OFFICIAL UNDERGRADUATE COURSE OUTLINE (page 1)

COURSE IMPLEMENTATION DATE:	September 2010
COURSE REVISED IMPLEMENTATION DATE:	
COURSE TO BE REVIEWED: *(four years after UPAC approval)*	January 2014 *(month, year)*

OFFICIAL UNDERGRADUATE COURSE OUTLINE INFORMATION

Students are advised to keep course outlines in personal files for future use.
Shaded headings are subject to change at the discretion of the department – see course syllabus available from instructor

PHYS 232	Science/Physics	2
COURSE NAME/NUMBER	FACULTY/DEPARTMENT	UFV CREDITS

Experimental Methods in Physics
COURSE DESCRIPTIVE TITLE

CALENDAR DESCRIPTION:

This course is an introduction to the techniques involved in designing a physics experiment. There is an emphasis on electric circuits and electrical measurements, but practical methodologies useful in all experimental physics courses are developed.

PREREQUISITES: **PHYS 112 or MATH 111 or MATH 115**
COREQUISITES:
PRE or COREQUISITES:

SYNONYMOUS COURSE(S):
(a) Replaces:
(b) Cross-listed with:
(c) Cannot take: for further credit.

SERVICE COURSE TO: *(department/program)*

TOTAL HOURS PER TERM: **45**

STRUCTURE OF HOURS:

Lectures:	**15**	Hrs
Seminar:		Hrs
Laboratory:	30	Hrs
Field experience:		Hrs
Student directed learning:		Hrs
Other (specify):		Hrs

TRAINING DAY-BASED INSTRUCTION:
Length of course:
Hours per day:

OTHER:
Maximum enrolment: **24**
Expected frequency of course offerings: annually
(every semester, annually, every other year, etc.)

WILL TRANSFER CREDIT BE REQUESTED? (lower-level courses only)	☒ Yes	☐ No
WILL TRANSFER CREDIT BE REQUESTED? (upper-level requested by department)	☐ Yes	☐ No
TRANSFER CREDIT EXISTS IN BCCAT TRANSFER GUIDE:	☐ Yes	☒ No

Course designer(s):	**Peter Mulhern**		
Department Head:	**Norm Taylor**	Date approved:	**November 2009**
Supporting area consultation (Pre-UPAC)		Date of meeting:	**November 20, 2009**
Curriculum Committee chair:		Date approved:	**January 2010**
Dean/Associate VP:	**Dan Ryan**	Date approved:	**January 2010**
Undergraduate Program Advisory Committee (UPAC) approval		Date of meeting:	**January 29, 2010**

LEARNING OUTCOMES:

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

- Display competence with the connection and measurement of simple electronic circuits.
- Automate the computation process with the aid of spreadsheets.
- Design procedures for the measurement of experimental results.
- Identify variables that might control the phenomenon being studied.
- Control variables as part of designing a course of action in an experiment.
- Design a lab from beginning to end and execute the lab to answer a specific question.
- Devise or modify experiments to resolve disagreements with an expected model, differentiate between competing models, search for and reduce hidden systematic errors, or further test a successful model.
- Judge whether or not a model fits a data set.

METHODS: *(Guest lecturers, presentations, online instruction, field trips, etc.)*

Core material is presented in lecture format; the material will be immediately re-enforced with hands-on work in a lab setting; homework assignments will reinforce specific analysis techniques.

METHODS OF OBTAINING PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):

☐ Examination(s) ☐ Portfolio assessment ☐ Interview(s)

☒ Other (specify): Evidence of industrial or related experience with sufficient overlap to the course material.

☐ PLAR cannot be awarded for this course for the following reason(s):

TEXTBOOKS, REFERENCES, MATERIALS: *[Textbook selection varies by instructor. An example for this course might be:]*

Phillip Bevington – Data Reduction and Error Analysis for the Physical Sciences
Young and Freedman – University Physics (any calculus based first year text will cover the minimum physics)

SUPPLIES / MATERIALS:

Access to computer with Excel or other spreadsheet program.

STUDENT EVALUATION: *[An example of student evaluation for this course might be:]*

Labs	50%
Assignments	20%
Midterm	10%
Final	20%

COURSE CONTENT: *[Course content varies by instructor. An example of course content might be:]*

Lectures:

Week 1:	Introduction: Philosophy of experimental science; models vs. reality; measurements in physics labs; review of concepts of voltage, current, and resistance
Week 2:	Basic computations for labs: mean, standard deviation, standard error of the mean; emphasize how these concepts relate to actual data sets and can be used to reject or accept theories
Week 3:	Elements of Electronics 1: Thevenin and Norton equivalents; frequency response; general circuit rules, e.g. locating a ground properly
Week 4:	Introduction to testing a formula experimentally: using theory to estimate values; deciding on display of data; controlling parameters.
Week 5:	Using standard spreadsheet tools to do the “grinding” work associated with error analysis and error propagation; graphing on a spreadsheet
Week 6:	Elements of Electronics 2: Voltage dividers; filters; impedance matching, transformers and power supplies
Week 7:	Midterm
Week 8:	Using graphs, statistical relationships, and estimation to refine an experiment.
Week 9:	Introduction to instrumentation: Some types of common apparatus and techniques including limitations and advantages, (e.g. VTVMs, Lock-in amplifiers, doing 4 point resistance measurements, bridge measurements.)

Week 10: Elements of Electronics 3: Introduction to the concepts of amplifiers and control.
Week 11: This class will be devoted to discussing some of the possible projects the students are to design in their final project, along with providing hints, suggestions, and other advice of general value.
Week 12: Other common electronic devices: this is a brief discussion of solar cells, various transducers, servo motors and stepper motors. Emphasis will be on the array of things that can be done at the level of this course.
Week 13: The next step: this class will relate how the material covered in the course is an introduction to the higher level labs. A final review prior to the final exam will be presented.

Lab 1: Use of Meters: Review of techniques; calculation of uncertainties; simple verification; format
Lab 2: The oscilloscope: proper use of the digital storage scope and various functions
Lab 3: LR circuits
Lab 4: LCR resonance
Lab 5: Project 1: Thevenin and Norton equivalents: lab with well specified goal, but no given procedures.
Lab 6: Diode lab
Lab 7: Transformers
Lab 8: Power Supplies
Lab 9: Introduction to Amplifiers
Lab 10: Introduction to Digital Electronics
Lab 11: Project 2: A lab designed and implemented by the students.