Faculty of Engineering
Department of Mechanical Engineering
COURSE OUTLINE

MECH220 – Mechanics of Solids I

Term – Summer 2016 (201605)

Instructor	**Office Hours**
Dr. Keivan Ahmadi	Days: Tuesday
Phone: 7218694	Time: 13-14 and open door policy*
E-mail:kvahmadi@uvic.ca	Location: EOW 539

* Feel free to come in to EOW 539 at any time that the office door is open. You can also arrange an appointment via email or phone calls to make sure about the instructor's availability.

prerequisites: ENGR 141
co-requisites: MATH 200

LECTURE DATE(S)

Section: A 01	Days: TWF	Time:11:30-12:20	Location: ECS 123

TUTORIAL SECTIONS

Section: T 02	Days: Thursday	Time: 17:30-18:20	Location: ECS 123
Section: T 01 (**cancelled**)	Days: Friday	Time: 16:30-17:20	Location: ECS 116

LAB SECTIONS

Section: B (Multiple)	Days:	Time:	Location:
Lab #1: B01	M	14:30-17:20	ELW A135
Lab #2: B02	T	13-15:50	ELW A135
Lab #3: B03	T	16-18:50	ELW A135
Lab #4: B04	Th	14:30-17:20	ELW A135
Lab #5: B05	W	12:30-15:20	ELW A135
Lab #5: B05	F	16:30-19:20	ELW A135

TA Name	**E-mail**	**Office Hours**
Tarek Elgnemi	telgnemi@uvic.ca	TBD
Kutturu Padmini	padminik@uvic.ca	TBD
Bahram Mirani	bmirani@uvic.ca	TBD
Sean Blaney	blaney@uvic.ca	TBD

Required Text
Title: Mechanics of Materials / 7th Edition
Author: Beer, F.P., Johnston, E.R., DeWolf, J.T. and Mazurek
Publisher/Year: McGraw-Hill 2015

COURSE OBJECTIVES:

Learning Outcomes next page

In this course the concepts of stress, strain, and their interrelation are introduced to relate the externally applied loads to the resulting internal forces and overall deformation of solid bodies. A set of solutions based on "mechanics of materials" approach will be discussed to analyse the stress and strain distributions in common machine elements such as beams, columns, and thin walled cylinders. The content of this course is fundamental to the topics that will be covered in future solid mechanics (e.g. MECH 320) and design (MECH 360) courses.

LEARNING OUTCOMES: At the end of this course, students will be able to:

1- Compute internal resultant forces by applying the equations of equilibrium.
2- Identify the general state of the stress and strain in solid structures.
3- Explain the relationship between stress and strain in homogeneous and isotropic materials and distinguish between the characteristics of brittle and ductile materials.
4- Identify 2D plain stress and plain stain problems.
5- Apply the generalized Hook's law to relate the stress and strain components in solid structures
6- Compute the stress distribution and twist angle of a prismatic bar with circular cross-section under torsional load
7- Relate the transverse load distribution to the internal moment and transverse shear load in Euler-Bernoulli beams
8- Compute the stress distribution and deflection of beams in pure bending
9- Describe the stress distribution in thin-walled cylindrical pressure vessels.
10- Manipulate a given state of stress or strain in order to resolve the normal and shear components along specific planes in 2D; construct and apply Mohr's circle to transform the state of stress in 2D
11- Apply energy methods to solve indeterminate problems.

Weight & Date(s) of Assessments:	**Weight**	**Date**
Quizzes	(5 quizzes x 2%=%10)	See the course schedule at the end of the document
Labs	(5 Labs x 2%=%10)	Lab reports are due <u>two weeks</u> after completion of each experiment
Mid-term	%20	Date: TBA
Final Exam	%50	Date: TBA

* Note: a passing grade is required for the Final Exam, in order to pass the course.

ASSIGNMENTS

The course includes ten assignments that will cover sample problems from the textbook, and other material. The assignments will not be marked, but their completion is strongly recommended. It should be noted that completion of sample problems from the textbook will assist students in preparing for the quizzes, mid-term, and final exam. Students are encouraged to review additional textbook problems, beyond those assigned. Assignment solutions will be posted online one week after posting the assignment questions. Assignments release dates are indicated in the course schedule available at the end of the document (also in CourseSpaces).

LABORATORIES

Each laboratory session will be divided into multiple student groups. These groups will be maintained throughout the term. <u>One lab report</u> must be submitted per group, per laboratory. The lab reports will be

due exactly two week after the completion of the scheduled lab session and will be submitted into MECH220 drop box.

- You must prepare in advance of the laboratory to be able to complete the lab on time.
- Lab Schedule and Lab Manual are posted on CourseSpaces

Lab #	Subject	Start	Due (5 pm)
1	Modulus of Elasticity of rubber	See the lab schedule posted on CourseSpaces	On week after the completion of the lab session
2	Torsion of Shafts	See the lab schedule posted on coursespaces	On week after the completion of the lab session
3	Thin-walled pressure cylinder	See the lab schedule posted on coursespaces	On week after the completion of the lab session
4	Tensile test	See the lab schedule posted on coursespaces	On week after the completion of the lab session
5	Buckling of Columns	See the lab schedule posted on coursespaces	On week after the completion of the lab session

NOTES:

Note 1: Self-contained (with no wireless communication capability) calculators are allowed in all exams. The instructor highly recommends a calculator specifically capable of handling: (i) systems of equations, and (ii) matrix operations. Students should note, however, that the grading of the assignment, test, and lab problems in this class will be based heavily on the methodology applied in calculating the final solution. A significant proportion of assignment and test marks are awarded based on a clear and logical description of the entire solution process. Using such grading criteria, specification of the correct numerical solution constitutes a small portion of the allotted marks.

COURSE LECTURE NOTES

Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.

Assignment of E grade and supplemental examination for this course will be at the discretion of the Course Instructor. The rules for supplemental examinations can be found in the current Undergraduate Calendar.

GENERAL INFORMATION

Note to Students:

Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

"**Attendance**

Students are expected to attend all classes in which they are enrolled. An academic unit may require a student to withdraw

from a course if the student is registered in another course that occurs at the same time.

An instructor may refuse a student admission to a lecture, laboratory, online course discussion or learning activity, tutorial or other learning activity set out in the course outline because of lateness, misconduct, inattention or failure to meet the responsibilities of the course set out in the course outline. Students who neglect their academic work may be assigned a final grade of N or debarred from final examinations.

Students who do not attend classes must not assume that they have been dropped from a course by an academic unit or an instructor. Courses that are not formally dropped will be given a failing grade, students may be required to withdraw and will be required to pay the tuition fee for the course." UVic Calendar, (2015) http://web.uvic.ca/calendar2015-09/FACS/UnIn/UARe/Atte.html

Accommodation of Religious Observance (AC1210)
http://web.uvic.ca/calendar2015-09/GI/GUPo.html

Discrimination and Harassment Policy (GV0205)
http://web.uvic.ca/calendar2015-09/GI/GUPo.html

Faculty of Engineering, University of Victoria
Standards for Professional Behaviour

"It is the responsibility of all members of the Faculty of Engineering, students, staff and faculty, to adhere to and promote standards of professional behaviour that support an effective learning environment that prepares graduates for careers as professionals…."

You are advised to read the Faculty of Engineering document Standards for Professional Behaviour which contains important information regarding conduct in courses, labs, and in the general use of facilities.
http://www.uvic.ca/engineering/current/undergrad/index.php#section0-23

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the Undergraduate Calendar for the UVic policy on academic integrity.

Policy on Academic Integrity
http://web.uvic.ca/calendar2015-09/FACS/UnIn/UARe/PoAcI.html

Course Schedule

#	Date	Topics (tentative)	Text book	Tentative Deadlines
1	Tuesday, May 3, 2016	Introduction and Review of internal force resultants	1.1	
2	Wednesday, May 4, 2016	Review of internal force resultants	5.1, 5.2	
3	Friday, May 6, 2016	Review of internal force resultants	5.4	
4	Tuesday, May 10, 2016	Introduction to the concept of stress	1.2, 1.3	
5	Wednesday, May 11, 2016	General state of stress; safety factor	1.4, 1.5	Quiz #1 (Internal forces)
6	Friday, May 13, 2016	Introduction to strain and stress/strain relations	2.1	
7	Tuesday, May 17, 2016	Statically indeterminate problems	2.2, 2.3	
8	Wednesday, May 18, 2016	Poisson's ratio and Generalized hook's law	2.4, 2.5	
9	Friday, May 20, 2016	Shearing strain	2.7	
10	Tuesday, May 24, 2016	Torsion of circular shafts	3.1	
11	Wednesday, May 25, 2016	Torsion- angle of twist; stress concentration	3.2	Quiz #2 (stress-strain)
12	Friday, May 27, 2016	Torsion- Statically indeterminate shafts	3.3	
13	Tuesday, May 31, 2016	Torsion of thin-walled shafts	3.10	
14	Wednesday, June 01, 2016	Bending of Beams	4.1, 4.2	
15	Friday, June 03, 2016	Deformation in a transverse cross section	4.3	
16	Tuesday, June 07, 2016	Stress Concentration in bending	4.5	
17	Wednesday, June 08, 2016	eccentric axial loading	4.7	
18	Friday, June 10, 2016	Curved beams	4.10	
19	Tuesday, June 14, 2016	Horizontal shearing stress in beams	6.1	
20	Wednesday, June 15, 2016	Shear stress in narrow rectangular beams	6.2	
21	Friday, June 17, 2016	Shearing stress in beams with arbitrary cross section; Shearing stress in thin-walled members	6.3, 6.4	
22	Tuesday, June 21, 2016	Unsymmetrical loading of thin-walled members; shear center	6.6	
23	Wednesday, June 22, 2016	Buckling of columns	10.1	Quiz #3
24	Friday, June 24, 2016	Stress transformation	7.1	

25	Tuesday, June 28, 2016	Mohr's circle	7.2	
26	Wednesday, June 29, 2016	Strain transformations	7.7	
	Friday, July 01, 2016	Holiday- Happy Canada Day		
27	Tuesday, July 05, 2016	Stress in thin-walled pressure vessels	7.6	
28	Wednesday, July 06, 2016	Stresses under combined loads	8.3	Quiz#4
29	Friday, July 08, 2016	Deformation of beams under transverse loading	9.1	
30	Tuesday, July 12, 2016	Statically indeterminate beams	9.2	
31	Wednesday, July 13, 2016	Method of Superposition	9.4	
32	Friday, July 15, 2016	Moment-Area Theorem	9.5	
33	Tuesday, July 19, 2016	Energy methods- Strain Energy	11.1, 11.2	
34	Wednesday, July 20, 2016	Energy formulation	11.3, 11.5	Quiz #5
35	Friday, July 22, 2016	Castigliano's theorem	11.7, 11.8,	
36	Tuesday, July 26, 2016	statically indeterminate structures	11.9	
37	Wednesday, July 27, 2016	Review #1		
38	Friday, July 29, 2016	Review #2		