X. COURSE SYLLABI

B. GENERAL ENGINEERING COURSES

GEEN 1211: Introduction to Engineering
GEEN 2311: Statics and Dynamics of Rigid Bodies I
GEEN 2312: Introduction to Computing
GEEN 2313: Thermodynamics I
GEEN 2314: Circuits I
GEEN 3211: Engineering Economy
GEEN 3311: Introduction to Fluid Mechanics
ASSE 4311: Learning Outcome Assessment III

Course Title: GEEN 1211: Introduction to Engineering

Semester Credit Hours: 2 (2,0)

I. Course Overview

This course is an introduction to engineering and engineering design at the freshman level. The disciplines of civil, electrical, and mechanical engineering are defined. A systems approach to engineering design is used to solve open-ended engineering design problems related to civil, electrical, and mechanical engineering. Principles of teaming are emphasized throughout the course in accord with the design problem.

II. PMU Competencies and Learning Outcomes

The competencies addressed in the course include professional competencies such as global awareness, critical thinking and problem solving, communication both oral and written, and teamwork. These competencies are centered around open-ended design problems at the freshman level.

III. Detailed Course Description

The subject matter includes explanations and examples of how the principles of mathematics, chemistry, and physics are applied in civil, electrical and mechanical engineering. Examples are at the elementary level. The systems design approach is taught and applied to open-ended freshman design problems in engineering.

IV. Requirements Fulfilled

This course is required for all majors in civil, electrical, and mechanical engineering.

V. Required Prerequisites

Completion of the PMU Preparation Year Program.

VI. Learning Outcomes

- an ability to apply knowledge of mathematics, science, and engineering.
- an ability to design a system, component, or process to meet desired ends.
- an ability to function on teams.
- an ability to identify, formulate, and solve engineering problems.
- an understanding of professional and ethical responsibility.
- an ability to communicate effectively.
- a recognition of the need for, and an ability to engage in life-long learning.

VII. Assessment Strategy

The assessment strategy includes homework, tests and/or papers, a presentation and a final examination.

- Homework – provides the student with an opportunity to solve basic problems assessing his critical thinking and analysis skills
- Design Projects – while these projects are elementary in nature, they provide opportunities for the students to work in teams, analyze and solve problems, and present solutions both orally and written
- Examinations – these provides an opportunity to assess the student's ability to work independently to solve engineering problems

VIII. Course Format

The course is a lecture course, however students is required to work on class projects outside of the class lecture time.

Classroom Hours (2 hours per week)	**Class: 2** **Lab: 0**

IX. Topics to Be Covered

A. Basics of teaming
B. Units and dimensions
C. Conventions in methods of analysis and measurement
D. Temperature and pressure
E. Physical and chemical properties of compounds and mixtures
F. Introduction to civil engineering
G. Introduction to electrical engineering
H. Introduction to mechanical engineering
I. Systems design
J. Techniques for solving problems
K. Material and energy balances

X. Laboratory Exercises

This course does not require a separate lab**.**

XI. Technology Component

Students use their personal laptop computers for report writing, presentations, and any calculations such as graphs.

XII. Special Projects/Activities

Students are assigned three design projects, about one per month. These projects completed in teams and require both oral and written reports.

XIII. Textbooks and Teaching Aids

A. Required Textbook

1. P. McCarthy, *Engineer Your Way to Success* published by the National Society of Professional Engineers
2. A. Eide, R. Jenison, etc., *Engineering Fundamentals and Problem Solving*, McGraw Hill Book Company.

B. Alternative Textbooks

None.

C. Supplemental Print Materials

None.

D. Supplemental Online Materials

None.

Course Title: GEEN 2311: Statics and Dynamics of Rigid Bodies I

Semester Credit Hours: 3 (3,0)

I. Course Overview

The course involves equilibrium of rigid bodies, resultants of force systems, centroids, and moments of intertia. Kinematics and kinetics of particles and rigid bodies also are covered.

II. PMU Competencies and Learning Outcomes

This is the first problem-solving course in mechanical engineering and a core course for all engineering majors. Critical thinking and problem solving are the major core competencies addressed.

III. Detailed Course Description

The course is the first mechanics course offered for all majors and the only mechanics course taken by electrical engineering majors. As such, it is a combined Statics and Dynamics class. This first class includes a thorough coverage of vectors and the application of dot and cross products to mechanics problems. Particle and rigid-body dynamics are covered, as well as kinematics, curvilinear motion, cylindrical motion, and relative motion.

IV. Requirements Fulfilled

This course is required for all majors in civil, electrical, and mechanical engineering.

V. Required Prerequisites

- PHYS 1421: Physics for Engineers I
- MATH 1423: Calculus II

VI. Learning Outcomes

- To learn the basic principles of statics and dynamics in this first mechanics course
- To develop the problem-solving skills to solve statics and dynamics problems

VII. Assessment Strategy

This course uses homework, short quizzes, and examinations to test the student's basic skills in statics and dynamics.

- Homework – Extensive homework is assigned to sharpen the student's critical thinking and problem-solving skills
- Short quizzes – Because of the problem-solving nature of this course, it lends itself to short quizzes to test the student's critical thinking and problem-solving skills
- Examinations – Additional, longer examinations assess each student's ability to think individually and to determine their ability to apply some of the basic knowledge in math and physics.

VIII. Course Format

This is a lecture course with many homework problems assigned to be completed outside of class.

Classroom Hours (3 hours per week)	**Class: 3**
	Lab: 0

IX. Topics to Be Covered

A. Force Vectors
B. Dot and Cross Products and Moments
C. Particle and Rigid Body Equilibrium
D. Analysis of Trusses
E. Friction
F. Centroids
G. Kinematics, Curvilinear, Cylindrical Motion
H. Relative Motion
I. Force and Acceleration

X. Laboratory Exercises

This course does not have a laboratory.

XI. Technology Component

This course is a problem-solving course that relies heavily on hand-held calculators. Computers and calculators are used for graphing and finding numerical solutions.

XII. Special Projects/Activities

No projects are assigned for this course.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Hibbeler, R. C., *Engineering Mechanics: Statics and Dynamics*, Tenth Edition. Upper Saddle River, New Jersey: Prentice Hall, 2003. ISBN: 0-131-04624-1

B. Alternative Textbooks

None.

C. Supplemental Print Materials

None.

D. Supplemental Online Materials

None.

Course Title: GEEN 2312: Introduction to Computing

Semester Credit Hours: 3 (3,0)

I. Course Overview

The course is an introduction to computer systems, problem solving methods and algorithm development.. Structured programming is taught using the programming language C, or C++. It includes designing coding, debugging and documenting programs using techniques of software development cycle. MATLAB also is taught, enabling students to solve mathematical problems with this tool.

II. PMU Competencies and Learning Outcomes

Critical thinking and problem solving is the essence of the course. Students solve real problems by writing and running actual programs. The course also addresses professional competence and information technology.

III. Detailed Course Description

The course teaches the fundamentals of C programming and how to use MATLAB to solve complicated mathematical problems. This includes general problem-solving techniques, designing, coding, debugging, and documenting programs, and the use of good programming style; especially as applied to engineering applications.

IV. Requirements Fulfilled

This course is required for all majors in civil, electrical, and mechanical engineering.

V. Required Prerequisites

MATH 1324: Calculus III

VI. Learning Outcomes

- an ability to apply knowledge of mathematics, science, and engineering.
- an ability to identify, formulate, and solve engineering problems.
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering.

VII. Assessment Strategy

Homework and quizzes are used to assess the course as well as graded programs, examinations and final examinations. The student's knowledge of C programming and MATLAB are used in the final capstone design course of each engineering discipline.

VIII. Course Format

The is a lecture course, but students are required to work on class projects outside of class using a computer.

Classroom Hours (3 hours per week) **Class: 3**
Lab: 0

IX. Topics to Be Covered

A. Introduction to computers and programming
   1. History and components
   2. Software, languages
   3. Development cycle

B. C program syntax
   1. Language elements and identifiers
   2. Variables, statements
   3. Form, expressions

C. Control structures and data files:
   1. Selection, repetition
   2. Simple I/O

D. Modular programming with functions
   1. Void and value returning functions
   2. Parameters
   3. Introduction to recursion
   4. Design using functions
   5. Functions and programming style

E. Arrays
   1. Designing using arrays
   2. Indexing
   3. Passing arrays as parameters
   4. Array of characters
   5. Integers and other types
   6. Arrays of arrays

F. File I/O
   Using text files on disk

G. Characters and text processing
   1. Input and output of characters and strings
   2. String functions

H. Introduction to MATLAB

X. Laboratory Exercises

This course does not require a separate laboratory.

XI. Technology Component

Students use their personal laptop computers extensively in this course. They use C programming language and MATLAB software and program solutions in class and for homework.

XII. Special Projects/Activities

Students are assigned six main programs in C language and three in MATLAB. These programs is graded by the instructor.

XIII. Textbooks and Teaching Aids

A. Required Textbook

1. Hanley and Koffman, *Problem Solving and Program Design in C*, 3rd Edition, Addison Weslkey, 1999.
2. Basic MATLAB software manual

B. Alternative Textbooks

None.

C. Supplemental Print Materials

None.

D. Supplemental Online Materials

1. C programming software
2. MATLAB software

Course Title: GEEN 2313: Thermodynamics I

Semester Credit Hours: 3 (3,0)

I. Course Overview

This course introduces students to the concepts of heat and energy and how they relate and interact. Mass systems, control volumes, reversible and irreversible processes, open and closed systems, and open and closed cycles are covered.

II. PMU Competencies and Learning Outcomes

Critical thinking and problem solving are the cornerstones of this course. The students is introduced to thermodynamic properties, processes, and cycles through the laws of conservation of mass and energy, the balance of momentum, and the second law of thermodynamics. They learn to solve problems involving changes in thermodynamic properties using these concepts. This course builds on the prior knowledge from chemistry, physics, and calculus. Written homework assignments are frequent. No formal oral presentations or group assignments are included in the course.

III. Detailed Course Description

The concepts of heat, work and energy are used within the context of the laws of thermodynamics to teach the students to solve problems in this very important area of mechanical engineering. The students learn about mass systems, control volumes, reversible and irreversible processes, open and closed systems, and open and closed cycles.

IV. Requirements Fulfilled

This course is required for all majors in civil, electrical, and mechanical engineering.

V. Required Prerequisites

- MATH 1324: Calculus III
- CHEM 1421: Chemistry for Engineers I
- PHYS 1422: Physics for Engineers II

VI. Learning Outcomes

- To teach students the fundamental concepts of thermodynamics and the parameters associated with them.
- To teach familiarity with the laws of thermodynamics and their application to the properties of real physical systems.
- To teach students how to analyze simple thermodynamic systems, accounting for energy flows and storage in reversible and irreversible processes.

VII. Assessment Strategy

The course is a lecture course in which the students are expected to be participants in classroom discussion. There are regular homework assignments and the students receive feedback from the instructor regarding their performance on the homework. The major part of the course grade is based on the performance of the student from tests taken in an in-class setting.

- Examinations – In-class exams are given to test the student's ability to solve problems using thermodynamics and to assimilate the material from previous courses, particularly, chemistry, physics, and mathematics.
- Homework – Problems are assigned for individual student submission.

VIII. Course Format

This course is a lecture course meeting three hours per week in a lecture room setting. The students are required to work on homework problems in an out-of-class setting.

Classroom Hours (3 hours per week) **Class:** 3
Lab: 0

IX. Topics to Be Covered

A. Review of concepts of mechanics, dimensions and unit systems.
B. Work. Closed and open systems. Reversible work modes. Heat as an energy transfer. First law of thermodynamics.
C. Properties and states. Concepts of mechanical and thermal equilibrium. Extensive and intensive variables. State postulate.
D. Properties of simple substances. Equations of state. pvT surfaces. Thermodynamic variables. The perfect gas. Mixture states.
E. Energy analysis of open and closed systems.
F. Concept of entropy. Reversible and irreversible processes. Statistical definition of entropy. Consequences of the second law. Thermodynamic definitions of temperature and pressure. Evaluation of entropy changes. Second law analysis of closed and open systems. Availability of energy.
G. Thermodynamics of state. Gibbs' equation. Properties of ideal and real gases. Van der Waals' equation and the principle of corresponding states. Maxwell's relations. Generalized thermodynamic property charts.
H. Elementary thermodynamic systems. Carnot cycle. Process models of energy transformation devices. Introduction to the Rankine cycle and some of its modifications. Gas cycles and vapor refrigeration cycles.

X. Laboratory Exercises

This course does not require a separate lab.

XI. Technology Component

The students are required to use their laptop computers in doing and submitting their homework assignments. Examinations are given in the classroom using no electronic assistance.

XII. Special Projects/Activities

There are no special projects associated with this course.

XIII. Textbooks and Teaching Aids

A. Required Textbook

M.J. Moran and H.N. Shapiro, J., *Fundamentals of Engineering Thermodynamics*, Fourth Ed., Wiley and Sons, 2000.

B. Alternative Textbooks

None.

C. Supplemental Print Materials

None.

D. Supplemental Online Materials

None.

Course Title: GEEN 2314: Circuits I
Also listed as COEN 2311: Circuits I

Semester Credit Hours: 3 (3,1)

I. Course Overview

This course covers important theory in DC and AC circuits analysis. Topics include a review of the solution of simultaneous equations; Kirchoff's Current and Voltage Laws; nodal and mesh circuit analysis; superposition; source transformations; Thevenin and Norton Equivalent circuits; ideal op-amps; and RC, RL, and RLC circuits.

II. PMU Competencies and Learning Outcomes

Skills in understanding of DC and AC circuit theory are major components of professional competence for electrical and computer engineers. Throughout the semester, students are encouraged to apply critical thinking and problem solving skills in the class discussions and assignments. Professional communication skills (written and oral) are encouraged through discussions and assignments. Effective use of the most modern technology is integral to the development of the knowledge and skills acquired in this class.

III. Detailed Course Description

This course covers important theory in DC and AC circuits analysis. Topics include a review of the solution of simultaneous equations; Kirchoff's Current and Voltage Laws; nodal and mesh circuit analysis; superposition; source transformations; Thevenin and Norton Equivalent circuits; ideal op-amps; and RC, RL, and RLC circuits.

IV. Requirements Fulfilled

This is a required course for majors in computer engineering

V. Required Prerequisites

Successful completion of:

- MATH 1324: Calculus III
- PHYS 1422: Physics for Engineers II

Concurrent registration in:

- COEN 2111: Circuits Lab

Completion of or concurrent registration in:

- MATH 2332: Differential Equations

VI. Learning Outcomes

At the end of this course, students will:

- Be able to accurately define current, voltage, energy, and power in DC and AC circuits
- Be able to solve for current, voltage, stored energy, and power in DC and AC circuits using the following techniques: Kirchoff's current and voltage laws; node voltage analysis; mesh current analysis; superposition; and source transformations.
- Be able to define time constants for RC and RL circuits
- Be able to calculate the total response of RC, RL, and RLC circuits

In addition to these outcomes, students develop an intuitive understanding of DC and AC circuits such that they can use this intuition in the analysis and design of circuits

VII. Assessment Strategy

The assessment strategy measures students' understanding of circuit theory and apply the knowledge acquired in the analysis and design. This is achieved in the following ways:

- Class participation is used to help indicate to the instructor and the student his or her level of involvement and understanding.
- Homework assignments are used to provide feedback to students and to indicate individual progress in meeting course goals
- Mid-term examinations are used to indicate students' developing level of mastery of the topics of the course
- An end-of-semester final examination is used to measure the student's mastery in understanding and application of the knowledge integral to the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. In cooperation with the instructor, each student select two design assignments to become a part of the student's portfolio.

VIII. Course Format

The course consists of lectures, class discussions, homework assignments to be completed outside of class, and examinations. Students prepare for class by reading the text and additional materials and by completion of assignments so that they may be discussed in class are expected as indicators of students' commitment to professional growth. In addition, a recitation session is used to give students practice and supervised instruction in the analysis of DC and AC circuits.

Classroom Hours: (4 hours per week) **Class Lecture:** 3
Recitation Session: 1

IX. Topics to be Covered

A. Definition of physical quantities: current, voltage, energy, and power
B. Basic circuit components
C. Voltage and current laws
D. Nodal and mesh analysis
E. Superposition and source transformation
F. Thevenin and Norton equivalent circuits
G. Operational amplifiers
H. Capacitors and inductors
I. RL and RC circuits
J. RLC circuits

X. Laboratory Exercises

There are no laboratory exercises associated with this course. Electrical engineering students receive this experience in EEEN 2111: Circuits I Lab.

XI. Technology Component

Students in this class are expected to have a computer account with the appropriate server to enable class communications. Media assisted instruction is a tool in this class. Use of appropriate technology for analysis of data and completion of problems is required, for example, use of a scientific calculator, and use of student owned laptop. Students utilize the application software packages (MATLAB and PSPICE) in homework problems.

XII. Special Projects/Activities

A student project is not required for this class.

XIII. Textbooks and Teaching Aids

A. Required Textbook

William Hayat, Jack Kemmerly, and Steven Durbin, *Engineering Circuit Analysis*, Sixth Edition, McGraw-Hill, 2002

B. Alternative Textbooks

None

C. Supplemental Textbooks

John O'Malley, *Schaum's Outline of Basic Circuit Analysis*, Second Edition, McGraw-Hill, 1992.

D. Supplemental Materials

1. Scientific calculator
2. Laptop Computer
3. MATLAB and PSPICE access either on laptop or in a general purpose computer lab
4. Engineering paper
5. CRC Standard Mathematical Tables and Formulae, Daniel Zwillinger

Course Title: GEEN 3211: Engineering Economy

Semester Credit Hours: 2 (2,0)

I. Course Overview

This course teaches the basic principles and techniques of economic analysis and cost engineering. Applications are made to real engineering problems and processes. The use of economics in evaluating engineering designs is emphasized.

II. PMU Competencies and Learning Outcomes

Engineering economics and design, as taught in this course, are major components world-wide of professional competence for engineers. Throughout the course, students are encouraged to apply critical thinking and problem solving skills in the economic design evaluation process. Teamwork and leadership are stressed through the lectures, class work, and in the practice a student interdisciplinary team. Oral and written communication skills through class discussions and through the team approach and presentations are integral to student learning in the course, as are understanding and effective use of design and information processing technology.

III. Detailed Course Description

This course is concerned with the application of theoretical and practical economic principles for the formulation, estimation, and evaluation of outcomes in industries. The course is an excellent one for doing interdisciplinary work. Because this course is taken by all the engineering disciplines, students from different disciplines are put on a team to solve an engineering economic problem. Ethical issues, safety, and environmental aspects are also addressed and/or practiced.

IV. Requirements Fulfilled

This course is required for all majors in civil, electrical, and mechanical engineering.

V. Required Prerequisites

GEEN 3311: Introduction to Fluid Mechanics

VI. Learning Outcomes

- To learn the engineering design process
- To apply economics to engineering problems and designs
- To learn to work on multidisciplinary engineering teams
- To recognize and discuss professional engineering ethical issues from a global as well as project focus

VII. Assessment Strategy

Student performance is evaluated by means of periodic homework assignment, two 2-hour examinations, one multidisciplinary team project, and one final comprehensive examination.

The test generally consists of two sections:

- a closed book section
- an open book section

The two examinations are cumulative. Some questions require the student to integrate general concepts from old material with the new material.

VIII. Course Format

This is a lecture course with a multidisciplinary team design project assignment.

Classroom Hours (2 hours per week) **Class:** 2
Lab: 0

IX. Topics to Be Covered

A. Elements of economic evaluation
   1. Definition
   2. Reasons for evaluation
   3. Factors to be considered
   4. Step-by-step procedure for evaluation of a project

B. Estimation of capital costs
   1. Classification
   2. Economy of scale
   3. Cost index
   4. Grass roots and total module costs

C. Estimation of operating costs
   1. Direct costs
   2. Fixed costs
   3. General costs
   4. Labor costs
   5. Utility costs
   6. Raw material costs

D. Time value of money
   1. Single payment compound amount factor
   2. Single payment present worth factor
   3. Equal payment series compound amount factor
   4. Equal payment series sinking fund factor
   5. Equal payment series present worth factor
   6. Equal payment series capital recovery factor
   7. Uniform gradient series factor

E. Measures of profitability
   1. Payout
   2. Profit to investment ratio
   3. Rate of return
   4. Net present value
   5. Others

F. Methods of comparing alternatives
   1. Present worth amount
   2. Annual equivalent amount
   3. Incremental rate of return
   4. Other value provisions

X. Laboratory Exercises

This course does not require a separate lab.

XI. Technology Component

Media assisted instruction is a tool in this class. Students are expected to have a computer account with the appropriate server to enable class communications for their multidisciplinary team, engineering project. Appropriate technology for collection, analysis, and interpretation of data is required. Completing assignments and examinations requires use of a personal computer and/or university computer labs. The project assignment requires that students use the Internet as a technology resource.

XII. Special Projects/Activities

None.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Jelen, F and Black, J., *Cost and Optimization Engineering*, Third Edition; McGraw-Hill, Inc.

B. Alternative Textbooks

Black, J. and Tarquin, R., *Engineering Economy*, Fifth Edition; McGraw-Hill, Inc.

C. Supplemental Print Materials

None.

D. Supplemental Online Materials

None.

Course Title: GEEN 3311: Introduction to Fluid Mechanics

Semester Credit Hours: 3 (3,0)

I. Course Overview

This course introduces students to the concepts of fluid statics and fluid dynamics. Fluid statics refers to a fluid at rest and the forces which act on the fluid in that state. Fluid dynamics refers to a fluid in motion and the forces that act on the fluid in that state.

II. PMU Competencies and Learning Outcomes

Critical thinking and problem solving are the cornerstones of this course. This course enhances professional competencies by building on students' prior knowledge of physics, calculus, and thermodynamics. Written homework assignments are frequent. No formal oral presentations or group assignments are included in the course.

III. Detailed Course Description

In this course, students are introduced to the concept of a fluid, as distinct from a solid. The students learn to solve problems related to the study of the forces (pressure) acting on a fluid at rest. They also learn to solve problems related to the study of a fluid in motion. The principles of conservation of mass and energy and the balance of momentum are used as the foundation of fluid dynamics. Students continue to learn about control volumes and their application to fluid mechanical systems.

IV. Requirements Fulfilled

This course is required for all majors in civil, electrical, and mechanical engineering.

V. Required Prerequisites

- GEEN 2313: Thermodynamics I

VI. Learning Outcomes

- To learn the fundamental concepts of fluid mechanics.
  - Students demonstrate basic competency (on written examinations) in identifying and explaining the concepts of fluid properties and kinematics, and hydrostatics.
  - Students demonstrate basic competency in identifying the differential forms of the continuity and momentum equations for inviscid and Newtonian viscous flows.
  - Students demonstrate basic competency in manipulating the concepts that underlie inviscid flow and internal incompressible Newtonian viscous flows.
- To learn to apply these fundamental concepts to suitable engineering problems.
  - Students are able to solve basic problems in hydrostatics, apply control volume analysis to simple engineering problems, and demonstrate proper application of the Bernoulli Euler equations.
  - Students apply the concepts of the Buckingham Pi theorem and of similarity analysis to basic engineering similitude problems.
  - Students are able to solve problems is viscous fluid flow in two dimensions and to flows in circular pipes.
- To expand the unifying approach embodied in the integral control volume form of the basic equations begun in Thermodynamics I.
  - Students demonstrate basic competency in identifying the function of the specific terms in the integral forms of the mass and momentum equations for fluid flow as they relate to the general form of the integral balance equations introduced in Thermodynamics I.

VII. Assessment Strategy

The course is a lecture course in which the students are expected to be participants in classroom discussion. There are regular homework assignments and the students receive feedback from the instructor regarding their performance on the homework. The major part of the course grade is based on the performance of the student from tests taken in an in-class setting.

- Examinations – in-class exams are given to test the student's ability to solve problems using the principles of fluid mechanics and to assimilate the material from previous courses, particularly, physics, mathematics, and thermodynamics.
- Homework – problems are assigned for individual student submission.

VIII. Course Format

This course is a lecture course meeting three hours per week in a lecture room setting. The students are required to work on homework problems in an out-of-class setting.

Classroom Hours (3 hours per week) **Class: 3**
Lab: 0

IX. Topics to Be Covered

A. Definition of a fluid, differential vs. integral approach, dimensions and unit systems.
B. Fundamental concepts
   1. Continuum
   2. Field variables
      a. Density
      b. Pressure
   3. One-, two-, and three-dimensional flows, Eulerian and Lagrangian descriptions, timelines, pathlines, streaklines, and streamlines
C. State of stress, scalar and vector fields
   1. Surface and body forces
   2. Gradient of pressure
   3. Definition of a Newtonian fluid
   4. Viscosity
D. Fluid statics
   1. Hydrostatic pressure in fluids of fixed and variable density
   2. Atmospheric pressure
   3. Manometry
   4. Forces on submerges surfaces
   5. Buoyancy
E. Basic equations in integral form for a control volume
   1. Mass
   2. Linear momentum
   3. Energy
   4. Entropy
F. Mass and momentum problems in one- and two-dimensional integral control volume flows. Inertial and accelerating control volume.
G. Differential analysis of fluid motion. Conservation of mass in rectangular and cylindrical coordinate systems
H. Kinematics of fluid motion, the substantial derivative, rotation, vorticity and circulation
I. The Navier Stokes Equations
J. Incompressible inviscid flow
   1. The ideal fluid
   2. Euler’s equations
   3. The Bernoulli equation
   4. The first law of thermodynamics and its relation to the Bernoulli equation

K. Irrotational flow
   1. Bernoulli equation and irrotational flows
   2. An introduction to simple potential flows
L. Dimensional analysis and similitude
   1. The dimensionless forms of the Continuity and Navier-Stokes equations
   2. Conditions for model-to-prototype similarity
   3. Buckingham Pi theorem
M. Internal incompressible viscous flow
   1. Fully developed laminar flow between parallel plates and in circular pipes
   2. The development region
   3. The laminar-to-turbulent transition in pipe flow
   4. Turbulent flow in pipes
   5. The Moody diagram
   6. Major and minor head loss calculations

X. Laboratory Exercises

This course does not require a separate lab.

XI. Technology Component

Students use their personal laptop computers in doing and submitting their homework assignments. Examinations are completed in the classroom using no electronic assistance. Computer solutions, using MATLAB, are required.

XII. Special Projects/Activities

There are no special projects associated with this course.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Fox, R.W., A.T. McDonald, and P.J. Pritchard. *Introduction to Fluid Mechanics*, 6th Edition. _____: J. Wiley and Sons, 2004.

B. Alternative Textbooks

None.

C. Supplemental Print Materials

None.

D. Supplemental Online Materials

None.

Course Title: ASSE 4311: Learning Outcome Assessment III

Semester Credit Hours: 3 (3,0)

I. Course Overview

The Capstone course in the PMU engineering program requires students to complete a design project from project identification through problem statement, conceptual design, project analysis, final design, report preparation, and a final oral presentation. Student work in groups of three (ideally, one student from each major) and apply the knowledge they have acquired to demonstrate their mastery of the discipline through a well-executed project.

II. Competencies Addressed

The course requires critical thinking and analysis as well as familiarization with the learning-outcome expectations and measures. The course provides a logical framework by which students demonstrate their capstone experience in their final project presentations. Students develop the fundamental concepts and tools used to enhance decision-making. They learn to recognize the importance of specific concepts and how they fit together. The students use appropriate communication to assess the degree to which they have achieved the learning-outcome requirements. The project design and execution exercises require students to work as a team to analyze a problem, and to write and orally present a report. Students use the Internet, library, and all available resources to retrieve relevant information and data needed to address the projects.

III. Detailed Course Description

The course requires students to complete a project using the knowledge they have acquired from their undergraduate program. The students work in groups of three under the supervision of a faculty member. Where appropriate, they also work with representatives of companies in the region to research and identify a problem to solve. Students identify tasks to be implemented and form their conceptual design. They shall raise questions and problems through group discussion and learn to clearly and precisely formulate answers. Students gather and assess relevant information, so that they can address the project objectives. They learn how to think within alternative systems of thought and communicate effectively with others to arrive at solutions to the problems. At the end of the course, students complete a final project report and make an oral presentation.

IV. Requirements Fulfilled

This course is required for all majors in civil, electrical, and mechanical engineering. It completes the PMU Assessment Capstone Series.

V. Required Prerequisites

- Academic standing as a second semester senior

VI. Learning Outcomes

- To design a system, component, or process to meet desired needs.
- To demonstrate knowledge in the major engineering discipline.
- To learn to abide by the professional code of ethics.
- To prepare a technical report of professional quality.
- To understand the components of decision making, such as leadership, teamwork, cooperation, and interpersonal skills.
- To make an oral presentation using technological tools.
- To solve problems.
- To develop a strategically organized, written and visual documentation and reflection of student performances and accomplishments.
- To demonstrate the use of spreadsheets, hi-tech presentations, telecommunications, graphics, and the Internet.
- To work effectively as a team or group member.

VII. Assessment Strategy

All of the following assessment strategies are linked to the course.

A. Pre/Post Testing (10% of grade)

To determine a student's progress, a progress report is required at the end of each month during the semester.

B. Portfolio Assessment (25% of grade)

Documentation of the project research, analysis, design, specific assignments, and/or other products are collected into a portfolio that is evaluated at various stages in the course.

C. Project Presentation (60% of grade)

The project presentation is evaluated based on the written project report and the quality of the final oral presentation.

VIII. Course Format

Students are expected to attend all classes, read the assigned material before class, and spend an average of five to eight hours per week on this course during the semester. These are minimum expectations. The class consists of presentations of each group's progress and discussions with the instructor on the group's progress and other technical issues encountered during the students' research. All presentations and progress reports should be done as part of a group.

Classroom Hours (3 hours per week) **Class:** 3
Lab: 0

IX. Topics to Be Covered

A. Written and oral communication
B. Critical thinking and problem solving
C. Quantitative analysis
D. Research
E. Information and computer literacy
F. Core competencies
    1. Continuous self-directed learning
    2. Initiative
    3. Results and achievement orientation
    4. Planning and organizing
    5. Learning and relationship management
    6. Quality and continuous improvement
    7. Communication
G. Shared competencies
    1. Coaching
    2. Consulting
    3. Critical thinking and problem solving
    4. Group facilitation
    5. Leadership
    6. Persuasion and influence
    7. Project management
    8. Self-management
    9. Visioning
    10. Work collaboration
H. Technology competencies
    1. Strong proficiency in personal computer use (i.e., word processing, spreadsheets, presentation, database, internet, email)
    2. Basic programming and principles of database development and management
    3. Project management fundamentals

X. Laboratory Exercises

This course does not require a separate lab.

XI. Technology Component

Students are expected to have a computer account on BLACKBOARD or some other server, so that the instructor and the students can communicate via e-mail. Students should immediately sign up for the online discussion group for the class. Students are expected to be familiar with the use of the Internet.

XII. Special Projects / Activities

This course itself is a special design project.

XIII. Textbooks and Teaching Aids

A. Required Textbook

None.

B. Alternative Textbooks

None.

C. Supplemental Print Materials

1. Paul, Richard, and Linda Elder. *Critical Thinking: Tools for Taking Charge of Your Professional and Personal Life*. Englewood Cliffs, New Jersey: Prentice Hall, 2002. ISBN: 0-13-064760-8
2. Paul, Richard, and Linda Elder. *The Miniature Guide to The Art of Asking Essential Questions*. Dillon Beach, California: Foundation for Critical Thinking, 2002. (No ISBN)
3. Paul, Richard, and Linda Elder. *The Miniature Guide on Active and Cooperative Learning*. Dillon Beach, California: Foundation for Critical Thinking, 2002. (No ISBN)
4. Paul, Richard, and Linda Elder. *The Miniature Guide to Understanding the Foundations of Ethical Reasoning*. Dillon Beach, California: Foundation for Critical Thinking, 2002. (No ISBN)

D. Supplemental Online Materials

None.