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

NJIT New Jersey Institute of Technology

MECH 320-102: Statics and Mechanics of Materials **Spring 2025**

Text: **Hibbeler, R.C, Statics and Mechanics of Materials, 5 Edition,** Pearson 2014, ISBN-10: 0-13-345160-7, ISBN-13: 978-0-13-438259-3 or ISBN-10: 0-13-438259-5

Instructor: Prof. M. Ala Saadeghvaziri, Room 260 Colton Hall, Tel: 973 596-5813, **Email**: ala@njit.edu
Office hours: Mondays & Wednesdays 1:00-2:30PM, other times by appointment. Please do not be shy and come and see me when you need help!

Lectures: Wed 6:00 - 8:50PM; CKB 204

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

Prerequisite *Phys 111 and Math 112, For chemical engineering and electrical engineering majors. Statics provides an understanding of the equilibrium of particles and rigid bodies, including simple machines, trusses, and frictional forces. Mechanics of materials covers pressure vessels, thermal stresses, torsion of shafts, stresses and deflection in beams, and column action.*

Course Format: Modular Mastery-based Model (M3)

This course will use a modular mastery-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) to demonstrate your mastery of the modules (learning objectives). 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, 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 excellently!

Course Modules (learning objectives)

It is expected that you learn and demonstrate mastery in the following modules:

1. Planar Force Summation and Equilibrium
2. Vector Product, Moment of a Force about a point, Couple and Force-Couple Systems
3. Equilibrium of Rigid Bodies & Special Cases
4. Structural Analysis: Trusses
5. Structural Analysis: Frames and Machine
6. Stress-Strain, Normal/Shear Stress, Allowable Stress Design
7. Axial Loading
8. Shear and Moment Diagrams, Flexural Formula
9. Stress Transformation, Mohr's Circle

Additionally, the following subjects are of special importance and will be assessed through homework assignments that have higher weights:

a) Center of gravity, and moment of inertia
b) Mechanical properties of materials
c) Column buckling

Course Assessment & Grade

	Assessment Opportunities				
	Classwork/Quiz	Test I	Test II	Test III	Final
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 10.5-points. For a total of 94.5 points. The other 5.5% is submitting homework (HWK) and class participation. Three HWK identified with an asterisk under weekly schedule each have 1%. Other HWK will be checked for completeness but not graded and have

You must demonstrate your mastery on all modules (i.e. score 60% or better). However, if the 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 performance counts as your grade for that module.

The minimum requirements for final letter grades are as follows:
A = 90%, B+ = 85%, B = 80%, C+ = 75%, C = 67%, D = 60%, F < 60%

All quizzes/tests will be "Closed Book". Only the FE Handbook is permitted as a resource, but NO notes may be added.

Please note that your final grade will reflect your work and calculated exactly as indicated in the above breakdown, no extra credits will be given.

The NJIT Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students.

Weekly Schedule – tentative

Please **note** that, due to the once-a-week schedule of our class meetings, quizzes (classwork) for some modules may be combined.

Week	Date	Module	Topic	Quiz / Test	Sections	Homework
1	1/22	1	General Principles, Concurrent Force Systems		1.1– 1.5 2.1 – 2.4	TBA
2	1/29	1/2	Cartesian Vectors, Position Vectors, Dot Product		2.5 – 2.9	
3	2/5	2	Moment Systems	1	3.1 – 3.7	

4	2/12	3/4	Equilibrium of Rigid Bodies, Structural Analysis	2	4.1 – 4.4	
5	2/19	4/5	Structural Analysis: Trusses	3	5.1 – 5.4	
6	2/26	5	Structural Analysis: Frames & Machines	**Test-1**	5.1 – 5.4	
7	3/5		Center of Gravity; Moment of Inertia	4	6.1 – 6.4	*
8	3/12	6	Stress and Strain Allowable Stress Design, Deformation	5	7.4, 7.6-7.8	
9	3/26	7	Mechanical Properties of Materials, Axial Loading (7)	6	8.1 – 8.3 9.1 – 9.2	*
10	4/2	8	Bending, Shear & Moment Diagrams, the Flexural Formula	**Test-2**	11.1, 11.2, 11.4	
11	4/9	8/9	Bending (cont'd); Stress Transformation	7	11.1, 11.2, 11.4	
12	4/16	9	Stress Transformation (Cont'd), Mohr's Circle	8	14.1 – 14.4	
13	4/23		Column Buckling	9	17.1 – 17.3	*
14	4/30		Review & Test-3	**Test-3**		
15	5/14			**Final Exam**		

Policies

Attendance: Attendance will be taken at the beginning of the class.

"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"*

EXAMS:

- There will be three exams during the semester.
- There will be a Final Exam during Finals Week.
- Exams must have Free-Body-Diagrams. ALL work must be shown for full credit.
- There will be NO make-up exams as the new pedagogy implemented provides multiple opportunities to be assessed on each module.
- We do NOT curve the grades.
- The solution must illustrate the understanding of the material. Correct numerical solutions alone are insufficient for any credit.
- All answers must be accompanied by the appropriate and correct units.
- The dates of the exams are shown on the schedule above. Dates may be changed at the instructor's discretion with a minimum of 2 weeks' notice.
- **No make-up exams will be needed/given** since under the pedagogy used there will be multiple opportunities to demonstrate mastery of each module (subject).

HOMEWORK:

- Homework sets must be uploaded on Canvas by the due date.
- Submit homework as one pdf file with pages arranged in order by problem number.
- Use any 8½ x 11 paper that will clearly show the problems when scanned.
- On the top of each page print your name, course and section, and problem number. • All problems must show the figure and data provided with the problem • All problems must have a free body diagram.
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Please **note** that while homework carries a very low weight in determining your overall course score, it is incredibly important for your success. I refer to quizzes as **classwork** because they are similar to homework problems but performed in class. Completing your homework diligently and on time will greatly enhance your understanding and preparation, ultimately helping you excel in the course. Make it a priority!

Outcomes Course Matrix – MECH 320 Statics and Mechanics of Materials

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Methods/Metrics
Student LearningOutcomes 1: Identify transition concepts from Physics (science) to Engineering Mechanics.			
Present the engineering approach and problem solving techniques.	1	1	Homework and exams
Present approach of going from the equilibrium of particles to that of rigid bodies.	1	1	Homework and exams.
Student LearningOutcomes 2: Formulate, diagram, and solve FBD problems.			
Require FBD's for all problems.	1	1	Homework and exams.
Illustrate the problem solution by formulating the appropriate equation set.	1	1	Homework and exams.
Student LearningOutcomes 3: Analyze the mechanical behavior of materials under various load conditions.			
Present various aspects of stress, strain and deformation relationships and their application to various engineering problems.	1	1	Homework and exams.
Provide examples of several analytical methods to determine the mechanical behavior of materials under various load conditions.	1	1, 2	Homework and exams.
Student Learning Outcomes 4: Apply problem solving techniques to real world situations.			
Provide analytical techniques for the types of mechanics problems, which commonly occur in the industries, which employ chemical engineers.	1, 2	1	Homework and exams.
Provide development of structured problem solving techniques for various classes of mechanics problems.	1	1	Homework and exams.

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

Program Educational Objectives

Our **Program Educational Objectives** are reflected in the achievements of our recent alumni:

- **Engineering Practice:** Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working towards safe, practical, resilient and sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.
- **Professional Growth:** Alumni will advance their technical and interpersonal skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as academia, business, and law through further education.
- **Service:** Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Student Outcomes

Our **Student Outcomes** are what students are expected to know and be able to do by the time of their graduation:

- an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
- 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
- an ability to communicate effectively with a range of audiences
- an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
- 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
- an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusion
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies