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Spring 2020

MECH 234-002: Engineering Mechanics - Statics

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JOHN A. REIF, JR. DEPARTMENT OF
CIVIL AND ENVIRONMENTAL ENGINEERING
NJIT New Jersey Institute of Technology

MECH 234
ENGINEERING MECHANICS: STATICS

Spring 2020

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, 8th Edition, 2nd. revision Can be purchased from bookstore or you can reproduce pages from: http://www.ncees.org/exams/study_materials/fe_handbook/

Classes and Instructors: MECH 234-002, Mon., 11:30-2:20, Cullimore Lecture Hall #1
MECH 234-004, Wed., 11:30-2:20, KUPF-210
Prof. G. Milano, P.E., milano@njit.edu, **239 Colton Hall, 973-596-5830**

Teaching Assistants: **Jin Fan, Ph.D. Candidate,** jf372@njit.edu
Tutoring in 423-Colton Hall - Schedule for Tutoring will be posted on the door of 423-Colton Hall. The tutoring schedule will also be emailed to you by your instructor and posted on Canvas.

Prerequisites: PHYS 111, MATH 112. A course for industrial and mechanical engineering students in which the equilibrium of particles and rigid bodies subject to concentrated and distributed forces is studied.

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

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

Below are additional **LINKS** to "Recitation Examples":

Recitation Examples
Useful solved problems from the Beer & Johnston text

Course Policies:

- Attendance is mandatory
- There will be NO need for electronic devices during class time.
  Turn OFF your cell phone and put it away.
  Put away your laptop, tablet, or any other electronic device.
- Bring your textbook to each class meeting or pages from the relevant chapter.
- Take notes. Ask questions.
- Be prepared to participate with board work and/or class problem solving. Bring your calculator.

Quizzes, Exams and Grading Policies:

- There will be 3 common exams on **Mondays**, 4:15-5:45 p.m. on **2/10, 3/9 and 4/20**
  Check for any conflicts NOW and make arrangements in advance. Common exams will be 60% of your overall grade.
- There may be additional quizzes during class time. These will be 10% of your grade.
- There will be a Final Exam in week 15 during Finals Week. This will be 25% of your grade.
- Quizzes and exams must have Free-Body-Diagrams with Force Vectors shown. ALL work must be shown for full credit.
- There will be NO make-up quizzes or exams unless there is documentation provided to the Dean of Students Office to validate your absence. Such circumstances may include sickness documented by a doctor or Health Service; a receipt from your mechanic for car failure; etc.
- We do NOT drop the lowest grade.
- We do NOT curve the grades.

GRADING	GRADE RANGE	GRADE
3 Common Exams …..60%	100-88	A
Other quizzes …….10%	87-82	B+
Homework ……..5%	81-76	B
Final Exam ……25%	75-70	C+
	69-65	C
*NOTE: There is no grade of D for CE Students	64-60	D*
	59 and below	F

Homework Policies:

- Follow the syllabus and do the homework problems listed in the Syllabus
- Have your homework ready each class meeting.
- Homework may be collected on a random basis. Not all assigned problems will be collected. Only a select few will be collected randomly.
- NO late homework will be accepted.
- 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.
- Homework NOT submitted will earn MINUS points deducted from your overall quiz grades.
- Homework copied from a solution source will NOT be awarded any credit.

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.

Problems in **Blue are links** to examples from a textbook by Beer & Johnston 6th edition, found at the Reserve Desk, Library, but similar to those found in current edition with different numbers.

Week	Topic	Study pages	Homework Problems**
1	Ch. 1: Introduction Ch. 2: Statics of Particles, Trig Method (sketch force polygon)	Study p. 2 - 14 p. 16 - 25	**Sketch force polygon**, use Law of Sines and Cosines to solve. Ch. 2: 2, 5, 9, 13, 20
2	Ch. 2: Rectangular Components Equilibrium of a Particle	p. 29 - 35 p. 39– 46	Ch. 2: 22 & 34, 23 & 32, 35 Ch. 2: 43, 45, pulley 66
3	Ch. 2: Forces in Space Forces and Equilibrium in Space Review and Summary	p. 52 - 62 p. 66–70 p. 75 - 78	Ch. 2: 77 & 78, 91 & 92 Ch. 2: 100, 109 **Helpful**:2-66, 89 & 90, 2-114
4	Ch. 3: Rigid Bodies: Equivalent System of Forces Scalar Products (Dot Products)	p. 82– 99 p. 105-113	Ch. 3: 5, 9, 21, 24 and 29 (3.11 done on "examples.htm") Ch. 3: 37, 3.43 find the angle
5	Ch. 3: Couples and Force-Couple Systems	p. 120 – 128	Ch. 3: 71, 73, 77, 98
6	Ch. 3: Equivalent Systems Review and Summary	p. 136– 150 p. 161 – 168	Ch. 3: 101, 105, 113
7	Ch. 4: Equilibrium of Rigid Bodies Equilibrium of a Two-Force Body Review and Summary	p. 170 – 184 p. 195 – 198 p. 225 – 229	Ch. 4: 3, 7, 22, 28, 33 Ch 4: 67, 68 **Helpful:** 4.3,12, 17, 26, 30, [43, 72, 101]
8	Ch. 6: Analysis of Structures: Method of Joints	p. 298 – 309	Ch. 6: 3, 7, 18, 19, 27 **Helpful:** 14, 27 [13, 28]
9	Ch. 6: Truss Analysis: Method of Sections	p. 317 – 324	Ch. 6: 45, 47, 52, 54
10	Ch. 6: Frames and Machines Review and Summary	p. 330 – 339 p. 361 – 365	Ch. 6: 76, 88, 92, 102, 105
11	Ch. 5: Distributed Forces: Centroids and Center of Gravity	p. 230 - 244	Ch. 5: 3, 5, 8, 9 **Helpful:** [25, 32, 34, 79]
12	Ch. 5: Distributed Loads	p. 262– 268 class notes	Ch. 5: 66, 68, 70, 76 **Helpful:** 5.78, 81, 83
13	Ch. 9: Distributed Forces: Moments of Inertia	p. 485 – 491 p. 498 – 506	Ch. 9: 4 and 8 composites, Ch. 9: 32 and 34, 44
14	Ch. 9: Parallel Axis Theorem	p. 513 – 519	Ch. 9: 72, 73, 74
15	Final Exam	Dates to be announced by Registrar at a later date.	

**Homework to be assigned by your professor. Homework will be collected randomly per your professor.NO LATE homework can be accepted after the due date.

*Students will be informed in advance by the instructor of any modifications or deviation from the syllabus throughout the course of the semester.

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 the instructors' 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

Revised by milano,10/2001, 1/2002, 1/2003, 1/2004, 9/2004, 1/2005, 8/2005, 9/2007, 8/2008, 8/2009, 1/2010, 1/2011, 8/2011, 8/2012, 1/2013, 8/2013, 7/2014, 8/2015, 1/2016, 1/2017, 7/2017, 1/2018, 1/2020

Outcomes Course Matrix; MECH 234 Engineering Mechanics: Statics

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Methods
Student Learning Outcome 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 Learning Outcome 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	1, 2, 4	1	Homework, bonus challenge problems, and exams.

compressive members in trusses and frames while emphasizing the importance of vector directions. .			
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. Rev. 1/6/13, 9/11/13

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

Rev. 4/4/12, 9/11/13, 2/13/18, 5/18/18