DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular Semester Examination – Summer 2023

Course: First Year B. Tech. (Semester II) **Branch: Group A / Group B**

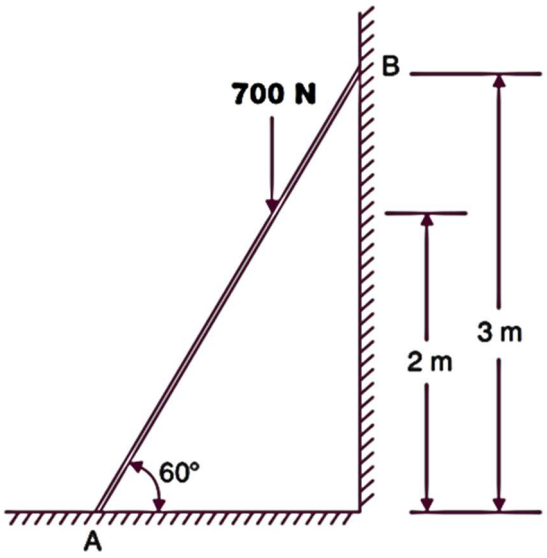
Subject Name: Engineering Mechanics **Subject Code: BTES203**

Max Marks: 60 **Date: 17/07/2023** **Duration: 3 Hrs.**

Instructions to the Students:

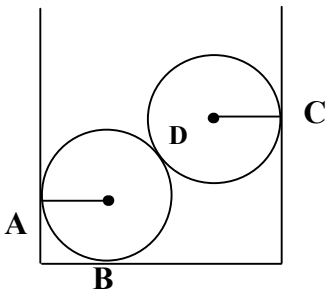
1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary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

		(Level/CO)	Marks
Q. 1	**Solve Any Two of the following.**		
A)	(I) Define following terms: Static, Dynamic, Law of parallelogram, Lami's Theorem. (II) Write down the characteristics of force.	**Remember**	**06**
B)	A ladder weighing 100 N is to be kept in the position shown in figure, resting on a smooth floor and leaning on a smooth wall, also a man weighing 700 N is at 2m above floor level. Determine (i) The horizontal force F required at floor level to prevent it from slipping. (ii) If the horizontal force F is to be applied at a height of 1 m above the ground level, how much should F be?	**CO 1**	**06**
C)	The following forces are acting at a point: (i) 20 N inclined at 30^0 from East to North, (ii) 25 N towards North, (iii) 30 N inclined at 45^0 from North to West, (iv) 35 N inclined at 40^0 from West to South. Find the magnitude and direction of the resultant force.	**CO 1**	**06**

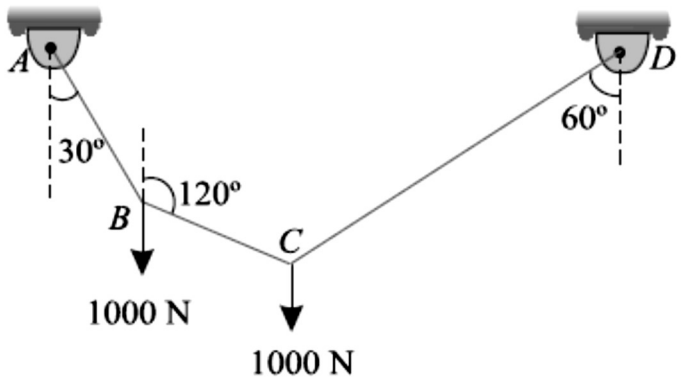


Q. 2 Solve Any Two of the following.

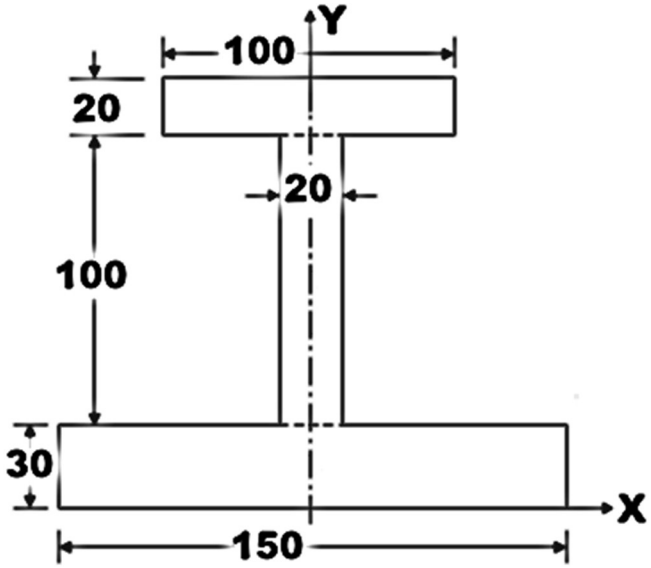
A) The cylindrical rollers of weight 50 N each having radius 0.3 m are placed inside a cup having base width 1 m. Find reactions at points of contact A, B, C and D. **CO 1** **06**



B) A string ABCD, attached to fixed points A and D has two equal weights of 1000 N attached to it at B and C. The weights rest with the portions AB and CD inclined at angles. Find the tensions in the portions AB, BC and CD of the string, if the inclination of the portion BC with the vertical is 120°. **CO2** **06**



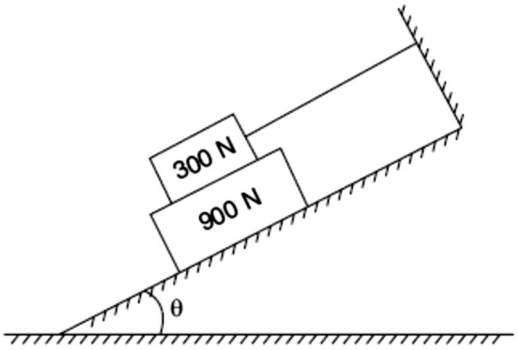
C) Locate the centroid of the I-section shown in figure with respect to the axes shown. (All dimensions are in mm) **Application** **06**



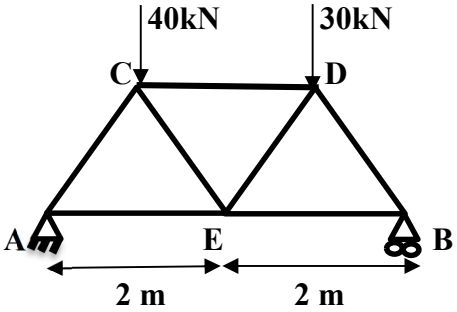
Q. 3 Solve Any Two of the following.

A) Define friction. What are the Coulomb's laws of dry friction? **Remember** **06**

B) What should be the value of θ 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. (Note: Upper block weighs 300 N) **CO2** **06**



C) Find out forces in all the members of truss. (All angles are 60º) **CO2** **06**



Q. 4 Solve Any Two of the following.

A) State and prove work energy principle. **Understand** **06**

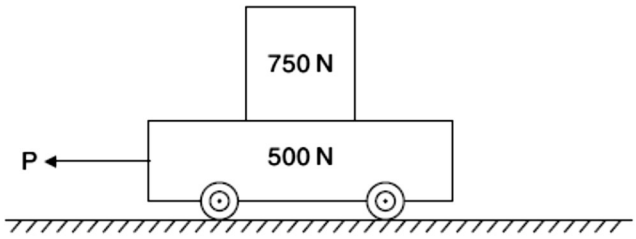
B) A body moves along a straight line and its acceleration 'a' which varies with time is given by $\mathbf{a = 2 - 3t}$. Five seconds after start of the observations, its velocity is found to be 20 m/sec. Ten seconds after start of the observation, the body is at 85 m from the origin. Determine its acceleration, velocity and distance from the origin. **CO 4** **06**

C) If a particle is projected inside a horizontal tunnel which is 5 meters high with velocity of 60 m/s, find the angle of projection and the greatest possible range. **CO 4** **06**

Q. 5 Solve Any Two of the following.

A) State and explain with mathematical equation: (i) Law of conservation of momentum (ii) Coefficient of restitution. **Remember** **06**

B) A 750 N crate rests on a 500 N cart. The coefficient of friction between the crate and the cart is 0.3 and between cart and the road is 0.2. If the cart is to be pulled by a force P such that the crate does not slip. **CO 5** **06**



Using D' Alembert's principle, determine:

(i) the maximum allowable magnitude of P,

(ii) the corresponding acceleration of the cart.

C) A 1500 N block is in contact with a level plane, the coefficient of friction between two contact surfaces being 0.1. If the block is acted upon by a horizontal force of 300 N, what time will elapse before the block reaches a velocity of 16 m/sec starting from rest? If 300 N force is then removed, how much longer will the block continue to move? Solve the problem using impulse momentum equation. **CO 5** **06**

***** End *****