WRITTEN EXAMINATION

Course Machine Elements

Sub-course

Course code MT507G

Credits for written examination 5 hp

Date 2025-01-10

Examination time 14:15 - 18:30

Examination responsible Tobias Andersson

Teachers concerned Tobias Andersson, Mahdi Eynian and Andreas Andersson Lassila

Aid at the exam/appendices

- Schmid, SR, Hamrock, BJ and Jacobson, BO (2014) Fundamentals of Machine Elements. CRC Press, Boca Raton FL, USA. (Sticky notes with dots or letters are allowed in the book but no text is allowed on the sticky notes)
- Sundström, B. (red.) . Handbook of Solid Mechanics. Stockholm: Department of Solid Mechanics, KTH. Optional edition
- Formula sheet

Other

- Sundström, B. . Handbok och formelsamling i hållfasthetslära. Tekniska högskolan Stockholm: Institution för hållfasthetslära. Valfri upplaga
- An approved calculator according to "Allmänna riktlinjer gällande utbildning på Institutionen for ingenjörsvetenskap":
  - o Casio Teknikräknare FX-82 all variants
  - o Texas Instruments Tl-30 all variants o
  - o Texas Instruments Tl-82, Tl-83, Tl-84
  - o Casio FX-7400Gii, Fx-9750GII
- An English-Swedish-English ordbok or English-Spanish-English dictionary.

No added notes are allowed in the texts used during the examination.

Calculator	☒	Provided by the University	Writing paper	☐	Lined
	☒	Student's own calculator		☒	Squared
	☐	Not allowed			

| **Instructions**	☐	Take a new sheet of paper for each teacher.
	☒	Take a new sheet of paper when starting a new question.

UNIVERSITY
OF SKÖVDE

Problem 1 (Springs/ Shrink fit)

A vehicle has individual wheel suspension in the form of helical springs. The free length of the spring is $l_f = 600$ mm, the solid length is $l_s = 240$ mm, the wire diameter is 15 mm and the inner diameter of the spring is 135 mm. The shear modulus of the spring material is G = 80 GPa. The spring ends are squared and ground.

Calculate the shear stress of the spring wire when the spring is compressed to a length of 300 mm (considering dynamic loading). Also, investigate if buckling is possible for this spring.   (5p)

Problem 2 (Threaded joints)

1. An M12×1.5 bolt, with head marking of 8.8 and a corresponding hexagonal nut keep two steel machine parts together as shown in the sketch, with a 40 kN preload. Determine the following

   a) The maximum external load that could be supported with a safety factor of 3 against both the joint separation and bolt breakage.

   b) Calculate the total extension of the bolt and the total compression of the steel machine parts (in micrometers) when an external load of 20 kN pulls the upper part away from the lower part. Draw the corresponding bolt diagram.
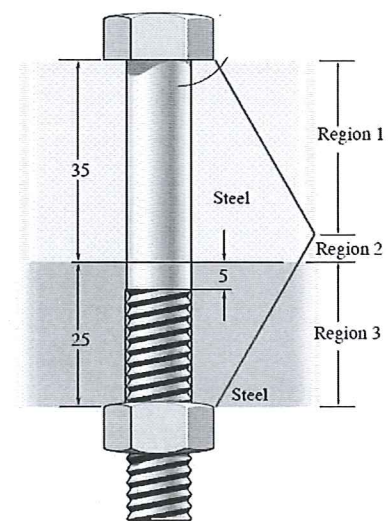
use Wileman's method to calculate the stiffness of the clamped machine parts and use E = 206.8 GPa as the modulus of elasticity of steel if it was needed.   (5p)