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CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. CONTACT

Contact Person Dennis Whitson and W. Larry Freeman Phone 7-4593/4592

Department Physics

II. PROPOSAL TYPE (Check All Appropriate Lines)

Rev.

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X **COURSE** Intro to Electronics
Suggested 20 character title

X New Course* EOPT 125 Introduction to Electronics
Course Number and Full Title

____ Course Revision _____
Course Number and Full Title

____ Liberal Studies Approval+ for new or existing course _____
Course Number and Full Title

____ Course Deletion _____
Course Number and Full Title

____ Number and/or Title Change _____
Old Number and/or Full Old Title

_____
New Number and/or Full New Title

____ Course or Catalog Description Change _____
Course Number and Full Title

PROGRAM: _____ Major _____ Minor _____ Track

____ New Program* _____
Program Name

____ Program Revision* _____
Program Name

____ Program Deletion* _____
Program Name

____ Title Change _____
Old Program Name

_____
New Program Name

III. Approvals (signatures and date)

Kenneth E. Hershman 11/16/00
Department Curriculum Committee

Richard D. Roberts 11/16/00
Department Chair

College Curriculum Committee 12/12/00

John D. Ellis 1/12/01
College Dean

_____
+ Director of Liberal Studies (where applicable)

1/15/01
*Provost (where applicable)

1993

Syllabus of Record for EOPT 125

I. Catalog Description

EOPT 125 Introduction to Electronics — 3 lecture hours, 3 lab hours, 4 credits (3c-3l-4sh)

Corequisite or Prerequisite: MATH 110 or MATH 121

This course is designed to introduce students to basic analog and digital electronics. Emphasis will be placed on direct current (DC) circuits and networks utilizing Ohm's Law and focused upon the use of electronic instrumentation and design using operational amplifiers as "black box" building elements. In addition the digital component of the course will cover basic digital logic and its implementation in hardware using integrated circuit based logic gates and counters. This course includes a lab component.

II. Course Objectives

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

1. Converse in the language of electronics and explain the pertinent symbols and draw complex electrical diagrams as well as operate standard measurement devices such as Oscilloscopes, multi-meters, computers, and chart recorders.
2. Classify and discuss the function of a resistor, capacitor, and inductor and how these components relate to the concepts of resistance, reactance, and impedance.
3. Apply Ohm's Law, Thevenin's theorem, and Norton's theorem to complex networks of passive and active components.
4. Explain the characteristics of time varying electrical currents (alternating currents (AC)) along with filters, transformers, and the function of a diode rectifier and how it is utilized in fabricating direct current (DC) power supplies from AC sources.
5. Explain and analyze the general principles of signal transducers and amplification with particular emphasis on the characteristics and utility of operational amplifiers.
6. Apply alternate numbering systems, the function and symbolism of digital logic gates and analyze how they may be implemented using switches and commercially available integrated circuits
7. Apply and discuss Boolean algebra and apply DeMorgan's Theorems and fabricate logic circuits to do the same.
8. Explain the operation and utility of flip-flop and register circuits.
9. Explain the general operation and utility of analog to digital converters (ADC) and digital to analog converters (DAC).

III-A Course Outline for Lectures (42 hrs)

A. Passive Electrical Components and Networks (6 hrs)
1. Resistors
   a. Ohms Law
   b. Series and parallel combinations
   c. Wheatstone Bridge and Potentiometer
2. Capacitors
   a. Charging and discharging through a resistor
   b. Series and parallel combinations
3. Inductors
   a. Faraday's Law
   b. Charging and discharging through a resistor
   c. Series and parallel combinations
4. Rectifier (Diode)
   a. Ideal Diode
   b. Real Diodes

B. Important Electronic Instruments (3 hrs)
1. Basic Meters
2. Measuring Instruments
   a. Voltmeter
   b. Ammeter
   c. Oscilloscope
3. Recorders

C. Transducers (2 hrs)
1. Resistive Input
2. Voltage Input
3. Other Transducers

D. Power Supplies (3 hrs)
1. Rectification
2. Filtering
3. Voltage Regulation

E. Amplifiers (2 hrs)
1. Amplifier Properties
2. Amplifier Types
3. Electronic Noise

F. Operational Amplifiers (op-amps) (8 hrs)
1. Properties of an Ideal Op-amp
2. Basic Circuits
3. Limitations of Real op-amps

G. Discrete Electronic Devices (4 hrs)
   1. Transistors
   2. Other Active Devices

H. Digital Logic Elements (2 hrs)
   1. Binary and Other Numbering Systems
   2. Basic Logic Gates
   3. Classes of Logic Gate Hardware

I. Gate Circuits (3 hrs)
   1. Boolean Algebra
   2. Gate Applications

J. Flip-Flops and Registers (4 hrs)
   1. Basic Flip-Flops
   2. Edge-Triggered Flip-Flops
   3. Master-Slave Flip-Flops
   4. Counters
   5. Shift Registers

K. Digital Instruments (3 hrs)
   1. Counting and Scaling Instruments
   2. Digital to Analog Conversion
   3. Analog to Digital Conversion

Testing (2 hrs)

III-B. Course Outline for Labs (14 labs, 3 hours per lab)

A. Introduction (1 lab)
B. Instrumentation and Basic DC Circuits (1 lab)
C. Simple Networks and Thevenin's Theorem (1 lab)
D. The Oscilloscope and Its Operation in Measuring Time Varying Signals (1 lab)
E. Characteristics of Capacitors and Inductors: Charging and Discharging (1.5 labs)
F. Diodes, Filters, and Power Supplies (1.5 labs)
G. Resonance, Reactance, Impedance, and Frequency Response (1.5 labs)
H. The Operational Amplifier (2 labs)
I. Bipolar Transistors (1 lab)
J. Digital Circuits (1.5 labs)
K. Lab Practical: Students will be required to take and analyze some data from set-ups that are similar to those they worked with during the semester. (1 lab)

IV. Evaluation Methods

The final grade for the course will be determined as follows:

50% Tests. Three tests (two during the semester and the final) consisting of solving word problems.

20% Homework

20% All Laboratory work

10% Quizzes in the lecture on the textbook and supplemental assignments

Grading Scale:

90-100% : A; 80-89% : B; 70-79%: C; 60-69% : D; below 60% F.

Attendance Policy: The attendance policy will conform to the University wide attendance criteria.

V. Required textbooks, supplemental books and readings

Textbook: Diefenderfer and Holton, *Principles of Electronic Instrumentation, 3rd*, Saunders College Publishing, 1994

Supplemental Readings:

1. Handouts

VI. Special resource requirements

None

VII. Bibliography

1. Barnaal, D., *Analog and Digital Electronics for Scientific Applications* Wadsworth Inc., 1982

2. Bogart, T.; Rico, Guillermo; Beasley, J.; *Electroic Devices and Circuits, 5th Ed.*, Prentice Hall, 2001

3. Boylestad, R.L., *Introductory Circuit Analysis, 9th Ed.*, Prentice-Hall Academic, 1999

4. Dailey, D.J., *Electronic Devices and Circuits: Discrete and Integrated, 1st Ed.*, Prentice Hall, 2001

5. Floyd, Thomas L., *Electronic Devices*, 5th Ed., Prentice-Hall Academic, 1999,

6. Floyd, T.L., *Principles of Electric Circuits, 6th Ed.*, Prentice-Hall Academic, 1999

7. Higgins, *Electronics with Digital and Analog Integrated Circuits*, Prentice Hall, 1983

8. Mitchell and Mitchell, *Introduction to Electronics Design*, Prentice Hall, 1988

9. Patrick, Dale and Fardo, Stephen, *Electricity and Electronics: A Survey*, 4th Ed., Prentice-Hall Academic, 1999

10. Paynter, R.T., *Introductory Electric Circuits: Conventional Flow Version, 1st Ed.*, Prentice Hall, Academic, 1999

Course Analysis Questionnaire
EOPT 125, Introduction to Electronics

Section A: Details of the Course

A1 This course is a requirement for the proposed degrees Associate in Applied Science in Electro-Optics (A.A.S.E.O.) and Associate in Science in Electro-Optics (A.S.E.O.). This course is not intended for inclusion in the Liberal Studies program.

A2 This course does not require changes in any other courses in the department. The Applied Physics program will have an additional track associated with the A.S.E.O. degree and this course will be part of that track.

A3 This course has not been offered on a trial basis at IUP.

A4 This course is not intended to be dual level.

A5 This course is not to be taken for variable credit.

A6 Similar courses are offered at these institutions:

1. Camden County College; Blackwood, New Jersey
   EET-211 Electronics I
   EET-212 Electronics II
2. Central Carolina Community College; Lillington, North Carolina
   ELN 131 Electronic Devices
3. Cincinnati Technical College; Cincinnati, Ohio
   EET 7730 Electronics 1
4. Northcentral Technical College; Wausau, Wisconsin
   605-110 Electronic Devices and Circuits I
5. Pueblo Community College; Pueblo, Colorado
   ELT 140 DC/AC Electronics
6. Three Rivers Community / Technical College; Norwich, Connecticut
   EET 1130/1131 Electric Circuits and Devices/Lab

A7 As far as I know, the contents or skills of this proposed course are not recommended or required by a professional society, accrediting authority, law or other external agency. The content and/or skills of this course cannot be incorporated into an existing course such as PHYS 231 (Electronics) because the material covered in the two courses is significantly different.

Section B: Interdisciplinary Implications

B1 This course will be taught by one instructor.

B2 This course does not overlap any course offered by any other department at the University.

B3 Seats will be available in this course for students in the School of Continuing Education.

Section C: Implementation

C1 The faculty resources are not adequate. In order to teach EOPT 125, as part of the Electro-Optics program there is a need for 0.250 FTE. (For the source of this faculty resource see pg. 23 of "SSHE Requirements for New Programs".)

C2 Other Resources

a. Space
It is anticipated that a new building will be constructed at the North Pointe (Slate Lick) site near Kittanning, PA before the Electro-Optics program starts in the Fall of 2002. This building will house the Electro-Optics program. If the building is not ready by Spring of 02-03 AY the program will be housed in the Electro-Optics Center (EOC) located in the West Hills.

b. Equipment
In order to implement this course, we will need approximately $35,000 for hardware and software about 6 months before classes start. The lead-time is necessary because of the time it takes to order and receive equipment; also the labs have to be tried out and the bugs worked out before classes start.

c. Laboratory Supplies and other Consumable Goods
About $2,000 approximately 6 months before classes start and about $2000 per year after that.

d. Library Materials
About $500 in years 0 and 1 and about $100 in the following years.

e. Travel Funds
None anticipated

C3 No grant funds are associated with the maintenance of this course.

C4 This course will be offered once a year, usually in the Spring semester.

C5 One section of this course will be offered at a time.

C6 Twenty-four students will be accommodated in this course. The nature of the available laboratory resources and activities restricts enrollment to this number.

C7 There is no professional society that recommends enrollment limits or parameters for a course of this nature.

Section D: Miscellaneous

No additional information is necessary.