OFFICIAL UNDERGRADUATE COURSE OUTLINE (page 1)

COURSE IMPLEMENTATION DATE:	June 1993
COURSE REVISED IMPLEMENTATION DATE:	September 2013
COURSE TO BE REVIEWED: *(six years after UEC approval)*	March 2018 *(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 312	Science/Physics	3
COURSE NAME/NUMBER	FACULTY/DEPARTMENT	UFV CREDITS

Intermediate Electromagnetism
COURSE DESCRIPTIVE TITLE

CALENDAR DESCRIPTION:

This course elaborates upon and extends many of the topics covered in PHYS 112. It begins with an introduction to vectors and vector calculus. These ideas are then applied to a study of electrostatics and magnetostatics, both in vacuum and in materials. Also, time-dependent electric and magnetic fields are considered. Faraday's law and the displacement current are introduced and serve to finalize Maxwell's equations.

Note: Students with credit for PHYS 222 cannot take this course for further credit.

PREREQUISITES: PHYS 112 and PHYS 381
COREQUISITES:
PRE or COREQUISITES: MATH 312 recommended

SYNONYMOUS COURSE(S):
(a) Replaces: **PHYS 222**
(b) Cross-listed with:
(c) Cannot take: for further credit.

SERVICE COURSE TO: *(department/program)*

TOTAL HOURS PER TERM: **60**

STRUCTURE OF HOURS:

Lectures:	**60**	Hrs
Seminar:		Hrs
Laboratory:		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):	**George McGuire and Derek Harnett**		
Department Head:	**Norm Taylor**	Date approved:	**December 6, 2011**
Supporting area consultation (Pre-UEC)		Date of meeting:	**February 17, 2012**
Curriculum Committee chair:	**Norm Taylor**	Date approved:	**February 24, 2012**
Dean/Associate VP:	**Ora Steyn**	Date approved:	**March 9, 2012**
Undergraduate Education Committee (UEC) approval		Date of meeting:	**March 30, 2012**

LEARNING OUTCOMES:

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

- perform a variety of computations in vector calculus including derivatives (gradient, divergence, and curl), integrals (line, flux, volume), and applications of the divergence theorem and Stokes's theorem
- relate charge, potential, and electric field
- calculate electrostatic fields and potentials using a variety of techniques such as Coulomb's law, Gauss's law, the method of images, separation of variables, and the multipole expansion
- demonstrate their understanding, both qualitatively and quantitatively, the relationships between dielectrics and electric fields
- compute electromagnetic forces on a variety of charge and current distributions
- relate current, vector potential, and magnetic field
- calculate magnetostatic fields using the Biot-Savart law, Ampere's law, and the mulitpole expansion
- derive the relationships between materials and magnetic fields (para-, dia-, and ferromagnetism)
- use Faraday's law to calculate induced and motional EMFs
- understand that a time-dependent magnetic field generates an electric field and vice-versa

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

This course is predominantly lecture-based.

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:]*

Griffiths D, Introduction to Electrodynamics (3rd Edition), Prentice Hall 1999

SUPPLIES / MATERIALS:

A computer lab at least twice per week.

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

Assignments	20%
Term tests	35%
Final exam	45%

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

1. Vector Analysis
   - curvilinear coordinates, gradient, divergence, curl, line/flux/volume integrals, Dirac delta function, divergence theorem, Stokes's theorem
2. Electrostatics
   - electric field, potential, work and energy, Coulomb's law, Gauss's law, method of images, electric dipoles, multipole expansion, electrostatic boundary conditions, separation of variables
3. Dielectrics
   - polarization, bound charge, electric displacement, linear dielectrics
4. Magnetostatics
   - Lorentz force law, current, Biot-Savart law, Ampere's law, magnetic dipoles, magnetic vector potential, multipole expansion, magnetostatic boundary conditions
5. Magnetism in Matter
   - magnetization, bound current, para-, dia-, and ferromagnetism, the H-field, linear materials
6. Electrodynamics
   - EMF, Faraday's law of induction, Ohm's law, displacement current, Maxwell's equations