P.R. Pote (Patil) Education & Welfare Trust's Group of Institutions
College of Engineering & Management, Amravati
Department of Applied Sciences & Humanities

First Year (Sem-I) **Sample Question Paper** **Sub: Engg Mech (1A3)**

Max. Marks: 80 **Max. Time: 3 hours**

Instructions to candidates:

1) Solve any two questions Q1 or Q2 and Q3 or Q4.
2) Draw neat and labeled diagram whenever necessary.
3) Due credit will be given to neatness an adequate dimension.
4) Assume suitable data whenever necessary.

Q1:

a) State different system of forces **3**

b) State and explain Varignon's theorem. **3**

c) Two sphere, each of weight 1000N & of radius 25cm rest on horizontal channel of width 90cm as shown in fig.(1) Find the reactions on the points of contact A, B & C. **8**

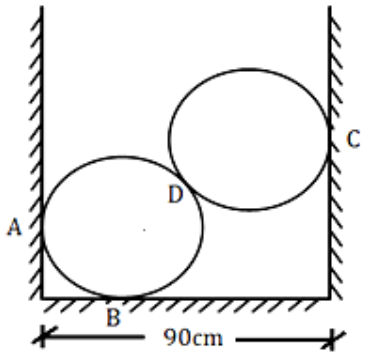


Fig.(1)

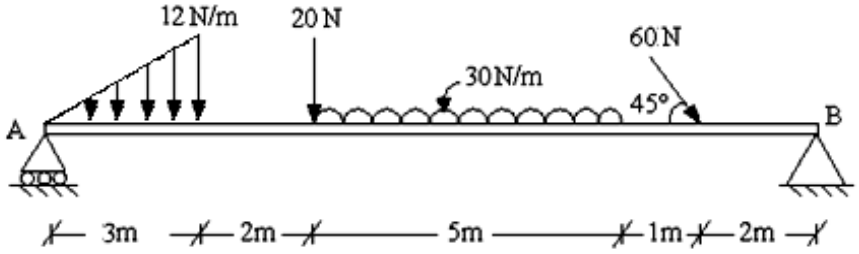
OR

Q2:

a) Define equilibrium and state conditions of equilibrium. **3**

b) What is Free body diagram? Draw FBD for various supports. **3**

c) Determine reactions developed at supports in the beam as shown in Fig. **8**



Q3:

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

b) Calculate the force in each member of the truss shown in fig.(3) and tabulate the results. **9**

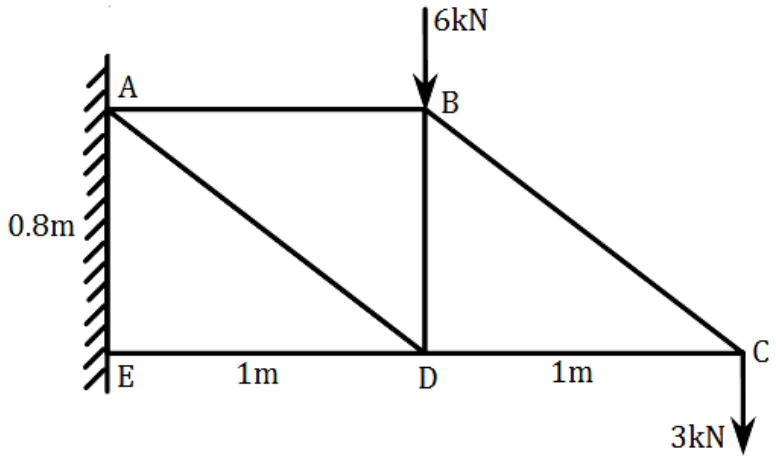


Fig.(3)

OR

Q4:

a) Derive the relation between tension in tight side and slack side in belt friction. **6**

b) Find the least value of P that will start the system of block as shown in fig.(4) moving in right, Take coefficient of friction under each block is 0.30. **7**

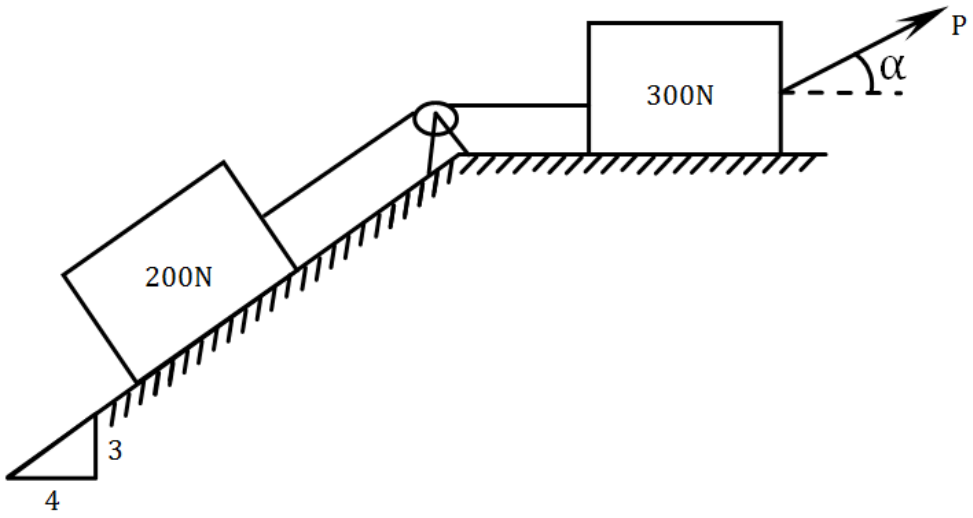


Fig.(4)

Q5:

a) State and explain parallel axis theorem. **4**

b) The Z-section is made up of rectangles as shown in fig.(5). Find moment of inertia of the section about centroidal axis. **9**

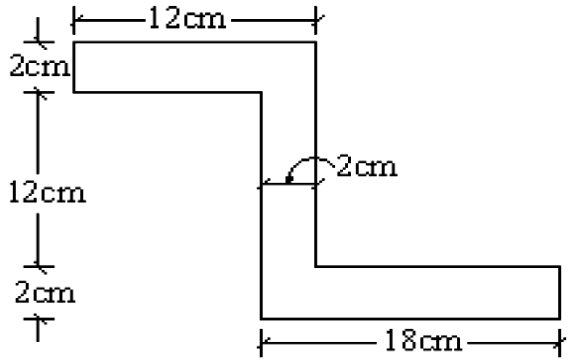


Fig.(5)

Q6:

a) An I-section is made up of rectangles as shown in fig.(6). Find moment of inertia of the section about axis passing through the center of gravity of the section. **13**

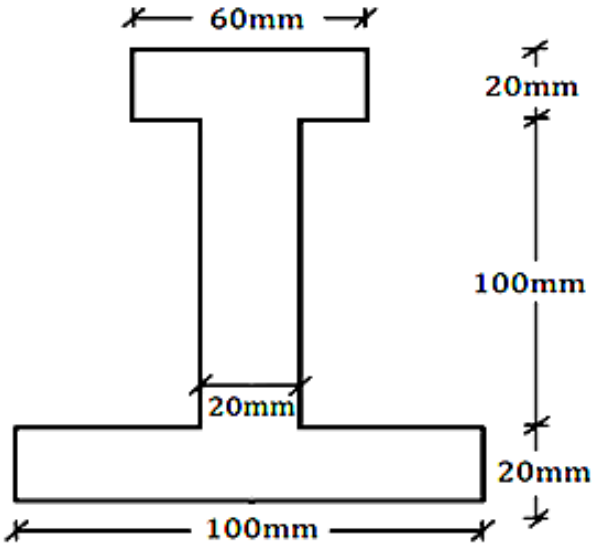


Fig.(6)

Q7:

a) Rectilinear motion of a particle is defined by $\boldsymbol{a = 6\sqrt{v}}$, where 'a' is in m/sec^2 & '$\boldsymbol{v}$' is in m/sec when $\boldsymbol{s = 30m, v = 36\,m/sec}$ & $\boldsymbol{t = 2sec}$. Find '$\boldsymbol{s}$' when '$\boldsymbol{t}$' $= \boldsymbol{3sec}$ **7**

b) From the top of tower 60m high, bullet is fired at an angle of 60^0 upward with the horizontal at an initial velocity of 120m/sec. Determine maximum height attended by bullet from the ground & time of travel. Assume ground to be plane. **7**

OR

Q8:

a) An automobile starting from rest speed up to 40m/sec with constant acceleration of 4m/sec^2, running at the speed for some time & finally comes to rest with retardation of 5m/sec^2 if total distance travelled is 1200m. Find the total time required. **7**

b) A stone is thrown with an initial velocity of 30m/sec upward at 60^0 to the horizontal. Compute the radius of curvature of its path at the position where it is 15m horizontally from the initial position and also at top of the path. **7**

Q9:

a) State and explain D'Alembert's principle. **4**

b) Determine the velocity of Block-B after Block-A has move 6m starting from rest. Use D'Alemberts principle. Take μ = 0.2. **9**

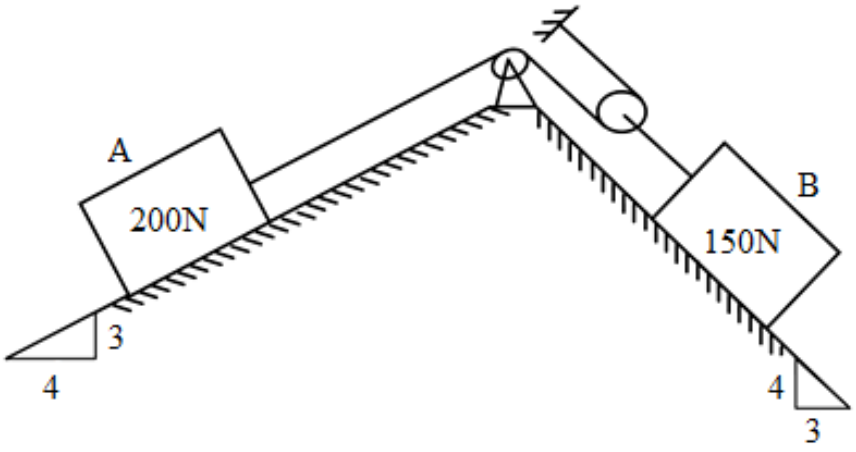


Fig.(7)

Q10:

a) Determine the tension in cord and acceleration in blocks supporting the body as shown in fig.(8). The pulleys are of frictionless & of negligible mass. **13**

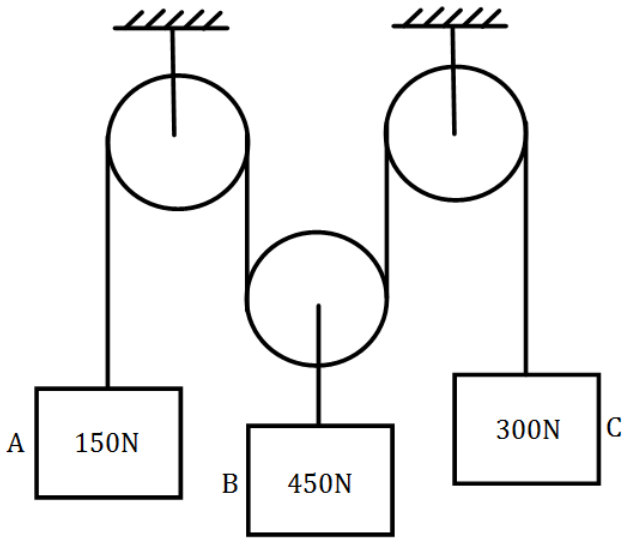


Fig.(8)

Q11:

a) Derive Work-Energy equation for translation. **4**

b) A bullet weighing 0.5N & moving at 400m/sec penetrates into 50N body & emerges with a velocity of 180m/sec. How far & how long does the body then move? Take $\mu = 0.2$ **9**

OR

Q12:

a) A wagon weighing 500kN starts from rest, runs 30m down one percent grade & strikes the bumper post. If the rolling resistance of the track is 5N/kN, Find the velocity of the wagon when it strikes the post. If the bumper spring compresses 1mm for every 15kN. Determine by how much this spring will be compressed. **6**

b) A ball is dropped from a height of 12m on a smooth horizontal floor from which rebound to a height of 7m. Determine 'e' & unknown height to which ball is rebound in second rebound. **7**

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