Total No. of pages __04__ Roll No. 2K21/CE/95

III SEMESTER B.Tech. [Civil Engg.]

Civil Branch/ Group code

END SEMESTER EXAMINATION Nov. 2022

CE203 Engineering Mechanics

Time: **03 Hours** **Max. Marks: 40**

Note: Question No. 01 is compulsory. Attempt remaining 4 questions selecting any two parts from each question. All questions carry equal marks. Take g = 9.81 m/sec^2 if required. Assume suitable missing data if any.

Q 01: Attempt all parts: (CO1, CO2, CO3, CO4 & CO5)

(a) Determine the mechanical advantage of the ramp shown in figure 1(a) below.

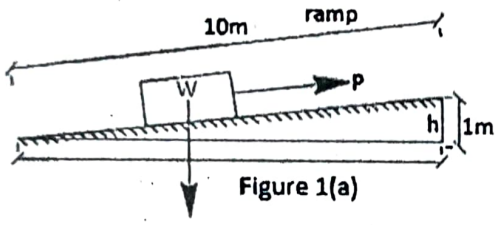

Figure 1(a)

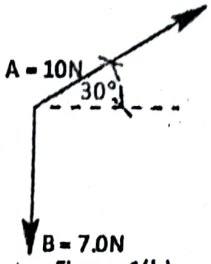

Figure 1(b)

(b) Determine $(\vec{A} - \vec{B})$ for the vectors shown in figure 1(b) above.

(c) Determine the unit vector/direction vector of the vector $\vec{V}$ Whose magnitude and the end coordinates are shown in figure 1(c) below.

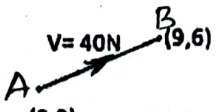

Figure 1(c)

(d) Determine the mechanical advantage of the pulley system shown in figure 1(d) below.

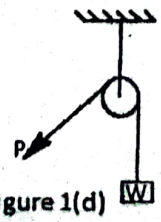

Figure 1(d)

(e) Explain the Pappus and Guldinus theorem of moments.

(f) Define reversible and irreversible machines.

(g) Explain the principle of conservation of angular momentum.

(h) Determine the centroid of a triangular geometry using the geometry approach.

Q 02: Attempt any two parts:

(a) For the jointed roof truss apparatus shown in figure 2(a) below, determine all the three-member forces analytically. (CO3)

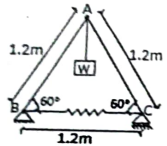

Figure 2(a)

(b) Verify the principle of moments for the Bell Crank lever laboratory apparatus shown in figure 2(b) below. (CO2)

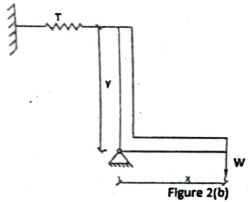

Figure 2(b)

(c) Analyze the simple truss shown in figure 2(c) below and find member forces in all members of the truss using the method of section. Take advantage of symmetry and report symmetric member forces. (CO3)

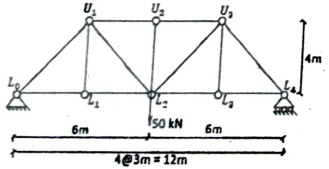

Figure 2(c)

Q 03: Attempt any two parts: (CO4)

(a) Explain the friction mechanism and Coulomb's law of dry friction.

(b) Determine the mechanical advantage and velocity ratio for the compound pulley system shown in figure 3(b) below.

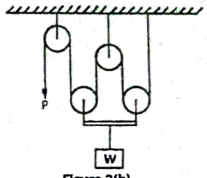

Figure 3(b)

(c) The block shown in figure 3(c) below is moved by force P in a uniform motion on the flat floor surface. Determine the point of application of 'P' above the floor, so that the block slides without tipping over. The coefficient of kinetic friction between the block and the floor surface is μ_k.

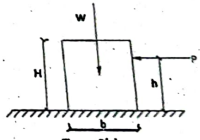

Figure 3(c)

Q 04: Attempt any two parts: (CO5)

(a) Determine the centroidal coordinates of the body from the origin. The body is at a distance 'a' from the origin along the axis of symmetry. Figure 4(a) below shows a hemi-spherical solid of revolution with radius R.

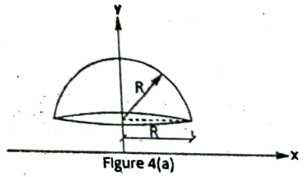

Figure 4(a)

(b) Determine the moment of inertia of the triangle shown in figure 4(b) below about its centroidal x'-axis parallel to the triangle's base.

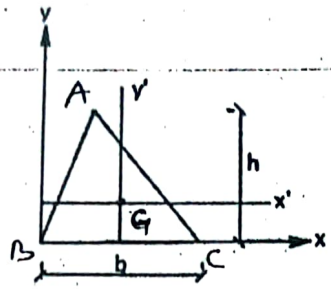

Figure 4(b)

(c) Explain the parallel axis theorem.

Q 05: Attempt any two parts: (CO5)

(a) The two blocks are joined together by an in-extensible cable, as shown in figure 5(a). The system is released from rest. Determine the velocity of block A after it moves 3m. Assume the coefficient of kinetic friction between block A and the plane as $\mu_k = 0.25$ and consider the pulley as weightless and frictionless. Analyze the problem using the work-energy method.

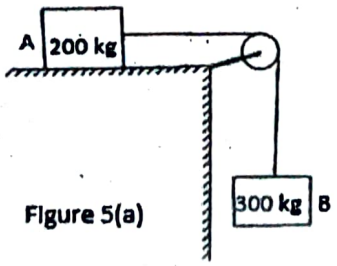

Figure 5(a)

(b) The maximum range of a field gun is 2000 m. If a target at 1300 m is to be hit, what should be the projection angle?

(c) Two bodies, one of which is 40 kg with a velocity of 8 m/sec and the other of mass 25 kg with a velocity of 12 m/sec, move towards each other along a straight line and impinge centrally. Find the velocity of each body after impact if the coefficient of restitution is 0.9.