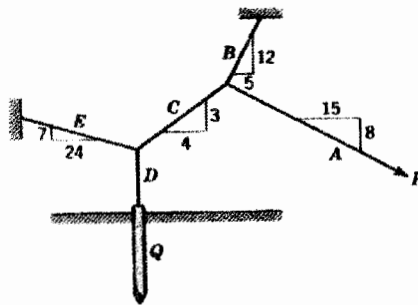


※考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Problem 1 (25 Points)

Consider the improvised system of cables shown below is used to remove the pile Q. A tractor with a maximum drawbar pull of 70kN is available to apply the force P. Cable A is a 25-mm diameter iron hoisting cable with a breaking load of 130 kN. Cable B, C, and D are parts of a continuous 20-mm carbon steel aircraft cable with a breaking strength of 220 kN. Cable E is a 23-mm diameter steel hoisting cable with a nominal area of 380 mm² and an ultimate tensile strength, based on the nominal area, of 500 MPa. The minimum factor of safety for each cable, based on fracture, is to be 2.0. Assuming there is no stress concentration in the system.

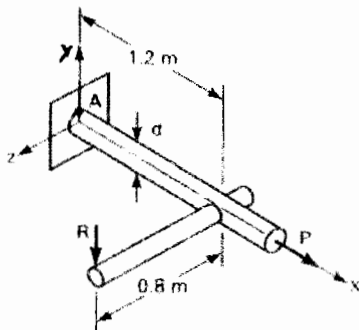


Please determining

- (a) The maximum allowable force that can be exert on the pile. (15 Points)
- (b) The factor of safety for each of the five cable when the load in part (a) is applied. (10 Points)

Problem 2 (25 Points)

A steel rod of diameter $d=50\text{mm}$ (with yield strength = 260 MPa) supports an axial load $P = 50R$ and vertical load R acting at the end of an 0.8m long arm. Given a factor of safety $n=2$. Please compute the largest permissible value of R using (a) maximum shearing stress and (b) maximum energy distortion criteria.



Problem 3 (24 Points)

Give brief answers to the following questions:

- What are the basic assumptions on the deformation of the Euler beam under pure bending? (8 Pts)
- Consider a circular shaft under torsion T . Length, radius and shear modulus of the shaft are L , r and G , respectively. What are the normal and shear strains in each cross-section of the shaft? (8 Pts)
- Buckling problems are considered as eigenvalue problems mathematically. What physical meanings do eigenvalues and eigenvectors correspond to? (8 Pts)

Problem 4 (26 Points)

The beam assembly shown is hinged at point C and is subjected to a concentrated load P at point B .

Determine the support reactions at the fixed end D and the maximum deflection of the assembly. Both beams are identical with cross-section area A , area moment of inertia I , the Young's modulus E , and the Poisson's ratio ν .

