

Strength of Materials 1

Syllabus Number 1E201
Basic Major Subjects
Requisites 2 credit
ISOGAI, Takeshi

1. Course Description

In this course, following topics are taught:

- (1) Stress and strain; Hook's law; Stress-strain curves
- (2) Deformation induced by weight; Stress and deformation induced by centrifugal force; Statically indeterminate problems; Thermal stress; Trusses
- (3) Bending of beams; Shear force and bending moment; Bending stress; Deflection of beams

2. Course Objectives

Strength of materials is the application of mechanics to design components of machines and structures. This course aims to teach definitions of stress and strain, stress and deformation of the components under uniaxial loading, and bending of beams, and to provide students with an understanding of the way in which engineers design mechanical components that can meet specified requirements.

3. Grading Policy

Your overall grade in the class will be decided based on followings:

- Midterm examination (20%)
- Term-end examination (40%)
- Report (20%)
- Mini tests in the lesson (20%)

We will give feedback by returning the previous mini test and comment on the answer during class. In addition to returning the midterm exam, special problems including guidance at the Learning Support Office will be imposed on those who are not performing well in their grade.

4. Textbook and Reference

Textbook

Seiichiro Seike Mechanics of Materials Kyoritsu Publishing (1997) ISBN 978-4-320-08117-8

Reference

Goichi Nabe et al. Mechanics of Materials Nikkan Kogyo Shimbun (2001) ISBN 4-526-047-19-8

JyuhachiOda, Toshiro Miyoshi Exercise on Strength of Materials [New Revised Edition] Science Co., Ltd. (2001) ISBN 4-7819-0975-2

5. Requirements(Assignments)

Students should practice well on how to handle units and conversion methods in dynamics learned in "Physics 1" etc. Please prepare a table of SI units and SI prefixes related to mechanics as a preparation for the first lesson and bring it to the class.

Please practice in order to be able to calculate scientific functions such as exponential function, logarithm function, trigonometric functions by using your own scientific calculator.

Please read the relevant part of the textbook before each lesson and check the relation with the contents of the last lesson. (1 hour)

After each lesson, please check the contents of the lesson again with help of textbooks and handouts distributed during the class. Please answer the examples and problems in the handouts. Also tackle the problems in the textbook that are instructed in the handouts. By repeatedly practicing, the ability to master the knowledge learned will be improved. (2 hours)

Detailed preparation for the subsequent lessons will be instructed in the class.

6. Note

We will do problem exercises during class, so be sure to bring a scientific calculator. A scientific calculator is also necessary for the examination. Please refrain from entering/leaving the class during classes.

As a result of the Midterm examination, students who are lack in mathematical skill in this course is judged. These students need to take special training by using the Learning Support Office in order to raise the level of basic skills.

7. Schedule

- [1] Stress and Strain 1: Engineering necessity of Strength of material, Nominal stress, Nominal strain
- [2] Stress and Strain 2: Shear Stress, Shear Strain, Poisson's Ratio
- [3] Stress and Strain 3: Stress-Strain Diagram, Hook's Law, Allowable Stress, Safety factor
- [4] Tension and Compression 1: Deformation and stress due to self weight, Simple truss
- [5] Tension and compression 2: Indefinite problem, Thermal stress

- [6] Tension and Compression 3 and Summary of First Half: Stress due to Centrifugal Force, Summary of lessons from 1st to 6th
- [7] Midterm exam and introduction of beam problem: Midterm exam (30 minutes), Cantilevered beam, Both end supported beam, Reaction force of beams
- [8] Shearing force and bending moment of beam 1: Definition and determination of shear force / bending moment
- [9] Shear force and bending moment of beam 2: Shear force diagram of cantilever beam, Bending moment diagram of cantilever beam
- [10] Shear force and bending moment of beam 3: Shear force diagram of beam supported at both ends, Bending moment diagram of beam supported at both ends
- [11] Bending stress of beam 1: Bending theory of beam, Bending stress, Second moment of area
- [12] Bending stress of beam 2: Second moment of area in various shapes, Shear stress of beams
- [13] Deflection of beams 1: Deflection and deflection angle, Deflection of cantilever beam
- [14] Deflection of beams 2: Deflection of beam supported at both ends
- [15] Overall summary and Term-end exam