HOCHSCHULE FÜR ANGEWANDTE WISSENSCHAFTEN MÜNCHEN	**Bachelor Degree Programme WI, LM, AU** **Examination Engineering Mechanics SoSe 2020**	**Dr. Anzinger, Dr. Günther, Dr. Hoffmann, Dr. Meier-Staude, Dr. Schulz**

Time to finish: 60 min 24.07.2020

Allowed resources: pocket calculator, all documents used in hardcopy paperwork

Name: ……. Sem.: …… Seat-Nr.: ……..

First Name: …… Room-Nr.: ……

Valid student ID together w/ a photo ID to be available during examination

Signature: ……. Invigilator: ……..

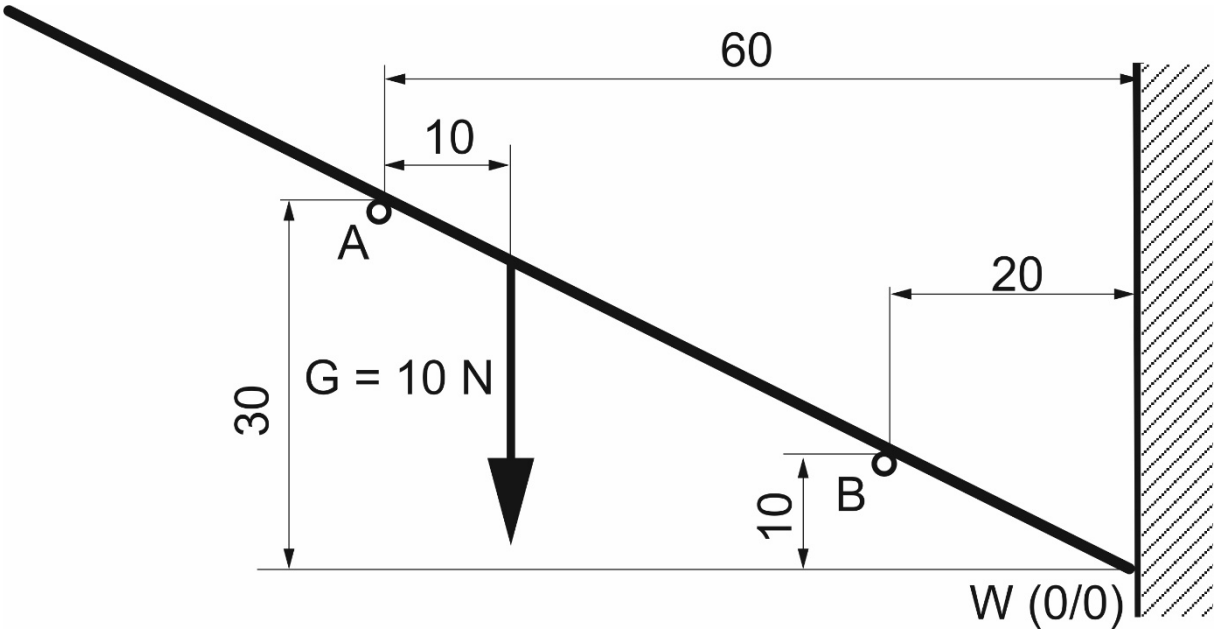
Task 1: Graphic Solution (12 points)

The beam is supported on both the two rods and the wall as shown. All supports/contact points are frictionless. The gravitational force G acts at the sketched position.

Determine the forces at the positions A, B and W graphically.

Transfer the drawing to your sheet of paper for finding the solution. Use the given dimensions therefore.

(scale 1 cm = 2 N)



Solution: A = [5,6] N, B = [5,5] N, W = [5,0] N

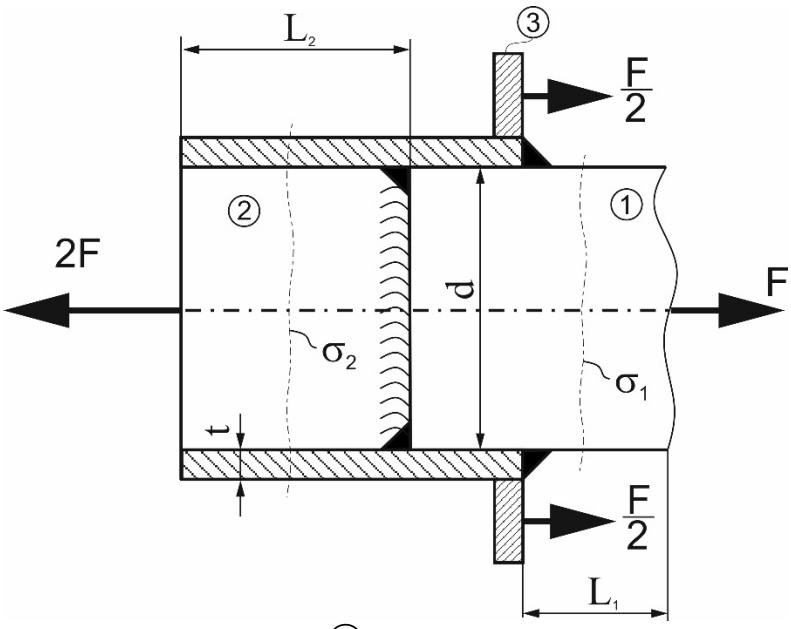
Task 2: Stresses (15 points)

The welded design is given as shown. The tube ② is subjected to the force 2F on the left side, while both the flange ③ and the rod ① are each subjected to the forces F.

Given: F = 15 kN L_1 = 50 mm d = 50 mm t = 5 mm

Young´s modulus tube E_2 = 110000 N/mm²

Young´s modulus rod E_1 = 70000 N/mm² Poisson´s ratio rod ν = 0,3



a) Determine the normal stress σ_1 in the rod ① within the marked section.

b) Determine the normal stress σ_2 in the tube ② within the marked section.

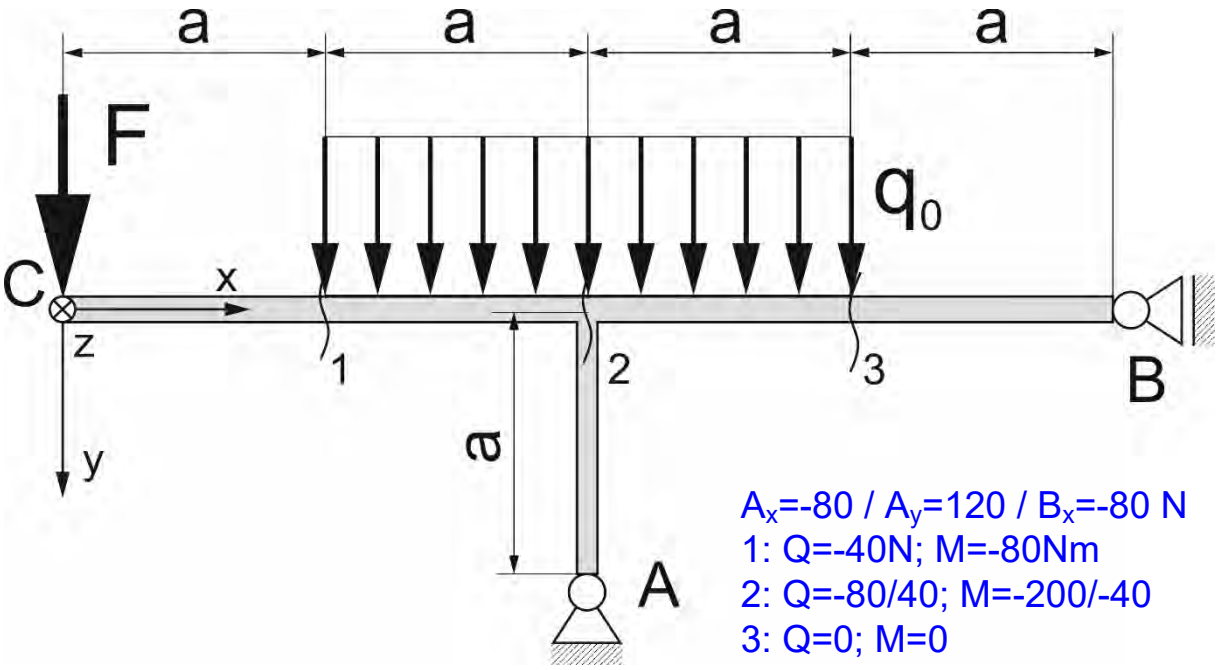
c) Determine the change in length ΔL_1 within the marked section L_1.

d) Determine L_2 such, that the change in length of the tube is equal to ΔL_1.

e) Determine the change in diameter within the rod ①.

a) 7,6 N/mm²
b) 34,7 N/mm²
c) 5,5 µm
d) 17,4 mm
e) 1,6 µm

Task 3: Stress resultants (20 points)



A beam is mounted in point B and, via support, in point A. The load F acts in point C against the beam. Additionally the line load q_o acts in the middle of the beam.

Given: F = 40 N q_0 = 20 N/m a = 2 m

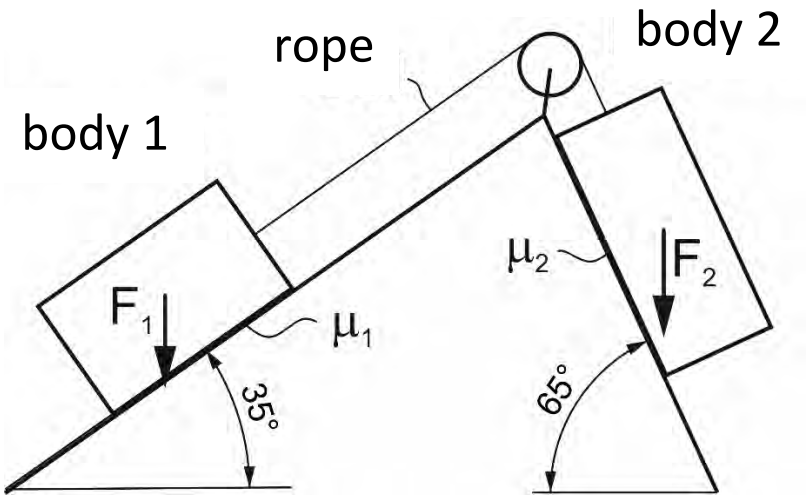
a) Determine the support reaction forces A_x, A_y and B_x.
b) Determine the run of both the transverse force and the bending moment within the beam all the way from C to B, incl. the numerical values at the positions 1, 2 and 3.

Task 4: Friction (13 points)

Both bodies are loaded by the gravitational forces F_1 respectively F_2 and they are connected with each other by a rope as shown. The pulley is frictionless.

Determine the coefficient of friction μ_2 between body 2 and the ramp such, that it can slide down with constant velocity. How large is the rope force S in that case?

Given: $F_1 = F_2 = 100$ N, $\mu_1 = 0{,}2$



$\mu 2 =$ [0,4] $S =$ [73,8 N]