Course Title: EEEN 4342: Digital Communication Systems

Semester Credit Hours: 3 (3,0)

I. Course Overview

This course presents an overview of the field of digital communications. The learning experiences provide students with grounding in the underlying basic theory of digital modulation and coding. Instruction in the course makes use of computer simulation and problem solving to encourage students' ability in practical applications.

II. PMU Competencies and Learning Outcomes

Knowledge and practice in digital communications, as taught in this course, are major components world wide of professional engineering expertise. As students progress in knowledge through the semester, they is encouraged to apply critical thinking and problem solving skills in class discussions, in homework assignments, in their projects. Computer simulation skills are emphasized. Professional demeanor and a team approach are taught and modeled throughout. Professional communication skills (written and oral) are encouraged in discussions, assignments, projects, and examinations. Students are led to further their awareness of the professional role and responsibilities of engineers in a global society. 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 constitutes an overview of the essentials of digital communications and practice in analyzing, problem solving, and designing systems with the use of computer simulation. Students are introduced to basic underlying theory and are led through increasing understanding for analysis and design skills necessary to the field. Probability and signal processing are utilized in problem solving. Digital modulation, error coding techniques, and system modeling are introduced. Computer simulation as a tool is emphasized.

IV. Requirements Fulfilled

This course is an elective in the telecommunications option for majors in electrical engineering.

V. Required Prerequisites

EEEN 4341: Communication Systems

VI. Learning Outcomes

A. To develop a theoretical understanding of digital communications.

B. To learn the components of digital modulation systems.

C. To learn and apply coding techniques.

D. To learn and apply ARC for error control.

E. To acquire an understanding of spread-spectrum, cellular, and satellite communications.

F. To develop further understanding of the global context of engineering practice.

G. To acquire a basis and commitment for career-long professional continuing education.

VII. Assessment Strategy

The assessment strategy measures students' understanding of the field of digital communication systems, its inclusive components and methodologies, and students' ability to analyze and design systems using the knowledge acquired.

- Class participation is monitored as an indicator of each student's level of involvement and understanding
- Homework assignments are utilized to provide feedback to students and to indicate individual progress in achievement of understanding.
- A mid-term examination is used to indicate students' developing level of mastery
- A student project requiring application of knowledge is used to determine student's ability to integrate knowledge, generate problem solutions, and design systems which demonstrate understanding of the engineer's global responsibilities.
- Presentation of the student project is used to measure student's communications skills and professional demeanor.
- 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. Students' preparation for the capstone experience is enhanced through progressive skill building in active listening, oral, and written communication, decision making, problem solving, professional demeanor and commitment. In cooperation with the instructor, each student selects one assignment to become a part of the student's portfolio.

VIII. Course Format

The course consists of lectures, class discussions, written assignments to be completed outside of class, a student project and presentation, and examinations. Preparation for class includes reading the text and additional materials and completing assignments so that they may be discussed in class. These are expected as indicators of students' commitment to professional growth.

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

IX. Topics to Be Covered

A. Basic features
B. Channels and impairments
C. Modulation/demodulation
D. Digital data transmission
E. Link power calculations
F. Equalization
G. Synchronization
H. Source coding
I. Error control coding
J. Multiple access
K. Spread spectrum communications
L. Cellular and satellite systems

X. Laboratory Exercises

A separate lab is not required for this course.

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 or use of the university computer labs. Students utilize the application software package MATLAB in homework problems and special projects. Use of the Internet may be indicated to support global understanding of the subject and its applications.

XII. Special Projects / Activities

A student project is assigned, to be completed outside of class and presented before the final examination. The project is intended to allow students to integrate the knowledge and skills acquired during the semester into analysis of a real-world problem with design of solution. Written and oral presentations are required.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Ziemer, Rodger E. and Roger L. Peterson. *Introduction to Digital Communication*, 3rd Edition. _____: Prentice Hall, 2001.
ISBN:

B. Alternative Textbooks

None.

C. Supplemental Print Materials

1. Proakis, John G. *Digital Communications*, 3rd Edition. _____: McGraw-Hill, 1995.
   ISBN:
2. Couch, II, Leon W. *Digital and Analog Communication Systems*, 6th Edition. _____: Prentice-Hall, 2001.
   ISBN:
3. *Schaum's Mathematical Handbook*, McGraw-Hill
   ISBN:
4. Zwillinger, Daniel. *CRC Standard Mathematical Tables and Formulae.*
   ISBN:

D. Supplemental Online Materials

None.

E. Other

1. Scientific calculator
2. Engineering paper
3. MATLAB

Course Title: **EEEN 4343: Wireless Communication Systems**

Semester Credit Hours: 3 (3,0)

I. Course Overview

This course constitutes an introduction to wireless communications and networks. Students acquire an understanding of this technology's development and study transmission fundamentals, principles of operation, design, and issues current to the field.

II. PMU Competencies and Learning Outcomes

Knowledge of wireless communications systems, as taught in this course, is an essential component of engineering education for today's world. Through this course, students link current technologies with earlier developments and learn the responsibility of professional engineers to act as leaders in shaping the growth and direction of wireless technologies. The course also encourages students to understand the need for career-long commitment to continuing professional education. Problem solving, critical thinking, communication skills (active listening, responding to issues, oral and written communication), and a teamwork approach are developed through lectures, class discussions, and research assignments. Effective use of the latest technologies is integral to the knowledge and skills developed in this course.

III. Detailed Course Description

This course presents an overview of wireless communications development, its practices, technologies, and current issues. Students design, study, and research the operation of wireless systems. System architecture, performance, modulation techniques, encoding, spread spectrum, coding and error control, networking and wireless LANS are studied.

IV. Requirements Fulfilled

This course is an elective in the telecommunications option for majors in electrical engineering.

V. Required Prerequisites

EEEN 3361: Electromagnetic Fields and Waves

EEEN 4341: Communication Systems

VI. Learning Outcomes

- To develop a theoretical understanding of wireless communications.
- To learn the fundamentals of wireless transmission.
- To learn the basic system concepts of wireless technology.
- To develop the ability to design wireless systems.
- To develop an understanding of wireless networking.
- To develop an understanding of wireless LANS.
- To develop further understanding of the global context of engineering practice.
- To acquire a basis and commitment for career-long professional continuing education.

VII. Assessment Strategy

The assessment strategy measures students' understanding of the field of wireless communication systems, its inclusive components and methodologies, and students' ability to analyze and design systems using the knowledge acquired.

- Class participation is monitored as an indicator of each student's level of involvement and understanding
- Out-of-class assignments are utilized to provide feedback to students and to indicate individual progress in achievement of understanding.
- A mid-term examination is used to indicate students' developing level of mastery
- A student team research project requiring application of knowledge is used to determine student's ability to integrate knowledge, generate problem solutions, and design systems which demonstrate understanding of the engineer's global responsibilities. Presentation of the student project is used to measure student's communications skills and professional demeanor.
- 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. Students' preparation for the capstone experience is enhanced through progressive skill building in active listening, oral, and written communication, decision making, problem solving, professional demeanor and commitment. In cooperation with the instructor, each student selects one assignment to become a part of the student's portfolio.

VIII. Course Format

The course consists of lectures, class discussions, assignments to be completed outside of class, a student research project and presentation, and examinations. Preparation for class includes reading the text and additional materials and completing assignments so that they may be discussed in class. These are expected as indicators of students' commitment to professional growth.

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

IX. Topics to Be Covered

A. Overview of development of wireless communication
B. Wireless transmission
C. Need for a protocol architecture
D. Antennas and propagation
E. Encoding
F. Spread spectrum
G. Coding and error control
H. Wireless networking
I. Wireless LANS

X. Laboratory Exercises

A separate lab is not required for this course.

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 or use of the university computer labs. Students utilize the application software package MATLAB in homework problems and special projects. Use of the Internet with sites specific to course content may be indicated to support global understanding of the subject and its applications.

XII. Special Projects / Activities

A student project is assigned, to be completed outside of class and presented before the final examination. The project is intended to allow students to integrate the knowledge and skills acquired during the semester into analysis of a real-world problem with design of solution. Written and oral presentations are required.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Stallings, William. *Wireless Communications and Networks*, 2nd Edition. _____: Prentice Hall, 2002.
ISBN:

B. Alternative Textbooks

None.

C. Supplemental Print Materials

As notified by the instructor.

D. Supplemental Online Materials

1. As notified by the instructor.
2. MATLAB

Course Title: EEEN 4351: Automatic Control Systems

Semester Credit Hours: 3 (2,3)

I. Course Overview

This course introduces automatic control systems. The elements of control systems are presented. Students progress through class activities and labs to apply knowledge through analysis and design of systems. The course includes mathematical modeling of systems.

II. PMU Competencies and Learning Outcomes

Knowledge of automatic control systems, as taught in this course, is a major component world wide of preparation for practice as a professional engineer. Throughout the semester, students is assisted to develop this knowledge as well as hands-on skills in analysis and design. Students are encouraged in development of professional engineering competencies, including critical thinking skills, problem solving skills, and application of these through the class discussions, assignments, and lab exercises. Professional demeanor and a team approach to understanding problems are practiced throughout lectures and discussions. Professional active listening skills and both written and oral communication skills are encouraged through discussions, assignments, and the student project. Students are led to develop awareness of the professional role and responsibilities of engineers in a global society. Effective hands-on use of the most modern technology is integral to the development of the knowledge and skills acquired in this course.

III. Detailed Course Description

This course presents students with knowledge and design applications in the field of Automatic Control Systems. Students are introduced to automatic control and the components of analysis. The course advances to mathematical modeling of systems and consideration of applications in a global context.

IV. Requirements Fulfilled

This course is an elective in the telecommunications option for majors in electrical engineering.

V. Required Prerequisites

Successful completion of:

- EEEN 3312: Electric Circuits II
- GENG 3311: Introduction to Fluid Mechanics

Concurrent registration in:

- EEEN 3391: Probability and Random Signal Analysis
- EEEN 4391: Advanced Applied Mathematics

VI. Learning Outcomes

- To learn the essential elements of control systems.
- To learn to identify open and closed-loop control systems.
- To learn to modify a control system's performance to specified design objectives.
- To learn to perform stability analysis of linear time-invatiant systems using Routh and Nyquist methods.
- To learn the principle of PID control and compensation methods.
- To develop knowledge of introductory state space systems.

VII. Assessment Strategy

The assessment strategy measures students' understanding of the principles of automatic control analysis and design and the students' development of global awareness as a responsible professional engineer, including the necessity of continuing professional education throughout their careers.

- Class participation is monitored as an indicator of each student's level of involvement, understanding, and commitment.
- Homework and lab assignments are utilized to provide feedback to students and to indicate individual progress in achievement of understanding.
- Student projects are required as measures of student's ability to integrate knowledge acquired and apply it in real-world examples.
- Computer programming skills are measured to indicate students' understanding of appropriate computer technologies and their applications in automatic control systems.
- Communication skills are measured through the student's in-class participation in discussions, written assignments, and student projects.
- Examinations are used to indicate student's progress in mastery of course content and hands-on lab expertise.
- Examinations are used to measure the student's mastery in understanding and application of the knowledge, the design skills, and the professionalism taught in the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. Student's preparation for the capstone experience is enhanced through progressive skill building in active listening, oral and written communication, decision making individually and as a class team member, problem solving, use of appropriate technology, and professional viewpoint. In cooperation with the instructor, each student selects one assignment to become a part of the student's professional portfolio.

VIII. Course Format

The class consists of lectures, class discussions, written assignments including computer programming to be completed outside of class, student projects, lab exercises, and examinations. Preparation for class includes reading the text and additional resources and completing assignments so that they may be discussed in class. These are expected as indicators of students' commitment to professional growth.

Classroom Hours (5 hours per week) **Class:** 2
Lab: 3

IX. Topics to Be Covered

A. Introduction to automatic control systems
B. Mathematical models of systems
C. Block diagrams and signal flow graphs
D. Transient and steady state responses
E. PID controllers
F. Stability of linear feedback systems
G. Root-locus and Rout's criteria
H. Frequency response methods
I. Stability margins
J. Introduction to state-variable formulation

X. Laboratory Exercises

Weekly lab exercises supplement instruction in the classroom and provide each student with hands-on utilization of automatic control systems analysis and design skills. The lab experiments and simulations are designed and conducted in the PMU Automation and Control System Laboratory utilizing lab apparatus such as the Educational Control Products electromechanical control system modules interfaced through high speed data acquisition hardware to computers for control algorithm implementation. Students also utilize the application software package MATLAB with Simulink to conduct analyses and designs and to model, simulate, and perform simulation studies on control systems.

XI. Technology Component

A. Computer Account

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 assignments and in-class work is required, for example, use of a scientific calculator or use of the university computer labs. Students utilize, for modeling, simulating, analyzing and designing control systems, the application software package MATLAB with Simulink. Use of the Internet may be indicated as notified by the instructor to support global awareness of applications.

B. Lab Work

Lab work for this course is completed using the lab exercises and appropriate technology in the PMU Automation and Control Systems Laboratory. The lab experience is designed to integrate knowledge and theory into applied practice.

XII. Special Projects / Activities

Students complete a project as a part of this course and present project reports (written and oral presentation). Projects are expected to demonstrate the student's ability to utilize knowledge acquired in an application of professional quality.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Dorf and Bishop. *Modern Control Systems*, 9th Edition. _____: Prentice Hall, 2001.

B. Alternative Textbooks

None.

C. Supplemental Print Materials

1. Phillips, Charles L. and Royce D. Harbor. *Feedback Control Systems*, 2nd Edition. _____: Prentice-Hall, 1991 (or latest edition).
   ISBN:
2. Kuo, Benjamin C. *Automatic Control Systems*, 6th Edition. _____: Prentice-Hall, 1991 (or latest edition).
   ISBN:
3. Instructor's Lecture Notes
4. Instructor's Lab Sheets

D. Supplemental Online Materials

As notified by the instructor.

E. Other

MATLAB with Simulink and Control Systems Tool Box

Course Title: EEEN 4361: Electric Machinery

Semester Credit Hours: 3 (2,3)

I. Course Overview

This course addresses the principles of electrical transformers and machinery, their analysis and design. Instruction begins with the basics of magnetic circuits and transformers and progresses through the study of electrical machinery, with an introduction to electrical power systems analysis.

II. PMU Competencies and Learning Outcomes

Knowledge of electromagnetic energy conversion, as taught in this course, is a major component world wide of preparation for practice as a professional engineer. Throughout the semester, students are assisted to develop this knowledge as well as hands-on skills. Students are encouraged in development of professional engineering competencies, including critical thinking skills, problem solving skills, and application of these through the class discussions, assignments, and lab exercises. Professional demeanor and a team approach to understanding problems are practiced throughout lectures and discussions. Professional active listening skills and both written and oral communication skills are encouraged through discussions and assignments. Students are led to develop awareness of the professional role and responsibilities of engineers in a global society. Effective hands-on use of the most modern technology is integral to the development of the knowledge and skills acquired in this course.

III. Detailed Course Description

This course presents students with knowledge and design applications in the field of Electric Machinery. Students are introduced to the field of magnetic circuits and electromagnetic energy conversion. Instruction progresses to synchronous machines, three-phase induction machines, DC machines, and an introduction to the fundamentals of modeling and design of electrical power systems.

IV. Requirements Fulfilled

This course is required for majors in electrical engineering.

V. Required Prerequisites

- EEEN 3312: Electric Circuits II
- EEEN 3361: Electromagnetic Fields and Waves

VI. Learning Outcomes

- To learn to analyze magnetic circuits.
- To learn to model and analyze power transformers.
- To learn to model and analyze 3-phase induction motors.
- To learn to model and analyze synchronous machines.
- To learn to model and analyze DC machines.
- To learn to analyze simple models of electric power systems.
- To develop an understanding of the role of ethics in the practice of the electric energy industry.
- To develop an understanding of the impact of the electrical energy industry on society and the environment.

VII. Assessment Strategy

The assessment strategy measures students' understanding of the principles of the analysis and design of electric machinery and the students' development of global awareness as a responsible professional engineer.

- Class participation is monitored as an indicator of each student's level of involvement, understanding, and commitment.
- Homework and lab assignments are utilized to provide feedback to students and to indicate individual progress in achievement of understanding.
- Student project reports are required as measures of student's ability to integrate knowledge acquired and apply it in real-world examples.
- Communication skills are measured through the student's in-class participation in discussions, written assignments, and presentation of the student report.
- Examinations are used to indicate student's progress in mastery of course content and hands-on lab expertise.
- An end-of-semester final examination is used to measure the student's mastery in understanding and application of the knowledge, the design skills, and the professionalism taught in the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. Student's preparation for the capstone experience is enhanced through progressive skill building in active listening, oral and written communication, decision making individually and as a class team member, problem solving, and professional viewpoint. In cooperation with the instructor, each student selects one assignment or paper to become a part of the student's professional portfolio.

VIII. Course Format

The class consists of lectures, class discussions, written assignments to be completed outside of class, project reports and presentations, lab exercises, and examinations. Preparation for class includes reading the text and additional resources and completing assignments so that they may be discussed in class. These are expected as indicators or students' commitment to professional growth.

Classroom Hours (5 hours per week) **Class:** 2
Lab: 3

.IX. Topics to Be Covered

A. Review
   1. Three-phase circuits and systems
   2. AC power
B. Magnetic circuits
C. Power transformers
D. Induction machines
E. Synchronous machines
F. Direct current machines
G. Electric power systems
   1. Per unit system
   2. Introduction to power system modeling

X. Laboratory Exercises

Weekly lab exercises supplement instruction in the classroom and provide each student with hands-on utilization of electric machinery analysis and design skills. The following lab topics are incorporated:

A. Electric power measurement
B. Equivalent circuit power transformers
C. Voltage regulation of power transformers
D. Efficiency of power transformers
E. Direct current generator characteristics
F. Direct current motor characteristics
G. Speed regulation of DC motors
H. Equivalent circuit of three-phase induction motors
I. Three-phase induction motor characteristics
J. Characteristics of synchronous machines

XI. Technology Component

A. Computer Account

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 assignments and in-class work is required, for example, use of a scientific calculator or use of the university computer labs, including the software application package MATLAB. Use of the Internet may be indicated as notified by the instructor to support global awareness of applications.

B. Lab Work

Lab work for this course is completed using the lab exercises and appropriate technology of the university's Electrical Energy Conversion and Power Systems Laboratory facilities. The lab experience is designed to integrate knowledge and theory into applied practice.

XII. Special Projects / Activities

Students complete and present project reports (written and oral presentation). Projects are expected to demonstrate the student's ability to utilize the knowledge acquired in an application of professional quality.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Guru and Hizroglu. *Electrical Machines and Transformers*, 3rd Edition. _____: OUP, 2001.
ISBN:

B. Alternative Textbooks

None.

C. Supplemental Print Materials

1. Fitzgerald, A.E., Kingsley, Jr., Charles, Umans, Stephen D. *Electric Machinery*, 6th Edition. _____: McGraw-Hill Higher Education, 2003.
   ISBN:
2. Chapman, Stephen J. *Electric Machinery and Power System Fundamentals*. _____: McGraw-Hill Higher Education, 2002.
   ISBN:

D. Supplemental Online Materials

As notified by the instructor.

E. Other

1. Instructor's Lab Sheets
2. MATLAB

Course Title: EEEN 4371: Electric Power Systems

Semester Credit Hours: 3 (3,0)

I. Course Overview

This course presents a study of electrical power systems, their analysis, operation, and design. Students are introduced to the fundamental concepts of the field. The class progresses through consideration of models to modern operations. Students consider issues and real-world problem analysis and solutions.

II. PMU Competencies and Learning Outcomes

Skills in understanding, operating, and designing electric power systems, as taught in this course, are integral to the world-wide practice of electrical engineering. This course is intended to instill knowledge and professional confidence in students who are working in the field. Students are encouraged in development of professional engineering competencies including critical thinking skills, problem solving skills, and application of these in real-world examples. Professional demeanor and a team approach to understanding problems are practiced throughout lectures and discussions. Professional active communication skills (written and oral) are encouraged through discussions and assignments. Students are led to develop awareness of the professional role and responsibilities of power systems engineers in a global society. Effective use of the most modern technology is integral to the development of the knowledge and skills acquired in this course.

III. Detailed Course Description

This course constitutes a comprehensive overview of electrical power systems. Fundamentals and underlying principles are addressed. Instruction includes topics which are encountered by practicing engineers. Real-world examples are presented for problem solving. The course also serves as preparation for further graduate study. Topics covered include basic concepts, modeling, power flow analysis, estimation and stability, and economic issues.

IV. Requirements Fulfilled

This course is an elective in the electrical power systems option for majors in electrical engineering.

V. Required Prerequisites

Successful completion of:

- EEEN 4361: Electric Machinery
- EEEN 4391: Advanced Applied Mathematics

Concurrent registration in:

- EEEN 4372: Electric Power Transmission and Distribution

VI. Learning Outcomes

- To learn the basic principles of electric power systems.
- To develop an understanding of transmission-line parameters and transmission line modeling.
- To develop an understanding of transformers.
- To develop understanding of the admittance model and the impedance model.
- To learn power flow analysis.
- To develop understanding of symmetrical components and imbalanced faults.
- To learn the basics of stability analysis.
- To develop the ability to design electric power systems.
- To develop an understanding of current economic issues and the engineer's professional responsibility in addressing these issues.
- To develop a basis for and understanding of the need for career-long continuing professional development.

VII. Assessment Strategy

The assessment strategy measures students' understanding of electrical power systems, their principles, operation, design, and current issues.

- Class participation is monitored as an indicator of each student's level of involvement, understanding, and commitment.
- Homework is utilized to provide feedback to students and to indicate individual progress in achievement of understanding.
- A student research project and report are required as measures of student's ability to integrate knowledge acquired and apply it in real-world examples and the student's understanding of a professional engineer's responsibilities in a global society
- Communication skills are measured through the student's in-class participation in discussions, written assignments, and presentation of the student report.

- Examinations are used to indicate student's progress in mastery of course content and lab expertise
- An end-of-semester final examination is used to measure the student's mastery in understanding and application of the knowledge and design skills in the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. Student's preparation for the capstone experience is enhanced through progressive skill building in active listening, oral and written communication, problem solving, decision making and professional viewpoint. In cooperation with the instructor, each student selects an assignment to become a part of the student's professional portfolio.

VIII. Course Format

The class consists of lectures, class discussions, homework to be completed outside of class, a student project and report, and examinations.

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

IX. Topics to Be Covered

A. Transformer models
B. Synchronous machine models
C. Transmission line models
D. The admittance model and Ybus
E. The impedance model and Zbus
F. Load flow analysis
G. Symmetrical faults
H. Symmetrical components
I. Unsymmetrical faults
J. Power system stability
K. Economic operation of power systems

X. Laboratory Exercises

A separate lab is not required for this course.

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 assignments and in-class work is required, for example, use of a scientific calculator or use of the university computer labs. Use of MATLAB (as indicated by the instructor) may be required. Use of the Internet may be indicated as notified by the instructor to support global understanding of applications.

XII. Special Projects / Activities

Students complete literature research projects in which a current issue is examined. The research is reported in two ways: oral presentation to the class; written report to the instructor. The project should demonstrate the student's ability to utilize knowledge acquired in an application of professional quality.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Grainger, John J. and William D. Stevenson, Jr. *Power System Analysis*. _____: McGraw-Hill, 1994.
ISBN:

B. Alternative Textbooks

None

C. Supplemental Print Materials

1. Bergen, Arthur R. and Vijay Vittal. *Power Systems Analysis*, 2nd Edition. _____: Prentice Hall, 2000.
   ISBN:
2. Saadat, Hadi. *Power Systems Analysis*, 2nd Edition. _____: McGraw-Hill, 2002.
   ISBN:

D. Supplemental Online Materials

As notified by the instructor.

E. Other

1. MATLAB
2. As notified by the instructor.

Course Title: EEEN 4372: Electric Power Transmission and Distribution

Semester Credit Hours: 3 (3,0)

I. Course Overview

This course addresses the principles of electrical power transmission and distribution. It covers analysis and design of overhead and underground transmission lines; electric and magnetic field profiles; medium and low voltage distribution systems; transformer connections; faults and selection of protective equipment.

II. PMU Competencies and Learning Outcomes

Knowledge of electrical power transmission and distribution, as taught in this course, is a major component world wide of preparation for practice as a professional engineer in the electrical energy industry. Throughout the semester, students are assisted to develop this knowledge as well as hands-on skills. Students are encouraged in development of professional engineering competencies, including critical thinking skills, problem solving skills, and application of these through the class discussions, assignments, and lab exercises. Professional demeanor and a team approach to understanding problems are practiced throughout lectures and discussions. Professional active listening skills and both written and oral communication skills are encouraged through discussions and assignments. Students are led to develop awareness of the professional role and responsibilities of professional engineers in a global society. Effective hands-on use of the most modern technology is integral to the development of the knowledge and skills acquired in this course.

III. Detailed Course Description

Students develop knowledge and skills in the modeling, analysis, and design of electrical power systems incorporating overhead transmission and distribution lines, as well as underground transmission and distribution cables. Instruction, homework, and special analysis and design projects include effects of imperfect earth on electrical transmission parameters; conductor-surface voltage gradients; corona, radio, and TV interferences; electric and magnetic field effects of overhead lines; line compensation; insulation design criteria; switchgear and protection; and introduction to high-voltage dc power transmission. Electrical power distribution topics for low and medium voltage distribution systems include transformer connections and phase shifts; conductor sizing; fault calculation; selection of protective equipment; shunt capacitors; and electrical power quality. Social, economic, environmental and ethical issues are also considered, including those issues related to high-voltage power transmission.

IV. Requirements Fulfilled

This course is an elective in the electrical power systems option for majors in electrical engineering.

V. Required Prerequisites

Successful completion of:

- EEEN 3361: Electromagnetic Fields and Waves
- EEEN 4391: Advanced Applied Mathematics

Concurrent registration in:

- EEEN 4371: Electric Power Systems

VI. Learning Outcomes

- To learn to model and analyze electrical transmission lines.
- To learn to model and analyze electrical distribution systems.
- To learn to analyze effects of imperfect earth on transmission line model parameters.
- To learn to model and analyze corona, radio, and TV interferences.
- To learn to model and analyze electric and magnetic field profiles around transmission lines.
- To learn how to design electrical transmission lines and distribution systems, including an understanding and incorporation of standards.
- To learn how to connect transformers, size conductors, calculate faults, select switchgear, select protective equipment.
- To develop an understanding of the economic and financial constraints in the electric energy industry.
- To develop an understanding of the role of professional ethics in the practice of engineering in the electric energy industry.
- To develop an understanding of the impact of electrical transmission lines and distribution systems on society and the environment.

VII. Assessment Strategy

The assessment strategy measures students' understanding of the principles of the analysis and design of electric power transmission lines and distribution systems and the students' development of global awareness as a responsible professional engineer.

- Class participation is monitored as an indicator of each student's level of involvement, understanding, and commitment
- Homework and lab assignments are utilized to provide feedback to students and to indicate individual progress in achievement of understanding.
- Student project reports are required as measures of student's ability to integrate knowledge acquired and apply it in real-world examples.

- Communication skills are measured through the student's in-class participation in discussions, written assignments, and presentation of the student report.
- Examinations are used to indicate student's progress in mastery of course content and hands-on lab expertise.
- An end-of-semester final examination is used to measure the student's mastery in understanding and application of the knowledge, the design skills, and the professionalism taught in the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. Student's performance in the capstone experience is enhanced through progressive skill building in active listening, oral and written communication, decision making individually and as a class team member, problem solving, and professional viewpoint. In cooperation with the instructor, each student selects one assignment or paper to become a part of the student's professional portfolio.

VIII. Course Format

The class consists of lectures, class discussions, written assignments to be completed outside of class, project reports and presentations, lab exercises, and examinations. Preparation for class includes reading the texts and additional resources and completing assignments so that they may be discussed in class. These are expected as indicators of students' commitment to professional growth.

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

IX. Topics to Be Covered

A. Overhead transmission lines mechanical design
B. Overhead transmission lines electrical design
C. Design of underground cables
D. Electric and magnetic field profiles around transmission lines
E. Effects of imperfect earth on electrical transmission parameters
F. Conductor surface voltage gradients
G. Interferences ─ corona, radio and TV
H. Insulation design criteria
I. Switchgear and protection
J. Introduction to high-voltage dc power transmission
K. Medium and low voltage distribution systems
L. Transformer connections
M. Transformer phase shifts
N. Conductor sizing
O. Fault calculation
P. Selection of protective equipment
Q. Shunt capacitors
R. Electric power quality

X. Laboratory Exercises

There is no separate lab for the course, but the course incorporates interactive demonstrations and special projects that provide hands-on experiences in the department's Electrical Energy Conversion and Power Systems Laboratory.

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 assignments and in-class work is required, for example, use of a scientific calculator or use of the university computer labs, including the software application package MATLAB with the Power System Block Set. Also in the Power System Lab, the students utilize PSS/ETM for modeling transmission and distribution. Use of the Internet may be indicated as notified by the instructor to support global awareness of applications.

XII. Special Projects / Activities

Students complete and present project reports (written and oral presentation). Projects are expected to demonstrate the student's ability to utilize the knowledge acquired in an application of professional quality.

XIII. Textbooks and Teaching Aids

A. Required Textbook

1. Bergen, Arthur R. and Vijay Vittal. *Power Systems Analysis*, 2nd Edition. _____: Prentice-Hall, 2000
   ISBN:
2. Fehr, Ralph E. *Industrial Power Distribution*. _____: Prentice-Hall, 2002.
   ISBN:

B. Alternative Textbooks

None.

C. Supplemental Print Materials

1. Kusic, George L. *Computer-Aided Power Systems Analysis*. _____: Prentice-Hall, 1986.
   ISBN:
2. Begamudre, R.E. *Extra High Voltage AC Transmission Engineering*. _____: Wiley Eastern Limited, 1986.
   ISBN:
3. *Transmission Line Reference Book, 345 KV and Above*, 2nd Edition Revised, EL-2500. Palo Alto, California: Electric Power Research Institute (EPRI), 1982.
   ISBN:

4. Barthold, Clayton, Grant, Longo, Stewart, Wilson. *Transmission Line Reference Book, 115-138 KV Compact Line Design, NP-23255*. Palo Alto, California: Electric Power Research Institute (EPRI), 1978.
   ISBN:
5. Young, F.S. *Electric and Magnetic Field Management Reference Book*, 1st Edition, TR-114200. Palo Alto, California: Electric Power Research Institute (EPRI), 1999.
   ISBN:

D. Supplemental Online Materials

As notified by the instructor.

E. Other

1. MATLAB Power System Block Set
2. PSS/ETM (Power System Simulator for Engineering)

Course Title: EEEN 4391: Advanced Applied Mathematics

Semester Credit Hours: 3 (3,0)

I. Course Overview

This course coves engineering applications of ordinary and partial differential equations, Fourier and Laplace transforms, linear algebra; introduction to numerical analysis and complex variables. Mathematical modeling with applications to analysis and design of deterministic engineering systems also are included.

II. PMU Competencies and Learning Outcomes

Knowledge of and skills in utilizing Fourier and Laplace transforms, ordinary and partial differential equations, linear algebra and matrix theory, complex variables, and numerical analysis are fundamental to the modeling, analysis and design of systems in electrical engineering. Throughout the semester, students are assisted to develop this knowledge and skill. Students are encouraged in development of professional engineering competencies including critical thinking skills, problem solving skills, and application of these in class active learning sessions and homework assignments. Professional demeanor and a team approach to understanding problems are practiced throughout lectures and discussions. Professional communication skills (written and oral) are encouraged through discussions and assignments. Students are led to develop awareness of the professional role and responsibilities of engineers in a global society.

Effective use of the most modern technology, including utilization of the MathCad and MATLAB application software packages, is integral to the development of the knowledge and skills acquired in this course.

III. Detailed Course Description

In this course students acquire knowledge of the applied mathematics involved and develop skills in working with mathematical modeling and analysis of linear deterministic systems. Students are led from the basics of applied mathematics through increasing understanding to the modeling and analysis of linear systems occurring in electrical engineering applications.

IV. Requirements Fulfilled

This course is required for majors in electrical engineering.

V. Required Prerequisites

- MATH 1324: Algebra III
- MATH 2332: Differential Equations

VI. Learning Outcomes

- To acquire the ability to formulate and solve problems involving linear systems.
- To learn to mathematically describe engineering systems with linear models in the time domain and the frequency domain and to go back and forth between the two domains.
- To learn to solve mathematical problems related to engineering systems.
- To learn to analyze engineering systems by solving ordinary and partial differential equations.

VII. Assessment Strategy

The assessment strategy measures students' understanding of the applied mathematics and the utilization of the math to analyze deterministic systems.

- Class participation is monitored as an indicator of each student's level of involvement, understanding, and commitment.
- Homework assignments are utilized to provide feedback to students and to indicate individual progress in achievement of understanding.
- Communication skills are measured through the student's in-class participation in discussions, written assignments, and presentation of material during active learning sessions in the class.
- Examinations ─ both announced and unannounced ─ are used to indicate the student's progress in mastery of course content.
- An end-of-semester final examination is used to measure the student's mastery in understanding and application of the knowledge, analysis and design skills in the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. Student's preparation for the capstone experience is enhanced through progressive skill building in active listening, oral and written communication, decision making individually and as a team member, problem solving, and professional viewpoint. In cooperation with the instructor, each student selects one assignment to become a part of the student's professional portfolio.

VIII. Course Format

The class consists of lectures, active problem-solving sessions in class, homework problem assignments to be completed outside of class, and examinations.

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

IX. Topics to Be Covered

A. Review of the Laplace transform and application to solution of ODE's
B. Linear algebra and matrix theory
   State space models of linear systems and solutions of ODE's
C. Numerical methods
   1. Numerical methods in linear algebra
   2. Numerical methods for ODEs
D. Review of fourier series and transforms
E. Partial differential equations
   1. Modeling
   2. Solutions
F. Complex variables
   1. Complex numbers and complex analytic functions
   2. Complex integration
   3. Residue theory

X. Laboratory Exercises

There is no laboratory for this course.

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 assignments and in-class work is required, for example, use of a scientific calculator or use of the university computer labs. Use of the Internet may be indicated as notified by the instructor to support global understanding of applications. For some homework problems, the MathCad or MATLAB application software package is required.

XII. Special Projects / Activities

No special projects are planned. Completion of several, normally weekly, homework assignments is required.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Greenberg, Michael. *Advanced Engineering Mathematics*, 2nd Edition. _____: Prentice-Hall, 1998.
ISBN:

B. Alternative Textbooks

1. Stroud, K.A. and Dexter J. Booth. *Advanced Engineering Mathematics*, 4th Edition. _____: Industrial Press, Inc., 2003.
   ISBN:
2. Kreyszig, Erwin. *Advanced Engineering Mathematics,* 8th Edition. _____: John Wiley & Sons, Inc.
   ISBN:

3. Spiegel, Murray. *Schaum's Outline of Advanced Mathematics for Engineers and Scientists.* _____: McGraw-Hill Trade, 1971. ISBN:

C. Supplemental Print Materials

As notified by the instructor.

D. Supplemental Online Materials

As notified by the instructor.