University of North Carolina at Charlotte ET 4-01-08

Revised Undergraduate

Course and Curriculum Proposal from: Department of Engineering Technology

Revision of Four-Year Electrical Engineering Technology Undergraduate Curriculum

A. PROPOSAL SUMMARY AND CATALOG COPY

1. Summary.

The Department of Engineering Technology proposes to significantly modify and repackage the electrical engineering technology curriculum to meet current trends and state of practice. This proposal eliminates sixteen undergraduate courses and seven laboratory courses, while adding sixteen new undergraduate courses and six new laboratory courses in the Electrical Engineering Technology program as follows:

- New required undergraduate courses will be: ELET1101, ELET2201, ELET2241, ELET3113, ELET3132, ELET3222, ELET3232, ELET4142, ELET4151, ELET4191, ELET4192, ELET4223, ELET4242, and ELET4293.
- New required undergraduate laboratory courses will be: ELET1212L, ELET1231L, ELET2241L, ELET3132L, ELET3222L, and ELET4151L.
- New undergraduate elective courses will be ELET4133 and ELET4152.

In addition, as part of this curriculum revision proposal, changes will be made to some course numbers, titles, and descriptions to reflect a consistent numbering and notation for the new program sequence. Some courses include revised course pre/co-requisites or additional limitations and requirements, which are provided in this document. Overall, the BSET Electrical Engineering Technology program requirements have increased from 124 credits to 128 credits. The changes outlined in this proposal are structured to meet minimum curriculum requirements for TAC of ABET accreditation. Course numbering and/or course titles will be modified for the existing courses as follows:

Revised Course Number	Former Course Number	Revised Course Name	Former Course Name
ELET1111	ETEE1123	DC Circuits	DC Circuit Analysis
ELET1111L	ETEE1101	DC Circuits Laboratory	Electronics Lab I
ELET1212	ETEE1223	AC Circuits	AC Circuit Analysis
ELET1231	ETEE1213	Digital Circuits	Digital Circuits I
ELET2121	ETEE2113	Electronics I	Electronic Devices
ELET2121L	ETEE2101	Electronics I Laboratory	Electronics Lab III
ELET2141	ETEE2143	Introduction to Power Systems	Introduction to Electrical Power Systems
ELET2231	ETEE2213	Microprocessor Fundamentals	Introduction to Microprocessors

2. **Proposed Catalog Copy.**

ELET1101. Simulation and Schematic Capture (1) This course introduces computer-aided design and engineering (CAD/CAE) with an emphasis on applications in the electronics field. Topics include electronics industry standards (symbols, schematic diagrams, and layouts); drawing electronic schematics; simulating electronic circuits and printed circuit board layout of electronic circuits. Techniques for capturing CAD/CAE output to include with reports are also covered. This course meets for three (3) lab hours per week in a computer lab. (Fall)

ELET1111. DC Circuits (3) Corequisites: ELET1101, ELET1111L and MATH1100. This course is an introduction to electric circuits with an emphasis on DC circuit analysis and design. Topics include fundamental electrical and magnetic principles, circuit analysis laws and theorems, and component characteristics and behaviors. This course meets for three (3) lecture hours per week. (Fall)

ELET1111L. DC Circuits Laboratory (1) Corequisite: ELET1101 and ELET1111. This laboratory course supports concepts and practices covered in ELET1111. This course meets for three (3) laboratory hours per week. (Fall)

ELET1212. AC Circuits (3) Prerequisites: ELET1101, ELET1111 and ELET1111L with a grade of C or better. Corequisites: ELET1212L and MATH1103. This course is the continuation of an introduction to electric circuits with an emphasis on AC circuit analysis and design. Topics include application of electrical and magnetic principles, analysis laws and theorems in AC circuits, an introduction to frequency response and circuit behaviors under AC excitation. This course meets for three (3) lecture hours per week. (Spring)

ELET1212L. AC Circuits Laboratory (1) Prerequisites: ELET1111 and ELET1111L with a grade of C or better. Corequisite: ELET1212. This laboratory course supports concepts and practices covered in ELET1212. This course meets for three (3) laboratory hours per week. (Spring)

ELET1231. Digital Circuits (3) Prerequisites: ELET1101, ELET1111 and ELET1111L with a grade of C or better. Corequisites: ELET1231L. This course covers fundamental digital concepts including number systems, logic gates, Boolean algebra, Karnaugh Maps, and combinational logic. Topics include combinational digital circuit design and analysis, minimization methods, and hardware descriptor languages such as VHDL. This course meets for three (3) lecture hours per week. (Spring)

ELET1231L. Digital Circuits Laboratory (1) Prerequisites: ELET1111 and ELET1111L with a grade of C or better. Corequisite: ELET1231. This laboratory course supports concepts and practices covered in ELET1231. This course meets for three (3) laboratory hours per week. (Spring)

ELET2121. Electronics I (3) Prerequisites: ELET1212 and ELET1212L with a grade of C or better, MATH1103. Corequisite: ELET2121L. This course is an introduction to semiconductor electronic devices and circuits. Topics include semiconductor diodes, bipolar junction transistors (BJTs), field-effect transistors (FETs), ideal operational amplifiers and the application of these solid state devices in basic circuits and systems. This course meets for three (3) lecture hours per week. (Fall)

ELET2121L. Electronics I Laboratory (1) Prerequisites: ELET1212 and ELET1212L with a grade of C or better. Corequisite: ELET2121. This laboratory course supports concepts and practices covered in ELET2121. This course meets for three (3) laboratory hours per week. (Fall)

ELET2141. Introduction to Power Systems (3) Prerequisites: ELET1212, ELET1212L, and MATH1103. This course is an introduction to electromagnetic fundamentals, power generation and distribution, ac and dc machines. This course meets for three (3) lecture hours per week. (Fall)

ELET2201. C Programming (3) This course is an introduction to the C programming language with an emphasis on applications in Electrical Engineering Technology. This course meets for three (3) lecture hours per week. (Spring)

ELET2231. Microprocessor Fundamentals (3) Prerequisite: ELET1231. Corequisite: ELET2201. This course covers application and design assembly and C language programming for AVR microprocessors. Topics include system timing, bus cycles, interrupts, stacks and subroutines. Upon completion, students should be able to design, program, verify, analyze, and troubleshoot AVR assembly and C language programs. This course meets for three (3) lecture hours per week. (Spring)

ELET2241. Instrumentation and Controls (3) Prerequisites: ELET1212, ELET1212L, and MATH1103. Corequisite: ELET2241L. This course is an introduction to instrumentation for measurement and control of physical variables, with an emphasis on electronic systems. Topics include a review of basic circuit analysis, electrical instruments, sensors and measurement principles and a survey of automatic controls from a systems point of view. This course is cross-listed as ETME3163 and meets for three (3) lecture hours per week. (Spring)

ELET2241L. Instrumentation Laboratory (1) Prerequisites: ELET1212 and ELET1212L. Corequisite: ELET2241. This laboratory course supports concepts and practices covered in ELET2241. This course is cross-listed as ETME3251 and meets for three (3) laboratory hours per week. (Spring)

ELET3113. Network Analysis (3) Prerequisites: ELET1212 and ELET1212L and with a grade of C or better, MATH1121, and junior standing in department. This course is an introduction to frequency domain analysis through Laplace Transforms and Fourier Analysis. Topics include a review of circuit analysis fundamentals in the time domain, circuit transformations, waveform analysis and synthesis and first order natural and

forced response with extensive utilization of circuit simulation software. This course meets for three (3) lecture hours per week. (Fall) (Internet)

ELET3132. Digital Systems (3) Prerequisites: ELET1231 and ELET1231L with a grade of C or better and junior standing in department. This course covers the design and implementation of digital systems. Topics include combinational and sequential digital circuits, minimization methods, state machine design and state assignment techniques, hardware descriptor languages such as VHDL, circuit implementation using MSI integrated circuits and programmable logic devices. This course meets for three (3) lecture hours per week. (Fall)(Internet)

ELET3132L. Digital Systems Laboratory (1)(W) Prerequisites: ELET1231 and ELET1231L with a grade of C or better and junior standing in department. Corequisite: ELET3132 or permission of the department. This laboratory course supports concepts and practices covered in ELET3132. This course meets for three (3) laboratory hours per week. (Fall, Summer)

ELET3222. Electronics II (3) Prerequisites: ELET2121 and ELET2121L with a grade of C or better and junior standing in department. This course is a continuation of the study of solid state devices begun in ELET2121. Topics include frequency response of single and multistage amplifiers, feedback and stability, linear and nonlinear operational amplifier circuits, and CMOS and BiCMOS circuits with extensive utilization of circuit simulation software. This course meets for three (3) lecture hours per week. (Spring) (Internet)

ELET3222L. Electronics II Laboratory (1)(W) Prerequisites: ELET2121 and ELET2121L with a grade of C or better and junior standing in department. Corequisite: ELET3222 or permission of the department. This laboratory course supports concepts and practices covered in ELET3222. This course meets for three (3) laboratory hours per week. (Spring, Summer)

ELET3232. Microcontroller Systems (3) Prerequisites: ELET2201 and ELET2231. This course covers application and design of ARM (Advanced RISC Machine) systems. Topics include assembly and C language programming and an introduction to the control and interfacing of ARM based systems. Upon completion, students should be able to design, construct, program, verify, analyze and troubleshoot ARM assembly and C language programs and supporting hardware. This course meets for three (3) lecture hours per week. (Spring) (Internet)

ELET4133. Embedded Systems (3) Prerequisites: ELET2231 and ELET3132. This course covers the external characteristics of digital and analog integrated circuits and their applications when interfaced to embedded digital systems. Design constraints and considerations due to device limitations and device selection based upon application requirements will be discussed. Upon completion, students should be able to design, program, verify, analyze, and troubleshoot hardware and software in embedded systems. This course meets for three (3) lecture hours per week. (On Demand) (Internet)

ELET4142. Power Electronics/Networks (3) Prerequisites: ELET2141, ELET3222 and ELET3222L. This course is an introduction to power electronic devices in electrical systems, including their characteristics, operation and application. It also introduces topics on transmission of electric power with emphasis on modeling of power network components and systems, power flow studies and calculations. This course meets for three (3) lecture hours per week. (Fall) (Internet)

ELET4151. Communication Systems (3) Prerequisites: ELET3222, ELET3222L, and ETGR3171. This course covers basic principles and concepts underlying modern communication systems. Topics include systems, signals, modulations (AM, FM, PM, FSK, PSK, QAM, PCM), transmission, reception, cellular, caller ID, and networks. This course meets for three (3) lecture hours per week. (Fall) (Internet)

ELET4151L. Communication Systems Laboratory (1)(W) Prerequisites: ELET3222, ELET3222L, and ETGR3171. Corequisite: ELET4151 or permission of the department. This laboratory course supports concepts and practices covered in ELET4151. This course meets for three (3) laboratory hours per week. (Fall, Summer)

ELET4152. Digital Signal Processing (3) Prerequisite: ELET3113. Discrete-time signals; discrete-time systems; Linear constant-coefficient difference equations; Periodic sampling; reconstruction from samples; changing the sampling rate; the z-transform; z-transform properties; transform analysis of linear time-invariant systems; digital filter design techniques; discrete Fourier Transform and the FFT algorithm. This course meets for three (3) lecture hours per week. (On Demand) (Internet)

ELET4191. Applied Project Management (2) Prerequisite: MATH1100 and senior standing in department. Corequisite: ELET4192. Statement of work, activity decisions, timelines, scheduling, and resource allocation methods. Techniques will be appropriate for large and small projects within commercial, academic, or non-profit organizations. This course meets for two (2) lecture hours per week. (Fall) (Internet)

ELET4192. Senior Project I (2)(W) Prerequisite: Senior standing in department. Corequisite: ELET4191. This is the first of a two semester sequence in senior design. Students will utilize previous coursework to creatively investigate and produce solutions for a comprehensive practical engineering technology project. This course meets for two (2) lecture hours per week. (Pass/No Credit Grading) (Fall) (Internet)

ELET4223. Active Filters (3) Prerequisites: ELET3222 and ETGR3171. This course involves the design, analysis, simulation and implementation of composite, cascaded and summation filters. Topics include bilinear transfer functions; cascade design with first-order circuits; biquad circuits; Butterworth lowpass circuits; Butterworth bandpass circuits; the Chebyshev response; sensitivity; frequency transformations; highpass and band-elimination filters. This course meets for three (3) lecture hours per week. (Spring) (Internet)

ELET4242. Control Systems (3) Prerequisites: ELET3113 and ETGR3171. Automatic control systems concepts, system modeling, control system components, state space model, transfer function model, time responses, poles and zeros, closed loop, reduction of multiple subsystems, stability analysis, Routh-Hurwitz, performance analysis, design techniques, root locus, Bode, Nyquist, PID, and MATLAB control tool box. This course meets for three (3) lecture hours per week. (Spring) (Internet)

ELET4293. Senior Project II (2)(W)(O) Prerequisites: ELET4191 with a grade of C or better and a passing grade in ELET4192. This is the second of a two semester sequence in senior design. Students will incorporate Applied Project Management techniques into the capstone project identified in ELET4192 to finalize project analysis, development and implementation. This course meets for two (2) lecture hours per week. (Spring, Summer)

B. JUSTIFICATION.

1. Need.

The Department of Engineering Technology at UNC Charlotte has provided a high quality technical education for over 30 years, with several of the department's programs satisfying rigorous accreditation standards through TAC/ABET. The proposed revision to the Electrical Engineering Technology program curriculum will allow us to simultaneously continue this tradition of quality education of the region's engineering technologists while making the program more current and technically relevant. The proposed curriculum will also address deficiencies commonly cited by industry in engineering and technology programs and address changes in specialized accreditation standards and best practices; namely, the lack of practical instruction and application in the areas of communications, project management and holistic project development and realization. By removing the tracks within the Electrical Engineering Technology program under the proposed curriculum, we will more effectively accommodate current findings with respect to a broad-based education. Our students will be exposed to a cohesive treatment of important topics necessary for their success as practicing engineering technologists and will be allowed the flexibility to specialize in an area of interest through the choice of major electives. Finally, the one-year, four-credit senior project sequence, in conjunction with a required Project Management course, will allow our students to participate in a meaningful capstone experience and allow them to effectively participate in the Lee College of Engineering Interdisciplinary Senior Project if desired.

2. Prerequisites/Corequisites.

Courses identified in this proposal are freshman, sophomore, junior and senior level. Prerequisites and corequisites have been established, where warranted and indicated in the course descriptions provided, to facilitate student success and to satisfy all applicable accreditation standards and requirements.

3. Course Numbering.

Course numbering as identified in this proposal is consistent with the university course numbering policy for undergraduate courses and the level of academic achievement of students for whom it is intended.

4. **Improvement of Scope, Quality and Efficiency of Program and Instruction.**
   Revision of the Electrical Engineering Technology curriculum as outlined in this proposal will allow the offering of a comprehensive, relevant and flexible program that is broad based, in addition to reflecting current technologies, knowledge and skills desired by employers and required for specialized accreditation.

C. IMPACT

1. **Students Served.**
   Undergraduate students majoring in Electrical Engineering Technology will be served by this proposal. Junior level transfer students with appropriate Associate of Applied Science (AAS) degrees will be able to matriculate into the on-campus four-year program under the department's existing 2+2 transfer arrangement. Junior level transfer students with appropriate AAS degrees will be able to matriculate into the part-time distance education program under the department's existing 2+2 transfer arrangement.

2. **Effect on Existing Courses and Curricula.**

   a. **Added Courses**
      New courses and laboratories will be taught on-campus on an annual basis beginning in Fall 2008. Upper level courses will be taught through distance education every other year beginning in Fall 2008. Upper level laboratories will be offered on-campus at least every other summer to accommodate distance education students in addition to the annual on-campus offerings.

   b. **Other Courses**
      The content and frequency of courses that have been renumbered will not be affected. Currently offered courses that are not identified as part of the revised curriculum will be discontinued. No substantive topical content or material currently provided will be removed.

   c. **Anticipated Enrollment in Added Courses**
      Since this proposal details a revision of the current ELET curriculum, enrollment in new courses will be consistent with enrollment in the current curriculum. It is anticipated that the ELET enrollment, both on-campus and distance education, will increase by between 5-10% per year.

   d. **Effect on Other Course Enrollment**
      Enrollments in courses outside of the Department of Engineering Technology are expected to increase commensurate with the increase in ELET enrollment.

   e. **Special Topics Courses**
      None of the courses in this proposal have been previously offered under special topic numbering.

   f. **Other Catalog Copy Changes**
      Proposed changes and additions to catalog copy, which will reflect curriculum outlines, course requirements, and program requirements, are as follows:

- ***Current catalog copy from 2007-2009 online catalog:***
  The department offers curricula leading to the Bachelor of Science in Construction Management (BSCM) and the Bachelor of Science in Engineering Technology (BSET) degrees. In addition to the BSCM, four disciplines of study are available in Engineering Technology: Civil Engineering Technology (with emphases in General Civil Engineering Technology or Construction Engineering Technology); Electrical Engineering Technology (with emphases in Electronics Engineering Technology or Computer Engineering Technology); Fire Safety Engineering Technology; and Mechanical Engineering Technology.

  Revised catalog copy:
  The department offers curricula leading to the Bachelor of Science in Construction Management (BSCM) and the Bachelor of Science in Engineering Technology (BSET) degrees. In addition to the BSCM, four disciplines of study are available in Engineering Technology: Civil Engineering Technology (with emphases in General Civil Engineering Technology or Construction Engineering Technology); Electrical Engineering Technology; Fire Safety Engineering Technology; and Mechanical Engineering Technology.

- ***Current catalog copy from 2007-2009 online catalog:***
  Disciplines of study in Engineering Technology at UNC Charlotte include: […]
  • **Electrical Engineering Technology**, (tracks in Electronics and Computers) which includes programming, AC/DC circuits, power systems, digital systems, electronics drafting, computer networks, microcomputer interfacing, solid-state electronics, integrated circuits, linear networks, communications and fiber optics, and control systems.

  Revised catalog copy:
  Disciplines of study in Engineering Technology at UNC Charlotte include: […]
  • **Electrical Engineering Technology**, which includes programming, AC/DC circuits, digital circuits, microprocessors and microcontrollers, solid-state electronics, integrated circuits, analog and digital systems, linear and nonlinear networks, power systems, communications, and control systems.

- ***Current catalog copy from 2007-2009 online catalog:***
  Discipline Specific Prerequisites:
  Electrical
  • Electrical Drafting
  • Computer Programming
    (high level language: e.g., BASIC, FORTRAN, PASCAL, C, C++)
  • D.C. Circuits
  • A.C. Circuits
  • Digital Circuits
  • Semiconductor Circuits
  • Communications, Electronics, Control Systems, or Microcomputers

Revised catalog copy:

Discipline Specific Prerequisites:

Electrical

- DC Circuits and DC Circuits Laboratory
- AC Circuits and AC Circuits Laboratory
- Circuit Simulation
- Digital Circuits and Digital Circuits Laboratory
- Electronic Devices and Electronics Laboratory
- Power Systems and Machines
- Microprocessors
- Instrumentation or Program Logic Controllers and associated laboratory
- C Programming

- *Revised catalog copy:*

CURRICULUM OUTLINE:
ELECTRICAL ENGINEERING TECHNOLOGY PROGRAM

Freshman Year			
Fall Semester		**Spring Semester**	
Course	**Credit**	**Course**	**Credit**
ENGL 1101 English Composition	3	ENGL 1102 Writing in the Academic Community **	3
MATH 1100 College Algebra & Probability(1)	3	MATH 1103 Precalculus (1)	3
ELET1101 Simulation and Schematic Capture	1	ELET1231 Digital Circuits	3
ELET1111 DC Circuits	3	ELET1231L Digital Circuits Laboratory	1
ELET1111L DC Circuits Laboratory	1	ELET1212 AC Circuits	3
ETGR 1100 Engineering Computer Apps	3	ELET1212L AC Circuits Laboratory	1
ETGR 1201 Intro to ET	2	Social Science Elective	3
TOTAL	**16**		**17**

Sophomore Year			
Fall Semester		**Spring Semester**	
Course	**Credit**	**Course**	**Credit**
STAT 1220 Elements of Statistics	3	MATH 1121 Calculus (ET)	3
PHYS 1101 Physics I	3	PHYS 1102 Physics II	3
PHYS 1101L Physics I Lab	1	PHYS 1102L Physics II Lab	1
ELET2121 Electronics I	3	ELET2231 Microprocessor Fundamentals	3
ELET2121L Electronic s I Laboratory	1	ELET2201 C Programming	3
		ELET2241 Instrumentation	3
ELET2141 Intro Power Systems	3	ELET2241L Instrumentation Laboratory	1
TOTAL	**14**		**17**

Junior Year			
Fall Semester		**Spring Semester**	
Course	**Credit**	**Course**	**Credit**
CHEM1251 Principles of Chemistry[4]	3	ELET3222 Electronics II	3
ELET3132 Digital Systems	3	ELET3222L Electronics II Laboratory (W)	1
ELET3132L Digital Systems Lab (W)	1	ETGR3222 Engineering Economics	3
ELET3113 Network Analysis	3	ELET3232 Microcontroller Systems	3
ETGR3071 ET Professional Seminar (W)	1	ETGR2122 Technical Programming	3
ETGR3171 Engineering Analysis	3	Directed Elective[2]	3
Directed Elective[2]	3		
TOTAL	**17**		**16**

Senior Year			
Fall Semester		**Spring Semester**	
Course	**Credit**	**Course**	**Credit**
ELET4142 Power Electronics/ Networks	3	ELET4223 Active Filters	3
ELET4151 Communication Systems	3	ELET4242 Control Systems	3
ELET4151L Communication Systems Laboratory (W)	1	ELET4293 Senior Project II	2
ELET4191 Applied Project Management	2	Major Elective[3]	3
ELET4192 Senior Project I (W)	2		
Major Elective[3]	3	Directed Elective[2]	3
Directed Elective[2]	3		
TOTAL	**17**		**14**

Total Credit Hours = 128

ELET Curriculum Outline Footnotes:

(1) Course selected based on Math Placement Test.

(2) Directed electives may be major field courses or general education courses. They are chosen jointly by student and advisor to ensure that all graduation requirements are met. Non AAS degreed students must satisfy University and ELET general education requirements. AAS degreed students must satisfy ELET general education requirements.

(3) Major elective courses are approved by the Department as major electives for the respective program. A list is maintained in and published by the Department.

(4)Transfer students with an AAS may have completed differing science courses at the community college. Generally, AAS transfer students entering the Mechanical or Electrical ET programs will take Chemistry in the junior year at UNC Charlotte; however, the following chart will provide additional guidance for fulfilling the science requirement at UNC Charlotte:

Mechanical & Electrical ET Transfer Students with an AAS Degree who have previously taken:	Shall Take at UNC Charlotte:
2 semesters of physics and no chemistry	CHEM 1251
1 semester of physics and 1 semester of chemistry	PHYS 1102 with lab
2 semesters of physics and 1 semester of chemistry	GEOL 1200, BIOL 1110, PHYS 1130, or CHEM 1252

D. RESOURCES REQUIRED TO SUPPORT PROPOSAL

1. Personnel.

a. New Instructional Requirements and Impact on Present Faculty Load

Currently, seven full-time and two part-time faculty members deliver the ELET program. There will be no additional faculty requirements and present faculty load will be unchanged.

b. Qualified Faculty Interested in Teaching New Courses

Current full-time ELET faculty consist of: Dr. Rosida Coowar, Mr. John Gresser, Mr. Steve Kuyath, Dr. Maciej Noras, Dr. Deborah Sharer, Dr. Barry Sherlock and Dr. Sheng-Guo Wang. Current part-time ELET faculty are: Mr. Majid Babaie and Mr. Jeric Newby. Primary faculty and additional support for courses are provided in the table below.

Course	Primary Faculty	Other Qualified Faculty
ELET1101	Gresser	Kuyath, Newby, Sherlock
ELET1111	Sherlock	Coowar, Noras, Sharer
ELET1111L	Sherlock	Babaie, Noras, Sharer
ELET1212	Coowar	Noras, Sharer, Sherlock
ELET1212L	Coowar	Babaie, Sharer, Sherlock
ELET1231	Gresser	Coowar, Kuyath, Sharer
ELET1231L	Gresser	Babaie, Kuyath, Sharer
ELET2121	Sharer	Gresser, Noras, Sherlock
ELET2121L	Sharer	Gresser, Noras, Sherlock
ELET2141	Noras	Sharer, Sherlock
ELET2201	Gresser	Kuyath, Newby, Sharer
ELET2231	Kuyath	Coowar, Gresser, Sherlock
ELET2241	Sharer	Gresser, Sharer, Sherlock
ELET2241L	Sharer	Gresser, Sharer, Sherlock
ELET3113	Sherlock	Gresser, Noras, Sharer
ELET3132	Kuyath	Coowar, Gresser, Sherlock
ELET3132L	Kuyath	Coowar, Gresser, Sherlock
ELET3222	Sharer	Gresser, Noras, Sherlock
ELET3222L	Sharer	Gresser, Noras, Sherlock
ELET3232	Kuyath	Coowar, Gresser, Sherlock
ELET4133	Kuyath	Gresser, Sherlock
ELET4142	Noras	Sharer, Wang
ELET4151	Wang	Sharer, Sherlock
ELET4151L	Wang	Sharer, Sherlock
ELET4152	Sherlock	Sharer, Wang
ELET4191	Coowar	Sharer
ELET4192	Coowar	All ELET Faculty
ELET4223	Sherlock	Sharer, Wang
ELET4242	Wang	Sharer, Sherlock
ELET4293	Coowar	All ELET Faculty

2. **Physical Facility.**
   No new facilities will be required to implement the proposed curriculum. Additional specialized laboratories will be brought online as part of regular program enhancement as funds become available.

3. **Equipment and Supplies.**
   No additional equipment and supplies will be required to implement the proposed curriculum.

4. **Computer.**
   No additional computers or software will be required to implement the proposed curriculum.

5. **Audio-Visual.**
   No additional audio-visual capabilities will be required to implement the proposed curriculum.

6. **Other Resources.**
   No additional resources will be required to implement the proposed curriculum.

7. **Funding Sources for New/Additional Resources.**
   No funding is required for new or additional resources to implement the proposed curriculum. Laboratory and program enhancements will be funded through funds allocated for

E. CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS OR UNITS

1. **Library Consultation.**
   The Atkins Library reference staff was contacted in reference to this proposal. They have indicated that existing library holdings are adequate to support the proposal. The Consultation on Library Holdings dated April 28, 2008 is included in Appendix G1 of this document.

2. **Consultation with Other Departments or Units.**
   The proposed curriculum revision will entail no additional assistance or support from other departments or units beyond what is currently incorporated into the ELET program.

F. INITIATION AND CONSIDERATION OF THE PROPOSAL

1. **Originating Unit.**
   The Department of Engineering Technology faculty unanimously approved this curriculum proposal on April 1, 2008.

2. **Other Considering Units.**
   The Electrical Engineering Technology Industrial Advisory Board reviewed and unanimously approved the proposed curriculum during the Fall 2007 meting.

G. ATTACHMENTS

1. Consultation Documentation.
2. Proposed Course Outlines.

Appendix G1: Consultation Documentation

UNC CHARLOTTE
J. Murrey Atkins Library

Consultation on Library Holdings

To: Deborah Sharer

From: Alison Bradley

Date: 4/28/08

Subject: Revision of Electrical Engineering Technology Undergraduate Curriculum

Summary of Librarian's Evaluation of Holdings:

Evaluator: Alison Bradley Date: 4/20/08

Check One:

1. Holdings are superior _____
2. Holdings are adequate __x__
3. Holdings are adequate only if Dept. purchases additional items. _____
4. Holdings are inadequate _____

Comments:

Current library holdings are sufficient to support the revised curriculum as proposed. A search for subject headings Microprocessors, Electronic Circuits, Digital Electronics, Electronics, and Electric Engineering finds over 1,500 items. We currently own 129 periodicals with these headings, and 460 electronic resources. We also provide access to relevant databases such as Compendex, IEEE Xplore, CRC Engineering Handbooks, Electronics & Communications Abstracts, Energy Citations Database, Computer and Information Systems Abstracts, and Solid State and Superconductivity Abstracts. Continued support of these subject areas through the current library purchasing guidelines should be sufficient to support this program in the future.

Alison Bradley

_____
Evaluator's Signature

4/28/08

_____
Date

Revised 4/28/2008
OAA ldo

Appendix G2: Proposed Course Outlines

ELET1101 – Simulation and Schematic Capture

Catalog Data This course introduces computer-aided design and engineering (CAD/CAE) with an emphasis on applications in the electronics field. Topics include electronics industry standards (symbols, schematic diagrams, and layouts); drawing electronic schematics; simulating electronic circuits and printed circuit board layout of electronic circuits. Techniques for capturing CAD/CAE output to include with reports are also covered. This course meets for three (3) lab hours per week in a computer lab. One (1) credit hour.

References Lab exercises provided by instructor.

Goals This course is designed to provide students with the fundamentals of computer aided design and engineering (CAD/CAE) systems. Students will be able to use CAD/CAE tools to draw schematic diagrams, run simulations and layout printed circuit boards for electronic circuits and to include the output from those CAD/CAE tools in reports.

Prerequisite None

Class Topics Topics may include, but are not limited to:

- Industry standards
- Introduction to Schematic Capture programs
- Creating and Editing Schematics
- Computer Simulation of Electronic Circuits
- Including CAD/CAE Output in Reports
- Printed Circuit Board Layout

Outcomes Upon successful completion of this course, students will be able to:

1. Use CAD/CAE software to create and edit electronic schematics.
2. Use CAD/CAE software to simulate electronic circuits.
3. Include CAD/CAE output in reports.
4. Use CAD/CAE software to design printed circuit boards for electronic circuits.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1, 3 and 6.

Computer Usage This course requires use of CAD/CAE packages.

Laboratory None

Design Content None

Grading To be determined by instructor.

Follow-up Courses ELET1212: AC Circuits
ELET1231: Digital Circuits

ELET1111 – DC Circuits

Catalog Data

This course is an introduction to electric circuits with an emphasis on DC circuit analysis and design. Topics include fundamental electrical and magnetic principles, circuit analysis laws and theorems, and component characteristics and behaviors. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References

Introductory Circuit Analysis, 10th Edition, Robert L. Boylestad , ISBN 0-13-097417-X

Goals

This is the first of a two-part sequence that introduces the fundamental concepts and techniques in circuit analysis and design. Emphasis will be placed on development of core competencies in the analysis, design and simulation of electrical circuits.

Prerequisite

(or Co-Requisite) ELET1101: Simulation and Schematic Capture
(or Co-requisite) ELET1111L: DC Circuits Laboratory
(or Co-requisite) MATH1100: College Algebra

Class Topics

After an introduction to basic electrical concepts, the following topics will be investigated:

- Current, voltage and resistance
- Equivalent Resistance and Conductance
- Independent and dependent current and voltage sources
- Ohm's Law, Power and Energy
- Source Transformations
- Mesh and Nodal Analysis
- Thevenin and Norton Theorems
- Superposition Theorem
- Maximum Power Transfer
- Series, Parallel and Series-Parallel Circuits
- Inductors and Capacitors
- Transient Response
- Magnetic fields, flux and flux density

Outcomes

Upon successful completion of this course, students will be able to:

1. Demonstrate an understanding of fundamental electric and magnetic phenomena.
2. Display proficiency in the use of common circuit analysis laws and theorems.
3. Exhibit competency in the analysis and design of basic DC circuits.
4. Show the ability to effectively utilize circuit simulation software.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1, 4 and 6.

Computer Usage

Extensive use of circuit simulation software.

Laboratory

None

Design Content

Students will be required to solve for component values to satisfy defined specifications in structured technical problems.

Grading

To be determined by instructor

Follow-up Courses

ELET1212: AC Circuit Analysis
ELET1212L: AC Circuits Laboratory
ELET1231: Digital Circuits I
ELET1231L: Digital Circuits I Laboratory

ELET1111L – DC Circuits Laboratory

Catalog Data This laboratory course supports concepts and practices covered in ELET1111 – DC Circuits. This course meets for three (3) laboratory hours per week. One (1) credit hour.

References *Experiments in Circuit Analysis to Accompany Introductory Circuit Analysis*, 10th Edition, Boylestad and Kousourou

Goals This laboratory course will support understanding of topics covered in ELET1111 – DC Circuits. Students will learn the skills of component identification, understand the concepts of tolerances as applied to components and measurements, and learn to use basic electrical/electronic measurement tools in a laboratory setting. Laboratory safety is essential topic and is emphasized throughout the course. Students are introduced to components of a written technical report and to make a formal oral presentation on a technical subject. Written assignments will be evaluated by an English grader for composition and by the instructor for technical content.

Prerequisite (or Co-Requisite) ELET1101: Simulation and Schematic Capture
(or Co-requisite) ELET1111: DC Circuits

Class Topics Experiments performed in this course are determined by material introduced in ELET1111. Topics may include, but are not limited to:

- Laboratory Safety
- Resistors and the Resistor Color Code
- DC Power Supplies
- Analog and Digital Multimeters
- Analog and Digital Oscilloscopes
- Series, Parallel, and Series-Parallel DC Circuits
- Verification of Circuit Analysis Laws and Theorems for DC Excitation
- Transient Behavior in RL, RC and RLC Circuits

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate an understanding of the coding of common resistors.
2. Exhibit competency in the operation of standard laboratory equipment.
3. Show the ability to assemble, troubleshoot, test and report results for DC resistive circuits.
4. Display the ability to communicate experimental results in written and oral formats.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1, 2, 3, 4 and 6.

Computer Usage Extensive use of circuit simulation, word processing and presentation software.

Laboratory This course is entirely laboratory based.

Design Content Students will be required to solve for circuit parameters to satisfy defined specifications in structured technical problems and implement these solutions in a laboratory setting.

Grading To be determined by instructor.

Follow-up Courses ELET1212: AC Circuit Analysis
ELET1212L: AC Circuits Laboratory
ELET12131: Digital Circuits I
ELET1231L: Digital Circuits I Laboratory

ELET1212 – AC Circuits

Catalog Data

This course is the continuation of an introduction to electric circuits with an emphasis on AC circuit analysis and design. Topics include application of electrical and magnetic principles, analysis laws and theorems in AC circuits, an introduction to frequency response and circuit behaviors under AC excitation. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References

Introductory Circuit Analysis, 10th Edition, Robert L. Boylestad , ISBN 0-13-097417-X

Goals

This is the second of a two-part sequence that introduces the fundamental concepts and techniques in circuit analysis and design. Emphasis will be placed on development of core competencies in the analysis, design and simulation of electrical circuits and systems.

Prerequisite

ELET1101: Simulation and Schematic Capture with a grade of C or better
ELET1111: DC Circuits with a grade of C or better
ELET1111L: DC Circuits Laboratory with a grade of C or better
(or Co-requisite) ELET1212L: AC Circuits Laboratory
(or Co-requisite) MATH1103: Pre-Calculus Mathematics

Class Topics

After a review of DC circuit concepts, the following topics will be investigated:

- Sinusoids: Frequency and Period; Peak, Average, Effective and RMS Values
- Phasors and Complex Algebra
- AC Characteristics of Circuit Components
- Equivalent Impedance and Admittance
- Application of Circuit Laws and Theorems Under AC Excitation
- Series, Parallel and Series-Parallel Circuits
- Power: Real, Reactive and Complex; Power Factor and Maximum Power Transfer; Load Matching
- Three-Phase Circuits: Delta-Wye, Wye-Delta Conversions
- Self and Mutual Inductance
- Transformers and Equivalent Circuits: Step-Up, Step-Down and Isolation; Impedance Matching
- Filters: Low- and High-Pass; Band-Pass and Band-Stop
- Voltage and Current Gain
- Frequency Response

Outcomes

Upon successful completion of this course, students will be able to:

1. Demonstrate an understanding of basic power concepts.
2. Display proficiency in the use of common circuit analysis laws and theorems.
3. Exhibit competency in the analysis and design of circuits with AC and DC excitation.
4. Show the ability to effectively utilize circuit simulation software.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1, 4 and 6.

Computer Usage

Extensive use of circuit simulation software.

Laboratory

None

Design Content

Students will be required to solve for circuit parameters to satisfy defined specifications in structured technical problems.

Grading

To be determined by instructor.

Follow-up Courses

ELET2121: Electronics I
ELET2121L: AC Circuits Laboratory
ELET2141: Introduction to Power Systems
ELET2241: Instrumentation and Controls
ELET2241L: Instrumentation Laboratory
ELET3113: Network Analysis

ELET1212L – AC Circuits Laboratory

Catalog Data

This laboratory course supports concepts and practices covered in ELET1212 – AC Circuits. This course meets for three (3) laboratory hours per week. One (1) credit hour.

References

Experiments in Circuit Analysis to Accompany Introductory Circuit Analysis, 10th Edition, Boylestad and Kousourou

Goals

This laboratory course will support understanding of topics covered in ELET1212 – AC Circuits. Students will expand the skills introduced in ELET1111L with respect to component identification, tolerances of components and measurements, and basic electrical/electronic measurement tools in a laboratory setting. Laboratory safety is essential topic and is emphasized throughout the course. Students are introduced to components of a written technical report and to make a formal oral presentation on a technical subject. Written assignments will be evaluated by an English grader for composition and by the instructor for technical content.

Prerequisite

ELET1111: DC Circuits with a grade of C or better
ELET1111L: DC Circuits Laboratory with a grade of C or better
(or Co-requisite) ELET1212: AC Circuits

Class Topics

Experiments performed in this course are determined by material introduced in ELET1212. Topics may include, but are not limited to:

- Laboratory Safety
- Component Identification and Behavior for AC and DC Operation
- Application of Test and Measurement Equipment for AC and DC Operation
- Behavior of RC, RL and RLC Circuits Under AC and/or DC Excitation
- Series, Parallel, and Series-Parallel Circuits Under AC and/or DC Excitation
- Verification of Circuit Analysis Laws and Theorems for AC and/or DC Excitation
- Measurement and Verification of Complex Power Concepts
- Behaviors of Transformers under AC and/or DC Excitation
- Characteristics of High-Pass, Low-Pass, Band-Pass and Band-Stop Filters
- Measurement and Verification of Voltage and Current Gains
- Frequency Response of Circuit Parameters, Characteristics and Behaviors

Outcomes

Upon successful completion of this course, students will be able to:

1. Demonstrate an understanding of practical behaviors of circuit components under AC and/or DC excitation.
2. Exhibit competency in the operation of standard laboratory equipment.
3. Show the ability to assemble, troubleshoot, test and report results for electric/electronic circuits under AC and/or DC excitation.
4. Display the ability to communicate experimental results in written and oral formats.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1, 2, 3, 4 and 6.

Computer Usage

Extensive use of circuit simulation, word processing and presentation software.

Laboratory

This course is entirely laboratory based.

Design Content

Students will be required to solve for circuit parameters to satisfy defined specifications in structured technical problems and implement these solutions in a laboratory setting.

Grading

To be determined by instructor.

Follow-up Courses

ELET2121: Electronics I
ELET2121L: Electronics I Laboratory
ELET2141: Introduction to Power Systems
ELET2241: Instrumentation and Controls
ELET2241L: Instrumentation Laboratory
ELET3113: Network Analysis

ELET1231 – Digital Circuits

Catalog Data This course covers fundamental digital concepts including number systems, logic gates, Boolean algebra, Karnaugh Maps, and combinational logic. Topics include combinational digital circuit design and analysis, minimization methods, and hardware descriptor languages such as VHDL. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References *Digital Fundamentals with VHDL*, 9th Edition, Thomas L. Floyd, ISBN: 0-07-246085-7

Goals The goal of this course is for students to demonstrate the ability to analyze and design, test, troubleshoot, simulate, and implement combinational circuits.

Prerequisite ELET1101: Simulation and Schematic Capture with a grade of C or better
ELET1111: DC Circuits with a grade of C or better
ELET1111L: DC Circuits Laboratory with a grade of C or better
(or Co-requisite) ELET1231L: Digital Circuits Laboratory

Class Topics Topics investigated in this course include: Decimal and binary number systems; Binary code representations, conversions and binary arithmetic; Logic gates and truth tables; Boolean Algebra; Karnaugh Maps; DeMorgan's Theorem; Xilinx, VHDL, and schematic entry; Combinational logic implementation and simulation; Adders and comparators; Decoders, encoders, and code converters; Multiplexers and demultiplexers; Latches and flip-flops; Synchronous and asynchronous binary counters

Outcomes Upon successful completion of this course, students will be able to:

1. Explain the basic logic operations of NOT, AND, NAND, OR, NOR, XOR, and XNOR gates.
2. Describe the basic functions of the comparator, adder, encoder, decoder, multiplexer, demultiplexer, counter, and register.
3. Demonstrate proficiency in converting between decimal, binary, octal, and hexadecimal numbers and apply arithmetic operations to decimal, binary, octal, and hexadecimal numbers.
4. Demonstrate the ability to apply the laws and rules of Boolean algebra, Karnaugh maps, and DeMorgan's Theorem to simplify expressions, convert to sum-of-products (SOP) form, and convert to product-of-sums (POS) form.
5. Analyze, design, and simulate combinational logic circuits, adders, comparators, latches, and flip-flops.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1, 3, 4, and 6.

Computer Usage Students will use Xilinx Integrated Software Environment to design and simulate combinational logic circuits. Students will simulate, test, and troubleshoot circuit designs and HDL circuit descriptions using the Xilinx Integrated Software Environment.

Laboratory None

Design Content Students will design and verify the operation of combinational logic circuits and fundamental MSI circuits.

Grading To be determined by instructor.

Follow-up Courses ELET2231: Microprocessor Fundamentals
ELET3132: Digital Systems
ELET3132L: Digital Systems Laboratory

ELET1231L – Digital Circuits Laboratory

Catalog Data This laboratory course supports concepts and practices covered in ELET1231. This course meets for three (3) laboratory hours per week. One (1) credit hour.

References *Digital Fundamentals with VHDL*, 9th Edition, Thomas L. Floyd, ISBN: 0-07-246085-7

Goals The goal of this course is for students to demonstrate the ability to analyze and design, test, troubleshoot, simulate, and implement combinational circuits.

Prerequisite ELET1111: DC Circuits with a grade of C or better
ELET1111L: DC Circuits Laboratory with a grade of C or better
(or Co-Requisite): ELET1231: Digital Circuits

Class Topics Experiments performed in this course are determined by material introduced in ELET1231.

Outcomes Upon successful completion of this course, students will be able to:

1. Explain the basic logic operations of NOT, AND, NAND, OR, NOR, XOR, and XNOR gates.
2. Describe the basic functions of the comparator, adder, encoder, decoder, multiplexer, demultiplexer, counter, and register.
3. Demonstrate proficiency in converting between decimal, binary, octal, and hexadecimal numbers and apply arithmetic operations to decimal, binary, octal, and hexadecimal numbers.
4. Demonstrate the ability to apply the laws and rules of Boolean algebra, Karnaugh maps, and DeMorgan's Theorem to simplify expressions, convert to sum-of-products (SOP) form, and convert to product-of-sums (POS) form.
5. Analyze, design, and simulate combinational logic circuits, adders, comparators, latches, and flip-flops.

Course Outcomes 1 through 5 above support achievement of Program Outcomes 1, 3, 4, and 6.

Computer Usage Students will use Xilinx Integrated Software Environment to design and simulate combinational logic circuits. Students will simulate, test, and troubleshoot circuit designs and HDL circuit descriptions using the Xilinx Integrated Software Environment.

Laboratory This course is entirely laboratory based.

Design Content Students will design and verify the operation of combinational logic circuits and fundamental MSI circuits.

Grading To be determined by instructor.

Follow-up Courses ELET3132: Digital Systems
ELET3132L: Digital Systems Laboratory

ELET2121 – Electronics I

Catalog Data This course is an introduction to semiconductor electronic devices and circuits. Topics include semiconductor diodes, bipolar junction transistors (BJTs), field-effect transistors (FETs), ideal operational amplifiers and the application of these solid state devices in basic circuits and systems. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References *Electronic Principles*, 6th Edition, Malvino

Goals This course will introduce students to the study of solid state devices and the utilization of these devices in common applications. Emphasis will be placed on development of core competencies in the analysis, design and simulation of circuits and systems incorporating electronic devices.

Prerequisite ELET1212: AC Circuits with a grade of C or better
ELET1212L: AC Circuits Laboratory with a grade of C or better
MATH1103: Precalculus Mathematics
(or Co-requisite) ELET2121L: Electronics I Laboratory

Class Topics After an introduction to semiconductor materials, the following topics will be investigated in detail:

- Semiconductor Diodes: Rectifiers; Clippers and Clampers
- Zener Diodes and Voltage Regulators
- Bipolar Junction Transistor (BJT): DC Biasing; Small Signal AC Analysis; Single and Multi-Stage Amplifiers
- Metal Oxide Semiconductor Field Effect Transistors (MOSFET): DC Biasing; Small Signal AC Analysis; Single and Multi-Stage Amplifiers
- Frequency Response of Transistor Amplifiers
- Ideal Operational Amplifiers and Applications

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate an understanding of the fundamental operation of the microelectronic devices under consideration.
2. Exhibit knowledge of the basic applications of semiconductor diodes, BJTs, MOSFETs, and operational amplifiers, and be able to analyze dc and ac circuits containing these devices.
3. Show the ability to design single stage and multiple stage amplifier circuits to satisfy defined specifications.
4. Display proficiency in the analysis and design of microelectronic circuits using computer simulation techniques.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1, 4 and 6.

Computer Usage Extensive use of circuit simulation software.

Laboratory None

Design Content Students will be required to design circuits containing defined microelectronic devices to satisfy defined specifications in structured technical problems.

Grading To be determined by instructor.

Follow-up Courses ELET3222: Electronics II
ELET3222L: Electronics II Laboratory

ELET2121L – Electronics I Laboratory

Catalog Data This laboratory course supports concepts and practices covered in ELET2121 – Electronics I. This course meets for three (3) laboratory hours per week. One (1) credit hour.

References Laboratory manual to accompany *Electronic Principles*, 6th Edition, Malvino

Goals This course is intended to reinforce concepts introduced in ELET2121 – Electronics I. Through comparison of theoretical analyses, computer simulation and laboratory experimentation of circuits containing common semiconductor devices, students will gain a deeper understanding of the considerations and limitations of microelectronic devices, circuits and systems. Students are also required to submit components of a written technical report and to make a formal oral presentation on a technical subject. Written assignments will be evaluated by an English grader for composition and by the instructor for technical content.

Prerequisite ELET1212: AC Circuits with a grade of C or better
ELET1212L: AC Circuits Laboratory with a grade of C or better
(or Co-requisite) ELET2121: Electronics I

Class Topics Experiments performed in this course are determined by material introduced in ELET2121. Topics may include, but are not limited to:

- Laboratory Safety
- Semiconductor Diode Characteristics and Circuits
- Half-Wave and Full-Wave Rectifiers
- Zener Diodes and Regulated Power Supplies
- Clipper and Clamper Circuits
- Bipolar Junction Transistor (BJT) Characteristics, DC Biasing, Small Signal Single and Multi-Stage Amplifiers, Frequency Response
- Metal Oxide Semiconductor Field Effect Transistor (MOSFET) Characteristics, DC Biasing, Small Signal Single and Multi-Stage Amplifiers, Frequency Response
- Operational Amplifiers and Common Applications

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate an understanding of the fundamental operation of the microelectronic devices under consideration and the limitations of idealized theoretical models in the practical implementation of electronic circuits.
2. Exhibit the ability to correctly interpret computer simulation results and compare with characteristics of physical devices.
3. Show the ability to assemble, troubleshoot, test, analyze and report results for microelectronic circuits under AC and/or DC excitation.
4. Display the ability to effectively communicate experimental results in written and oral formats.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1, 2, 3, 4 and 6.

Computer Usage Extensive use of circuit simulation, word processing and presentation software.

Laboratory This course is entirely laboratory based.

Design Content Students will be required to design circuits containing defined microelectronic devices to satisfy defined specifications in structured technical problems, implement these solutions and verify in a laboratory setting.

Grading To be determined by instructor.

Follow-up Courses ELET3222: Electronics II
ELET3222L: Electronics II Laboratory

ELET2141 – Introduction to Power Systems

Catalog Data This course is an introduction to electromagnetic fundamentals, power generation and distribution, ac and dc machines. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References *Electric Machinery and Power System Fundamentals,* Stephen J. Chapman, ISBN 0-07-229135-4

Goals This course will introduce students to the study of single- and three-phase power generation and distribution, in addition to an introduction to common ac and dc motor and generator configurations. Emphasis will be placed on development of core competencies in the analysis, design and simulation of power circuits and systems.

Prerequisite ELET1212: AC Circuits
ELET1212L: AC Circuits Laboratory
MATH1103: Pre-calculus Mathematics

Class Topics After a review of relevant AC circuit concepts, the following topics will be investigated in detail:

- Conventional Methods of Electrical Energy Conversion
- Magnetic and Electromagnetic Fundamentals
- Introduction to Power Flow
- Transformers: Ideal vs Actual, Equivalent Circuits; Voltage Regulation and Efficiency
- Single-Phase AC circuits
- Balanced Three-Phase Circuits
- AC and DC Machines: Rotating Machines; DC Motor and Generators; Equivalent Circuits; Open and Short-Circuit Characteristics; Efficiency and Voltage Regulation

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate an understanding of the fundamental operation of power generation and distribution.
2. Exhibit knowledge of the basic configurations of ac and dc machines, and be able to analyze systems containing these machines.
3. Show the ability to analyze single and three-phase ac circuits.
4. Display proficiency in the analysis and design of transformer circuits and systems.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1, 4 and 6.

Computer Usage Extensive use of circuit simulation software.

Laboratory None

Design Content Students will be required to design power circuits or systems to satisfy defined specifications in structured technical problems.

Grading To be determined by instructor.

Follow-up Courses ELET4142: Power Electronics/Networks

ELET2201 – C Programming

Catalog Data This course is an introduction to the C programming language with an emphasis on applications in Electrical Engineering Technology. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References *C by Dissection: The Essentials of C Programming, 4th Edition,* Kelley & Pohl, ISBN 10-02-0171374-8

Goals This course will familiarize students with structured programming, the C programming language, and the use of computers for solving problems relevant to Electrical Engineering Technology.

Prerequisite None

Class Topics The following topics will be addressed:

- Pseudocode and Flowcharting
- Arithmetic operators
- Loops
- Arrays, memory allocation and pointers
- File I/O
- Advanced topics as time permits

Outcomes Upon successful completion of this course, students will be able to:

1. Display proficiency in the development of pseudocode and/or flowcharting for logic development from a problem statement.
2. Show the ability to develop C language code with the proper syntax and grammar.
3. Exhibit the ability to compile and debug programs.

Course Outcomes 1 through 3 above support achievement of Program Outcomes 1, 3, 4 and 6.

Computer Usage Students are required to use computers to perform assignments and projects.

Laboratory None

Design Content The emphasis of this course is designing and implementing C programs.

Grading To be determined by instructor.

Follow-up Courses ELET3232: Microcontroller Systems

ELET2231 – Microprocessor Fundamentals

Catalog Data

This course covers application and design assembly and C language programming for AVR microprocessors. Topics include system timing, bus cycles, interrupts, stacks and subroutines. Upon completion, students should be able to design, program, verify, analyze, and troubleshoot AVR assembly and C language programs. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References

Programming and Customizing the AVR Microcontroller, Dhananjay V. Gadre, ISBN 0-07-134666-X

Goals

This course will introduce students to the study of single- and three-phase power generation and distribution, in addition to an introduction to common ac and dc motor and generator configurations. Emphasis will be placed on development of core competencies in the analysis, design and simulation of power circuits and systems.

Prerequisite

ELET1231: Digital Circuits with a grade of C or better
(or Co-Requisite) ELET2201: C Programming

Class Topics

After a review of relevant digital circuit concepts, the following topics will be investigated in detail:

- Microcontroller architecture
- The AVR microcontroller
- The AVR instruction set
- Memory systems, interrupts, and timers
- AVR development systems and development boards
- Code development with C
- AVR hardware design issues
- Hardware and software interfacing issues
- Expanding the AVR's I/O
- Interfacing A/D and D/A converters
- AVR applications

Outcomes

Upon successful completion of this course, students will be able to:

1. Demonstrate the ability to design, troubleshoot, and simulate AVR assembly and C language programs.
2. Demonstrate the ability to perform logic and timing simulations using an AVR development system.
3. Demonstrate an understanding of controlling circuits and systems interfaced to an AVR development board.

Course Outcomes 1 through 3 above support achievement of Program Outcomes 1, 3, 4, and 6.

Computer Usage

Students will use a development system to write, simulate and troubleshoot AVR assembly and C language programs. Students will download machine code to an AVR development system to control interfaced devices and systems.

Laboratory

None

Design Content

Students will design assembly and C language programs for AVR processors.

Grading

To be determined by instructor.

Follow-up Courses

ELET3232: Microcontroller Systems
ELET4133: Embedded Systems

ELET2241 – Instrumentation and Controls

Catalog Data This course is an introduction to instrumentation for measurement and control of physical variables, with an emphasis on electronic systems. Topics include a review of basic circuit analysis, electrical instruments, sensors and measurement principles and a survey of automatic controls from a systems point of view. This course is cross-listed as ETME3163 and meets for three (3) lecture hours per week. Three (3) credit hours.

References *Essentials of Circuit Analysis, 1st Edition,* Robert L. Boylstadt

Goals This course is designed to teach the student the laws and theorems used to analyize electrical circuits and for the student to develop skills and experience in applying this knowldge to analyize simple AC and DC circuits. This knowdledge is a necessary prerequisite for understanding and applying many of the sensors and measurement systems the students will need to learn about for their professions.

Prerequisites ELET1212: AC Circuits with a grade of C or better
ELET1212L: AC Circuits Laboratory with a grade of C or better
MATH1103: Pre-calculus Mathematics
(Co-requisite): ELET2241L: Instrumentation Laboratory

Class Topics Ohms Law, series circuits, parallel circuits, series-parallel circuits, Kirchhoffs Law, current and voltage sources, mesh analysis, Thevenin's theorem, capacitors, inductors, transient analysis, control system theory

Outcomes Upon successful completion of this course, students will be able to:

1. Calculate current, voltage, and resistance in series, parallel, and series-parallel DC and AC circuits using Ohm's Law, Kirchhoff's Law's, mesh circuit analysis, and Thevenin's Theorem,.
2. Calculate resistance, voltage, and current in a Wheatstone bridge.
3. Calculate transient current and voltage in RC and RL circuits with DC and AC sources.

Course Outcomes 1 through 3 above support achievement of Program Outcomes 1, 3, and 6.

Computer Usage Extensive circuit modeling and simulation.

Laboratory None

Design Content None

Grading To be determined by instructor.

Follow-up Courses None

ELET2241L – Instrumentation Laboratory

Catalog Data This laboratory course supports concepts and practices covered in ELET2241. This course is cross-listed as ETME3251 and meets for three (3) laboratory hours per week. One (1) credit hour.

References *Essentials of Circuit Analysis, 1st Edition,* Robert L. Boylstadt
Laboratory notes provided by instructor

Goals Students will gain skill in wiring and troubleshooting series, series-parallel and bridge-type DC and AC circuits. Students will gain a basic understanding of the principles and operation of process control systems, including feedback control. Students will also gain an understanding of the applications and limitations of common sensors.

Prerequisites ELET1212: AC Circuits with a grade of C or better
ELET1212L: AC Circuits Laboratory with a grade of C or better
(Co-requisite) ELET2241: Instrumentation and Controls

Class Topics Laboratory exercises may include, but are not limited to:

- Construction and Calibration of a DC Voltmeter
- DC Circuit Analysis
- Thevenins Theorem and Maximum Power Transfer
- Construction and Calibration of a Series-Type Ohmmeter
- Wheatstone Bridge
- Linear Variable Differential Transformers
- X-Y Recorder
- Introduction to General Purpose Oscilloscope
- Slider-Crank Mechanism w/ Digital Storage Oscilloscope
- Fiber-Optic Displacement Sensors
- Process Control System demonstration

Outcomes Upon successful completion of this course, students will be able to:

1. Use a multimeter to measure resistance, voltage, and current.
2. Wire series, parallel, series-parallel, and Wheatstone bridge circuits, power them with DC power supplies, and measure resistances, voltages, and currents.
3. Use a general-purpose dual-trace oscilloscope to view waveforms and determine period and frequency.
4. Set up and use an X-Y recorder to record transient voltage in an RC circuit.
5. Use a Linear Variable Differential Transformer (LVDT) to record mechanical displacement,.
6. Use a Linear Velocity Transducer (LVT) to determine and record linear velocity.

Course Outcomes 1 through 6 above support achievement of Program Outcomes 1, 3 and 6.

Computer Usage Extensive use of circuit simulation software.

Laboratory This course is entirely laboratory based.

Design Content None

Grading To be determined by instructor.

Follow-up Courses None

ELET3113 – Network Analysis

Catalog Data This course is an introduction to frequency domain analysis through Laplace Transforms and Fourier Analysis. Topics include a review of circuit analysis fundamentals in the time domain, circuit transformations, waveform analysis and synthesis and first order natural and forced response with extensive utilization of circuit simulation software. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References *Basic Circuit Analysis*, *5th Edition,* J.David Irwin
Introductory Circuit Analysis, 10th Edition, Robert L. Boylestad , ISBN 0-13-097417-X

Goals The course will provide students with adequate theoretical and technical background in the broad field of elementary circuit analysis. Let students become familiar with the concepts and techniques of utilizing Laplace transforms for circuit design and analysis; investigation of circuit performance in the frequency domain; computer-aided-engineering (CAE) software for solution and analysis of active and passive circuits.

Prerequisite ELET1212: AC Circuits with a grade of C or better
ELET1212L: AC Circuits Laboratory with a grade of C or better
MATH1121: ET Calculus
Junior standing in department

Class Topics After a review of relevant circuit concepts, the following topics will be investigated in detail:

- Waveform Analysis: Switching functions, Test Signals
- Circuit Parameters: Capacitance, Self and Mutual Inductance, Ideal Transformer
- The Basic Time-Domain Circuit: Steady-State and Transient, Initial Conditions, Differential Equations
- The Laplace Transforms: Laplace Transform Operation, Inverse Transform, Multiple-Order and Complex Poles, Circuit Analysis by Laplace Transform
- System Considerations: Transfer function, Step and Impulse Responses, Poles and Zeros, Stability
- The Sinusoidal Steady State: Sinusoidal Steady-State, The Steady-State Transfer Function, Frequency Response Plots
- Introduction to Fourier Analysis: Fourier Series, Common Periodic Waveforms and Their Fourier Series

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate an understanding of switching and test signals.
2. Exhibit knowledge of initial conditions, transient and steady-state responses.
3. Display proficiency in the analysis of passive circuits using Laplace Transforms.
4. Demonstrate an understanding of transfer function, frequency response and frequency domain analysis.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1, 3, 4 and 6.

Computer Usage Extensive utilization of circuit simulation and/or MATLAB simulation packages.

Laboratory None

Grading To be determined by instructor.

Follow-up Courses ELET4152: Digital Signal Processing
ELET4242: Control Systems

ELET3132 - Digital Systems

Catalog Data

This course covers the design and implementation of digital systems. Topics include combinational and sequential digital circuits, minimization methods, state machine design and state assignment techniques, hardware descriptor languages such as VHDL, circuit implementation using MSI integrated circuits and programmable logic devices. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References

Fundamentals of Digital Logic with VHDL Design, 2nd edition , Stephen Brown and Vranesic, Zvonko, ISBN: 0-07-246085-7

Goals

The goal of this course is for students to be able to design, test, troubleshoot, and implement and simulate combinational and sequential digital circuits in a professional manner by using medium scale integration (MSI) ICs and programmable logic devices.

Prerequisite

ELET1231: Digital Circuits with a grade of C or better
ELET1231L: Digital Circuits Laboratory with a grade of C or better
Junior standing in the department

Class Topics

After a review of relevant digital circuit concepts, the following topics will be investigated in detail:

- Static and dynamic electrical characteristics of the CMOS, TTL, DTL, and ECL families of logic ICs
- Logic function optimization and hazard protection
- Programmable logic device architecture and introduction to VHDL
- The Xilinx Integrated Software Environment
- Decoders, Encoders, Comparators and other MSI building blocks
- Analysis and operation of flip-flops and counter operation and design
- Principles of state machine analysis and design
- Synchronous state machine design
- Advanced topics in VHDL

Outcomes

Upon successful completion of this course, students will be able to:

1. Demonstrate the ability to design, troubleshoot, and implement digital systems.
2. Demonstrate the ability to design a Mealy or Moore Finite or Algorithmic State Machine.
3. Demonstrate the ability to perform logic and timing simulations using the Xilinx Integrated Development System.
4. Demonstrate the ability to implement designs using a CPLD or FPGA.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1, 2, 3, 4, and 6.

Computer Usage

Students will use Xilinx Integrated Software Environment to design combinational and sequential circuits. Students will download, test, and troubleshoot circuit designs and HDL circuit descriptions using the Xilinx Spartan 3 FPGA Boards.

Laboratory

None

Design Content

Students will design synchronous sequential systems as well as Finite and Algorithmic State Machines.

Grading

To be determined by instructor.

Follow-up Courses

ELET4133: Embedded Systems

ELET3132L – Digital Systems Laboratory (W)

Catalog Data This laboratory course supports concepts and practices covered in ELET3132. This course meets for three (3) laboratory hours per week. One (1) credit hour.

References *Fundamentals of Digital Logic with VHDL Design, 2nd Edition* , Stephen Brown and Vranesic, Zvonko, ISBN: 0-07-246085-7

Goals The goal of this course is for students to be able to design, test, troubleshoot, and implement and simulate combinational and sequential digital circuits in a professional manner by using medium scale integration (MSI) ICs and programmable logic devices.

Prerequisites ELET1231: Digital Circuits with a grade of C or better
ELET1231L: Digital Circuits Laboratory with a grade of C or better
Junior standing in department
(Co-requisite) ELET3132: Digital Systems or permission of department

Class Topics Experiments will be determined by topics covered in ELET3132: Digital Systems.

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate the ability to design, troubleshoot, and implement digital systems.
2. Demonstrate the ability to design a Mealy or Moore Finite or Algorithmic State Machine.
3. Demonstrate the ability to perform logic and timing simulations using the Xilinx Integrated Development System.
4. Demonstrate the ability to implement designs using a CPLD or FPGA.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1, 2, 3, 4, and 6.

Computer Usage Students will use Xilinx Integrated Software Environment to design combinational and sequential circuits. Students will download, test, and troubleshoot circuit designs and HDL circuit descriptions using the Xilinx Spartan 3 FPGA Boards.

Laboratory This course is entirely laboratory based.

Design Content Students will design synchronous sequential systems as well as Finite and Algorithmic State Machines.

Grading To be determined by instructor.

Follow-up Courses None

ELET3222 – Electronics II

Catalog Data This course is a continuation of the study of solid state devices begun in ELET2121. Topics include frequency response of single and multistage amplifiers, feedback and stability, linear and nonlinear operational amplifier circuits, and CMOS and BiCMOS circuits with extensive utilization of circuit simulation software. This course meets for three (3) lecture hours per week. Three (3) credit hours.

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References: *Operational Amplifiers with Linear Integrated Circuits, 4th Edition*, William D. Stanley

Goals: To increase the student's understanding of semiconductor devices and circuits, and to enable the student to design, simulate, build, and test circuits using operational amplifiers and other linear integrated circuits as solutions to engineering technology problems**.**

Prerequisite ELET2121 Electronics I with a grade of C or better
ELET2121L: Electronics I Laboratory with a grade of C or better
Junior standing in department

Class Topics Topics may include, but are not limited to:

- General amplifier circuits: modeling; analysis and/or design for frequency response; Bode plots
- Computer simulation of linear and non-linear circuits using Op-Amps
- Effects of finite, real-device parameters on ideal amp assumptions
- DC effects and limitations: offset voltages & currents, saturation
- AC effects and limitations: frequency response, slew-rate
- Op-Amp Linear Amplifier Applications Circuits
- Comparators, Oscillators & Waveform Generators
- Regenerative Oscillators, Feedback Oscillators
- Specialized Integrated Circuits
- Active Filters and Power Supplies

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate knowledge of ideal amplifier approximations and how real devices deviate from those behaviors.
2. Exhibit ability in the calculation of amplifier gains, bandwidths, slew-rate limitations, and oscillator parameters for common applications.
3. Show proficiency in the analysis and design of circuits to perform common amplifier functions.
4. Display skill in the explanation of the performance and behaviors of commonly used circuits and why some model-predicted performance does not match practical results.

Course Outcomes 1 through 4 support achievement of Program Outcomes 1, 3, 4 and 6.

Computer Usage Extensive use of circuit simulation software.

Laboratory None

Design Content Students will be required to design circuits containing defined microelectronic devices to satisfy defined specifications in structured technical problems.

Grading To be determined by instructor.

Follow-up Courses ELET4142: Power Electronics/Networks
ELET4151: Communication Systems
ELET4151L: Communication Systems Laboratory
ELET4223: Active Filters

ELET3222L – Electronics II Laboratory (W)

Catalog Data This laboratory course supports concepts and practices covered in ELET3222. This course meets for three (3) laboratory hours per week. One (1) credit hour.

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References: *Operational Amplifiers with Linear Integrated Circuits, 4th Edition*, William D. Stanley
Laboratory notes provided by instructor

Goals: To increase the student's understanding of semiconductor devices and circuits, and to enable the student to design, simulate, build, and test circuits using operational amplifiers and other linear integrated circuits as solutions to engineering technology problems**.**

Prerequisite ELET2121 Electronics I with a grade of C or better
ELET2121L: Electronics I Laboratory with a grade of C or better
Junior standing in department
(or Co-requisite) ELET3222: Electronics II or permission of department

Class Topics Laboratory experiments will be based on material covered in ELET3222: Electronics II

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate the ability to effectively design and simulate amplifier circuits using common operational amplifiers and linear ICs.
2. Exhibit competency in the operation of standard laboratory equipment.
3. Show the ability to assemble, troubleshoot, test and report results for electronic circuits.
4. Display the ability to communicate experimental results in written and oral formats.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1, 2, 4, and 6.

Computer Usage Extensive use of circuit simulation software.

Laboratory This course is entirely laboratory based

Design Content Students will be required to determine appropriate circuit components and topologies to satisfy defined problems.

Grading To be determined by instructor.

Follow-up Courses ELET4142: Power Electronics/Networks
ELET4151: Communication Systems
ELET4151L: Communication Systems Laboratory

ELET3232 - Microcontroller Systems

Catalog Data This course covers application and design of ARM (Advanced RISC Machine) systems. Topics include assembly and C language programming and an introduction to the control and interfacing of ARM based systems. Upon completion, students should be able to design, construct, program, verify, analyze and troubleshoot ARM assembly and C language programs and supporting hardware. This course meets for three (3) lecture hours per week. Three (3) credit hours.

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References: *ARM: System-on-Chip Architecture, 2nd Edition*, Steve Furber, ISBN: 0-201-67519-6

Goals: The goal of this course is for students to be able to design, troubleshoot, simulate, and execute working ARM assembly and C language programs.

Prerequisite ELET2201: C Programming
ELET2231: Microprocessor Fundamentals

Class Topics The following topics will be investigated:

- An introduction to processor design and the RAM architecture
- ARM assembly language programming
- The ARM instruction set
- Architectural support for high-level languages
- The Thumb instruction set
- Architectural support for system development
- ARM core processors
- Memory hierarchy
- Embedded ARM applications

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate the ability to design, troubleshoot, and simulate ARM assembly and C language programs.
2. Demonstrate the ability to perform logic and timing simulations using an ARM development system.
3. Demonstrate an understanding of controlling circuits and systems interfaced to an ARM development board.

Course Outcomes 1 through 3 support achievement of Program Outcomes 1, 2, 4, and 6.

Computer Usage Students will use a development system to write, simulate, and trouble shoot ARM assembly and C language programs. Students will download machine code to an ARM development system to control interfaced devices and systems.

Laboratory None

Design Content Students will design assembly and C language programs for ARM processors.

Grading To be determined by instructor.

Follow-up Courses None

ELET4133 – Embedded Systems

Catalog Data This course covers the external characteristics of digital and analog integrated circuits and their applications when interfaced to embedded digital systems. Design constraints and considerations due to device limitations and device selection based upon application requirements will be discussed. Upon completion, students should be able to design, program, verify, analyze, and troubleshoot hardware and software in embedded systems. This course meets for three (3) lecture hours per week. Three (3) credit hours.

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References*:* *ARM: System-on-Chip Architecture, 2nd Edition*, Steve Furber, ISBM: 0-201-67519-6

Goals: The goal of this course is for students to be able to design, troubleshoot, and execute complete embedded systems based on design constraints and device limitations.

Prerequisite ELET2231: Microprocessor Fundamentals
ELET3132: Digital Systems

Class Topics Topics investigated in this course include:

- Embedded systems hardware and software overview
- Interfacing analog and digital devices to the AVR microcontroller
- Software control of I/O port lines
- Output peripherals – interface devices
- Case study – weight measurements with a load cell
- Interfacing analog and digital devices to the ARM microcontroller
- External memory system design
- I/O system design
- Designing a complete system
- Interfacing A/D and D/A converters

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate the ability to implement state machines with embedded systems.
2. Demonstrate the ability to interface microcontrollers to a variety of hardware devices for process control, including A/Ds, serial I/O and parallel I/O ICs.
3. Demonstrate an understanding of processes to acquire data from interfaced analog devices including temperature, light, strain and position.

Course Outcomes 1 through 3 support achievement of Program Outcomes 1, 2, 4, and 6.

Computer Usage Students will use a development system to write, simulate, and troubleshoot AVR and ARM assembly and C language programs. Students will download machine code to an AVR and ARM development system to control interfaced devices and systems.

Laboratory None

Design Content Students will design assembly and C language programs for AVR processors to control external interfaced analog and digital devices.

Grading To be determined by instructor.

Follow-up Courses None

ELET4142 – Power Electronics and Power Networks

Catalog Data

This course is an introduction to power electronic devices in electrical systems, including their characteristics, operation and application. It also introduces topics on transmission of electric power with emphasis on modeling of power network components and systems, power flow studies and calculations. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References

Electric Machinery and Power System Fundamentals, Stephen J. Chapman, ISBN 0-07-229135-4

Goals

This course will introduce students to the study of power electronic devices and their applications, along with the basic knowledge on electric power distribution systems. Emphasis will be placed on development of core competencies in the analysis, design and simulation of power systems and power networks.

Prerequisite

ELET2141: Intro Power Systems
ELET3222: Electronics II
ELET3222L: Electronics II Laboratory

Class Topics

After a review of fundamental power and electronic concepts, the following topics will be investigated:

- Devices and power electronics: diodes; thyristors; bipolar transistors; MOSFETs; IGBTs; MCTs; basic characteristics of power semiconductor devices; drive requirements; thermal management; protection.
- Converters: Consideration of pulse rectifier systems; variable speed drives; motoring and regeneration; cycloconverter.
- Inverters: 3-phase inverters; dc link inverter; forced-commutation thyristor circuits; BJT and IGBT, comparison with thyristor; variable speed induction motor drive.
- Power supplies: Linear and switched mode power supplies; practical characteristics and analysis of step-up and step-down switched mode power supplies.
- Power networks: Power in balanced three-phase circuits; per-unit calculations; network parameters; parallel and serial compensation; power quality; power flow problems and solutions for transmission networks; symmetrical fault calculations; sequence networks and unsymmetrical faults.

Outcomes

Upon successful completion of this course, students will be able to:

1. Perform design calculations for drive and power supply applications.
2. Analyze operation of power converters and inverters.
3. Explain principles of operation of interconnected electric power transmission systems.
4. Apply the techniques currently employed by industry for modeling and analyzing large-scale transmission systems.
5. Use basic design principles for long-distance electric power transmission lines and facilities.
6. Analyze real and reactive power flow on large-scale transmission networks using computer based techniques.
7. Use techniques/procedures in analysis of faulted power transmission systems.

Course Outcomes 1 through 7 support achievement of Program Outcomes 1, 2, 4, and 6.

Computer Usage

Extensive use of circuit simulation software (Matlab: SimPowerSystems).

Laboratory

None

Design Content

Students will be required to design and analyze power circuits or systems to satisfy defined specifications in structured technical problems.

Grading

To be determined by instructor.

Follow-up Courses

None

ELET4151 - Communication Systems

Catalog Data This course covers basic principles and concepts underlying modern communication systems. Topics include systems, signals, modulations (AM, FM, PM, FSK, PSK, QAM, PCM), transmission, reception, cellular, caller ID, and networks. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References *Electronic Communications Systems -Fundamentals through Advanced, 5th Edition,* Wayne Tomasi

Goals To provide students with adequate theoretical and technical background in the broad field of communication systems.

Prerequisite ELET3222: Electronics II
ELET3222L: Electronics II Laboratory
ETGR3171: Engineering Analysis I

Class Topics Topics include: power measurements dB, dBm, spectrum, bandwidth, noise analysis, information capacity, signal analysis and mixing, continuous wave modulation (AM, FM, PM), brief MATLAB, digital modulation (ASK, FSK, PSK, QAM), digital transmission (PCM), companding (compressing and expanding) μ-law, A-law, telephone instruments and signals, cellular phone concepts, caller ID, and satellite communication concepts.

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate understanding of the basic principles and concepts of the modern communication systems, including noise factor, noise figure, spectrum, information capacity, AM, FM, ASK, FSK, PSK, QASK, PCM, cellular phone concepts, satellite communication concepts, and caller ID.
2. Know how some current communication systems for transmission and reception of information work.
3. Show the ability to use Matlab for simulation of modulated signals, and modulation index.

Course Outcomes 1 through 3 above support achievement of Program Outcomes 1, 4 and 6.

Computer Usage Utilization of MATLAB.

Laboratory None

Design Content Homework includes many practical problems in the text book, e.g., noise temperature, noise factor, noise figure, S/N, AM, FM modulations, caller ID coding and decoding.

Grading To be determined by instructor.

Follow-up Courses None

ELET4151L - Communication Systems Laboratory (W)

Catalog Data This laboratory course supports concepts and practices covered in ELET4151. This course meets for three (3) laboratory hours per week. One (1) credit hour.

References *Electronic Communications Systems -Fundamentals through Advanced, 5th Edition,* Wayne Tomasi
Laboratory notes provided by instructor

Goals To provide students with adequate experiments related to the theoretical and technical background in the broad field of communications, networks, test and measurement, simulations, and analysis. The student is expected to gain experience in Technical Writing. The principle emphasis of this course will be on the students' efforts in performing an experiment and preparing a report describing results.

Prerequisites ELET3222: Electronics II
ELET3222L: Electronics II Laboratory
ETGR3171: Engineering Analysis I
(or Co-requisite): ELET4151: Communication Systems or permission of department

Class Topics Use of various modern test and measurement instruments (e.g., Spectrum Analyzer, General Function Generator, etc.), spectrum and waveform of various signals, AM, FM, PM, PCM, communication software (MATLAB etc.), networking simulation.

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate hands-on skills on basic modern test and measurement instruments in communication systems.
2. Show the ability to use hardware and software for simulation of modulated signals, modulation index, and spectrum analysis.
3. Become familiar with and hands on the concepts and techniques in the communications lecture course, and various simulation software for solution and analysis of communications by using the state-of-the-art instruments and software.

Course Outcomes 1 through 3 above support achievement of Program Outcomes 1 and 6.

Computer Usage Utilization of MATLAB and the Communication Tool box.

Grading To be determined by instructor.

Follow-up Courses None

ELET4152 - Digital Signal Processing

Catalog Data Discrete-time signals; discrete-time systems; Linear constant-coefficient difference equations; Periodic sampling; reconstruction from samples; changing the sampling rate; the z-transform; z-transform properties; transform analysis of linear time-invariant systems; digital filter design techniques; discrete Fourier Transform and the FFT algorithm. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References *Discrete-Time Signal Processing*, A.V. Oppenheim and R.W. Schafer

Goals This course introduces the fundamental concepts and techniques in the processing of discrete-time signals. Emphasis is placed upon sampling of continuous-time signals, the z-transform, structures for discrete-time systems, filter design techniques and the discrete Fourier transform.

Prerequisite ELET3113: Network Analysis

Class Topics The following topics will be investigated in detail:

- Discrete-time signals and systems
- Sampling of continuous-time signals
- The Z-transform
- Structures for discrete-time systems
- Filter design techniques
- The discrete Fourier transform

Outcomes Upon successful completion of this course, students will be able to:

1. Explain the principles involved in the sampling of discrete-time systems.
2. Make use of the basic network structures used for finite impulse response filter design.
3. Design IIR filters based upon an existing analog design.
4. Understand and make use of the z-transform in connection with digital signal processing.
5. Understand the use of, and make use of, the DFT and the FFT in signal processing.

Course Outcomes 1 through 5 above support achievement of Program Outcomes 1, 2, 4, and 6.

Computer Usage Extensive use of circuit simulation software

Laboratory None

Design Content Design content is extensive, including the design of digital filters and other algorithms for the processing of digital signals.

Grading To be determined by instructor.

Follow-up Courses None

ELET4191 – Applied Project Management

Catalog Data Statement of work, activity decisions, timelines, scheduling, and resource allocation methods. Techniques will be appropriate for large and small projects within commercial, academic, or non-profit organizations. This course meets for two (2) lecture hours per week. Two (2) credit hours.

References *Effective Project Management : Traditional, Adaptive, Extreme. Latest Edition. Wiley Publishing*

Goals This course will provide students with the background required to manage a project. Students will learn how to implement the various phases in a project including the selection phase, the concept phase, the development phase, the implementation phase and the control phase.

Prerequisite MATH1100: College Algebra
Senior standing in department
(Co-requisite): ELET4192: Senior Project I

Class Topics Topics include, but are not limited to:

- Introduction to Project Management
- Project Selection Techniques
- Development of a Project Charter
- Development of a Work Breakdown Structure
- Organizing the Project Team
- Performing Network Analysis
- Development of Schedules
- Development of Plans
- Implementation and Project progress
- Scope Verification
- Contract Close-out

Outcomes Upon successful completion of this course, students will be able to:

1. Apply fundamental concepts of project management
2. Use project management tools
    a. Identify, define and apply various project selection techniques.
    b. Be able to develop a project charter
    c. Be able to develop project requirements
    d. Describe the elements of a state of work.
    e. Develop a WBS
    f. Perform a network analysis
    g. Develop schedules using a Gantt chart
    h. Develop a risk management plan
3. Function as a project management team member

Course Outcomes 1 through 3 above support achievement of Program Outcomes 1 through 6.

Computer Usage Assignments will require the use of Microsoft Project, Excel and Word..

Laboratory None

Design Content Students will be expected to work on case studies.

Grading To be determined by instructor.

Follow-up Courses ELET4293: Senior Project II

ELET4192 - Senior Project I (W)

Catalog Data This is the first of a two semester sequence in senior design. Students will utilize previous coursework to creatively investigate and produce solutions for a comprehensive practical engineering technology project. This course meets for two (2) lecture hours per week. Two (2) credit hours. Pass/No credit grading.

References As appropriate for project.

Goals To let students with adequate practical environment solve real and practical industrial problems or work on faculty's projects. Develop and demonstrate the ability to integrate technical and communications abilities. The student will be expected to conduct a technical project, fitting the complexity level expected of a college senior. In doing so, the student will be expected to demonstrate skills in project planning, teamwork, budgeting of time and expenses, writing, and oral presentation, especially the ability to solve the engineering and technology problem and successfully complete the project by using learned knowledge, techniques and skills.

Prerequisite Senior status in department
(Co-requisite) ELET4191: Applied Project Management

Class Topics Determined by project.

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate their ability to investigate and solve practical problem and complete the project in required time period.
2. Demonstrate knowledge of a wide range of engineering technology topics and skills and display significant understanding of specific topic(s).
3. Show the ability to use appropriate hardware and/or software for the project.
4. Show the ability to develop and document a project plan, develop technical approach and scheme, carry out the project, and provide a summative oral and written report to document project results.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1 through 6.

Computer Usage As appropriate for project.

Laboratory As appropriate for project.

Design Content The course and the follow-on are a demonstration of the ability to define a concept, design a device or system, realize that design and validate the results for a practical project. Working demonstration models are an essential feature of this class whenever appropriate.

Grading To be determined by instructor.

Follow-up ELET4293: Senior Project II

ELET4223 - Active Filters

Catalog Data

This course involves the design, analysis, simulation and implementation of composite, cascaded and summation filters. Topics include bilinear transfer functions; cascade design with first-order circuits; biquad circuits; Butterworth lowpass circuits; Butterworth bandpass circuits; the Chebyshev response; sensitivity; frequency transformations; highpass and band-elimination filters. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References

Analog Filter Design, M.E. Van Valkenburg, Oxford University Press

Goals

This is the third of a three-part sequence that introduces the fundamental concepts and techniques in electronic device, circuit and system analysis and design. Emphasis will be placed on the design of analog filters having Butterworth and Chebyshev responses, and the use of frequency transformations to obtain highpass, bandpass and band-elimiate filters from lowpass prototypes.

Prerequisites

ELET3222: Electronics II
ETGR3171: Engineering Analysis I

Class Topics

The following topics will be investigated in detail:

- Bilinear Transfer Functions
- Cascade design using first-order circuits
- The Biquad circuit
- Butterworth Lowpass and Bandpass Filters
- The Chebyshev response
- Sensitivity
- Frequency transformations
- Highpass and band-eliminate filters

Outcomes

Upon successful completion of this course, students will be able to:

1. Design and analyze filters making use of bilinear transforms.
2. Design active filters by cascading first-order circuits.
3. Demonstrate an understanding of the design and analysis of active filters using the biquad circuit.
4. Design filters having a lowpass Butterworth response
5. Design filters having a bandpass Butterworth response.
6. Design lowpass and bandpass filters having a Chebyshev response.
7. Perform sensitivity analysis upon a given active filter circuit.
8. Make use of frequency transformation methods to convert prototype lowpass filters into highpass, bandpaass or band-reject filters.

Program Outcomes 1 through 8 above support achievement of Program Outcomes 1, 3, 4 and 6.

Computer Usage

Circuit simulation software

Laboratory

None

Design Content

This course is design based.

Grading

To be determined by instructor.

Follow-up Courses

None

ELET4242 - Control Systems

Catalog Data

Automatic control systems concepts, system modeling, control system components, state space model, transfer function model, time responses, poles and zeros, closed loop, reduction of multiple subsystems, stability analysis, Routh-Hurwitz, performance analysis, design techniques, root locus, Bode, Nyquist, PID, and MATLAB control tool box. This course meets for three (3) lecture hours per week. Three (3) credit hours.

References

Control Systems Engineering, *5th Edition*, Norman S. Nise

Goals

To provide students with adequate theoretical and technical background in the broad field of control systems engineering analysis and design. Let students become familiar with the concepts and techniques of linear time-invariant control system analysis and design; computer-aided-engineering (CAE) software MATLAB and Simulink for solution, analysis and design of automatic control systems. The MATLAB and Control Tool Box program will be used extensively.

Prerequisite

ELET3113: Network Analysis
ETGR3171: Engineering Analysis I

Class Topics

Topics may include:

- Introduction to Frontier of Automatic Control: History, State-of-the-Art and Future of Automatic Control; Control Systems Engineering, Analysis and Design Objectives
- System State-Space Representation: Introduction; General State Space Representation; Transfer Functions; system modeling
- Time Response: Introduction; Poles, Zeros, and System Response; First-Order Systems; Second-Order Systems; Systems Response with Poles and Zeros
- System Structure and Representation: Introduction Block Diagrams and Signal Flow Graphs; Mason's Rule
- Stability of Control Systems: Introduction Definitions and Determinations; Routh-Hurwitz Criterion; Robust Control – Kharitonov's Theorem; Stability in State-Space
- Steady-State Errors: Introduction; Steady State Errors in Linear Time Invariant Systems
- Control System Design Technique I -- Root Locus: Introduction Definition, Properties and Sketching of Root Locus of Control Systems; Improving Steady-State Error and Transient Response; Feedback Compensation
- Control System Design Technique II -- Frequency Response Technique: Introduction; Bode Plots, Nyquist Diagram; Gain Margin and Phase Margin; PID; Stability; Closed Loop Transient Responses and Frequency Responses

Outcomes

Upon successful completion of this course, students will be able to:

1. Demonstrate expertise with fundamental control concepts, control system analysis and design of linear time-invariant control systems, including stability and performance.
2. Display proficiency in the use of MATLAB, Control Toolbox and Simulink for control systems analysis and practice of control systems.
3. Show familiarity with the basic systems point of view to do analysis and synthesis for practical problems, especially control problems.

Course Outcomes 1 through 3 above support achievement of Program Outcomes 1, 4 and 6.

Computer Usage

Extensive utilization of the MATLAB and Control Tool Box.

Laboratory

None

Design Content

Homework includes many practical automatic control problems, e.g., ship, aircraft, space shuttle, remote camera, robot, in the text book, that are heavily utilization of analysis and design skills, MATLAB and control tool box software.

Grading

To be determined by instructor.

Follow-up Courses

None

ELET4293 – Senior Project II (W)(O)

Catalog Data This is the second of a two semester sequence in senior design. Students will incorporate Applied Project Management techniques into the capstone project identified in ELET4192 to finalize project analysis, development and implementation. This course meets for two (2) lecture hours per week. Two (2) credit hours.

References As appropriate for project.

Goals To let students with adequate practical environment solve real and practical industrial problems or work on faculty's projects. Develop and demonstrate the ability to integrate technical and communications abilities. The student will be expected to conduct a technical project, fitting the complexity level expected of a college senior. In doing so, the student will be expected to demonstrate skills in project planning, teamwork, budgeting of time and expenses, writing, and oral presentation, especially the ability to solve the engineering and technology problem and successfully complete the project by using learned knowledge, techniques and skills.

Prerequisite ELET4191: Applied Project Management with a grade of C or better
ELET4192: Senior Project I with a passing grade

Class Topics Determined by project.

Outcomes Upon successful completion of this course, students will be able to:

1. Demonstrate their ability to investigate and solve practical problem and complete the project in required time period.
2. Demonstrate knowledge of a wide range of engineering technology topics and skills and display significant understanding of specific topic(s).
3. Show the ability to use appropriate hardware and/or software for the project.
4. Show the ability to develop and document a project plan, develop technical approach and scheme, carry out the project, and provide a summative oral and written report to document project results.

Course Outcomes 1 through 4 above support achievement of Program Outcomes 1 through 6.

Computer Usage As appropriate for project.

Laboratory As appropriate for project.

Design Content The course is the capstone of the student's educational experience and, as such, requires a demonstration of the ability to define a concept, design a device or system, realize that design and validate the results for a practical project. Working demonstration models are an essential feature of this class whenever appropriate.

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Grading To be determined by instructor.

Follow-up Courses None