CATALOGUE DESCRIPTION:

A study of steady state and time varying electric and magnetic fields, elements of DC and AC currents, complex vector representation of sinusoidal quantities, electric and magnetic properties of solids, culminating in Maxwell's Equations. Experiments in voltage; current, flux, fields, and impedance measurements; RC, RL, and RLC circuits. The course will be presented using lectures and laboratory experiments.

A study of gradient, divergence, and curl in orthogonal curvilinear coordinates will permit the student to better understand the concepts being studied.

COURSE PREREQUISITES:  Physics 221

COURSE COREQUISITES:  Math 212 and Math 213 or Math 214
PHYSICS 222
NAME & NUMBER OF COURSE

COURSES FOR WHICH THIS IS A PREREQUISITE: Any 3rd year level physics course

RELATED COURSES

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)


REFERENCES:


OBJECTIVES:

If successful in this course, students should be able to:

1. understand the fundamental concepts and laws involved in electricity and magnetism and learn how to apply theory to solve related problems;
2. have some knowledge and understanding of basic principles being studied as applied in various instruments and machines which are encountered in everyday life;
3. apply the classroom learning in the laboratory;
4. feel confident about taking further courses in physics or engineering.

METHODS:

This course will be presented using lectures and laboratory experiments. Audio-visual aids will be used where appropriate. Close coordination will be maintained between laboratory and classroom work whenever possible.
**PHYSICS 222**

**NAME & NUMBER OF COURSE**

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**STUDENT EVALUATION PROCEDURE:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Assignments</td>
<td>20%</td>
</tr>
<tr>
<td>Mid-term and in-term exams</td>
<td>25%</td>
</tr>
<tr>
<td>Laboratory Work</td>
<td>15%</td>
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<tr>
<td>Final examination</td>
<td>40%</td>
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**COURSE CONTENT:**

**Electrostatics:** electric fields, Gauss’ Law

**Electric Potential:** work and potential energy, conservative fields, potential energy in electric field, potential difference, absolute potential, superposition principle applied to potential

**Mathematical Physics:** use of gradient, divergence, and curl in orthogonal curvilinear coordinate systems

**Capacitance:** systems of capacitors, electrostatic stored energy, use of capacitors in AC and DC circuits

**Dielectrics:** introduction to polarization, dipole moment per unit volume, electric displacement vector, permittivity, susceptibility, dielectric constant, stored energy in a dielectric medium

**Current and Circuits:** resistance and conductivity, current density, combinations of resistors, circuit analysis using Kirchhoff’s Rules, Norton’s and Thevenin’s theorem

**Magnetic Fields:** properties of a B field, Ampere’s Law, Biot-Savart Law, magnetic flux, torque on a current loop, forces on isolated charges, curl, Hall Effect

**Induction:** Faraday’s Law, Lenz’ Law, induced electric fields, motional emf, stored energy in a magnetic field, mutual inductance, self inductance

**Magnetism in Matter:** magnetic contribution of matter, the three magnetic vectors (H, B, and M), paramagnetism, diamagnetism, ferromagnetism

**Alternating Current:** complex representation of AC circuits, series and parallel RLC circuits, resonance, transient and steady state responses in AC circuits

**Maxwell’s Equations:** electromagnetic waves, wave equation, determination of the speed of light from Maxwell’s Equations, displacement current, propagation of energy and momentum by electromagnetic waves, Poynting vector
LABORATORY EXPERIMENTS:

1. Plotting Electrostatic Fields

2. Millikan Experiment (2 periods)

3. Diodes

4. Magnetic Moment (2 periods)

5. Simple AC Circuits

6. Damped Harmonic Motion

7. Forced LRC Circuits