Optical Communications Systems - EE3OCS

Module Type		Taught				
Level		6	Credit Value	10		
Programme(s) in which module is available		BEng: Electrical & Electronic Engineering; Communications Engineering				
Involvement of Other Schools		None				
Resource Split		N/A				
Name of Module Co-ordinator		Prof Sergei Turitsyn, Prof Ian Be	nnion			
Related Modules	Pre-requisites	EE2ESE or equivalent				
	Co-requisites	None				
	Prohibited Combinations	None				
Minimum and Maximum Intake Sizes		None				
Aims of the Module	e					
The course will g	jive an overview of optical communi	cations from principles of fibres through	n to modern developments in t	the latest high speed networks. The students will		
acquire a good knowledge of the principles and practice of modern optical communications and be aware of current developments and future opportunities.						
Summary of Content						
Introduction to optical communications: Motivation for using optical methods in data transmission. Brief history of optical communications. Generic optical communication						
system. Key com	ponents and their functions.					
Propagation of light	ght in fibres: Principles of optical wa	aveguiding. Detailed study of optical pro	pagation in fibres. Fibre mode	es and their properties. Single mode, multimode		
fibres. Recently developed fibre types.						
Signal attenuation: Optical losses: intrinsic loss mechanisms; extrinsic loss (bending, splicing, coupling). Dispersion: modal dispersion, waveguide dispersion, dispersion						
Snitting.						
Oplical Systems. Oplical transmission formats: return-to-zero, non-return-to-zero encoding. Binary transmission: statistics, noise and errors. Propagation of optical pulses in dispersive media. Less limited systems and dispersion limited system.						
Uspensive metrid. Loss infliced systems and dispension infliced system.						
heterostructures: p-i-n detectors: avalanche detectors: common types of photodiodes						
Optoelectronic components II - Optical Sources: Laser: emission and amplification of light: optical gain: principle of laser: laser modes: rate equations. Laser diodes:						
photons in semic	photons in semiconductors: generic structure of laser diode: double heterostructure: performance characteristics of laser diodes: rate equations: common types of laser					
diodes.						
Optical amplifiers amplified systems: Design and principles of optical fibre amplifiers. Main characteristics: power, gain, noise. Saturation effects. Noise accumulation in						
long-span systems. Implications for long distance (trans-oceanic) data transmission.						
Nonlinear effects: Effective length of nonlinear interaction. Main effects: Self-phase modulation; Raman scattering; Brillouin scattering; four-wave mixing. Optical solitons.						
Advanced optical systems: Wavelength multiplexing and time-division multiplexing of optical signals. Ultrahigh-capacity optical data transmission; review of terabit-per-						
second systems. Detrimental effects of nonlinearities and dispersion on system performance. Useful effects: dispersion management; optical solitons. Current performance						
Summary of Methods and Frequency of Teaching						
Lectures 16 x 1 hour						
I ULUNIAIS 4 X T NOUL						
Laboratory	Labulatory work 5 x 5 hours Design project and Private study 71 hours					
Design proj	Design project and Private study /1 hours					

Summary of Methods of Assessment and Feedback (including formative feedback) Continuous Assessment (100%), comprising: Laboratory reports and design project Feedback will be provided according to School guidelines. 1-to-1 feedback will be provided orally at tutorials and in laboratory classes 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	Learning and Teaching and Assessment Strategies to enable						
		outcomes to be achieved and demonstrated					
		Learning and Teaching Methods	Assessment Methods				
Knowledge and Understanding of							
 The students will have a good knowledge of the pri 	Lectures, tutorials, design project	Examination and coursework					
communications and be aware of current developments and future opportunities							
Intellectual Skills							
Analyse basic, but multidisciplinary problems assoc	Lectures, tutorials, design project	Examination and coursework					
technology and relevant to Optics, Electronics and Information Theory.							
Professional/Subject Specific Skills							
 Estimate various parameters of a given optical fibre 	Lectures, tutorials, design project	Coursework					
Estimate limitations imposed on performance of a data transmission link by each component:							
fibre, transmitter, receiver etc.							
Calculate basic parameters of a generic optical dat							
I ransferable Skills	Lasturas tutoriola design project	Eveningtion and opurpowerk					
 Analyse complex, multitask technical problems and analyse to the astrution 	Lectures, tutonais, design project	Examination and coursework					
approaches to the solution.							
Simpling a complex task and produce an "order of value" estimate.							
Search for detailed information, specific to the given subject, and self-educate.							
Core Texts reading list	Nouve momation, tutorial material and generic recuback will be available on Diackboard						
Core Texts, reading list G.P.Agrawal,	-Iber-Optic Communication Systems, 2-nd ed., Wiley-Interscience, 1997.						
L.Nazovsky, S.Benedetto, A.Willner, Optical Fiber Communication Systems, Artech House, 1996.							
I.M. Senior (Intragalation in the optics, ca	Practice 2nd ed Prentice Hall 199	12				
G Keiser Op	tical Fibre Communications 2nd ed McGra	w-Hill 1991	· - ·				
J.Gowar, Optical Communication Systems, 2nd ed. Prentice Hall, 1993.							
R.Papannareddy, Lightwave Communication Systems, Artech House, 1997.							
G.P. Agrawal, Applications of Nonlinear Fiber Optics, Academic Press, 2001							
Specification completed by: Geof Carpenter							
Date	23.7.09						