

# Radio & Optical Signal Propagation

## Module Information

2022.01, Approved

### Summary Information

Module Code	7453MWCS
Formal Module Title	Radio & Optical Signal Propagation
Owning School	Engineering
Career	Postgraduate Taught
Credits	10
Academic level	FHEQ Level 7
Grading Schema	50

### Teaching Responsibility

LJMU Schools involved in Delivery
Engineering

### Learning Methods

Learning Method Type	Hours
Lecture	22
Practical	6

### Module Offering(s)

Display Name	Location	Start Month	Duration Number Duration Unit
JAN-CTY	CTY	January	12 Weeks

### Aims and Outcomes

Aims	To design and analyse the telecommunications systems and to critically evaluate the choices available
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**After completing the module the student should be able to:**

## Learning Outcomes

Code	Number	Description
MLO1	1	Critically analyse the advantages and disadvantages of different choices for the design of a telecommunication system
MLO2	2	Design a high level transmission system to meet a particular need
MLO3	3	Critically evaluate possible technical solutions to practical issues, such as attenuation and dispersion

## Module Content

Outline Syllabus	The electromagnetic spectrum and wireless radio signal transmission: frequency bands and bandwidth, Surface, Space, and Sky waves, Line of sight, Ionosphere and Tropospheric refraction, Critical frequency. Antennas: Radiation pattern and properties, Beamwidth and impedance match, Dipole, Monopole, Yagi-Uda, Computer aided design, Antennas for 5G. Electrical transmission line: lossless and lossy circuit models, Wave equations, Characteristic impedance and propagation coefficient, Attenuation and dispersion, Reflection coefficient and its evaluation. Optical fibres: Materials, structure, and fabrication. Modes and coupling, Scattering and absorption, Selection of wavelength and C-band, Wavelength division multiplexing. Dispersions and compensation, Bit-rate distance product, Soliton. LED and Laser diodes: Materials and structures, Direct bandgap and photon emission, Quantum well, Stimulated emission and population inversion, Spectrum and applications. Optical amplification: Types of amplifiers, SOA, Raman, and EDFA, Principles and structures, Pumping source and noise figure. Modulation and photodetectors: Direct and external modulations, Digital and analogue modulation, Chirp, Sensitive volume and equivalent circuits, Photovoltaic and photoconductive, PIN and avalanche photodetectors, bandwidth and noise. Phase locked loops: Key components, principle, and properties, Capture and lock ranges, Phase detectors and charge pumping, VCO and ring oscillators, FM modulation and demodulation, Frequency shift keying.
Module Overview	
Additional Information	This module looks at the key components of a telecommunication system and the design issues. UNESCO Sustainable Development Goals 1. Good Health and Wellbeing 2. Quality Education 3. Decent Work and Economic Growth 4. Industry, Innovation and Infrastructure 5. Responsible Consumption and Production 6. Partnerships for the Goals

## Assessments

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Module Learning Outcome Mapping
Presentation	Design, analyse and research	100	0	MLO1, MLO2, MLO3

## Module Contacts

### Module Leader

Contact Name	Applies to all offerings	Offerings
Jian Zhang	Yes	N/A

### Partner Module Team

Contact Name	Applies to all offerings	Offerings
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