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UPES

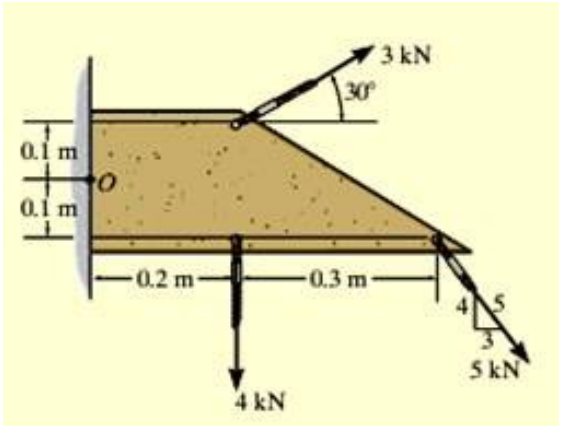
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

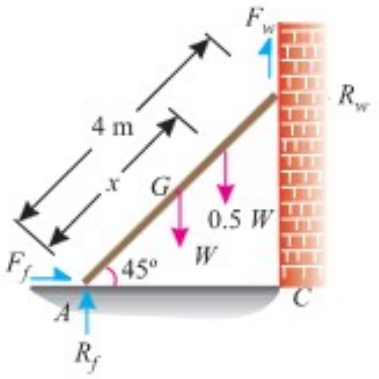
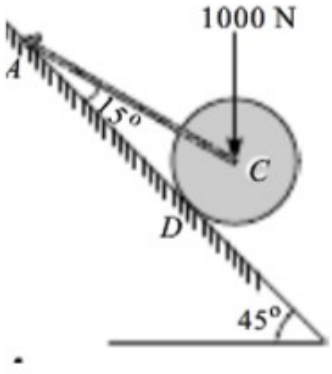
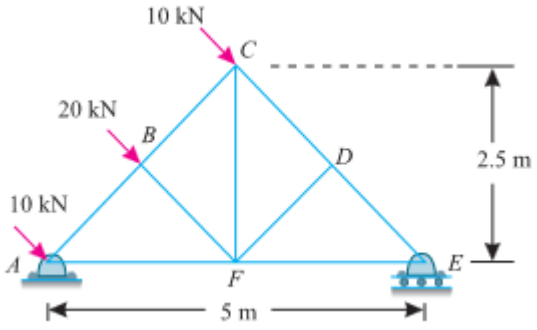
End Semester Examination, May 2018

Programme: B.Tech/common subject **Semester – : II**

Course Name: Engineering Mechanics **Max. Marks : 100**
Course Code: MECH 1002 **Duration : 3 Hrs**
No. of page/s:04

Note: Attempt all the questions. There is internal choice in section B and section C. Assume suitable data if missing.

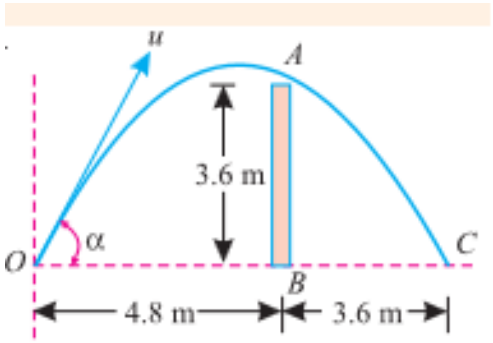
Section 'A'		
	Marks	**CO**
1. Replace the loading on the frame given in figure by its resultant in magnitude and position. 	**5**	**CO1 CO2**
2. Derive an expression for the limiting tension ratio for a belt pulley system considering the belt friction.	**5**	**CO6**
3. Define a perfect frame. Also discuss at least four differences between method of section and method of joint for the analysis of truss.	**5**	**CO4**
4. The equation of motion of an engine is given by $s = 2t^3 - 6t^2 - 5$, where (s) is in metres and (t) in seconds. Calculate (a) displacement and acceleration when velocity is zero ; and (b) displacement and velocity when acceleration is zero.	**5**	**CO7**
Section 'B'		
5. A uniform ladder of 4 m length rests against a vertical wall with which it makes an angle of 45°. The coefficient of friction between the ladder and the wall is 0.4 and that between ladder and the floor is 0.5. If a man, whose `weight is one-half of that of the ladder ascends it, compute the distance	**10**	**CO4**

ascended by the man when the ladder slips.  		
6. For the system shown in figure, find the tension in the cable and reaction at the support.  	**10**	**CO1** **CO2**
7. Find the forces in the members AB, BC, BF and FD of truss in magnitude and direction.  	**10**	**CO3** **CO4**
8. Two rockets are launched at a fireworks display. Rocket A is launched	**10**	**CO7**

with an initial velocity v_0 = 100 m/s and rocket B is launched 't' seconds later with the same initial velocity. The two rockets are timed to explode simultaneously at a height of 300 m as A is falling and B is rising. Assuming a constant acceleration g = 9.81 m/s^2, determine the time 't'.

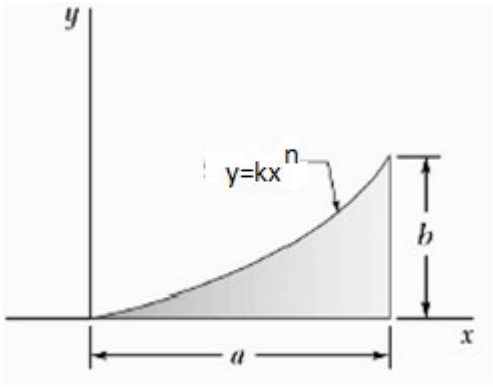
OR

Find the least initial velocity which a projectile may have, so that it may clear a wall 3.6 m high and 4.8 m distant (from the point of projection) and strike the horizontal plane through the foots of the wall at a distance 3.6 m beyond the wall. The point of projection is at the same level as the foot of the wall.



Section 'C'

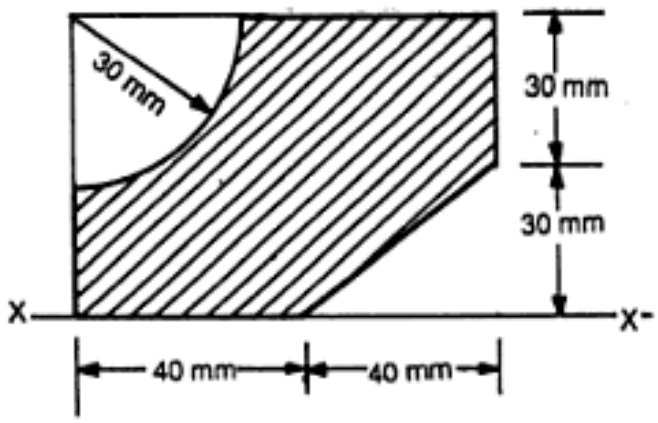
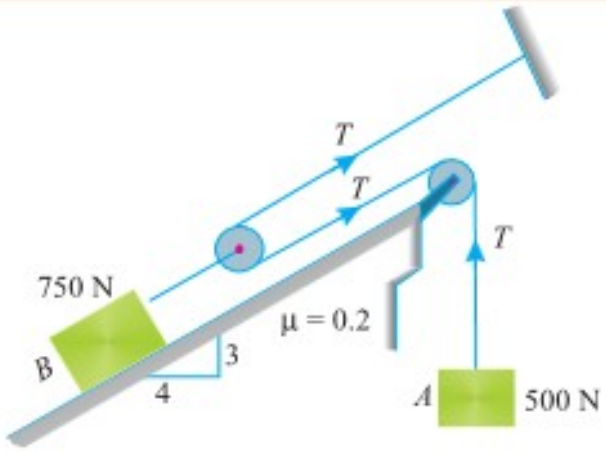
9. (a) Determine, by direct integration, the moment of inertia of the parabolic spandrel of ***n*** th order with respect to the x axis. **12** **CO5**



(b) Derive an expression for the moment of inertia for a triangular lamina about its centroidal axis parallel to the base and its base. **8**

OR

Find the moment of inertia of the shaded portion: **20**
(a) about the given axis X-X and;
(b) about the centroidal axis parallel to the given X-X **axis**

		
10. The system of bodies shown in figure starts from rest. Determine the acceleration of body B and the tension in the string supporting body A, when body B is moving upward. 	**20**	**CO7**