Electronic Systems Analysis – EE2ESA

Module Type		Taught		
Level		5	Credit Value	20
Programme(s) in which module is available		BEng: Electrical and Electronic Engineering; Communication Engineering;		
Involvement of Other Schools		None		
Resource Split		N/A		
Name of Module Co-ordinator		Drs Vladimir Mezentsev, Sonia Boscolo		
Related Modules	Pre-requisites	AM11EM, AM12EM, EE1EPC, EE1ESE		
	Co-requisites	None		
	Prohibited Combinations	None		
Minimum and Maximum Intake Sizes		None		

Aims of the Module

- To understand a range of techniques based in mathematics which can be used to model and analyse electrical, electronic and cognate systems
- To be able to select the techniques which are most suitable
- To be able to apply those techniques to simple circuits and systems to calculate their performance

Summary of Content

Mathematics

Revision of complex numbers. exp(jωt).
Fourier series: periodic signals; whole range/half range Fourier series. Complex number formulation.
Further calculus: Partial differentiation; chain rule; errors. Integration: Double integrals; polar integrals; triple integrals. Partial Differential Equations

Application to EE Signals and Systems

Revision of network theorems (Norton, Thevenin, superposition, reciprocity, nodal and loop analysis). Application to RLC passive networks. Revision of use of operational amplifiers. AC applications. Three phase systems. Resonance. Decibels. Bode plots.
Signal models and concepts. Special signals: sinusoidal signals; unit step, rectangular and Dirac pulses, etc. Operations of signals: time shifting, scaling, folding. Energy and power signals. LTI systems..
Predicting system behaviour using differential equations. The simple series RC network: sinusoidal input; step input, impulse input. The simple series RCL network: sinusoidal input; step input, impulse input.

Mathematics

Transfer functions in the time, s- or Laplace and frequency domains. Filters.
Laplace transforms. Laplace transform theorems and solution of differential equations.
Laplace transform techniques in simple circuit and network analysis. Natural, forced and transient responses.

Application to EE Signals and Systems

Superposition or convolution integral. Predicting system behaviour, given impulse response. Graphical and analytical convolution. Power relationships.
Fourier analysis. Response of a linear system to a periodic input. Its response to a square wave input.

Mathematics

FT definition; frequency and angular frequency forms. Duality. Amplitude and phase spectra. Look-up tables for FTs. FT of impulse, step, sinusoids, periodic signals. Fourier transforms and aperiodic signals.

Application to EE Signals and Systems

Summary of Methods and Frequency of Teaching Contact hours spread over teaching periods 1 and 2: Lectures: 44 hours Tutorials: 11 hours Laboratory: 4 x 3 hours total supervised laboratory work Private study: 137 hours		
Summary of Methods of Assessment and Feedback (including formative feedback) The module will be assessed by: Examination (40%); Class Tests (20%); Laboratory reports (40%) Feedback will be provided according to School guidelines. 1-to-1 feedback will be provided orally in the laboratory and in tutorials, and by written comments on written reports. Generic feedback will be provided orally in class and via Blackboard.		
Module Outcomes – what the student should gain from successful completion of the module:	Learning and Teaching and Assessment Strategies to enable outcomes to be achieved and demonstrated	
	Learning and Teaching Methods	Assessment Methods
Knowledge and Understanding of • basic mathematical techniques for solving problems of engineering systems in Engineering. • ability in handling electrical circuits and systems	Lectures, tutorial problems, lab simulation	Examination and laboratory work
Intellectual Skills • practical skills in mathematical analysis • mathematical abstractions and simplifications	Lectures, tutorial problems, lab simulation	Examination and laboratory work
Professional/Subject Specific Skills • familiarity with analysis of simple electrical and cognate systems. Some facility with computer based electric circuit simulations	Lectures, tutorial problems, lab simulation	Examination and laboratory work
Transferable Skills • analytical methods applicable to electronic circuits and to automatic control systems. Self expression in the language of the course.	Lectures, tutorial problems, lab simulation	Examination and laboratory work
Introductory Learning Resources	Module information, tutorial material and generic feedback will be available on Blackboard	
Core Texts, reading lists	James, Glyn, Advanced Modern Engineering Mathematics Stroud, Further Engineering Mathematics O' Neil, Advanced Engineering Mathematics Denbigh, K G, System Analysis & Signal Processing, Addison-Wesley (1998) Howatson,A M, Electrical Circuits & Systems, Oxford (1996) Chen, Chi-Tsong, Signals & Systems, 3rd ed, Oxford(2004)	
Specification completed by: Date	Geof Carpenter 28.7.09	