Indian Institute of Technology Guwahati

ME 101: Engineering Mechanics (2016-2017, Sem II)

Tutorial 10 (24.04.2017) (Div 1 & 4)

Time: 8:00 AM – 8:55 AM **Full Marks**: 40

Q.1 – The uniform rectangular block of dimensions shown is sliding to the left on the horizontal surface with a velocity v_1 when it strikes the small step at *O*. Assume negligible rebound at the step and compute the minimum value of v_1 which will permit the block to pivot freely about *O* and just reach the standing position *A* with no velocity. Compute the percentage energy loss *n* for $b = c$.

Q.2 – The mass center *G* of the slender bar of mass 0.8-kg and length 0.4 m is falling vertically with a velocity v = 2 m/s at the instant depicted. Calculate the angular momentum *Ho* of the bar about point *O* if the angular velocity of the bar is (*a*) ω_a = 10 rad/s clockwise and (*b*) ω_a = 10 rad/s counterclockwise.

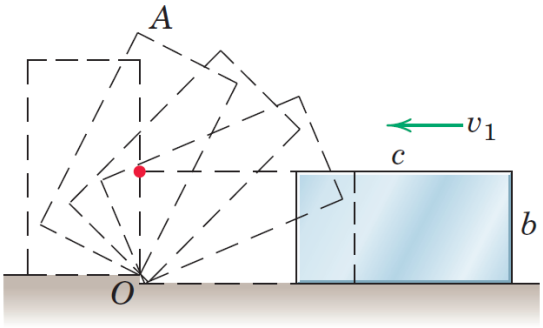

Fig. 1 (Question 1)

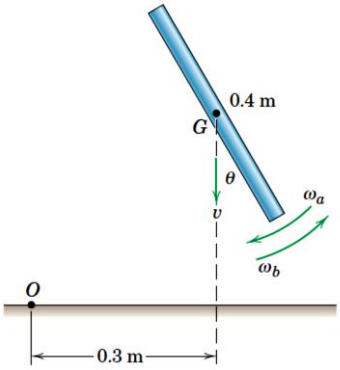

Fig. 2 (Question 2)

Q.3- The 28-g bullet has a horizontal velocity of 500 m/s as it strikes the 25-kg compound pendulum, which has a radius of gyration k_0=925 mm. If the distance h = 1075 mm, calculate the angular velocity ω of the pendulum with its embedded bullet immediately after the impact.

Q.4– The large rotor has a mass of 60-kg and a radius of gyration about its vertical axis of 200 mm. The small rotor is solid circular disk with a mass of 8-kg and is initially rotating with an angular velocity ω_1= 80 rad/s with the large rotor at rest. A spring-loaded pin *P* which rotates with the large rotor is released and bears against the periphery of the small disk, bringing it to a stop relative to the large rotor. Neglect any bearing friction and calculate the final angular velocity of the assembly.

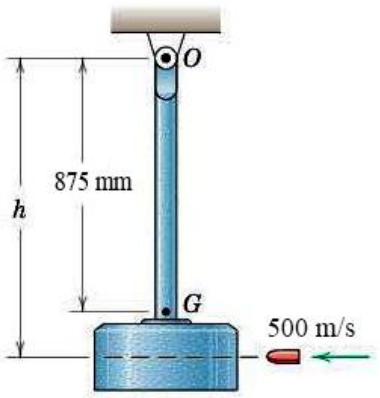

Fig. 3 (Question 3)

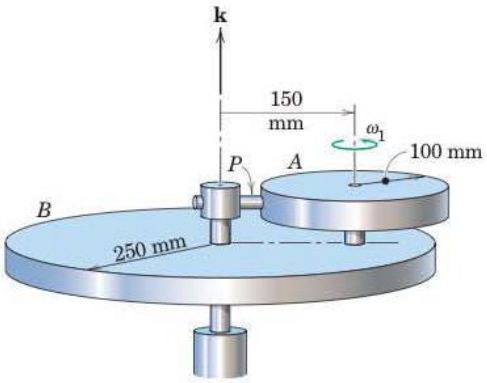

Fig. 4 (Question 4)

Q.5 – The slender bar of mass *m* and length *b* is pivoted at its lower end at O in the manner shown in the separate detail of the support *O*. The bar is released from rest in the vertical position 1. When the middle of the bar strikes the pivot at *A* in position 2, it becomes latched to the pivot, and simultaneously the connection at *O* becomes disengaged. Determine the angular velocity ω_3 of the bar just after it engages the pivot at *A* in position 3.

Q.6– In the rotating assembly shown, arm *OA* and the attached motor housing *B* have a combined mass of 4.5-kg and a radius of gyration about the *z*-axis of 175 mm. The motor armature and attached 125-mm-radius disk have a combined mass of 7-kg and a radius of gyration of 100 mm about their own axis. The entire assembly is free to rotate about the *z*-axis. If the motor is turned on with *OA* initially at rest, determine the angular speed *N* of *OA* when the motor has reached a speed of 300 rev/min *relative* to arm *OA*.

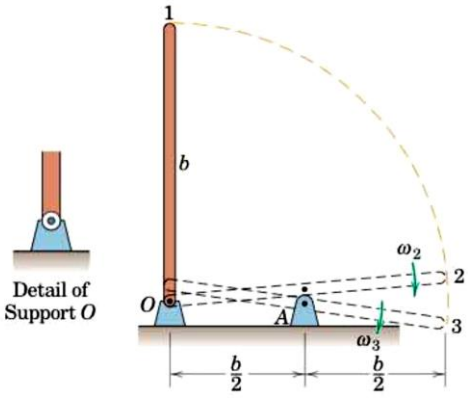

Fig. 5 (Question 5)

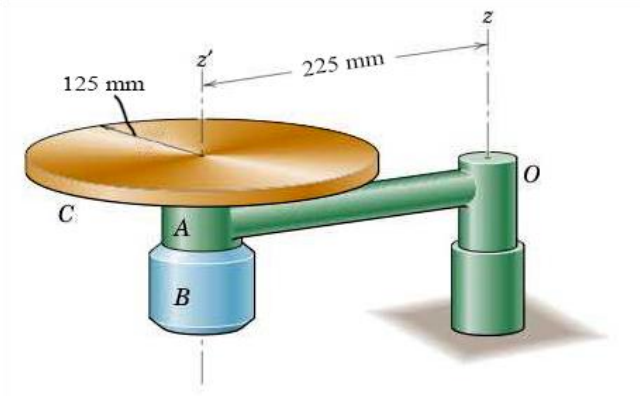

Fig. 6 (Question 6)