# 445.204

# Introduction to Mechanics of Materials

# (재료역학개론)

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## Course objective

The aim of this course is to understand the relationship between the load and deformation applied on materials, and to learn fundamental knowledges necessary to develop better materials and to design engineering devices

재료에 가해지는 힘과 변형과의 관계를 파악하여 우수한 재료를 개발하고, 타당한 부품설계를 하는데 필요한 기초지식을 습득

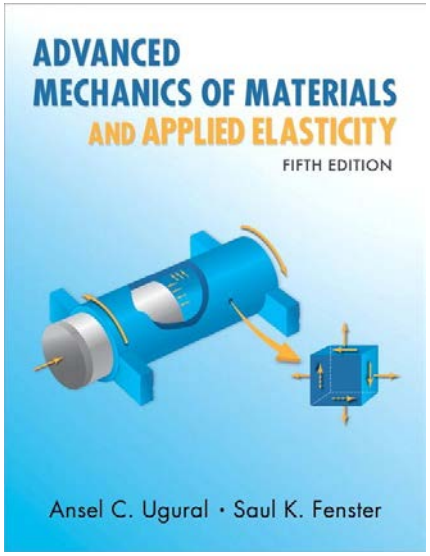
# Mechanics of materials, strength of materials

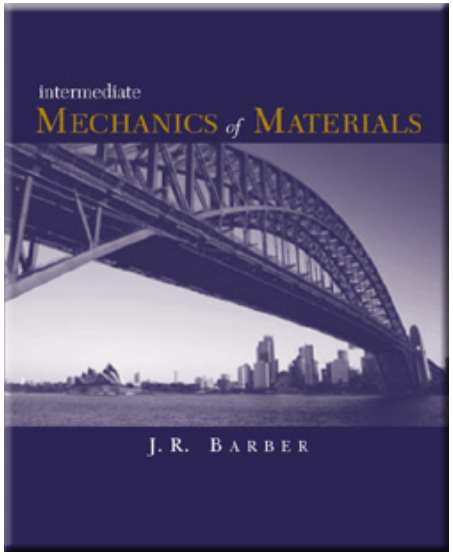
**(From Wikipedia)**

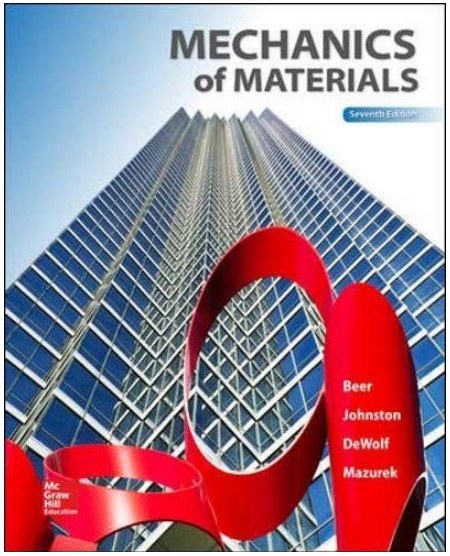
**Strength of materials**, also called **mechanics of materials**, is a subject which deals with the behavior of solid objects subject to stresses and strains. The complete theory began with the consideration of the behavior of one and two dimensional members of structures, whose states of stress can be approximated as two dimensional, and was then generalized to three dimensions to develop a more complete theory of the elastic and plastic behavior of materials. An important founding pioneer in mechanics of materials was Stephen Timoshenko.

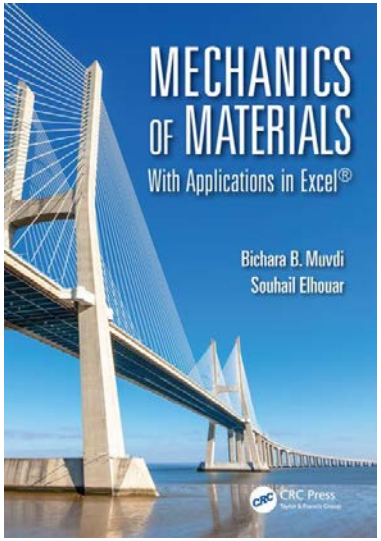
The study of strength of materials often refers to various methods of calculating the stresses and strains in structural members, such as beams, columns, and shafts. The methods employed to predict the response of a structure under loading and its susceptibility to various failure modes takes into account the properties of the materials such as its yield strength, ultimate strength, Young's modulus, and Poisson's ratio; in addition the mechanical element's macroscopic properties (geometric properties), such as its length, width, thickness, boundary constraints and abrupt changes in geometry such as holes are considered.

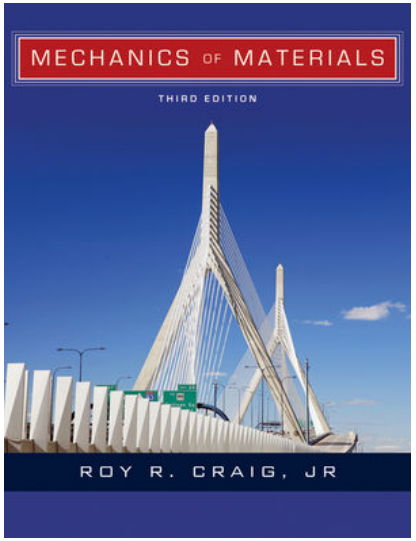
# Mechanics of materials ?

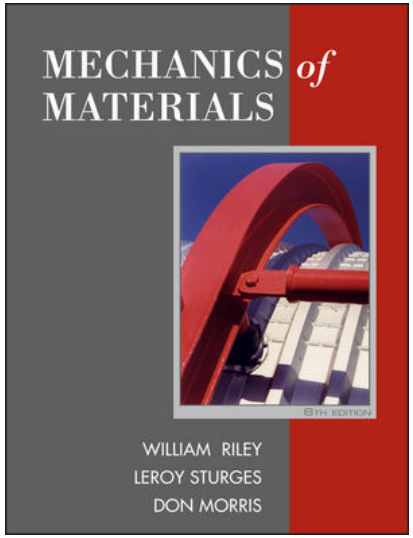


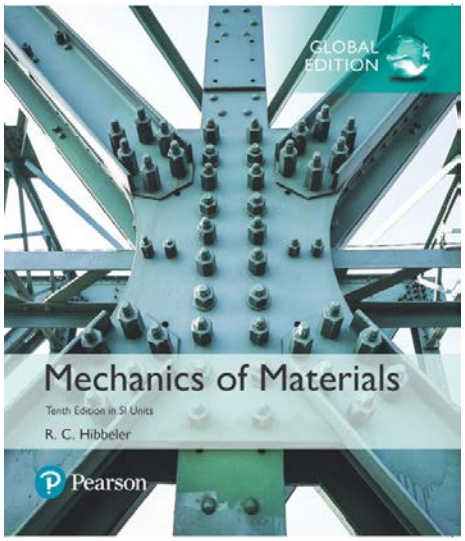



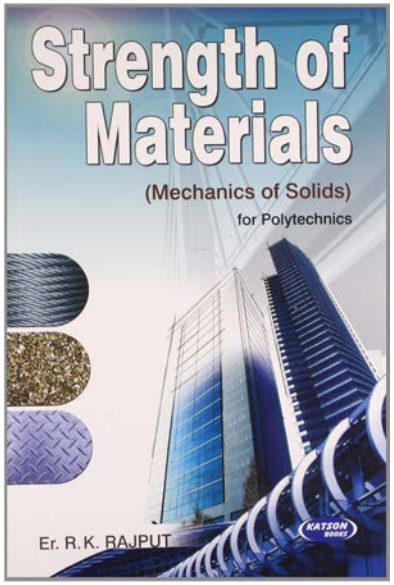



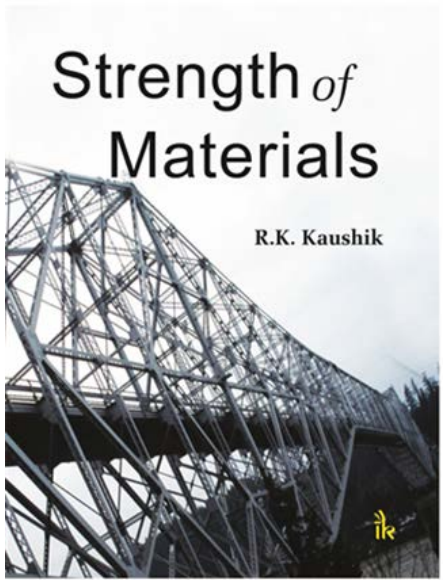



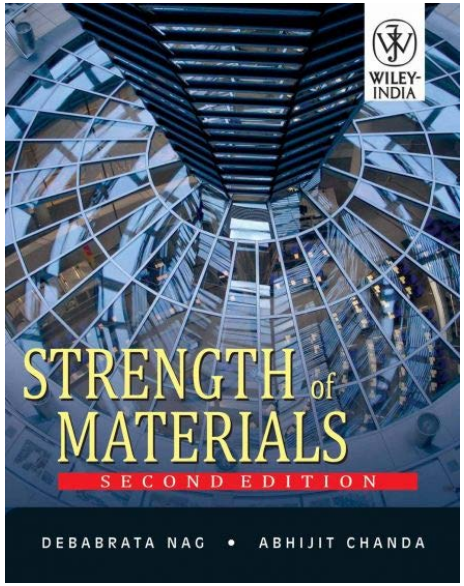



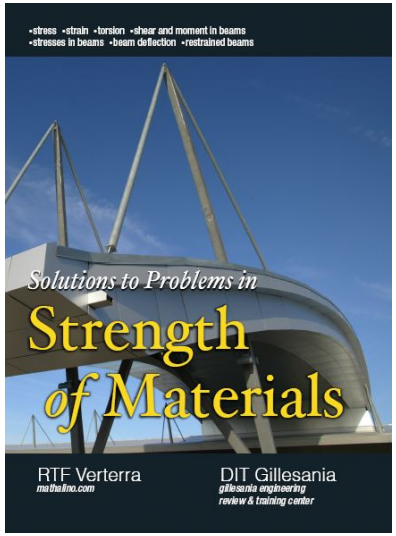



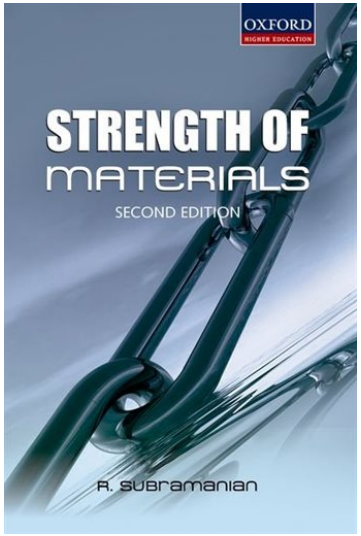
# Strength of materials ?

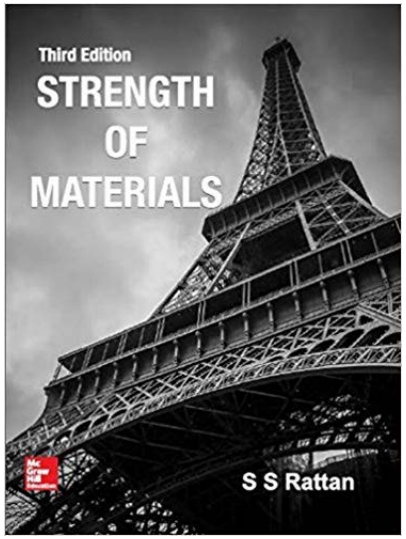


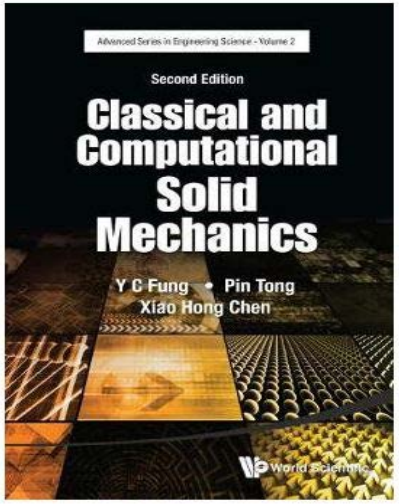



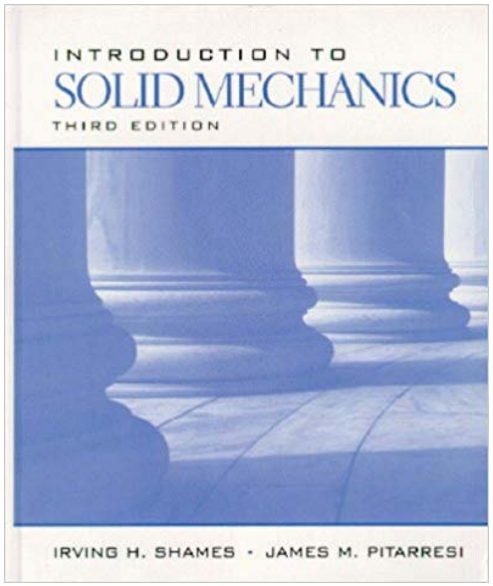



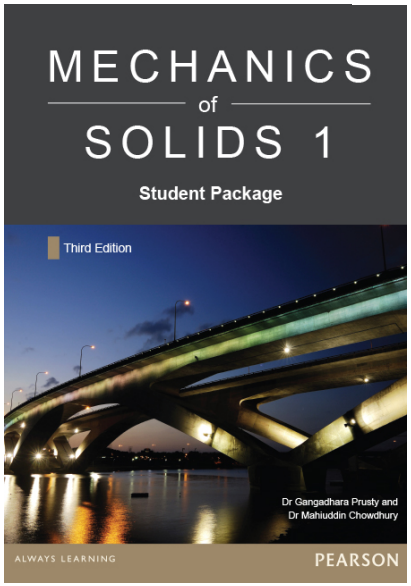
# Solid mechanics
**(From Wikipedia)**

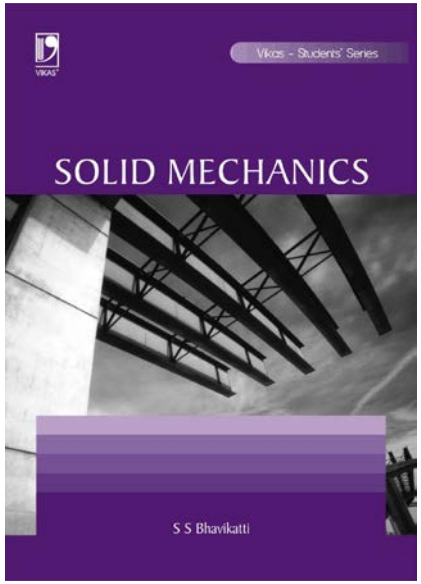
**Solid mechanics** is the branch of continuum mechanics that studies the behavior of solid materials, especially their motion and deformation under the action of forces, temperature changes, phase changes, and other external or internal agents. Solid mechanics is fundamental for civil, aerospace, nuclear, biomedical and mechanical engineering, for geology, and for many branches of physics such as materials science.[1] It has specific applications in many other areas, such as understanding the anatomy of living beings, and the design of dental prostheses and surgical implants. One of the most common practical applications of solid mechanics is the Euler-Bernoulli beam equation. Solid mechanics extensively uses tensors to describe stresses, strains, and the relationship between them.

# Solid mechanics ?

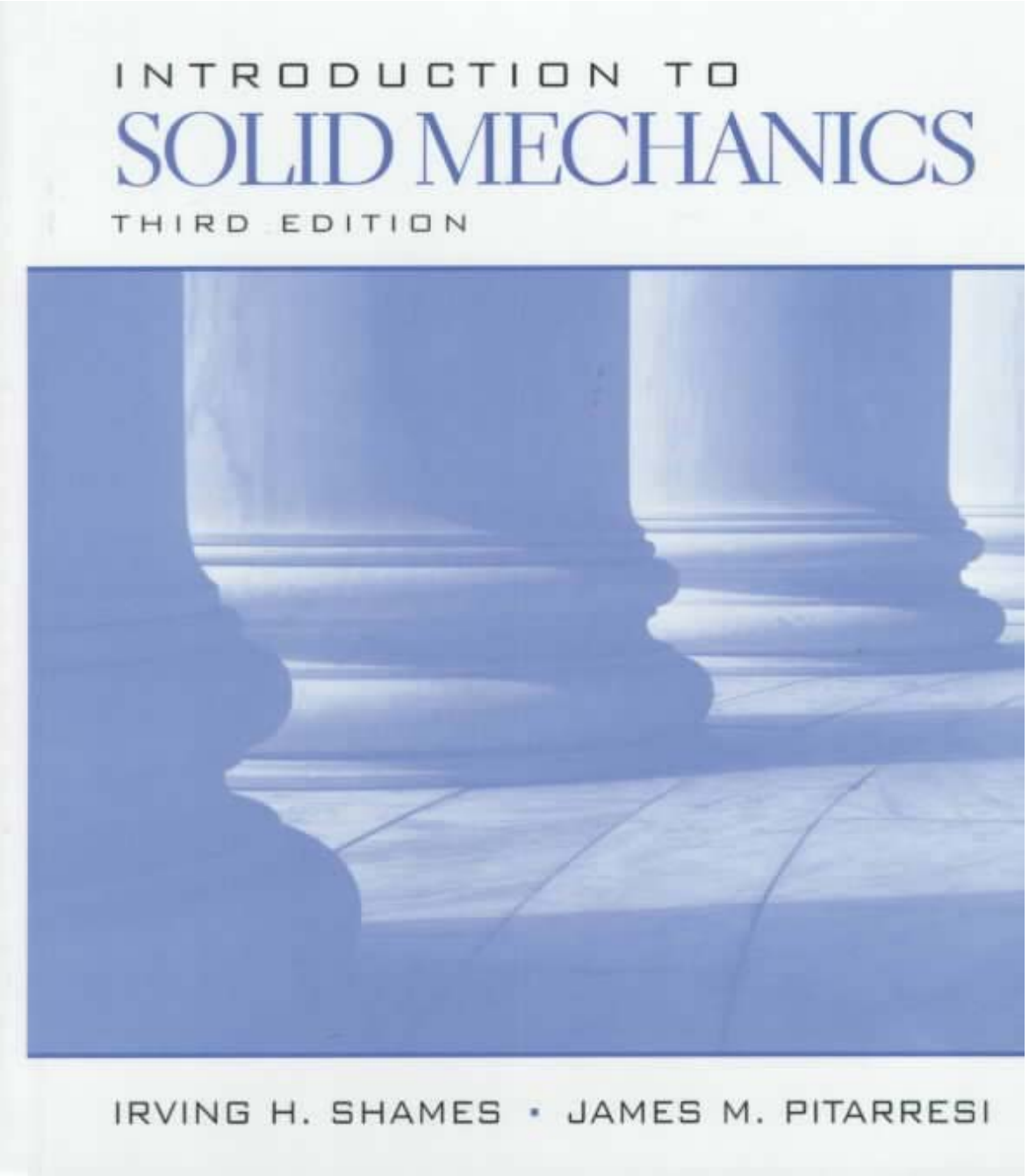


**Textbook**


INTRODUCTION TO
SOLID MECHANICS
THIRD EDITION
IRVING H. SHAMES • JAMES M. PITARRESI

## Class

**Writing on a white board is always preferred.**
**But, if necessary, power point slides will be used as well.**

**Therefore,**

**Pls bring a notebook with you in the class.**

**When I use the ppt slides, I will upload it to CTL in advance.**

**Please don't hesitate to give questions (to me)and have discussion (with me and peers) during the class.**

**Let's make our classroom lively !**
**Be interactive!**

## Contents of course

1. Introduction
2. Stress.
3. Strain.
4. Introduction to Mechanical Properties of Solids.
5. One-Dimensional Problems (Axially loaded structure)

(Mid-term exam.)

6. Generalized Hooke's Law and Introduction to Energy Methods.
7. Plane Stress.
8. Plane Strain.
9. Failure Criteria.

14. Torsion.
10. Section Forces in Beams. (shear and moment in beams)
11. Stresses in Beams.

13. *Singularity Functions.

15. Three Dimensional Stress Properties at a Point. (Transformation of stress)
16. Three-Dimensional Strain Relations at a Point. (Transformation of strain)
12. Deflection of Beams.

(Final term exam.)

17. Introduction to Elastic Stability.
18. * Energy Methods.
19. Introduction to Finite Elements.

## Course schedule

**No class**

May 6 (Children's day)
June 3, 5 (IDDRG International Conference) – Makeup classes are scheduled

And unscheduled absence may be expected due to domestic conference, project et. But, if possible, these will be avoided. If not, we will have make-up schedule after prior discussion with students.

## Evaluation

Homework 10 pts

Mid-term exam 40 pts
Final term exam 40 pts

Class attendance 10 pts (-1 pt per missing class <4; -2 pts per missing class >=4; Fail if 1/3 or more missing classes without prior notice

Evaluation Relative evaluation

## Homework

- Basic principle of homework: I recommend you to do the on your own, but it is acceptable to discuss with peers. Nevertheless, the answer sheet should be composed independently.
- If cheating is confirmed, both sides are punished to the zero point. Happening twice, it becomes serious.
- Please submit your homework to TA within due date (through email or CTL)