AM 110 Engineering Mechanics
Quiz I

Date: 14th September 2007 Time: 0800 – 0850 hrs.

Instructions:

1. Answer all questions.

2. State clearly all the assumptions and conventions used while answering your questions.

3. Wish you all the best.

1. The following five sub-questions have only ONE right answer. Choose the right answer and indicate the same in your answer book. (5x1 = 5)

(i) Which of the following statements is NOT a correct statement, with reference to a rigid body?

A) A system can always be replaced by an equivalent single force and an equivalent single moment.

B) The moment of a force is the sum of the moments of its components

C) Real work can always be done in structures that are assembled with rigid bodies.

D) A force may act at any point along its line of action without changing its effects on the rigid body.

(ii) The beam and the cable (with a frictionless pulley at D) support a 100 kg load at C as shown in Figure 1. For equilibrium, the tension in the cable must be

(A) Cannot be determined from static equilibrium

(B) 125 kg

(C) 91.7 kg

(D) 105.8 kg

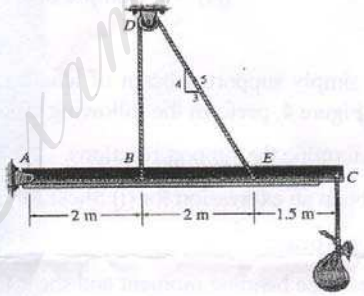


Figure 1

(iii) Figure 2 is a sketch of a retaining wall structure used as an earth embankment. The vertical wall ABC and the bottom floor DCA act as a single unit. The earth that is retained has a density of γ and the earth pressure exerted by the earth has a linear variation from zero at the top to γh at the bottom. The maximum height h of earth that the wall can retain without overturning about A, is given by

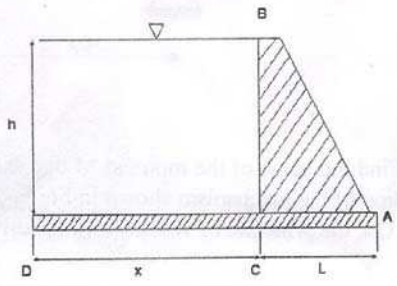


Figure 2

(A) $\sqrt{6x(L+0.5x)}$ (B) $\sqrt{4x(L+0.5x)}$

(C) $\sqrt{6x(L+x)}$ (D) $3x(L+0.5x)$

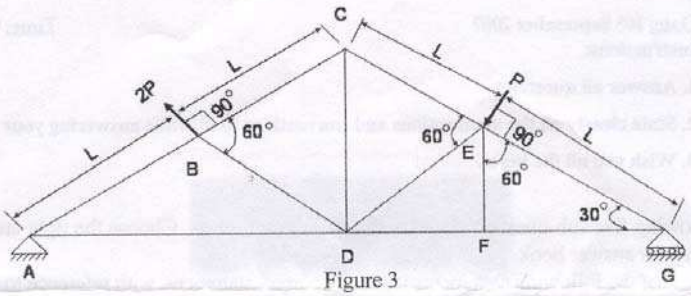


Figure 3

(iv) In the truss shown in Figure 3, the force in the member BD will be

(A) 4P Compressive (B) $\frac{4P}{\sqrt{3}}$ Tensile (C) 4P Tensile (D) $\frac{4P}{\sqrt{3}}$ Compressive

(v) In the truss shown in Figure 3, the force in member EF will be

(A) $\frac{P}{\sqrt{3}}$ Compressive (B) $\frac{P}{\sqrt{3}}$ Tensile (C) P Compressive (D) Zero

2. For a simply supported beam of length l, subjected to a concentrated moment M at the center, as shown in Figure 4, perform the following tasks.

(a) Determine the support reactions.

(b) Obtain an expression for (i) Shear force variation in the beam and (ii) Bending moment variation in the beam.

(c) Draw the bending moment and shear force diagrams for the beam. (5)

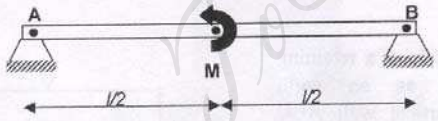
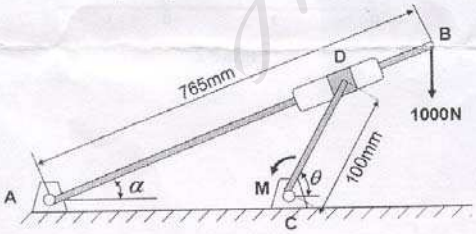


Figure 4

3. Find the value of the moment M that should be applied to the crank CD considering the equilibrium position of the mechanism shown in Fig.5 .The block at D is pinned to crank CD &is free to slide along AB. Use the principle of virtual work to solve the problem. (5)



Given: $\alpha = 10^0; \theta = 60^0;$ l_{AB} =765mm and l_{CD} =100mm.

Figure 5