

## **ENGR 221-3 Principles of Engineering I**

**Department: Mathematics, Physics and Engineering**

**Credit Hours: 3**

**Required or Elective (circle one)**

### **Current Catalog Description:**

Unified presentation of conservation principles applied to engineering mechanics systems in statics and dynamics.

### **Course Schedule:**

3 lecture hr/ wk, 2. lab hr/week

### **Textbook(s):**

### **Instructor:**

Dr. Mircea Agapie

### **Course Web Page:**

### **Prerequisites by Topic:**

ENGR 112-3 – Foundations of Engineering II

PHYS 122-4 – Physics I (calculus based)

MATH 209-4 – Calculus II (Corequisite)

### **Course Grading:**

Homework	25%
Quizzes	10%
Notebook	5%
Mid-terms and final	20% each

### **Program Outcome and Course Learning Goals Map:**

The Program Outcomes for Engineering Physics are:

\* A-L omitted here to meet 2-page requirement \*

### **Course Learning Goals:**

Upon completion of this course with a C or better, students will

1. be expected to develop an understanding of mechanics including static and dynamic equilibrium
2. be able to state precisely Newton's Laws and be able to identify when each applies
3. be expected to develop an understanding of basic principles of conservation including
  - a. conservation of mass
  - b. conservation of energy
  - c. conservation of linear and angular momentum
4. be expected to learn how and when to draw free-body diagrams and control volumes
5. be expected to further develop capabilities with vector arithmetic including
  - a. use of dot (scalar) and cross products
  - b. use of components in Cartesian and other coordinate systems
6. be expected to develop an understanding of moments of area and inertia and be able to use in determining mass resistance to acceleration
7. be expected to classify problems based upon concepts of kinematics and dynamics
8. be expected to develop an understanding of the relationship between work and energy and the influence of mass in determining quantities of work and energy required and available
9. be expected to develop an understanding of the relationship between force and acceleration
10. be expected to develop an understanding of impulse and momentum
11. be expected to develop an understanding of couples and torques

12. be expected, at varying levels, to synthesize the above material to solve relatively more complex problems requiring a combination of principles

**Topics Covered:**

<b>Topic</b>	<b>Course Goal</b>	<b>Program Outcomes</b>	<b># Lec/Lab (approx.)</b>
Review external forces on free-body diagrams, force vectors, vector and scalar operations	1, 2, 4, 5, 7, 9	a, c, e, g, k	3/1
Equilibrium of a particle, force system resultants, equilibrium of a rigid body.	1, 2, 4, 5	a, c, e, g, k	3/1
Structural analysis including trusses	1, 2, 4, 5, 12	a, c, e, g, k	3/1
Internal forces, shear and moment equations and diagrams, relationships between distributed loads, shears, and moments	1, 2, 4, 5, 11, 12	a, c, e, g, k	3/1
Friction	1, 2, 4, 5, 7	a, c, e, g, k	1/0.5
Center of mass, center of gravity, centroids, moments of area and inertia	1, 6	a, c, e, g, k	2/0.5
Virtual work	1, 2, 7, 8	a, c, e, g, k	2/0
Kinematics of particles, rectilinear motion, curvilinear motion, projectiles, cylindrical components	1, 2, 4, 5, 7, 9	a, c, e, g, k	3/1
Kinetics of particles – force and acceleration, Newton's Laws, the Equation of Motion, coordinate systems	1, 2, 4, 5, 7, 9, 12	a, c, e, g, k	4/1
Work and energy of a particle, power, conservation forces, potential energy, conservation of energy	1, 2, 3, 5, 8, 12	a, c, e, g, k	3/1
Impulse and momentum, impact, linear and angular momentum	1, 2, 3, 4, 5, 9, 11, 12	a, c, e, g, k	3/1
Rigid-body motion, translation, rotation, relative motion analysis for velocity and acceleration, rotating axes	1, 2, 3, 4, 5, 9, 11, 12	a, c, e, g, k	3/1
Planar kinetics: force and acceleration	1, 2, 3, 4, 5, 7, 9, 12	a, c, e, g, k	3/1
Planar kinetics: work and energy	1, 3, 8, 12	a, c, e, g, k	3/0.5
Planar kinetics: impulse and momentum	1, 2, 3, 4, 5, 9, 10, 12	a, c, e, g, k	3/0.5
Lab and recitations	12	a, c, e, g, k	0/13
Small design projects	12	a, c, d, e, g, k	0/2
<b>Exams</b>	1 - 12	a, e, g, k	1/3

**Academic Honesty:**

Cheating, plagiarism (submitting another person's materials or ideas as one's own), or doing work for another person who will receive academic credit are all-impermissible. This includes the use of unauthorized books, notebooks, or other sources in order to secure or give help during an examination, the unauthorized copying of examinations, assignments, reports, or term papers, or the presentation of unacknowledged material as if it were the student's own work. Disciplinary action may be taken beyond the academic discipline administered by the faculty member who teaches the course in which the cheating took place.

**Students with Disabilities Policy:**

It is the policy of Tarleton State University to comply with the Americans with Disabilities Act (ADA) and other federal, state, and local laws relative to the provision of disability services. Students with disabilities attending Tarleton State University may contact the Office of Disability Services at (254) 968-9478 to request appropriate accommodation. Furthermore, formal accommodation requests cannot be made until the student has been officially admitted to Tarleton State University.

**Contribution of Course to Meeting the Professional Requirement:**  
Engineering Topics: 100%

**Status of Continuous Improvement Review of this Course:**

**Prepared by:** *Robert DeOtte*

**Date:** *08/23/2004*

**Reviewed by:** *Denise Martinez*

**Date:** *03/09/05*

**Reviewed by:** *Beth Jones*

**Date:** *Aug. 2006*