JOHN A. REIF, JR. DEPARTMENT OF
CIVIL AND ENVIRONMENTAL ENGINEERING

NJIT New Jersey Institute of Technology

MECH 234 Hybrid course for Mechanical Engineering Students
ENGINEERING MECHANICS: STATICS Fall 2024

Text:

1. Beer, Johnston, Mazurek, **Vector Mechanics for Engineers: Statics, 12th edition**, McGraw-Hill, 2016, ISBN 978-1-259-97726-8

2. NCEES, Fundamentals of Engineering Supplied-Reference Handbook, (any edition) Purchase from bookstore - or - download pages from: http://www.ncees.org/exams/study_materials/fe_handbook/

Instructor: Prof. M.A. Saadeghvaziri, Ph.D., P.E., ala@njit.edu, 260-Colton Hall, 973-596-5813; Office Hours: Mondays 9:30-11:00AM, and Thursdays 4:30-5:30PM; other times by appointment. Do not be shy and seek help when needed!
Personal Zoom Link: https://njit-edu.zoom.us/my/alaroom

Grader Aderibigbe, Ayodeji D ada49@njit.edu; Office Hours: Mondays 2 – 4PM, Thursdays 9:30-11:00 AM; Room: 421L (Colton Hall)

Tutoring

Tutoring in 423-Colton Hall - Schedule for Tutoring will be posted on the door of 423-Colton Hall. The tutoring schedule will also be posted on Canvas.

***Prerequisites**: Phys 111, Math 112. Provides an understanding of equilibrium of particles and rigid bodies subject to concentrated and distributed forces.*

Students must earn a C or better in this course to register for Strength of Materials, MECH237.

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. ***Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.*** *If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"*

Course Format: Modular Mastery-based Model (M3)

This course will use a modular master-based model (M3) pedagogy; whereby the course is partitioned into modules, and you will be given multiple assessment opportunities (as shown in the table below). There will be nine different course modules as described. These modules represent the main topics covered in this course and define the learning objectives for the course and lectures. I have adopted this model (M3) for several semesters on another similar course and it is quite popular with students as it gives a great learning experience. It enhances students' engagement and lowers – almost eliminates – test anxiety.

I will explain the details when we meet. At this stage my only suggestion to you is get involved from day one and you will do excellent!

Course Modules / Topics

I expect you to learn and demonstrate mastery in the following topics/modules:

1. Planar Force Summation and Equilibrium (11-pt/10-pt honors)
2. Adding Forces and Equilibrium in Space (11-pt/10-pt honors)
3. Vector Product, Moment of a Force about a Point (11-pt/10-pt honors)
4. Couple and Force-Couple Systems (11-pt/10-pt honors)
5. Equilibrium of Rigid Bodies & Special Cases (11-pt/10-pt honors)
6. Analysis of Structures: Trusses (11-pt/10-pt honors)
7. Analysis of Structures: Frames and Machines (10-pt)
8. Distributed Forces, Centroids, and Center of Gravity (10-pt)
9. Moment of Inertia and Parallel Axis Theorem (10-pt)

Course Grade

	Assessment Opportunities					
	Classwork/Quiz	Test I 9/30	Test II 10/28	Test III 11/18	Test IV 12/9	Final TBA
Module 1	☒	☒	☒	☐	☐	☒
Module 2	☒	☒	☒	☐	☐	☒
Module 3	☒	☐	☒	☒	☐	☒
Module 4	☒	☐	☒	☒	☐	☒
Module 5	☒	☐	☐	☒	☒	☒
Module 6	☒	☐	☐	☒	☒	☒
Module 7	☒	☐	☐	☒	☒	☒
Module 8	☒	☐	☐	☐	☒	☒
Module 9	☒	☐	☐	☐	☒	☒

Course grade is based on sum of modules grade.
Each Module will have 10 (or 11)-points. For a total of 96 points.
You must demonstrate your mastery on all modules (i.e. score 60% or better). However, if overall score is higher than 60% then two modules can have a score lower than 60% but not less than 40%.

NOTE: Last performance in each module NOT best counts as your grade for that module.

Homework / class participation – 4 points

Computer Problems: 6 points (Honors Section Only) – to be assigned.

GRADE RANGE	GRADE
100-88	A
87-82	B+
81-76	B
75-70	C+
69-65	C
64-60	D*
59 and below	F

*NOTE: You cannot register for MECH 237 with a D

Course Policies:

- Attendance is mandatory whether face-to-face or remote.
- There will be NO need for electronic devices during class time.
  Turn OFF your cell phone and put it away.
  You may take notes on a tablet, but do not bring a laptop to class.
- Bring your textbook to each class meeting or pages from the relevant chapter.
- Take notes. Ask questions.
- Be prepared to participate in class problem solving. Bring your calculator.

Quizzes, Exams and Grading Policies:

- There will be **three common exams** on campus. They will be on **Monday 4:15pm - 5:45pm – 09/30; 10/28; and 11/18.** Check for conflicts now. Make other arrangements early. If you are satisfied with your classwork/quizzes scores you do not need to take common exam(s). Remember it is the last performance not the best performance.
- There will be another Exam on week 14 and a Final Exam in week 15 during Finals Week. If you are satisfied with your all modules' scores you do not need to take these exams. Remember it is the last performance not the best performance.
- Classwork (quizzes) / exams must have Free-Body-Diagrams with Force Vectors shown. ALL work must be shown for full credit.
- There is no need for make-up exams/classwork. You are provided with multiple opportunities for each module.

Homework Policies:

- Homework has a small percentage of total grade, but I cannot emphasis enough how **critical it is to your performance** in the course. With many years of experience teaching this or similar courses, I have yet to find a student that did well while doing poorly or not doing homework!!! Classwork/quizzes are similar to homework problems. I call it CLASSwork as opposed to HOMEwork to highlight this point! You do similar problems in class.
- Follow the syllabus and do the homework problems listed in the syllabus.
- Submit online via Canvas.
- NO late homework will be accepted.
- We have no time to solve all homework problems as we devote a good amount of time to classwork/quizzes. It is your responsibility to make sure you can do all problems but feel free to ask in class our go to office hours or tutoring hours for help.
- All homework must be submitted on quadrille 8-1/2 x 11 engineering paper sold at the NJIT bookstore or equivalent sold at any office supply store. Write on ONLY the front of the paper.
- All homework MUST include a Free-Body-Diagram to show Force Vectors. All work must be shown for full credit. SCAN your pages and upload to Canvas.

Tutoring:

- Tutoring will be provided in room 423-Colton Hall. Additional information concerning the tutoring schedule will be provided in the class and posted on Canvas.

Useful Resources / Links:

- https://www.coursera.org/learn/engineering-mechanics-statics Statics: 15 hours flexible schedule
- https://www.coursera.org/learn/mastering-statics Mastering Statics: 21 hours to complete
- https://www.coursera.org/learn/engineering-mechanics-statics-2 Applications in Engineering Mechanics: 15 hours
- Here is a **LINK** to additional solved "Recitation Examples": Recitation Examples Useful solved problems from the Beer & Johnston text, an earlier edition. Therefore, the problem numbers will be different, but you can find them in the current edition (by Prof. Milano)
- **Jeff Hanson's videos have been adopted by McGraw-Hill. Look on YouTube for lectures by Jeff Hanson:** ***How to Ace Statics with Jeff Hanson.*** **https://www.youtube.com/watch?v=nDL25cfTdBQ**
- https://www.khanacademy.org For every student, every classroom, real results

Weekly Schedule to the Extent Possible:

F2F = Face-to-Face; ONL = Online; + Common Exam Weeks

Week	Module	Topic	Study pages	Homework Problems (* optional)
1 F2F	1	Ch. 1: Introduction Ch. 2: Statics of Particles, Trig Method (sketch force polygon)	p. 2 - 15 p. 16 - 25	**Sketch a force polygon**, use Law of Sines and Cosines. 2.2, 2.6, 2.10, 2.11, 2.15 (2.8*, 2.12*)
2 ONL	1	Ch. 2: Rectangular Components Equilibrium of a Particle	p. 29 - 34 p. 38– 47	2.21 & 2.31, 2.23 & 2.32, 2.45 (2.25*, 2.47*, 2.60*, 2.62*)
3 F2F	2	Ch. 2: Forces in Space Forces and Equilibrium in Space	p. 54 - 63 p. 67–70 p. 76 - 79	2.71& 2.72, 2.91 & 2.92, 2.112 (2.75* & 2.76*, 2.87*, 2.100*, 2.113*)
4+ ONL	3	Ch. 3: Rigid Bodies; Vector product, Moment of a force	p. 84– 99	3.6, 3.10, 3.21, 3.24
5 ONL	4	Ch. 3: Couples and Force-Couple Systems	p. 119 – 130	3.70, 3.78, 3.81, 3.90 (3.80*, 3.89*)
6 F2F	4	Ch. 3: Equivalent Systems Review and Summary	p. 138– 152 p. 161 – 168	3.108, 3.114 (3.112*, 3.120*)
7 F2F	5	Ch. 4: Equilibrium of Rigid Bodies; Equilibrium of a Two-Force Body, Equilibrium in 3-D	p. 170 – 187 p. 199 – 202 p. 207 – 216	4.4, 4.7, 4.15, 4.19, 4.27 (4.13*, 4.16*, 4.35*, 4.67* and 3D: 4.94*)
8+ ONL	6	Ch. 6: Analysis of Structures: Method of Joints	p. 299 – 311	6.2, 6.5, 6.9, 6.15, (6.27*, 6.28*)
9 F2F	6	Ch. 6: Truss Analysis: Method of Sections	p. 319 – 328	6.45, 6.46, 6.49, (6.53*, 6.55*)
10 F2F	7	Ch. 6: Frames and Machines, Review and Summary	p. 334 – 341 p. 361 – 365	6.77, 6.79, 6.89, 6.102 (6.105*, 6.127*)
11+ TBA	8	Ch. 5: Distributed Forces: Centroids and Center of Gravity	p. 232 - 245	5.3, 5.5, 5.7, (5.4*)
12 ONL	8	Ch. 5: Distributed Loads	p. 262– 271	5.68, 5.69, 5.71, 5.76 (5.78*)
13 F2F	9	Ch. 9: Moments of Inertia Parallel Axis Theorem/Composites	p. 485 – 493 p. 497 – 509	9.4 and 9.8 9.31 and 9.33, 9.41 (9.36*, 9.43*)
14 F2F	9	Test IV		
15 F2F		Final Exam	Dates to be announced by Registrar at a later date.	

Outcomes Course Matrix; MECH 234 Engineering Mechanics: Statics

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Methods
Student LearningOutcome 1: Provide transition from Physics (science) to Statics (engineering).			
Present engineering approach and problem solving techniques used for vector analysis while building on math and physics fundamentals relevant to force systems in equilibrium.	1, 2, 4	1	Homework, exams and success in future courses.
Illustrate applications to practical problems of torque, moments, and couples. Reinforce the application of geometry and trigonometry to realistic-type problems and demonstrate the application of math skills such as cross products and dot products.	1, 2, 4	1	Homework, bonus problems, and exams.
Student LearningOutcome 2: Master the concept of two-dimensional and three-dimensional vectors.			
Illustrate 2D vector components and orientation using trigonometry and proportions.	1, 2, 4	1	Homework and exams.
Use vivid Power Point examples to demonstrate analysis technique for force systems on beams and trusses and frames.	1, 2, 4	1	Homework and exams.
Demonstrate logical approach to spatial vectors by visualization of forces, moments. Provide basic concepts for visualizing orientation of spatial components to develop techniques using geometry and projections.	1, 2, 4	1	Homework, exams, and bonus challenge problems.
Student Learning Outcome 3: Master the concept of developing free body, diagrams and how to formulate and structure problems solving techniques which is fundamental to the solution of all engineering problems.			
Demonstrate the ability to translate a problem statement into a FBD and distinguish tensile and compressive members in trusses and frames while emphasizing the importance of vector directions. .	1, 2, 4	1	Homework, bonus challenge problems, and exams.
Illustrate the approach of going from the FBD to the problem solution by formulating the appropriate equation set as applied to beams, trusses, and frames.	1, 2, 4	1	Homework, bonus challenge problems, and exams.
Provide numerous solved problems available on web that reinforce the technique of problem solving strategy.. Require numerous homework problems weekly.	1, 2, 4	1	Homework, exams and bonus challenge problems.

CEE Mission, Program Educational Objectives and Student Outcomes

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Our program educational objectives are reflected in the achievements of our recent alumni.

1 - Engineering Practice: Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.

2 - Professional Growth: Alumni will advance their skills through professional growth and development activities such as graduate study in engineering, professional registration, and continuing education; some graduates will transition into other professional fields such as business and law through further education.

3 - Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, and humanitarian endeavors.

Our student outcomes are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering and make informed judgments which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies