Bergen Community College
Division of Math, Science and Technology
Department of Physical Sciences

Master Course Syllabus
PHY-294 Engineering Mechanics - Statics

Semester and year:
Course and Section Number:
Meeting Times and Locations:

Instructor:
Office Location:
Phone:
Office Hours:
Email Address:

Course Title and Number: Engineering Mechanics - Statics, PHY-294
Pre-requisites: Calculus II (MAT-281) with grade of "C" or better or permission of the Physical Science Department Chair; Physics I (PHY-280) with grade of "C" or better
Course Credits: 4
Course Hours: 4 lecture hours

Course Description: Engineering Mechanics - Statics is a study of the state of rest of bodies under the action of forces. This course builds a foundation of analytic capability for the solution of a great variety of engineering problems. Topics covered include the statics of particles and rigid bodies.

Student Learning Outcomes/Behavioral Objectives

The student, drawing upon knowledge and skills previously acquired in the prerequisite courses, will begin to synthesize that important material. The student will also demonstrate the following skills:

1. Precise planning of the solution to a physical problem by paying strict attention to the very finest of details.
2. Precise use of coordinate systems advantageously in any given problem.
3. Precise use of mathematical symbols, diagrams, graphs, and sketches.
4. Precise use of the laws of statics with appropriate mathematics using precise diagrams and critical thinking.

Means of Assessment

The Student Learning Objectives (SLOs) in this course are aligned with the Learning Goals of both the Engineering Program and the Physics Program. In addition, student progress in reaching the course's SLOs is assessed through a variety of assessment types (tools) and on the basis of a variety of assessment criteria. The means of assessment utilized in this course are in-class exams, hand-written homework problems and extensive use of the online MasteringEngineering tutorials and associated online homework problems. In addition the instructor may issue quizzes. The instructor may also require a course project (individual or group) with a final demonstration and/or oral presentation and/or written report.

Special Features of the Course

This course requires the use of learning technologies and technological literacy. The required MasteringEngineering tutorials make use of adaptive learning and active learning. The required MasteringEngineering homework assignments are designed to encourage critical thinking. The course also requires the use of Excel or other spreadsheet software for additional in-depth analysis of some instructor-chosen homework problems. Free-ware open software may also be used for truss analysis and other problems at the prerogative of the instructor.

Course Texts and/or Other Study Materials

Textbook (required) - Options:
Engineering Mechanics: Statics Plus MasteringEngineering with Pearson eText - Access Card Package, 14th Edition, by Russell C. Hibbeler, Pearson, 14th edition, 2015 ISBN #: 978-0-13-416068-9 (Hard Cover) (Price: $239.95 from www.mypearsonstore.com)

Engineering Mechanics: Statics, Student Value Edtion Plus MasteringEngineering with Pearson eText - Access Card Package, 14th Edition, by Russell C. Hibbeler, Pearson, 14th edition, 2015 ISBN #: 978-0-13-420929-6 (Loose Leaf - 3-ring binder) (Price: $171.27 from www.mypearsonstore.com)

Homework Website (required):
MasteringEngineering, www.masteringengineering.com
Course ID: ###########

Materials and Supplies (required):
In addition to the required text and access to MasteringEngineering as indicated above, a simple pocket-sized non-programmable scientific calculator is required for exam purposes, soft #2 pencils, a see through 12 inch ruler and graph paper. Smart phones are not permitted to be substituted for calculators. Also, access is needed to a laptop or desktop computer with spreadsheet/plotting software such as Excel installed and possibly the latest edition of the free-ware open software GNU Octave (MATLAB compatible) installed and/or other chosen software per the instructor's prerogative.

Supplemental Notes:
The instructor may provide additional notes on topics outside the contents of the course text including, but not limited to notes on the topics of Stress, Strain and Elasticity as well as matrix solutions to truss and other problems. Additional tutorials on the use of Excel and GNU Octave (MATLAB compatible) and/or other chosen software may be provided.

Bibliography and Supporting Materials:
Vector Mechanics for Engineers: Statics, by Ferdinand P. Beer and E. Russell Johnston, Jr., McGraw-Hill Education, 11th edition, 2015. ISBN # 978-0077687304

Course Contents:

1. General Principles
2. Force Vectors
3. Equilibrium of a Particle
4. Force System Resultants
5. Equilibrium of a Rigid Body
6. Structural Analysis (with supplemental notes)
7. Internal Forces
8. Friction
9. Center of Gravity and Centroid
10. Virtual Work

Research, Writing, and/or Examination Requirement(s)

The instructor may require a course project (individual or group) with a final demonstration and/or oral presentation and/or written report.

Grading Policy

The general grading for the course is weighted according to the following scheme:

1. Three or more non-cumulative (modular) exams and possibly quizzes..... 30%
2. Homework, tutorial completion, project 35%
2. Final Exam (Cumulative)..... 35%

There are no make-ups issued for missed exams.
An instructor may issue penalties for late assignments, and the instructor will provide that policy.
An instructor may modify this general Grading Policy, and the instructor will provide that policy.

Attendance Policy

All students are expected to attend punctually every scheduled meeting of each course in which they are registered. Attendance and lateness policies and sanctions are to be determined by the instructor for each section of each course. These will be established in writing on the individual course outline. Attendance will be kept by the instructor for administrative and counseling purposes.

Other College, Divisional, and/or Departmental Policy Statements

Cheating and Plagiarism: This course follows the definition and consequences of cheating and plagiarism as described in the Bergen Community College Catalog under **ACADEMIC REGULATIONS**.

Student and Faculty Support Services

Services for Students with Disabilities:
Bergen Community College aims to create inclusive learning environments where all students have maximum opportunities for success. Any student who feels he or she may need an accommodation based on the impact of a disability should contact the Office of Specialized Services at 201-612-5269 or via email at ossinfo@bergen.edu for assistance.

Course Outline and Calendar

Note: Instructor will decide on which homework problems shall be assigned, including which of these must be hand-written and which must be online.

Week	Class	Topics	Text Reading Assignments (Chapter Section, Topic, Page Number)	Online Tutorial Homework	Chapter Homework Problems
1	1	General Principles	1.1 Mechanics 3 1.2 Fundamental Concepts 4 1.3 Units of Measurement 7 1.4 The International System of Units 9 1.5 Numerical Calculations 10 1.6 General Procedure for Analysis 12		
	2	Force Vectors	2.1 Scalars and Vectors 17 2.2 Vector Operations 18 2.3 Vector Addition of Forces 20 2.4 Addition of a System of Coplanar Forces 32		
2	3		2.5 Cartesian Vectors 43 2.6 Addition of Cartesian Vectors 46		
	4		2.7 Position Vectors 56 2.8 Force Vector Directed Along a Line 59 2.9 Dot Product 69		

Week	Class	Topics	Text Reading Assignments (Chapter Section, Topic, Page Number)	Online Tutorial Homework	Chapter Homework Problems
3	5	Equilibrium of a Particle	3.1 Condition for the Equilibrium of a Particle 85 3.2 The Free-Body Diagram 86 3.3 Coplanar Force Systems 89		
	6		3.4 Three-Dimensional Force Systems 103		
4	7	Exam 1			
	8	Force System Resultants	4.1 Moment of a Force—Scalar Formulation 117 4.2 Cross Product 121 4.3 Moment of a Force—Vector Formulation 124 4.4 Principle of Moments 128 4.5 Moment of a Force about a Specified Axis 139		
5	9		4.6 Moment of a Couple 148 4.7 Simplification of a Force and Couple System 160 4.8 Further Simplification of a Force and Couple System 170 4.9 Reduction of a Simple Distributed Loading 183		
	10	Equilibrium of a Rigid Body	Equilibrium in Two Dimensions 5.1 Conditions for Rigid-Body Equilibrium 199 5.2 Free-Body Diagrams 201 5.3 Equations of Equilibrium 214 5.4 Two- and Three-Force Members 224		
6	11		Equilibrium in Three Dimensions 5.5 Free-Body Diagrams 237 5.6 Equations of Equilibrium 242 5.7 Constraints and Statical Determinacy 243		
	12	Exam 2			
7	13	Structural Analysis	6.1 Simple Trusses 263 6.2 The Method of Joints 266 6.3 Zero-Force Members 272		
	14		Supplemental notes on matrix equations of The Method of Joints Supplemental notes on Stress, Strain and Elasticity		
8	15		Supplemental notes on the use of GNU Octave for the solution of 2-D plane truss problems		
	16		6.4 The Method of Sections 280 6.5 Space Trusses 290 6.6 Frames and Machines 294		

Week	Class	Topics	Text Reading Assignments (Chapter Section, Topic, Page Number)	Online Tutorial Homework	Chapter Homework Problems
9	17	Project Work Session	Supplemental notes on course project topic		
	18	Internal Forces	7.1 Internal Loadings Developed in Structural Members 331 7.2 Shear and Moment Equations and Diagrams 347		
10	19		7.3 Relations between Distributed Load, Shear, and Moment 356 7.4 Cables 367		
	20	Exam 3			
11	21	Friction	8.1 Characteristics of Dry Friction 389 8.2 Problems Involving Dry Friction 394		
	22		8.3 Wedges 416 8.4 Frictional Forces on Screws 418 8.5 Frictional Forces on Flat Belts 425		
12	23		8.6 Frictional Forces on Collar Bearings, Pivot Bearings, and Disks 433 8.7 Frictional Forces on Journal Bearings 436 8.8 Rolling Resistance 438		
	24	Center of Gravity and Centroid	9.1 Center of Gravity, Center of Mass, and the Centroid of a Body 451 9.2 Composite Bodies 474 9.3 Theorems of Pappus and Guldinus 488		
13	25		9.4 Resultant of a General Distributed Loading 497 9.5 Fluid Pressure 498		
	26	Virtual Work	11.1 Definition of Work 567 11.2 Principle of Virtual Work 569 11.3 Principle of Virtual Work for a System of Connected Rigid Bodies 571		
14	27		11.4 Conservative Forces 583 11.5 Potential Energy 584 11.6 Potential-Energy Criterion for Equilibrium 586 11.7 Stability of Equilibrium Configuration 587		
	28	Final Exam			
15	29	Project Work Session			
	30	Project Presentations			