Code : 011101

B.Tech. 1st Semester Exam., 2014

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 weight of a body is a

(i) body force

(ii) surface force

(iii) line force

(iv) reactive force

(b) 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

(c) Why is force treated as a vector quantity?

(d) Varignon's theorem is applicable only when the forces are

(i) coplanar

(ii) concurrent

(iii) non-concurrent

(iv) parallel

(e) Which of the following system of forces cannot be reduced to a single force?

(i) Non-concurrent forces in space

(ii) Non-concurrent forces in plane

(iii) Parallel forces in space

(iv) Parallel forces in a plane

(f) A rigid body has —— degree(s) of freedom.

(i) one

(ii) two

(iii) four

(iv) six

(g) How many constrains a hinge support will provide?

(h) Coulomb's laws of friction can be applied to

(i) fluid friction

(ii) fluid-structure interaction

(iii) dry friction between solid bodies

(iv) lubricated surfaces

(i) Limiting friction and impending motion are related. Explain.

(j) Impulse momentum equation relates

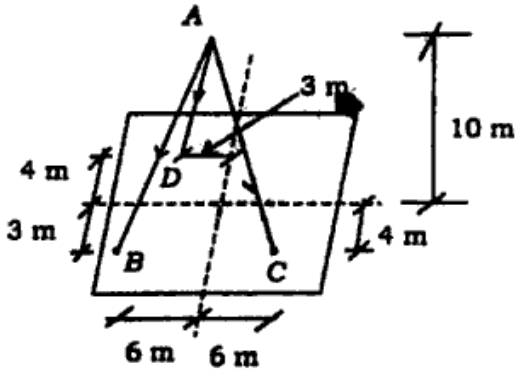
(i) force, velocity and displacement

(ii) force, velocity and time

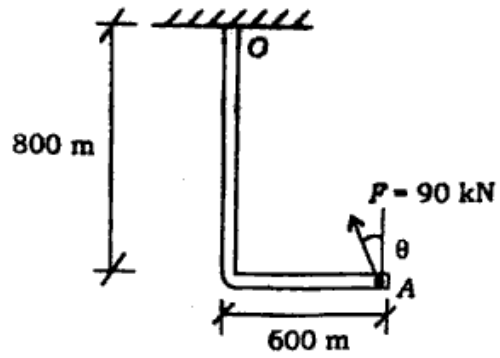
(iii) force, displacement and time

(iv) force and acceleration

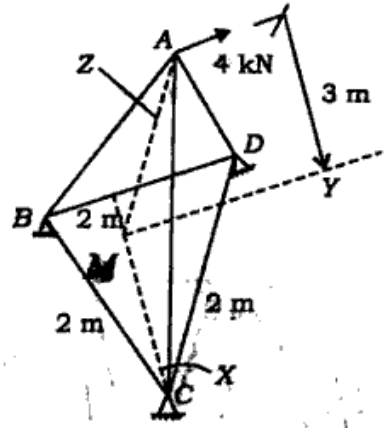
2. Find the resultant of the tension forces concurrent at *A*. The tensions along cables *AB*, *AC* and *AD* are 120 kN, 150 kN, 150 kN.



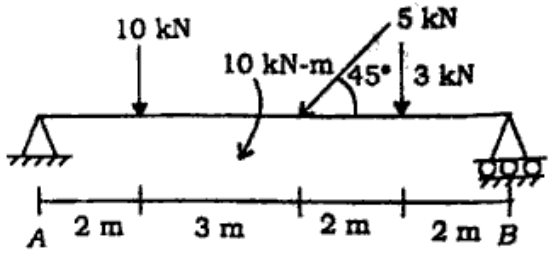
3. Calculate the moment of the 90 kN force about *O* for the condition $\theta = 15°$. Also determine, the value of θ for which the moment about *O* is zero and maximum.



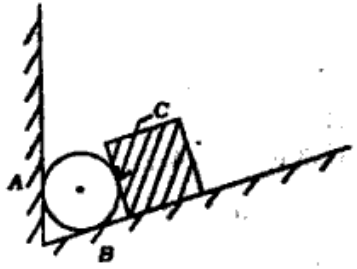
4. Determine the forces in members *AB*, *AC* and *AD*. Point *M* is the centroid of triangle *BCD*.



5. Find the reaction at *A* and *B*.

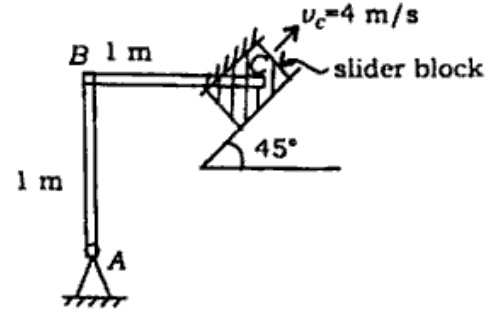


6. A smooth sphere of weight 50 N and a smooth block of weight 150 N are placed in a smooth trough as shown below. Determine the reaction forces at points *A*, *B*, and *C*.

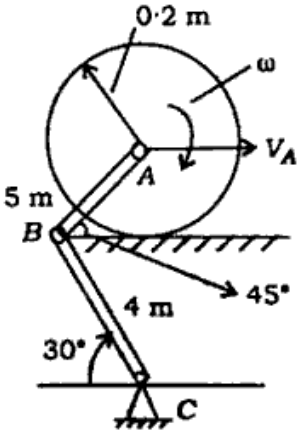


7. Determine the moment *M* applied to the lower link through its shaft which is necessary to support the load *P* in terms of θ. Neglect the weights of the parts.

8. The slider block *C* is moving 4 m/s up the incline. Determine the angular velocities of links *AB* and *BC* and the velocity of point *B* at the instant shown.



9. A cylinder rolls without slipping. It has an angular velocity $\omega = 0 \cdot 3$ rad/s and an angular acceleration $\dot{\omega} = 0 \cdot 014$ rad/sec^2. What are the angular velocity and angular acceleration of the member *AB*?



★ ★ ★