Subject (English)	Mechanics of Materials II	Semester	Fall * Quarter Subject	Day/Slot	Mon. / 1st 8:50-10:20 Thu. / 1st 8:50-10:20
科目名 (日本語)	材料力学 II				
Course Code	TB14161	Course Numbering	TMA-MEE215E	Period	Nov. 28, 2019 – Jan. 30, 2020*
Instructor (Post)	Toshiyuki Hashida (Prof.) Yoshiteru Aoyagi (Assoc. Prof.)	*This is a **Quarter Subject**. Make sure not to conflict with other courses.		Campus	Aobayama
				Building	Mechanical Engineering Research Bld. No. 2
Faculty	School of Engineering	Credits	2	Class Room	2-214 (2nd floor)

Class subject	Mechanics of Materials

Object and summary of class

Mechanics of Materials utilizes fundamental models that drastically simplify the geometry of structures/components to be designed and the loading modes acting on them, while retaining their essential features. On the basis of the simplified models the necessary knowledge and formulations of their mechanical responses are provided for the design of structures/components. Mechanics of Materials II discusses the loading mode of bending in addition to tension/compression and torsion treated in Mechanics of Materials I. In particular, beams subjected to bending moments are extensively analyzed. The topics covered in this course includes; (1) theory of beams which allows us to calculate bending/shear stresses in beams and their deflections; (2) energy methods such as Castigliano's theorem; and (3) compression-induced failure such as buckling. This course is one quarter course (twice a week).

Keywords	Beams, Bending stress, Deflection, Strain Energy, Energy Methods, Buckling of columns

Goal of study

At the end of the course, students should be able to calculate the stresses and deformation, and to determine the condition of buckling in simple structures/components such as beams and frames.

Contents and progress schedule of class

The topics covered in this course are shear force/bending moment diagrams, bending stress, deformation of beams, statically indeterminate beams, energy methods, compression of columns

No.	Date	Instructor	Contents
1	11/28	Assoc. Yoshiteru Aoyagi	Introduction: Design of structures and approach of Mechanics of Materials
2	12/2		Types of loads and supports in beams; Shear force diagram and bending moment diagram
3	12/5		Stresses in beams: Bending stress and curvature, geometrical parameters of cross section-1
4	12/9		Stresses in beams: Bending stress and curvature, geometrical parameters of cross section-2
5	12/12		Deflection of beams: Differential equation of the elastic curve, and end conditions-1
6	12/16		Deflection of beams: Differential equation of the elastic curve, and end conditions-2
7	12/19		Deflection of beams: Deflections by superposition
8	12/23		Statically indeterminate beams: Compatibility of deformation, method of superposition-1
9	1/6		Statically indeterminate beams: Compatibility of deformation, method of superposition-2
10	1/9		Mid-term examination
11	1/16	Prof. Toshiyuki Hashida	Strain energy and energy methods: Formulations of strain energy, Castigliano's theorem
12	1/20		Strain energy and energy methods: Application to statically indeterminate beams:
13	1/23		Column: Failure due to axial compression, Buckling, Euler's formula of buckling loads
14	1/27		Column: Effects of end conditions on buckling loads, semi-empirical formulas
15	1/30		Final examination

Preparation	It is assumed that the students have some experience in elementary physics (mechanics of rigid bodies) and mathematics (differentiation, integration and differential equations).
Record and evaluation method	The students' performance will be evaluated by considering the results of homework and examinations. Grades of the courses will be assigned as follows; AA = Excellent (90-100%) / A = Good (80-89%) / B = Fair (70-79%) /C = Passing (60-69%) / D = Failure (0-59%)
Textbook and references	1) S. Timoshenko and D. H. Young, "Elements of Strength of Materials," Van Nostrand Reinhold Company (1968), 2) W. Nash and M. Potter, "Strength of Materials, 5th Edition", McGraw-Hill, (2011).
Self study	After the presentation of the underlying theory for each topic, the students will be provided with problems for homework to aid the understanding of the principles.
In addition	Contact e-mails: aoyagi@tohoku.ac.jp; hashida@rift.mech.tohoku.ac.jp