

Submit original with signatures + 1 copy + electronic copy to Faculty Senate (Box 7500).  
See <http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures/> for a complete description of the rules governing curriculum & course changes.

**TRIAL COURSE OR NEW COURSE PROPOSAL**  
(Attach copy of syllabus)

## SUBMITTED BY:

Department	Mechanical Engineering	College/School	CEM
Prepared by	Cheng-fu Chen	Phone	7265
Email Contact	cchen4@alaska.edu	Faculty Contact	Cheng-fu Chen

1. ACTION DESIRED  
(CHECK ONE): Trial Course ☒ New Course ☐

2. COURSE IDENTIFICATION: Dept ME Course # 494 No. of Credits 3

Justify upper/lower division status & number of credits:

This class is based on ES 331 Mechanics of Materials to learn how to study material models which require rigorous analyses, formulation, and calculations of stress in the elastic regime, and apply fundamental theories to complicated engineering problems. Per the UA Board of Regent Regulation 10.04.090, section F, this trial class is therefore justified to be in the upper division 400-499.

3. PROPOSED COURSE TITLE: Intermediate Mechanics of Materials

4. To be CROSS LISTED? YES/NO NO If yes, Dept: Course #

NOTE: Cross-listing requires approval of both departments and deans involved. Add lines at end of form for additional required signatures.

5. To be STACKED?\* YES/NO NO If yes, Dept: Course #

How will the two course levels differ from each other? How will each be taught at the appropriate level?:

\* Use only one Format 1 form for the stacked course (not one for each level of the course!) and attach syllabi. Stacked course applications are reviewed by the (Undergraduate) Curricular Review Committee and by the Graduate Academic and Advising Committee. Creating two different syllabi (undergraduate and graduate versions) will help emphasize the different qualities of what are supposed to be two different courses. The committees will determine: 1) whether the two versions are sufficiently different (i.e. is there undergraduate and graduate level content being offered); 2) are undergraduates being overtaxed?; 3) are graduate students being undertaxed? In this context, the committees are looking out for the interests of the students taking the course. Typically, if either committee has qualms, they both do. More info online - see URL at top of this page.

6. FREQUENCY OF OFFERING: As Demand Warrants  
Fall, Spring, Summer (Every, or Even-numbered Years, or Odd-numbered Years) - or As Demand Warrants

7. SEMESTER & YEAR OF FIRST OFFERING  
(Effective AY2015-16 if approved by 3/31/2015; otherwise AY2016-17) Effective Spring of 2016

## 8. COURSE FORMAT:

NOTE: Course hours may not be compressed into fewer than three days per credit. Any course compressed into fewer than six weeks must be approved by the college or school's curriculum council. Furthermore, any core course compressed to less than six weeks must be approved by the Core Review Committee.

COURSE FORMAT: (check all that apply) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☒ 6 weeks to full semester

OTHER FORMAT (specify)

Mode of delivery (specify lecture, field trips, labs, etc) lecture



## 9. CONTACT HOURS PER WEEK:

3

LECTURE  
hours/weeks

0

LAB  
hours /week

0

PRACTICUM  
hours /week

Note: # of credits are based on contact hours. 800 minutes of lecture=1 credit. 2400 minutes of lab in a science course=1 credit. 1600 minutes in non-science lab=1 credit. 2400-4800 minutes of practicum=1 credit. 2400-8000 minutes of internship=1 credit. This must match with the syllabus. See

<http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/guidelines-for-computing-/> for more information on number of credits.

OTHER HOURS (specify type)

NA

## 10. COMPLETE CATALOG DESCRIPTION including dept., number, title, credits, credit distribution, cross-listings and/or stacking (50 words or less if possible):

Example of a complete description:

FISH F487 W, O Fisheries Management  
3 Credits Offered Spring

Theory and practice of fisheries management, with an emphasis on strategies utilized for the management of freshwater and marine fisheries. Prerequisites: COMM F131X or COMM F141X; ENGL F111X; ENGL F211X or ENGL F213X; ENGL F414; FISH F425; or permission of instructor. Cross-listed with NRM F487. (3+0)

## ME 494 Intermediate Mechanics of Materials

3 Credits Offered as demand warrants

Applications of Hooke's law and energy method to thin-walled beams and shafts, and analysis of stress and strain under combined loading. Introduction to fatigue and fracture of materials. Applications to engineering problems. Prerequisite: ES 331. (3+0)

## 11. COURSE CLASSIFICATIONS: Undergraduate courses only. Consult with CLA Curriculum Council to apply S or H classification appropriately; otherwise leave fields blank.

H = Humanities

S = Social Sciences

Will this course be used to fulfill a requirement for the baccalaureate core? If YES, attach form.

YES:

NO:

x

If YES, check which core requirements it could be used to fulfill:

O = Oral Intensive,  
Format 6

W = Writing Intensive,  
Format 7

X = Baccalaureate Core

## 11.A Is course content related to northern, arctic or circumpolar studies? If yes, a "snowflake" symbol will be added in the printed Catalog, and flagged in Banner.

YES

NO

x

## 12. COURSE REPEATABILITY:

Is this course repeatable for credit? YES

NO

x

Justification: Indicate why the course can be repeated (for example, the course follows a different theme each time).

How many times may the course be repeated for credit?

TIMES

If the course can be repeated for credit, what is the maximum number of credit hours that may be earned for this course?

CREDITS

If the course can be repeated with variable credit, what is the maximum number of credit hours that may be earned for this course?

CREDITS

## 13. GRADING SYSTEM: Specify only one. Note: Changing the grading system for a course later on constitutes a Major Course Change - Format 2 form.

LETTER:

x

PASS/FAIL:



**RESTRICTIONS ON ENROLLMENT (if any)**

**14. PREREQUISITES**

ES 331 Mechanics of Materials

These will be required before the student is allowed to enroll in the course.

**15. SPECIAL RESTRICTIONS, CONDITIONS**

**16. PROPOSED COURSE FEES**

\$ 0

Has a memo been submitted through your dean to the Provost for fee approval?

Yes/No

**17. PREVIOUS HISTORY**

Has the course been offered as special topics or trial course previously?

Yes/No

NO

If yes, give semester, year, course #, etc.:

**18. ESTIMATED IMPACT**

WHAT IMPACT, IF ANY, WILL THIS HAVE ON BUDGET, FACILITIES/SPACE, FACULTY, ETC.

There is no impact to the claimed aspects.

**19. LIBRARY COLLECTIONS**

Have you contacted the library collection development officer (kljensen@alaska.edu, 474-6695) with regard to the adequacy of library/media collections, equipment, and services available for the proposed course? If so, give date of contact and resolution. If not, explain why not.

No

☒

Yes

**20. IMPACTS ON PROGRAMS/DEPTS**

What programs/departments will be affected by this proposed action?

Include information on the Programs/Departments contacted (e.g., email, memo)

The proposed class will be serving as an elective class for the Department of Mechanical Engineering.

**21. POSITIVE AND NEGATIVE IMPACTS**

Please specify positive and negative impacts on other courses, programs and departments resulting from the proposed action.

Positive:

(1) This class can be an elective course for engineering undergraduate students who have taken ES 331 Mechanical of Materials. For ME students, this class can be a ME elective. For non-ME students, this class can be a technical elective.

(2) This class will serve as a transition course to ME 631 Advanced Mechanics of Materials to facilitate the Fast-Track Program in the Department of Mechanical Engineering.

Negative:

None.


**JUSTIFICATION FOR ACTION REQUESTED**


The purpose of the department and campus-wide curriculum committees is to scrutinize course change and new course applications to make sure that the quality of UAF education is not lowered as a result of the proposed change. Please address this in your response. This section needs to be self-explanatory. Use as much space as needed to fully justify the proposed course.

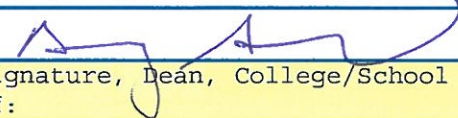
In the past two decades there has been lacking a transition class between the fundamental mechanics of materials (ES 331) and advanced mechanics of materials (ME 631). There is a need for an intermediate class, to provide undergraduate students a better preparation for analysis and design of mechanical systems.

Offering this class will meet the need. This class can enhance the curriculum of the Department of Mechanical Engineering, and add one more option to the choice of elective classes for other non-ME-major engineering students.

**APPROVALS:** Add additional signature lines as needed.

Rorik Peterson	Date	9/3/15
Signature, Chair, Program/Department of:		

	Date	9/8/15
Signature, Chair, College/School Curriculum Council for:	CEM	

	Date	9/9/15
Signature, Dean, College/School of:	CEM	

Offerings above the level of approved programs must be approved in advance by the Provost.

	Date	
Signature of Provost (if above level of approved programs)		

ALL SIGNATURES MUST BE OBTAINED PRIOR TO SUBMISSION TO THE GOVERNANCE OFFICE

	Date	
Signature, Chair Faculty Senate Review Committee: <input type="checkbox"/> Curriculum Review <input type="checkbox"/> GAAC <input type="checkbox"/> Core Review <input type="checkbox"/> SADAC		

**ADDITIONAL SIGNATURES:** (As needed for cross-listing and/or stacking)

	Date	
Signature, Chair, Program/Department of:		

	Date	
Signature, Chair, College/School Curriculum Council for:		

	Date	
Signature, Dean, College/School of:		



**ATTACH COMPLETE SYLLABUS (as part of this application).** This list is online at:

<http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/uaf-syllabus-requirements/>

The Faculty Senate curriculum committees will review the syllabus to ensure that each of the items listed below are included. If items are missing or unclear, the proposed course (or changes to it) may be denied.

**SYLLABUS CHECKLIST FOR ALL UAF COURSES**

During the first week of class, instructors will distribute a course syllabus. Although modifications may be made throughout the semester, this document will contain the following information (as applicable to the discipline):

**1. Course information:**

☐ Title, ☐ number, ☐ credits, ☐ prerequisites, ☐ location, ☐ meeting time (make sure that contact hours are in line with credits).

**2. Instructor (and if applicable, Teaching Assistant) information:**

☐ Name, ☐ office location, ☐ office hours, ☐ telephone, ☐ email address.

**3. Course readings/materials:**

☐ Course textbook title, ☐ author, ☐ edition/publisher.

☐ Supplementary readings (indicate whether ☐ required or ☐ recommended) and

☐ any supplies required.

**4. Course description:**

☐ Content of the course and how it fits into the broader curriculum;

☐ Expected proficiencies required to undertake the course, if applicable.

☐ Inclusion of catalog description is *strongly* recommended, and

☐ Description in syllabus must be consistent with catalog course description.

**5. ☐ Course Goals (general), and (see #6)**

**6. ☐ Student Learning Outcomes (more specific)**

**7. Instructional methods:**

☐ Describe the teaching techniques (eg: lecture, case study, small group discussion, private instruction, studio instruction, values clarification, games, journal writing, use of Blackboard, audio/video conferencing, etc.).

**8. Course calendar:**

☐ A schedule of class topics and assignments must be included. Be specific so that it is clear that the instructor has thought this through and will not be making it up on the fly (e.g. it is not adequate to say "lab". Instead, give each lab a title that describes its content). You may call the outline Tentative or Work in Progress to allow for modifications during the semester.

**9. Course policies:**

☐ Specify course rules, including your policies on attendance, tardiness, class participation, make-up exams, and plagiarism/academic integrity.

**10. Evaluation:**

☐ Specify how students will be evaluated, ☐ what factors will be included, ☐ their relative value, and ☐ how they will be tabulated into grades (on a curve, absolute scores, etc.) ☐ Publicize UAF regulations with regard to the grades of "C" and below as applicable to this course. (Not required in the syllabus, but is a convenient way to publicize this.) Link to PDF summary of grading policy for "C":

[http://www.uaf.edu/files/uafgov/Info-to-Publicize-C\\_Grading-Policy-UPDATED-May-2013.pdf](http://www.uaf.edu/files/uafgov/Info-to-Publicize-C_Grading-Policy-UPDATED-May-2013.pdf)

**11. Support Services:**

☐ Describe the student support services such as tutoring (local and/or regional) appropriate for the course.

**12. Disabilities Services:** Note that the phone# and location have been **updated**.

<http://www.uaf.edu/disability/> The Office of Disability Services implements the Americans with Disabilities Act (ADA), and ensures that UAF students have equal access to the campus and course materials.

☐ State that you will work with the Office of Disabilities Services (208 WHITAKER BLDG, 474-5655) to provide reasonable accommodation to students with disabilities.

5/21/2013

**ME 494 Intermediate Mechanics of Materials**  
**(CRN XXXXX), 3 credits, Spring 2016**  
 University of Alaska Fairbanks

You are responsible to check your \*\*\*@alaska.edu email account daily, for any pertinent information from the instructor. If you miss any important information, you miss it!

All classroom behavior should be strictly compliant to the **UAF's Honor Code**.

"Students will not collaborate on any quizzes, in-class exams, or take-home exams that will contribute to their grade in a course, unless permission is granted by the instructor of the course. Only those materials permitted by the instructor may be used to assist in quizzes and examinations.

Students will not represent the work of others as their own. A student will attribute the source of information not original with himself or herself (direct quotes or paraphrases) in compositions, theses and other reports.

No work submitted for one course may be submitted for credit in another course without the explicit approval of both instructors.

Violations of the Honor Code will result in a failing grade for the assignment and, ordinarily, for the course in which the violation occurred. Moreover, violation of the Honor Code may result in suspension or expulsion."

**Instructor:** Dr. Cheng-fu Chen, Professor, Mechanical Engineering  
**Office:** Duckering 351A, 474-7265, [cf.chen@alaska.edu](mailto:cf.chen@alaska.edu)  
**Lecture:** MWF 1-2 pm  
**Classroom:** TBA  
**Office Hours:** T/TR 1-2 pm or by appointment.  
**Course website:** UAF blackboard

#### Textbook

Required: *Mechanics of Materials*, 7th Ed., F. Beer, E. Johnston, J. Dewolf, and D. Mazurek, McGraw Hill, ISBN 9780073398235 2014. (5<sup>th</sup> and 6<sup>th</sup> Ed. also work.)

Required: Instructor's notes

Recommended: *Advanced Strength and Applied Stress Analysis*, R. G. Budynas, McGraw Hill, 2<sup>nd</sup> Ed., 1999.

Recommended: *First Course in Continuum Mechanics*, Y.C. Feng, Prentice Hall, 1994.

**Catalog Description.** Applications of Hooke's law and energy method to thin-walled beams and shafts, and analysis of stress and strain under combined loading. Introduction to fatigue and fracture of elastic materials. Applications to engineering problems. Prerequisite: ES 331.

**Course Description.** This course expands the knowledge in fundamental mechanics of materials by considering aspects such as basic elasticity, thermal stress, thin-walled hollow shafts, curved beams, shearing stress in thin-walled members, transformation of stress and strain, combined loading, energy method, failure theories, and introduction to fatigue and fracture.

**Prerequisite.** ES 331.

**Goals.** The goals of this class are

- Analyze stresses of elastic materials under individual or combined loading.
- Learn and implement transformation of stresses and strains in 2D and 3D.
- Develop skills for using the energy method.
- Acquire basic knowledge about the criteria and theories of material failure.

**Student Learning Outcomes.** By the end of the semester, you will have acquired the following skills

- Establish the relation of stress and strain for axially orthogonal materials.
- Analyze shearing stress in thin-walled shafts under torsion.
- Analyze normal stress in curved beams.
- Analyze shearing stress in thin-walled members under transversal loading.
- Use the Mohr's circle method to conduct transformation of stress and strain in 2D, and calculate the principal stresses/strains in 3D for isotropic materials.
- Apply the Castigliano's theorem to engineering problems.
- Apply the criteria of failure.

#### Use of Blackboard, which you will be living on

Blackboard is the platform for announcements, handouts, and homework submissions. You will be heavily using Blackboard as a learning tool in this class.

You also need to check your @alaska.edu email account for information sent from Blackboard. In Blackboard,

- In **Course Handouts** you can find and download slides, self-exercise problems (with solutions), and other supplementary handouts for each chapter.
- In **HW Assignments & Submissions** you will find the assigned homework problems for each chapter. You also need to submit homework at here. (See the detail in the next section.)
- The instructor will also use Blackboard for making announcements and sending emails.

### Homework

For each major topic there will be a set of assigned homework problems posted in Blackboard under **HW Assignments & Submissions** in the left panel of the browser. The instructor has programmed Blackboard to automatically grade each problem once you submit your answers.

You need to calculate each problem on scratch paper, and then key in your answer to each problem in a HW assignment in Blackboard. If your answer is correct, you earn points for each problem. For any incorrect answer, you can re-submit another answer for another grading. No partial points will be given to each trial. You have unlimited attempts until reaching a correct answer before the due time. Please refer to the class schedule for the due date of each assignment (see p.3). Discussions of, or group-work on homework problems is OK. Also note that the Blackboard is programmed to prevent you from attempting an overdue assignment. Solutions will be posted after the due time in Blackboard under **HW Assignments & Submissions**.

### Tests

A calculator is needed for tests and exams, but use of any other communication devices such as cell phones is prohibited during each of the tests. All the tests are open to the cheat sheet only. There are 6 in-class closed-book tests. See p.3 the class schedule for the date of each test. It suggests that you practice self-exercise and assigned problems, and attend each lecture for preparing tests. You should logically present the solution process and correctly calculate the answers in order to score full points. (Also refer to **Grading Policy** below.)

### Policy of Make-ups

The tests should be taken when given. Makeup HW, tests, or exams will be accommodated **only** for the leave of intercollegiate sports, jury duties, and (short-term) medical leave with a support document from the head coach, court, and doctors. You are responsible to any absence from classes, tests and exams for any personal excuse or reasons. Therefore, you should make any pre-arrangement with the instructor for your absence.

If you would need to take a makeup exam, we ask that you have no substantial knowledge of the content of the original exam. If you have found out about the exam content, you are obligated to tell this to your professor well before the scheduled time of the makeup exam.

### Appropriate Class Behavior

Arrive on time or be prepared to be asked to leave, remain in the classroom during class time (wandering not allowed), stay alert, and participate actively. If you choose not to attend class you should be on your own for catching up the lecture contents, as no office hours will be provided for repeating lectures for your missing. Non-alcohol drinks or snacks are allowed to class, as long as you clean up after yourself and avoid distracting the class.

### Students with Disabilities

Reasonable accommodation will be provided for students with disabilities, who may wish to contact the Office of Disability Services (208 WHITAKER BLDG, 474-5655) for further assistance.

**Grading Policy.** The “NB” (no base) grade is not appropriate for grade assignment for this class. Final course grades will be determined by:

8 HW assignments	5 % each
6 tests	10 % each
Total	100 %

A+	$96 \leq P$	B-	$78 \leq P < 82$
A	$92 \leq P < 96$	C+	$73 \leq P < 78$
A-	$90 \leq P < 92$	C	$68 \leq P < 73$
B+	$86 \leq P < 90$	C-	$63 \leq P < 68$
B	$82 \leq P < 86$	D	$60 \leq P < 63$
		F	$P < 60$

## ME 494 Class Schedule

Date	Week		Contents (based on the 7 <sup>th</sup> version)	HW due
1/15	1	notes	Introduction	
1/18	2	2.5	Generalized Hooke's law. Relation of E, G, and $\nu$	
1/20		2.6	Dilatation and Bulk modulus.	
1/22		2.9	Axially orthogonal materials.	
1/25	3	3.1	Review of shafts under torsion.	HW 1 due at 1 pm, 1/25
1/27		3.9	Torsion of noncircular members	
1/29		3.9	(cont'd)	
2/1	4	3.10	Thin-walled hollow shafts under torsion	HW 2 due at 1 pm, 2/5
2/3		3.10	(cont'd)	
2/5		4.1	Review of pure bending	
2/8	5	<b>Test 1</b>		
2/10		4.4	Composite beams	
2/12		4.8	Unsymmetric bending	
2/15	6	4.9	Beams under eccentric axial loading	HW 3 due at 1 pm, 2/21 (S)
2/17		4.10	Curved beams	
2/19		4.10	(cont'd)	
2/22	7	<b>Test 2</b>		
2/24		6.1	Review of transverse loading	
2/26		6.2	Distribution of stresses in narrow rectangular beams	
2/29	8	6.2, notes	(cont'd)	
3/2		notes	Distribution of stresses in boxed beams	
3/4		6.6	Shear center of thin-walled members	
3/7	9	6.6, notes	(cont'd)	HW 4 due at 1 pm, 3/11
3/9		notes	Moment of inertias of unsymmetrical members	
3/11		7.1	Review of Mohr's circle	
3/14-3/18	10		Spring recess	
3/21	11	<b>Test 3</b>		
3/23		7.1, notes	Transformation of plane stress	
3/25		7.1, notes	Transformation of 3D stress. Cauchy Theorem.	
3/28	12	7.7	Transformation of plane strain	HW 5 due at 1 pm, 4/3 (S)
3/30		7.7	(cont'd)	
4/1		7.9	Measurement of strains	
4/4	13	<b>Test 4</b>		
4/6		11.4, 11.5	Work and energy under single load/impact load	
4/8		11.6	Work and energy under multiple loads	
4/11	14	11.7	Castigliano's theorem	HW 6 due at 1 pm, 4/17 (S)
4/13		11.8	Application to determining deflections of beams	
4/15		11.9	Application to indeterminate problems	
4/18	15	<b>Test 5</b>		
4/20		notes	Introduction to fatigue	
4/22		notes		
4/25	16	notes	Introduction to fracture	HW 7 due at 1 pm, 4/25
4/27		notes	Introduction to fracture	
4/29			no class (spring clean day)	
5/2	17	notes	Introduction to fracture	HW 8 due at 1 pm, 5/2 (T)
5/3		<b>Test 6, 1-3 pm in the classroom</b>		