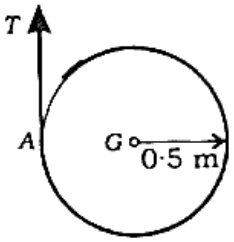
9. A cord is wrapped around a homogeneous disk of mass 15 kg. The cord is pulled upwards with a force $T = 180$ N. Determine *(a)* the acceleration of the center of the disk, *(b)* the angular acceleration of the disk and *(c)* the acceleration of the cord :



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B.Tech 2nd Semester Exam., 2015

ENGINEERING MECHANICS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) All questions carry equal marks.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct option/Answer the following (any *seven*) :

(a) The tangent of the angle of friction is

(i) angle of repose

(ii) coefficient of friction

(iii) cone of friction

(iv) limiting friction

(b) Fore couple is a/an

(i) fixed vector

(ii) sliding vector

(iii) free vector

(iv) unit vector

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(c) The principle of transmissibility can be applied only when the body is treated as

(i) a particle

(ii) a rigid body

(iii) deformable

(iv) a continuum

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(d) State and explain the principle of transmissibility.

(e) State and explain Varignon's theorem.

(f) State and explain Coulomb's law of dry friction.

(g) Explain determinate and indeterminate structures with examples.

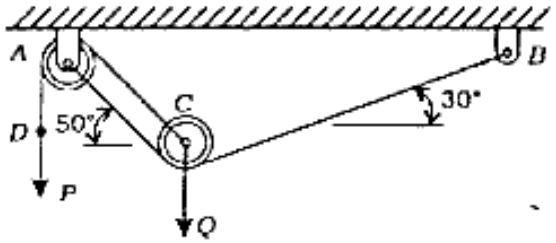
(h) Explain Newton's law of restitution.

(i) What is the physical significance of vector cross product and vector dot product?

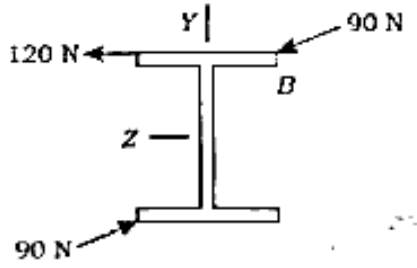
(j) What do you mean by idealization of mechanics?

(Continued)

2. A 2000 N load Q is applied to the pulley C, which can roll on the cable ACB. The pulley is held in the position shown by a second cable CAD, which passes over the pulley A and supports a load P. Determine *(a)* the tension in cable ACB and *(b)* the magnitude of load P :



3. A force and a couple lying in the yz-plane are applied to the end of a cantilevered wide-flange beam. This system is to be replaced with a single-equivalent force. *(a)* For $\theta = 15°$, determine the magnitude and the line of action of the equivalent force and *(b)* determine the value of θ if the line of action of the equivalent force intersects a line drawn through the points B and C 40 mm above C :



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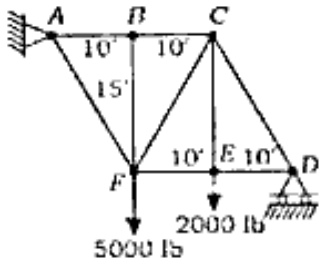
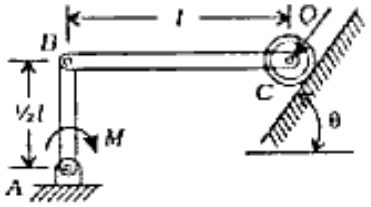
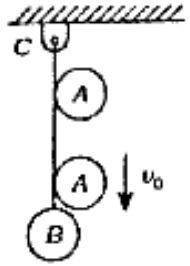
4. Find the forces in the members of the truss given below :



5. For the linkage shown, determine the couple M required for equilibrium when $l = 548$ m, $Q = 40$ N and $\theta = 65°$.

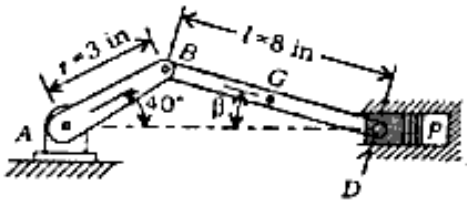


6. Ball B is hanging from an inextensible cord. An identical ball A is released from rest when it is just touching the cord and acquires a velocity v_0 before striking the ball B. Assuming perfectly elastic impact ($e = 1$) and no friction, determine the velocity of each ball immediately after impact :



(Continued)

7. The crank AB has a constant clockwise angular velocity of 2000 r.p.m. For the crank position indicated, determine *(a)* the angular velocity of the connecting rod BD and *(b)* the velocity of the piston P :



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8. A sphere, cylinder and hoop, each having the same mass and radius, are released from rest on an incline. Determine the velocity of each body after it has rolled through a distance corresponding to a change of elevation h :

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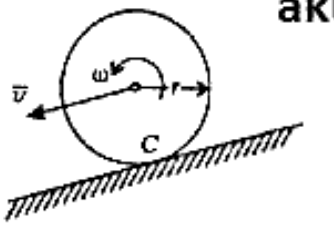

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