

ARO4360 - COMPOSITES SYLLABUS

Todd D. Coburn, (909) 869-2235, <http://toddcoburn.com>, tdcoburn@cpp.edu, Office: 17-2111.

Class	Section	Number	Lecture	Location
ARO4360	1	32853	10:00 am – 11:15 am TuTh	Bldg 17, Room 1635

CLASS SCHEDULE

Week	Date	Lecture	Day	Topics	Text Sections			HW Due	PJ Due
					Jones	Barbero	Coburn		
1	22-Jan	1	Tu	Introduction to Composites	1	1	1	-	-
	24-Jan	2	Th	Matrices & MATLAB	App A	App A.1	App B	1	-
2	29-Jan	3	Tu	Lamina Macro Stiffness & Compliance	2.1-2.5	~5.1-5.3	2.1-2.2	2	1
	31-Jan	4	Th	Lamina Macro Orientation	2.6-2.7	~5.4	2.3-2.4	3	-
3	5-Feb	5	Tu	Lamina Macro Strength	2.8-2.9.6	7.0-7.1	2.5	4	2
	7-Feb	6	Th	Lamina Micro Stiffness	3.1-3.2.5	4.0-4.4	3.0-3.4	5	-
4	12-Feb	7	Tu	Lamina Micro Strength	3.5 - 3.6	4.5	3.3	6	3
	14-Feb	8	Th	Classical Lamination Theory (CLT)	4.1-4.2.4	6.1-6.2	4.0-4.3	7	-
5	19-Feb	-	Tu	Test #1 (Lectures 1-7)	---	---	---	-	-
	21-Feb	9	Th	Applications of CLT	4.1-4.2.4	6.1-6.2	4.0-4.3	8	-
6	26-Feb	10	Tu	Hygro-Thermal (HT) CLT Analysis	4.5.3-4	6.6	4.4	9	4
	28-Feb	11	Th	Test Methods	2.8.2	---	---	-	-
7	5-Mar	12	Tu	Laminate Special Cases	4.3-4.6	6.3	---	10	5
	7-Mar	-	Th	Test #2 (Lectures 1-11)	---	---	---	11	-
8	12-Mar	13	Tu	Bending of Beams	---	10	5	12	-
	14-Mar	14	Th	Guest - Bob Farahmand of Boeing	---	---	---	13	-
9	19-Mar	15	Tu	Sandwich Analysis	---	---	11	14	6
	21-Mar	16	Th	Sandwich Strength	---	---	11	15	-
10	26-Mar	17	Tu	Interlaminar Stresses	4.6	---	6	16	-
	28-Mar	-	Th	Test #3 (Lectures 1-16)	---	---	---	-	-
H	2-Apr	-	Tu	Holiday - Easter Break	---	---	---	-	-
	4-Apr	-	Th	Holiday - Easter Break	---	---	---	-	-
11	9-Apr	-	Tu	Composite Build Discussions	---	---	---	17	7
	11-Apr	18	Th	Sandwich - Analysis of Bolted Joints	---	---	---	-	-
12	16-Apr	19	Tu	John Hartsmith's 10% Rule	---	---	---	18	8
	18-Apr	-	Th	Test #4 (Lectures 1-19)	---	---	---	19	-
13	23-Apr	-	Tu	Salami/Amon Composite Workshop in 13-1114	---	---	---	-	-
	25-Apr	20	Th	Fatigue, Holes & Fracture Mechanics	6.3-5.2	7.5,8	7,8	-	-
14	30-Apr	-	Tu	Guest - Gil Carrillo of Boeing & UTC Aerospace	---	---	---	20	9
	2-May	21	Th	Bending, Buckling & Vibration of Plates	5.1-.6,7.2,.5	11	9-10	20G	-
15	7-May	-	Tu	Test #5 (Lectures 1-24)	---	----	---	21	-
	9-May	-	Th	Summary	---	---	---	-	-
F	14-May	-	Tu	Final Exam (cum) 9:00 AM - 10:50 AM	---	---	---	-	-

Note: This syllabus plan is subject to change. Keep your eyes peeled for updates & have the latest on hand.

GRADING SCALE & WEIGHTS and TEXTS & TOOLS

Course Grading	-----
Homework	15%
Projects	15%
Quizzes	20%
Test #1-4	10% Ea.
Test #5	10%
Final Exam	+2%

-----	Grading Scale	-----		
	A	100 % - 93 %		
B+	89 % - 87%	A-	92 % - 90 %	
C+	79 % - 77%	B	86 % - 83%	
D+	69 % - 66%	C	76 % - 73%	
	F	55 % - 0%	C-	72 % - 70%
			D-	60 % - 56%

The final exam is optional & provides opportunity to better grade.

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COURSE DESCRIPTION & EXPECTATIONS

Required (Hardcopy) Text & Tools:

- Coburn, Todd. *Mechanics of Composites Handbook*, r3, Bronco Copy'n Mail. 01/12/19.
- Barbero, E.J.. *Introduction to Composite Materials Design*. 3rd Edition. CRC Press. 2018.
- Barbero, *Workbook for Introduction to Composite Materials Design-Third Edition*. CRC Press. 2018.
- Pencil, Paper (Quad or Quint Pad Recommended).
- Engineering or Scientific Calculator with matrix capability.

Optional Additional or Alternate Texts:

- Jones, R.M.. *Mechanics of Composite Materials*. 2nd Edition. Taylor & Francis. 1999.
- Agarwal, et. al. *Analysis & Performance of Fiber Composites*. 3rd Edition. John Wiley & Sons. 2006.
- Gibson, R.F.. *Principles of Composite Material Mechanics*. 4th Edition. CRC Press. 2016.
- Baker & Scott. *Composite Materials for Aircraft Structures*. 3rd Edition. AIAA. 2016.
- Kaw, A.K.. *Mechanics of Composite Materials*. 2nd Edition. CRC Press, Taylor & Francis. 2006.

Prerequisites:

- C or better in ARO326 for ARO Majors, & C- or better in ME 315 & ME 319 for ME Majors.

Course Description: An introduction to composite materials & their manufacture with a focus on the mechanics of fiber-reinforced composites. Micromechanics & macromechanics of a lamina, macromechanics of a laminate including classical lamination theory, strength of lamina, laminate & constituents, analysis & test procedures, special cases, limitations & emergent research will all be covered. The focus will be on hand analysis procedures, but MATLAB programs will also be developed & utilized.

Important Notes, Expectations & Comments:

- Attendance is required. Every class has deliverables which will result in loss of points if missed.
- Be on time to class. Late arrival will result in loss of homework, project & quiz points.
- Students who are late or who miss any class may be dropped from the class.
- Cell phones & laptops may not be used in class. Use will result in loss of class credit.
- Eating, drinking & sleeping are not allowed in the classroom.
- Cheating is unacceptable and will result in immediate failure of the class.
- Participation in class is desired, recommended, and rewarded.
- All student work must have the student's name written legibly at the top, AND have the first three letters of their last name written in large capital letters at the uppermost left corner of the first page.

Homework & Project Expectations & Guidelines:

- Homework will consist of hand-worked HW due each class & Bb HW due weekly.
- Homework & project due-dates are shown in the Syllabus.
- Homework & projects are due at the start of class. Credit will be lost if turned in after class starts.
- Homework & projects will not be accepted or scored after class ends on the day they are due.
- Collaboration on homework & projects is recommended. Copying is considered cheating.
- Homework & projects must be graded by student per grading procedure shown below prior to submittal.
- Ungraded & misgraded homework submittals will receive zero points. Plan accordingly.
- Each missing homework or project assignment will score -5 points (rather than zero).
- Projects consist of MATLAB programs & solutions composed by students. The programming portion of this class enables students to prepare error-free solutions for complex laminates after careful programming and debugging. MATLAB basics will be taught in this course, but students with limited programming experience should plan additional time to master the MATLAB portion of the class.

Quiz & Test Expectations & Guidelines:

- Quizzes will be given nearly every class. Expect them & be prepared.
- Quizzes will usually be given at the start of class. Late arrival will likely miss the quiz.
- No make-up quizzes or exams will be administered.
- Most quizzes & exams will be open book (hardcopy only) & closed notes.

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- No electronic devices (including electronic texts) except calculators will be allowed during exams or quizzes.
- During quizzes & tests, talking, communicating, sharing with other students, and getting out of seat without permission are not allowed and will be considered cheating. Raise your hand to be recognized if you need something during a quiz or test and do not get out of your seat without permission except to turn in your completed work.
- Bb & online quizzes may also be used, and must be taken within the allotted time.
- Bb & online quizzes must be taken individually without collaboration or help from others.
- Seating will be rearranged during quizzes & tests. Plan to sit alone & to do your own work.
- Each missing quiz (without prior authorization) will be scored -5 points (rather than zero).
- Each missing exam (without prior authorization) will be scored -50 points (rather than zero).

HOMEWORK & PROJECT GRADING PROCEDURE

Each student must grade their own homework & project prior to submittal using a colored pen or marker that stands out from your work. Any ungraded or unidentified work will not be scored, & will show a zero in my gradebook. Detailed grading procedure as follows.

Homework Grading Procedure:

- Score each problem as follows:
 - SETUP: Score 1 point if all the following is present in your solution:
 - Problem Number - Identified (1, 2, 3, etc) & circled
 - Given, Find, & Solution - Clearly marked & appropriate pertinent data recorded.
 - Sketch – Pertinent sketch of problem shown.
 - Neatness – Setup is legible & clear.
 - Note: Only claim this point if you also have a complete attempted solution for the problem.
 - WORK: Score 2 points if all the following is present in your solution:
 - Equations – All pertinent equations needed and/or used are shown
 - Sketches & FBDs – Includes sketch of problem or idealization & FBDs showing applied loads and reactions wherever possible.
 - Neatness – All work is legible and clear.
 - Complete - Problem is worked to completion & all answers are boxed.
 - ACCURACY: Score 0, 1, or 2 points, as follows.
 - If all answers of a problem are boxed & match the answer provided, score 2 points.
 - In only some of the answers provided match the solution, score 1 point.
 - If no answer is provided, score 0 points (as if you got it right).
- This means each problem score will range from 1 to 5 based on the above.
- Sum your scores to the top of the first page with the total points earned over the total possible (5 times the number of problems), and circle the total score (xx/yy) conspicuously.
- If you want me to see or score something, write “See XYZ” & I will take a look & evaluate.
- I will make any modifications to the grades as needed, and may score punitive point reductions if I feel the scoring is intentionally misleading.
- Any ungraded homework or homework without a name will not be scored, and will show a zero in my gradebook.
- If your HW does not have the first 3 letters of your last name printed large and legible in the upper left-hand corner of the front page of your work, as well as your name, then deduct 3 points.

Project Grading Procedure:

- Score each project, with 15 points possible per problem in the project, as follows:
 - CODE: (5 points)
 - Present code first. Score 5 points if complete and annotated.
 - OUTPUT: (5 points)
 - Present the output of the code second.
 - Score 5 points if output for each problem requested is shown.

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- ACCURACY: (5 points)
 - If answers are provided or available from homework, score 5 points if code output matches all subparts. Score partial credit for partial matches.
 - If no answers are provided or available, score all 5 points as if correct.
- This means each project score will range from 0 to 15 per problem based on the above.
- Sum your scores to the top of the first page with the total points earned over the total possible & circle the total score conspicuously.
- I will make any modifications to the grades as needed, & may score punitive point reductions if I feel the scoring is intentionally misleading.
- If your HW does not have the first 3 letters of your last name printed large and legible in the upper left-hand corner of the front page of your work, as well as your name, then deduct 3 points.

If there are questions, see me.