Subject Description Form

Subject Code	AP20001
Subject Title	Electromagnetism
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	AP10009
Objectives	To introduce the basic concepts and laws in electromagnetism, and to formulate the laws in vector format.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) understand the basic vectorial operations and their application in the formulation of electromagnetism; (b) learn the basic laws of electromagnetism in vector notation including Coulomb's law, Gauss' law, Biot-Savart law, Ampere's circuital law, and Maxwell's equations; and (c) solve problems related to electromagnetism using different analytical techniques such as image method, boundary value approaches, the symmetric conditions and energy method.
Subject Synopsis/ Indicative Syllabus	**Vectors and vector fields**: vector algebra; vector calculus & integrals, gradient, divergence, Stokes operation, the Laplacian, Curl, coordinate systems. **Time-independent Maxwell equations**: reviews the force laws of electrostatics and magnetostatics as vector field equations. **Time-dependent Maxwell equations**: the derivation of the full set of time dependent Maxwell equations. **Electrostatic calculations**: investigation of vector electric fields generated by stationary charge distributions using Maxwell's equations. Using boundary conditions, image methods, complex analysis, solution of Poisson's equations etc for the investigations. **Dielectric and magnetic media**: uses Maxwell's equations to investigate the interaction of dielectric and magnetic media with quasi-static electric and magnetic vector fields. Applications of boundary conditions for **E** & **B**. **Magnetic induction**: uses Maxwell's equations to investigate magnetic induction and related phenomena. Includes self- and mutual inductance.
Teaching/Learning Methodology	**Lecture**: The fundamentals in electromagnetism will be explained. Examples will be used to illustrate the concepts and ideas in the lecture. Homework problem sets will be given. **Student-centered Tutorial**: Students will work on a set of problems in tutorials. Students are encouraged to solve problems and to use their own knowledge to verify

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<tr><td></td><td>their solutions before seeking assistance. These problem sets provide them opportunities to apply their knowledge gained from the lecture. They also help students to consolidate what they have learned. Furthermore, students can develop a deeper understanding of the subject in relation to daily life phenomena or experience.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="3">Intended subject learning outcomes to be assessed
(Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td></tr>
<tr><td>(1) Continuous assessment</td><td>40</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>(2) Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100</td><td colspan="3"></td></tr>
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The continuous assessment includes assignments, quizzes and tests which aim at checking the progress of students study throughout the course, assisting them in fulfilling the learning outcomes.
Assignments will strengthen the students' basic knowledge and the analytical skill to solve the problems related to electromagnetism. Tests will review their understanding of the course and examination will improve their manipulation on problem solving.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>• Lecture</td><td>33 h</td></tr>
<tr><td>• Tutorial</td><td>6 h</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Self-study</td><td>81 h</td></tr>
<tr><td>Total student study effort</td><td>120 h</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>R. Fitzpatrick, "Maxwell's equations and the principles of Electromagnetism", Infinity Science Press LLC, 2008.

W.H. Hayt and J.A. Buck, "Engineering Electromagnetics", 7th Edition, McGraw-Hill, 2006.

D.K. Cheng, "Fundamentals of Engineering Electromagnetics", Addison-Wesley, 1993.</td></tr>
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