# 112 - Engineering Mechanics

P. Pages : 4

Time : Three Hours

1150

GUG/W/18/1452

Max. Marks : 80

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Notes :   1.   All questions carry equal marks.
2.   Due credit will be given to neatness and adequate dimensions.
3.   Assume suitable data wherever necessary.
4.   Retain the construction lines.
5.   Illustrate your answers wherever necessary with the help of neat sketches.
6.   Scientific non programmable calculator is permitted.

1.   a)   A bar of negligible weight is subjected to a vertical force of 60kN and horizontal force of 30kN as shown in figure. Assuming inclining surface to be smooth, determine the angle θ at which the equilibrium will exist.   **8**
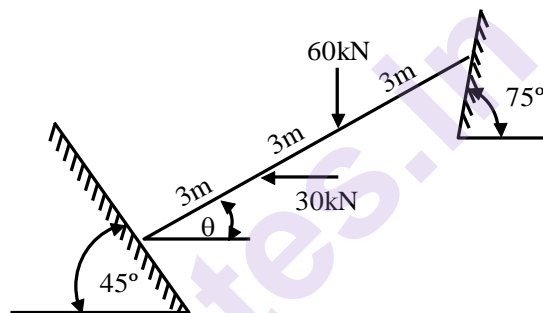

b)   Two cylinders having the dimensions as shown in figure are joined by a stiff weightless rod and rest on two smooth planes. What is the angle between the connecting rod and the horizontal at the equilibrium position?   **8**


OR
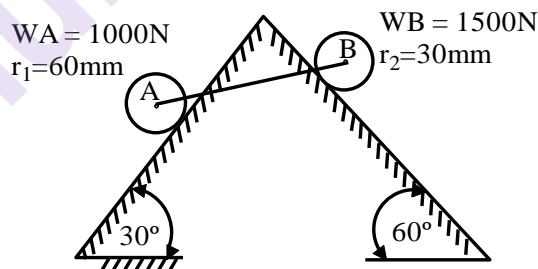
2.   a)   State the Varginons theorem.   **4**

b)   Reduce the following set of forces to a single resultant force   **12**
F = 140N acting from A (3, 7, -1) towards B (5, 1, 2)
P = 260N acting from C (-6, 4, 1) towards D (6, 7, 5)
T = 270N acting from E (-2, 4, 1) towards G (4, -2, 4)
Find the force Q to be applied at origin to reduce that their resultant to a couple. What is the resultant couple.

3. a) State the various assumptions made in the analysis of truss. **4**

b) Find the forces in the members of the truss shown in figure and show the resultant on sketch the truss indicating clearly whether they are in tension or compression. **12**
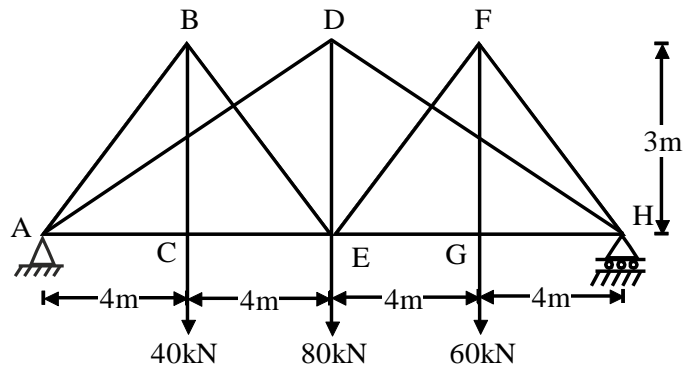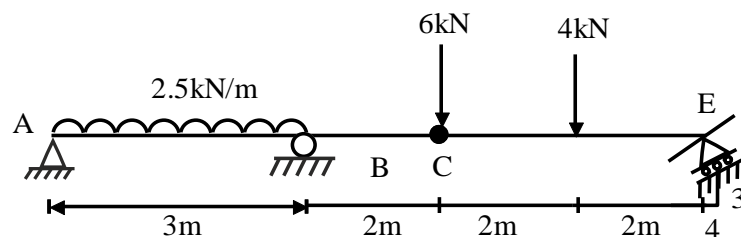

OR

4. a) State the various laws of friction. **4**

b) Find the braking torque produced by a force 40N applied to the level of the band brake at point C as shown in figure. The coefficient friction between Flywheel & belt is 4. **8**
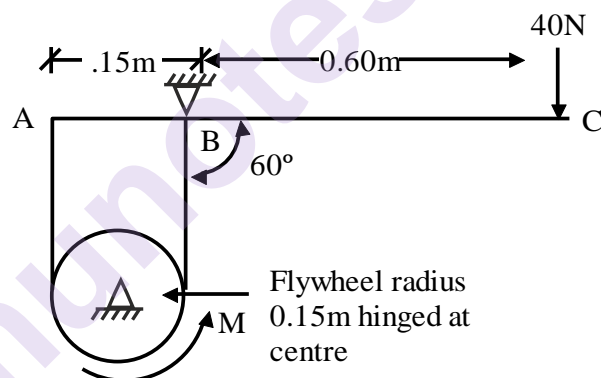
c) Define the term maximum MA and maximum efficiency. **4**

**5.** a) Determine the reactions at A, B & E by using principle of virtual work. There is an internal hinge at C. **8**

b) Using the principle of virtual work determine the force in member DE as shown in figure. **8**
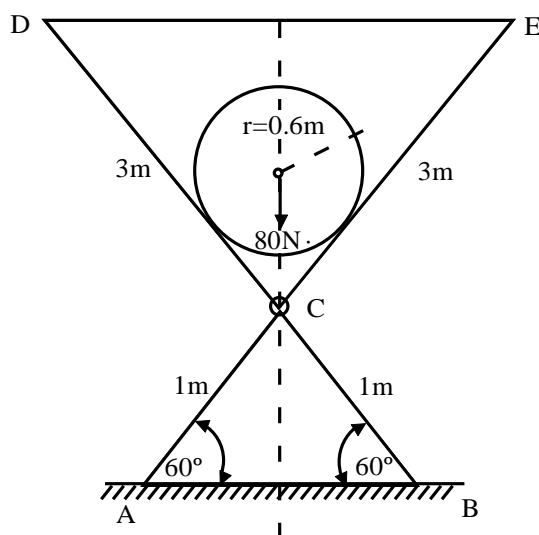

OR

6. a) State the parallel axis Theorem. **4**

b) For the shaded area as shown: **12**
   i) Locate position of centroid.
   ii) Find the moment of inertia about the specified x, y axis
   iii) Find moment of inertia about centroidal axis.
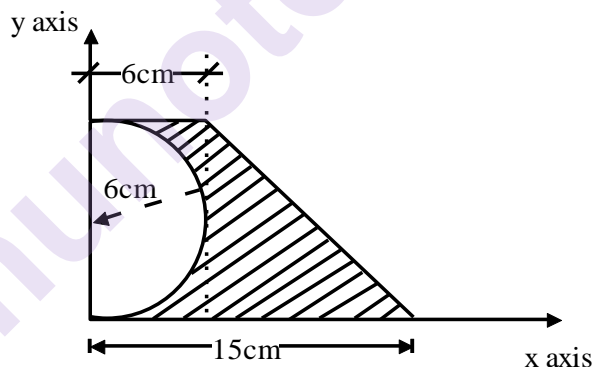
7. a) Curved portion of v-t curve shown in following figure are second degree parabolas with horizontal slope at t = 0 & t = 12 sec. Sketch the a- t & s- t curves if 50=0. Calculate the distance covered in 18 sec. **10**
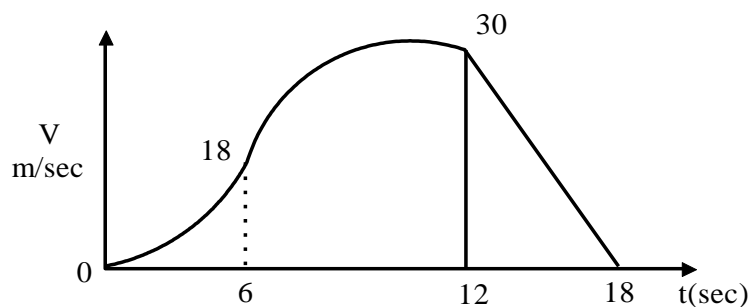

b) Obtain the expression for x & y components of motion of projectile with some salient features. **6**

OR

8. a) The rectilinear motion of a particle is defined by $a = 10V^{\frac{1}{2}}$ at the instant t = 2 second velocity is 100 m/sec and displacement is 100 meter, determine the displacement at t = 4 seconds. **8**

b) The rectangular components of the acceleration for a particle $a_x = 3t$ and ay = 30-10t, where a in meter per sec^2. If a particle starts from rest at origin. Find the radius of curvature of bath at t = 2 sec. **8**

9. a) Explain D'Alembert's principle. **4**

b) In the given figure determine acceleration of blocks A and B at the given position when the system is released from rest. A weight 300N and B weights 400N. Assume surfaces are smooth. **12**
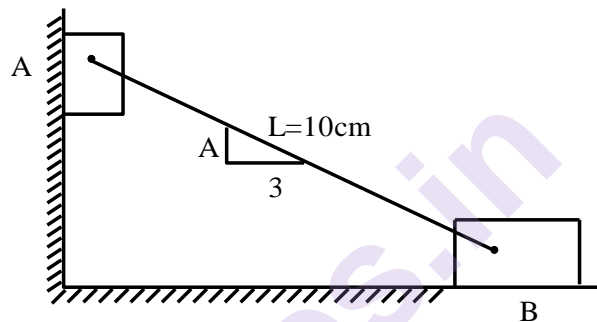
OR

10. a) Explain the term elastic impact. **4**

b) The 50N block 'A' in fig has a velocity of 30m/sec when it strikes a 100N ball suspended from 1.8 M cord. If e = 0.8
determine
i) Find position of block A.
ii) If impacts lasts for 0.01 sec determine average impulse force.
iii) Maximum & minimum tension in the chord supporting B. **12**

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