

## Mechanics of Materials

### ENGR-330

CG Section 16WK 07/01/2018 to 12/31/2199 Modified 05/17/2022

### Course Description

A thorough study of the principles that govern the internal effects of stress and strain in solid bodies that are subjected to external loading. The purpose is to enable the engineering student to design solid components and structures by selecting materials and geometry. Students learn to compare strength of materials against internal stresses, and deformation of materials against internal strains. Topics also include: mechanical properties of materials, types of loading, plane-stress and plane-strain conditions, design of beams and shafts, and buckling.

#### Requisites

For information regarding prerequisites for this course, please refer to the [Academic Course Catalog \(https://catalog.liberty.edu/\)](https://catalog.liberty.edu/).

### Rationale

Design of solid components and structures learned in this course is of crucial importance for solving many engineering problems. In this course, students build on knowledge obtained in Statics. Students learn to analyze the strength of solid materials and structures.

### Course Learning Outcomes

- A. Describe the concepts of stress, strain, strength and deformation of materials (SOs: 1, 6).
- B. Be able to distinguish the various types of loading, including axial, shear, torsional, and bending (SOs: 1, 6).
- C. Use Stress-Strain Diagrams to analyze mechanical properties of engineering materials (SOs: 1, 6).
- D. Generate state of stress caused by combined loading in engineering problems (SOs: 1, 2, 6).
- E. Identify and solve problems in plane-stress and plane-strain conditions (SOs: 1, 2, 6).
- F. Use theories of failure in the design of solid structures and components (SOs: 1, 2, 3, 6).
- G. Design prismatic beams and shafts based on the resistance of both bending and torsional moments (SOs: 1,6).
- H. Use the integration method, discontinuity functions, and superposition methods to determine deflection and slope of beams and shafts (SOs: 1).
- I. Design both concentrically and eccentrically loaded columns made of common engineering materials (SOs: 1, 6).
- J. Describe a biblical worldview of mechanics of materials and its impact on society (SOs: 3,4,7).

### Course Resources

Click on the following link to view the required resource(s) for the term in which you are registered: [Liberty University Online Bookstore \(https://bncvirtual.com/liberty/\)](https://bncvirtual.com/liberty/).

#### Additional Materials for Learning

- A. Computer with basic audio/video output equipment
- B. Internet access (broadband recommended)
- C. Canvas [recommended browsers \(https://community.canvaslms.com/t5/Canvas-Basics-Guide/What-are-the-browser-and-computer-requirements-for-Canvas/ta-p/66\)](https://community.canvaslms.com/t5/Canvas-Basics-Guide/What-are-the-browser-and-computer-requirements-for-Canvas/ta-p/66)
- D. Microsoft Word and PowerPoint

## ☰ Course Assignments

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### Textbook readings and lecture presentations

#### Course Requirements Checklist

After reading the Course Syllabus and [Student Expectations \(https://www.liberty.edu/institutional-effectiveness/student-expectations/\)](https://www.liberty.edu/institutional-effectiveness/student-expectations/), the student will complete the related checklist found in the Course Overview.

#### Homework Assignments (10)

Homework sets will be assigned based on chapters covered. Some homework sets will be graded and some will be only for practice.

#### Read & Interact (10)

Read & Interact quizzes are meant to help learner focus in the material while reading the sections.

#### Quizzes (4)

Quizzes are problem solving activities. Make sure to study well before taking the quizzes as they are limited in time.

#### Project and Presentation

The final project is meant to provide learner with a more practical design activity.

#### Mid-Term Exams (2)

Exams are problem solving activities. Make sure to study well before taking the exams as they are limited in time.

#### Final Exam

Final exam is comprehensive and time limited.

## ✓ Course Grading

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Assignments/Evaluations	Points
Course Requirements Checklist	10
Homework Assignments (10 @ 10 pts each)	100
Reading Quizzes (10 @ 10 pts each)	100
Quizzes (4 @ 50 pts each)	200
Project and Presentation	150
Mid-Term Exams (1 @ 100 pts, 1 @ 150 pts)	250

Final Exam	200
TOTAL	1010

## Policies

### Late Assignment Policy

Course Assignments, including discussions, exams, and other graded assignments, should be submitted on time.

If the student is unable to complete an assignment on time, then he or she must contact the instructor immediately by email.

Assignments that are submitted after the due date without prior approval from the instructor will receive the following deductions:

1. Late assignments submitted within one week after the due date will receive up to a 10% deduction.
2. Assignments submitted more than one week and less than 2 weeks late will receive up to a 20% deduction.
3. Assignments submitted two weeks late or after the final date of the course will not be accepted outside of special circumstances (e.g. death in the family, significant personal health issues), which will be reviewed on a case-by-case basis by the instructor.
4. Group projects, including group discussion threads and/or replies, and assignments will not be accepted after the due date outside of special circumstances (e.g. death in the family, significant personal health issues), which will be reviewed on a case-by-case basis by the instructor.

### Disability Assistance

Students with a disability and those with medical conditions associated with pregnancy may contact Liberty University's Online Office of Disability Accommodation Support (ODAS) at [LUOODAS@liberty.edu](mailto:LUOODAS@liberty.edu) for accommodations. Such accommodations require appropriate documentation of your condition. For more information about ODAS and the accommodations process, including how to request an accommodation, please visit <https://www.liberty.edu/online/online-disability-accommodation-support/> (<https://www.liberty.edu/online/online-disability-accommodation-support/>). Requests for accommodations not related to disabilities or pregnancy must be directed to the Registrar's Office, which generally handles medical needs support.

If you have a complaint related to disability discrimination or an accommodation that was not provided, you may contact ODAS or the Office of Equity and Compliance by phone at (434) 592-4999 or by email at [equityandcompliance@liberty.edu](mailto:equityandcompliance@liberty.edu). Click to see a full copy of Liberty's [Discrimination, Harassment, and Sexual Misconduct Policy](https://www.liberty.edu/media/1226/Liberty_University_Discrimination_Harassment_and_Sexual_Misconduct_Policy.pdf) ([https://www.liberty.edu/media/1226/Liberty\\_University\\_Discrimination\\_Harassment\\_and\\_Sexual\\_Misconduct\\_Policy.pdf](https://www.liberty.edu/media/1226/Liberty_University_Discrimination_Harassment_and_Sexual_Misconduct_Policy.pdf)) or the [Student Disability Grievance Policy and Procedures](http://www.liberty.edu/media/8021/Disability_Grievance_Procedures.pdf) ([http://www.liberty.edu/media/8021/Disability\\_Grievance\\_Procedures.pdf](http://www.liberty.edu/media/8021/Disability_Grievance_Procedures.pdf)).

### Course Attendance

In an effort to comply with U.S. Department of Education policies, attendance is measured by physical class attendance or any submission of a required assignment within the enrollment dates of the course (such as examinations, written papers or projects, any discussion posts, etc.) or initiating any communication with one's professor regarding an academic subject. More information regarding the [attendance policy](https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwiki.os.liberty.edu%2Fdisplay%2FIE%2FOnline%2BAttendance%2BAnd%2BNon-Attendance&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbaf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613719138&sdata=%2BNBTsPOoXuHAPLfISQRugK7cRSuV6UyC7qD3agf3l2k%3D&reserved=0) (<https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwiki.os.liberty.edu%2Fdisplay%2FIE%2FOnline%2BAttendance%2BAnd%2BNon-Attendance&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbaf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613719138&sdata=%2BNBTsPOoXuHAPLfISQRugK7cRSuV6UyC7qD3agf3l2k%3D&reserved=0>) can be found in the [Academic Course Catalogs](https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.liberty.edu%2Findex.cfm%3FPID%3D791&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbaf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613729132&sdata=DjjhMiRBFnF%2B2ZJUC8eBd1OdNb26S9ADukODYsilXIA%3D&reserved=0) (<https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.liberty.edu%2Findex.cfm%3FPID%3D791&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbaf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613729132&sdata=DjjhMiRBFnF%2B2ZJUC8eBd1OdNb26S9ADukODYsilXIA%3D&reserved=0>). Regular attendance in online courses is expected throughout the length of the term. Students who do not attend within the first week of a sub-term by submitting a required academic assignment (such as the Course Requirements Checklist, an examination, written paper or project, discussion post, or other academic activity) will be dropped from the course. Students who wish to re-engage in the course are encouraged to contact Academic

Advising to discuss their enrollment options. Students who begin an online course, but at some point in the semester cease attending, and do not provide official notification to withdraw, will be assigned a grade of "FN" (<https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwiki.os.liberty.edu%2Fdisplay%2FIE%2FUnofficial%2BWithdrawals&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613729132&data=MoMvZdPfza69InuhVHMHAVgu59ZP0Fw45xJTU9PIBrU%3D&reserved=0>). Students wishing to withdraw from courses after the official start date should familiarize themselves with the [withdrawal policy](#).

## Grading Scale

A	B	C	D	F
900-1010	800-899	700-799	600-699	0-599

For courses with a Pass/NP final grade, please refer to the Course Grading section of this syllabus for the assignment requirements and/or point value required to earn a Passing final grade.

## Add/Drop Policy

The full policy statement and procedures are published in the [Policy Directory](https://wiki.os.liberty.edu/display/IE/Dropping+and+Adding+Online+Classes) (<https://wiki.os.liberty.edu/display/IE/Dropping+and+Adding+Online+Classes>).

## Honor Code

Liberty University comprises a network of students, Alumni, faculty, staff and supporters that together form a Christian community based upon the truth of the Bible. This truth defines our foundational principles, from our Doctrinal Statement to the Code of Honor. These principles irrevocably align Liberty University's operational procedures with the long tradition of university culture, which remains distinctively Christian, designed to preserve and advance truth. Our desire is to create a safe, comfortable environment within our community of learning, and we extend our academic and spiritual resources to all of our students with the goal of fostering academic maturity, spiritual growth and character development.

Communities are predicated on shared values and goals. The Code of Honor, an expression of the values from which our Doctrinal Statement was born, defines the fundamental principles by which our community exists. At the core of this code lie two essential concepts: a belief in the significance of all individuals, and a reliance on the existence of objective truth.

While we acknowledge that some may disagree with various elements of the Code of Honor, we maintain the expectation that our students will commit to respect and uphold the Code while enrolled at Liberty University.

Adherence to the principles and concepts established within facilitates the success of our students and strengthens the Liberty community.

The Code of Honor can be viewed in its entirety at <http://www.liberty.edu/index.cfm?PID=19155> (<http://www.liberty.edu/index.cfm?PID=19155>).

## Schedule

When	Topic	Notes
Course Overview	Student Acknowledgements	Course Requirements Checklist
	Technology Integration Set-Up	Read: Technology Integration Set-Up Overview Explore: McGraw Hill Student Resources Prepare: Register for Connect

When	Topic	Notes
<b>Module 1</b>	Learn	Read: 4 items Watch: 1 item Explore: 1 item
	Apply	Homework: Introduction Assignment
<b>Module 2</b>	Learn	Read & Interact : 1 item Read: 2 items Watch: 3 items Explore: 1 item
	Apply	Homework: Stress and Deformation Assignment
<b>Module 3</b>	Learn	Read & Interact : 1 item Read: 3 items Watch: 2 items
	Apply	Homework: Torsion Part I Assignment Quiz: Torsion Part I
<b>Module 4</b>	Learn	Read & Interact : 1 item Read: 1 items Watch: 1 item
	Apply	Homework: Torsion Part II Assignment
<b>Module 5</b>	Learn	Read & Interact : 1 item Read: 3 items Watch: 2 items
	Apply	Homework: Bending Part I Assignment Quiz: Bending Part I
<b>Module 6</b>	Learn	Read: 3 items Watch: 1 item
	Apply	Homework: Bending Part II Assignment
<b>Module 7</b>	Learn	Read & Interact : 1 item Read: 2 items Watch: 1 item Interact: 1 item
	Apply	Quiz: First Mid-Term

When	Topic	Notes
<b>Module 8</b>	Learn	Read & Interact : 1 item Read: 2 items Watch: 1 item
	Apply	Project and Presentation Assignment
<b>Module 9</b>	Learn	Read & Interact : 1 item Read: 2 items Watch: 1 item Interact: 1 item
	Apply	Quiz: Beams and Thin-Walled Members
<b>Module 10</b>	Learn	Read: 3 items Watch: 1 item
	Apply	Homework: Stress and Strain Transformations Assignment
<b>Module 11</b>	Learn	Read & Interact : 1 item Read: 2 items Watch: 1 item Interact: 1 item
	Apply	Quiz: Principal Stresses
<b>Module 12</b>	Learn	Read: 3 items Watch: 1 item
	Apply	Homework: Deflection of Beams Assignment
<b>Module 13</b>	Learn	Read & Interact : 1 item Read: 5 items Watch: 2 items
	Apply	Homework: Columns Assignment Quiz: Second Mid-Term
<b>Module 14</b>	Learn	Read & Interact : 1 item Read: 4 items Watch: 2 items Interact: 1 item
	Apply	Homework: Energy Methods Assignment Quiz: Final