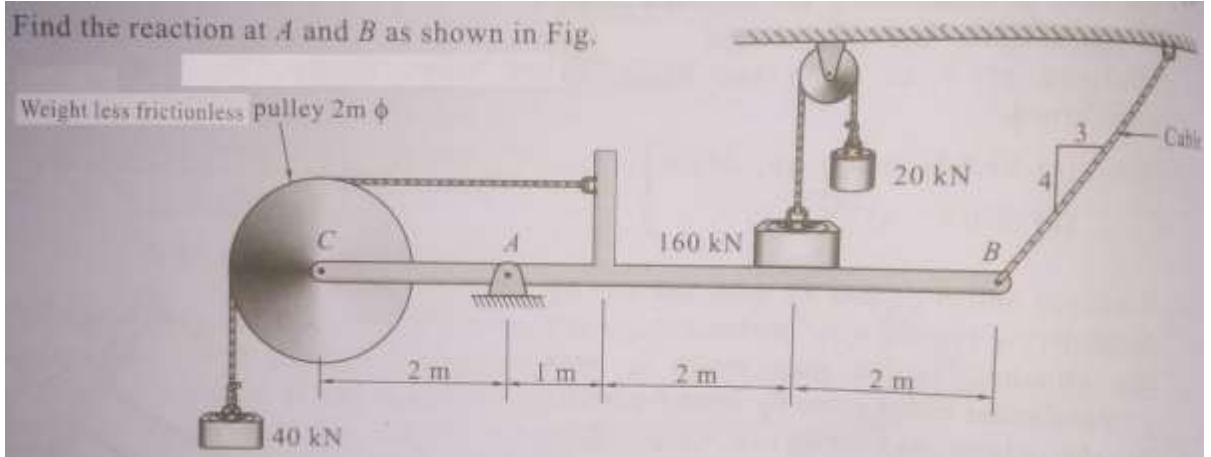


D	<p>A roller of radius 400 mm, weighing 4 kN is to be pulled over a rectangular block of height 200 mm as shown in Fig. , by a horizontal force applied at the end of a string wound round the circumference of the roller. Find the magnitude of the horizontal force <math>P</math> and the reaction at <math>B</math>, which will just turn the roller over the corner of the rectangular block. Also determine the least force and its line of action at the roller centre, for turning the roller over the rectangular block.</p> 
E	<p>The distance between two stations is 2.50 km. A locomotive starting from one station gives the train an acceleration reaching a speed of 36 km/h in 30 s until the speed reaches 54 km/h. This speed is maintained until the brakes are applied and the train is brought to rest at the second station under a retardation of <math>1 \text{ m/s}^2</math>. Find the time taken to perform the journey and the distances covered during the accelerated, uniform and retarded motion.</p>
F	<p>The rod <math>BE</math> in the mechanism shown in Fig. has an angular velocity of <math>4 \text{ rad/s}</math>; at the instant under observation; in counterclockwise direction, calculate the</p> <ol style="list-style-type: none"> <li>angular velocity of rod <math>AD</math>,</li> <li>velocity of point <math>A</math>, and</li> <li>velocity of collar <math>D</math>.</li> </ol> 

**Q3. Solve any Two Questions out of Three**

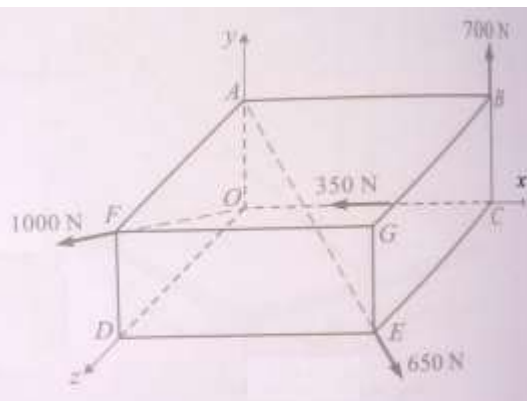
**10 marks each**

A



Four forces acting on a parallelepiped are shown. Find their resultant force acting at the origin and a moment. Given:  $OC=5m$ ,  $OA=3m$ ,  $OD=4m$  [10 Marks]

B



C

The magnitude and direction of the velocities of two identical frictionless balls before they strike each other is shown in Fig. Assume  $e = 0.9$ , determine the magnitude and direction of the velocity of each ball after the impact.

