Ryerson University  
Department of Electrical and Computer Engineering  

ELE401: Field Theory

Course Contents:

Course hours: 4 lecture hours and 2 tutorial hours per week.


Important References:

Course Management/Evaluation:
- Three Quizzes 10%
- Two Tests 40%
- Final Examination 50%

Quizzes are conducted during tutorial sessions. The duration of each quiz is up to 30 minutes.

Course written materials are assessed not only on their technical or academic merit, but also on the communication skills of the author as exhibited through these written materials.

Detailed Course Outline:

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<th>Lecture Hours</th>
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<td>1.0 Review of Vector Analysis and Coordinate Systems</td>
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<td>2.0 Electrostatic Field</td>
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<td>2.1 Coulomb's law and electric field intensity</td>
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<td>2.2 Electric fields due to continuous charge distributions</td>
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<td>2.3 Electric flux density and Gauss's law</td>
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<td>2.4 Applications of Gauss's law</td>
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<td>2.5 Point form of Gauss's law</td>
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<td>2.6 Electric potential and potential gradient</td>
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<td>2.7 Electric dipole</td>
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<td>2.8 Energy stored in the electric field</td>
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3.0 **Electric Field in Material Space**
3.1 Current and current density
3.2 Convection and conduction currents
3.3 Resistance
3.4 Polarization in dielectrics
3.5 Dielectric constant and strength
3.6 Continuity equation and relaxation time
3.7 Electric field boundary conditions

4.0 **Electrostatic Boundary Value Problems**
4.1 Poisson's and Laplace's equations
4.2 Uniqueness theorem
4.3 Capacitance and leakage conductance
4.4 Solutions of Poisson's and Laplace's equations
4.5 Method of images

5.0 **Magnetic Field**
5.1 Biot-Savart law and magnetic field intensity
5.2 Ampere's circuital law
5.3 Applications of Ampere's circuital law
5.4 Point form of Ampere's circuital law
5.5 Magnetic flux density

6.0 **Magnetic Forces and Materials**
6.1 Forces due to magnetic fields
6.2 Magnetic torque and moment
6.3 Magnetization in materials
6.4 Magnetic field boundary conditions
6.5 Energy stored in the magnetic field
6.6 Self and mutual inductances

7.0 **Time-Varying Fields and Maxwell's Equations**
7.1 Faraday's law
7.2 Displacement current
7.3 Maxwell's equations

Dr. Ali M. Hussein (Course Coordinator)
Professor

Counselling Hours:
Tuesdays: 2 – 3 P.M.
Thursdays: 2 – 3 P.M.

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“Learning is not attained by chance: It must be sought for and attended with diligence.”
Abigail Adams (in letter to her 13-year old son John Quincy Adams, who became the sixth USA President)