Subject Description Form

Subject Code	AP30004
Subject Title	Electromagnetic Fields
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	AP20001 AP20008
Objectives	The aim of this subject is to provide a basic understanding of the electromagnetic fields and a sound foundation for students who want to pursue their study in Telecommunications and Fibre Optics. Practical applications based on electromagnetic technology, such as waveguide, satellite communication and radar, will be highlighted.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) describe and apply Maxwell's equations for time-varying fields; derive boundary conditions and use them to solve problems; (b) apply Maxwell's equations to derive the wave equations/solutions for the propagation of uniform plane waves; (c) describe how the fields behave in different types of media and solve practical problems; distinguish between phase and group velocities and to understand their physical meaning; (d) develop equations to describe wave behaviours along uniform guiding structures and to solve different waveguide problems; (e) specify and interpret the basic antenna parameters; and (f) describe different types of antennas and identify their uses in different applications.
Subject Synopsis/ Indicative Syllabus	**Time-varying field**: Faraday's law of electromagnetic induction; Maxwell's equations; boundary conditions; electromagnetic spectrum. **Plane electromagnetic waves**: solution of wave equations; plane waves in lossless and lossy media, group velocity; flow of electromagnetic power and the Poynting vector; plane waves at plane boundaries. **Waveguides**: wave behaviours along uniform guiding structures; guided modes. **Antenna**: physical aspects of radiation; basic antenna parameters; antenna patterns and directivity; Friis transmission formula and radar equation.
Teaching/Learning Methodology	The methodology includes classroom teaching and laboratory experiments. The teaching session will focus on basic principles of electromagnetic fields related to all of the learning outcomes (a–f). The laboratory session contains some experiments on Maxwell equations (outcome a), wave propagation (outcome c) and antenna (outcome e and f), which will help the student to better understand the fundamental issues.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	f
(1) Continuous assessment	40	✓	✓	✓	✓	✓	✓
(2) Examination	60	✓	✓	✓	✓	✓	✓
Total	100						

Continuous assessment is based on assignments, laboratory report and a mid-term test. The assessment of the laboratory session is based on the laboratory reports. The examination is a 3-hour written final examination, which may cover all of the key issues related to the learning outcomes.

Student Study Effort Expected

Class contact:	
• Lecture	26 h
• Tutorial	6 h
• Laboratory	9 h
Other student study effort:	
• Self-study	79 h
Total student study effort	120 h

Reading List and References

Kraus, J D, Electromagnetics (5th Ed.), McGraw-Hill, 1999.

Paul, C R and Nasar, S A, Introduction to Electromagnetic Fields (3rd Ed.), McGraw-Hill, 1997.

Inan, U S and Inan A S, Electromagnetic Waves, Prentice Hall, 2000.