



**UNIVERSITY OF ARIZONA**  
**Department of Civil Engineering and Engineering Mechanics**  
**CE214 - STATICS**  
**POLICY & SYLLABUS**  
Spring 2018

**Catalog Description:** (3 units) Equilibrium of a particle, equivalent and resultant force systems, equilibrium, geometric properties of areas and solids, trusses, frames and machines, shear force and bending moments, friction.

**Instructor:** George N. Frantziskonis, Room 206A, Civil Engineering Building  
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**Email:** [frantzis@email.arizona.edu](mailto:frantzis@email.arizona.edu), <http://civil.arizona.edu/george-frantziskonis>  
**Lecture:** Section 2, TuTh 9:30-10:45 Harvill building, Room 302  
**Office hours:** M 1:00 – 2:00pm, W 1:00-2:30pm. See TA office hours for recitations and homework.

**Teaching Assistant:** Touhid Ahamed, Room 214, Civil Engineering Building  
**Email** TAHAMED@email.arizona.edu  
**Office hours** Mo 3:30pm – 3:30pm, Tu 1:30pm – 3:30pm, We 1:30pm – 4:30pm in Civil Engineering building room 214

**Recitations** Tuesdays 4:00pm-4:50pm, Harvill, Rm 140  
Thursdays 4:00pm-4:50pm, Chavez, Rm 306  
Fridays 2:00pm-2:50pm, Harvill, Rm 130

**Prerequisites:** Math 129 (Math 223 recommended) and Phys 141

**Textbook:** Engineering Mechanics - Statics, by R.C. Hibbeler, 14<sup>th</sup> Edition, Pearson Publications.

**Weights for course grade:**

10 points – homework,  
50 points – 3 tests @ 16.67 points each,  
25 points – final exam,  
8 points – attendance (main lecture and recitations),  
7 points – quizzes

**Scale for final grade:**

A Outstanding	90 - 100
B Above Average	80 < 90
C Average	70 < 80
D Below Average	60 < 70
E Failure	< 60

*The cutoffs for grades may be lower, but will not be higher (I will not raise the standards mid-semester). The course grades are not curved. I feel very strongly that learning should be measured with a standard (maybe a high standard, but a standard none the less) and that you should not be directly competing with anyone other than yourself. I fully expect everyone in the course to be successful and if you are having problems, then you must initiate a process for improvement.*

**LEARNING GOALS**

In this course, we will use fundamental laws (such as Newton's laws) and concepts to determine the actions of forces on rigid bodies. The important goals to be achieved are:

1. An understanding of the principles of mechanics
2. Application of these principles to analyze physical systems

### 3. Develop problem-solving skills

#### **COURSE CONTENT**

<u>Week of</u>	<u>ARTICLES</u>
Jan. 10,15	Mechanics, Scalars and Vectors, Newton's law, Units, Accuracy Limits and approximation, Problem solving, Force systems, Vector, Rectangular components
22	Moment, Couple, Resultants
29	Dot product, Moment in 3D, Cross product, Couple, Resultants
Feb. 5	REVIEW, Equilibrium in 2D, Free body diagram, Equilibrium
12	Equilibrium in 3D
<b>Exam 1 Thursday Feb. 15</b>	
19	Truss structures, Method of joints
26	Method of Sections, Frames and machines
Mar. 12	Frames and machines, Review
19	Centroids of lines, areas, volumes
<b>Exam 2 Tuesday Mar. 20</b>	
26	Composite bodies, Theorem of Pappus
Apr. 2	Beams, external loads
9	Beams, internal effects, shear, bending moment diagrams
16	Fluid statics, fluid pressure, hydrostatic pressure, buoyancy
<b>Exam 3 Tuesday Apr. 17</b>	
23	Friction, static, kinetic friction, friction angles
30	Wedges, screws, Review
<b>Final Exam Tuesday May 8, 2018, 8:00am-10:00pm in the regular classroom (per Schedule of Final Exams)</b>	

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#### **HOMEWORK**

Homework problems will be collected, graded and returned. Homework is to be done in a neat, orderly fashion on Engineering Problem paper using only one side of a sheet. Homework is due at the beginning of the period in which it is due or as mentioned orally in class. Late homework is not accepted for any reason and receives a grade of zero.

A problem statement in sufficient detail must precede each problem solution so that grading can be done without reference to the textbook. The purpose of the problem statement is to ensure that the problem is understood.

Failure to comply with the policy on homework may result in downgrading and/or refusal to accept the work.

#### **EXAMINATIONS**

You must take three examinations during the semester and a final examination. All examinations will be held during the regular class session in the lecture room assigned to this course. All exams are closed book and calculators are permitted. **However, only calculators approved by the Civil Engineering department are allowed. A list of approved calculators will be emailed to all students shortly. The list can also be found in:**

<http://ncees.org/exams/calculator/>

No credit is given for correct answers obtained by incorrect reasoning and/or compensating errors. Partial credit will be given for work that pertains to the correct solution. The final exam is mandatory and there will be no change in time as this would be a violation of University policy. A similar policy holds

in this class for the tests, yet under exceptional circumstances other arrangements may be made, on a case-by-case basis. There will be no make up for missed examinations. The final examination score will be adjusted for, at most, one acceptable excused missed examination. An unexcused missed examination or a second missed examination is scored as zero.

Examinations are regarded as engineering reports. Procedures and presentation of solutions should be precise and legible. Penalties are assessed for:

- (I) algebra and arithmetic errors;
- (II) answers presented without proper units, sign or direction;
- (III) incomplete free body diagram; and
- (IV) messy or illegible presentation.

**A summary of your grades will be posted regularly in D2L. You must check that your grades are correct. You must notify the instructor of any omission or error within 10 days after grades are posted. Changes may not be accepted after that.**

### **ACADEMIC INTEGRITY**

One sanction for dishonest academic work permitted under the University CODE OF ACADEMIC INTEGRITY is a failing grade in the course. The grade of E will be assigned for dishonest academic work.

### **ATTENDANCE POLICY**

The following is the University policy on absence:

Students are expected to be regular and punctual in class attendance. The University believes that students themselves are primarily responsible for attendance. Instructors will provide students with written statements of their policies with respect to absences. Excessive or extended absence from class is sufficient reason for the instructor to recommend that the student be administratively dropped from the course. For those courses in which enrollment is limited, missing the first class session may be interpreted as excessive absence. If this action is filed in the Registrar's Office by the end of the fourth week of classes, it will result in cancellation of registration in the course. If the student is administratively dropped after the end of the fourth week of classes, it will result in a failing grade being awarded in that course.

Policy of this class:

- If you need to be absent from the class for justifiable reasons (sickness, family obligations, etc.), you must inform the instructor in advance or immediately after the day of absence.
- It is required that you attend all classes and recitations. The instructor may report to the Registrar's Office if absence is excessive, which may result in administrative drop from the class. Attendance accounts for 5% of the course grade.

Auditors are also expected to attend the classes.

***THIS POLICY WILL BE STRICTLY ENFORCED.***

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### **WHY MECHANICS?**

Mechanics was the first branch of analytical science and is the foundation of all branches of engineering. It comprises of two parts, Statics and Dynamics. An understanding of Mechanics is essential for all engineers, since it is fundamental to the design and construction of a wide variety of every day structures, such as buildings, bridges, electric power transmission towers, cables, machines, airplanes, ships, trains, chains, pencil sharpeners, doors, windows, etc. It also has extensive applications in the oil, gas, nuclear, and chemical industries, including offshore oil platforms, pressure vessels, storage tanks and pipelines. New applications emerge each year; for example, rapid advances are being made in the following fields: "smart" structures, which can sense and

respond automatically to damage, temperature changes, etc.; large deployable structures for use in outer space; biomechanics; environmental systems.

### **Engineering and Mechanics; the inseparable partnership.**

Engineers need to be familiar with all phases of a project including:

- specification of the purpose of a new structure
- determination of the applied loads (e.g., from design codes, or tests on models or prototypes)
- identification of a number of possible solutions (creativity and experience help)
- materials selection
- Modeling and analysis of possible solutions
- comparison of solutions on technical, economic, environmental and aesthetic grounds
- optimization of the chosen solution (computers widely used)
- construction, testing and commissioning
- service and maintenance
- decommission (and feedback to help future designers)

Engineers need to be aware of possible failure mechanisms, including:

- failure of ductile materials, in tension, shear or compression
- brittle failure
- fatigue (caused by repeated applied loading, or vibration)
- buckling
- failures caused by dynamic loads, such as blast or impact
- deterioration due to wear or corrosion
- excessive deflection
- unacceptable effects on the environment
- aesthetic failures

It is surprisingly easy to overlook a possible loading, or possible failure mechanism, without considerable experience. Unfortunately, many spectacular failures have occurred, and continue to occur where engineers overlook a simple factor.

There are many uncertainties in the field of design. The nature and magnitude of loadings applied to a structure cannot always be predicted with great accuracy (e.g., wind loads on a bridge), nor too can the support conditions. Material properties are variable (e.g., concrete) and structural geometry is not known precisely. Engineers must appreciate these uncertainties when selecting appropriate safety factors in design.

### **WHY STATICS?**

Statics is the study of forces and their effects on systems in equilibrium (without producing motion of the system). Statics includes systems of forces, which are equivalent to one another. Engineers need to *understand* the way in which loaded structures behave, i.e., the way structures *carry* loads. This, in turn, requires understanding of:

- application of the principles of *equilibrium*, to determine the internal forces caused by applied loads
- material properties* of the structure, to determine strains and deformation of each component or member of the structure
- the geometric and kinematic relationships between the various components or members, which will determine the overall deflections of the structure, from considerations of "*compatibility*".