Subject Description Form

Subject Code	EIE566
Subject Title	Wireless Communications
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Exclusion: EIE579
Objectives	1. To introduce the fundamental issues, concepts, and design principles in cellular and wireless communications. 2. To model how various channel-fading phenomena degrades a transmitted wireless signal. 3. To introduce various techniques to mitigate various channel impairments.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: <u>Category A: Professional/academic knowledge and skills</u> a. Understand and describe the physical-layer features of wireless communication systems and their potential applications to Internet of things. b. Understand the frequency-reuse concept in cellular communications, and to analyze its effects on interference and system capacity. c. Understand large-scale and small-scale fading-channel models, and to analyze their influence on the performance of a wireless communication system. <u>Category B: Attributes for all-roundedness</u> d. Communicate effectively. e. Think critically and creatively. f. Assimilate new technological development in related field.
Subject Synopsis/ Indicative Syllabus	**1. Cellular communication systems** Cellular structure, frequency reuse, cell splitting, Channel assignment. Co-channel interference, adjacent-channel interference, system capacity, power control, call handoffs. **2. Macroscopic fading models for radiowave propagation** Free-space radio-wave propagation. Reflection, diffraction, and scattering. Various path-loss models such as ground-reflection, log-distance, lognormal. **3. Microscopic fading models for radiowave propagation** Rician and Rayleigh fading models. Doppler frequency, delay spread, coherence bandwidth. Characterization of multipath phenomena. Fading effects due to multi-path time delay spread. Fading effects due to Doppler spread. 4. **Digital modulation schemes, multiplexing and multiple access schemes** Analog versus digital modulations. Phase shift keying (BPSK), frequency shift keying (FSK), amplitude shift keying (ASK), quadrature amplitude modulation (QAM). Frequency-division multiplexing (FDM) and multiple-access (FDMA), time-division multiplexing (TDM) and multiple-access (TDMA), code-division multiplexing (CDM) and multiple-access (CDMA), Orthogonal frequency-division multiplexing (OFDM), orthogonal frequency-division multiple access (OFDMA), multiple-input multiple-output (MIMO) transceiver. **5. Wireless standards and Internet of Things (IoT)** Mobile Communication Systems, Wi-fi, Zigbee, narrow-band IoT, LoRa technology

Teaching/Learning Methodology

Through the lectures and tutorial sessions, students can learn basic knowledge of wireless communications.

Through the laboratory session, students can learn how to analyse a wireless communication system through simulation

Through the mini-project, students can further enhance their knowledge on modern wireless systems.

Teaching/Learning Methodology	Intended Subject Learning Outcomes					
	a	b	c	d	e	f
Lectures / Tutorials	✓	✓	✓		✓	
Laboratory	✓		✓			
Mini-project				✓	✓	✓

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. Test	25%	✓	✓	✓			
2. Laboratory	10%	✓		✓			
2. Mini-project	25%				✓	✓	✓
3. Examination	40%	✓	✓	✓			
Total	100%						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Tests and examination let students review the taught materials, do further reading for deeper learning and apply the learnt materials to solving common communication system problems.

The techniques for analysing wireless communication system can be assessed through the laboratory session.

Mini-project requires the student to do further reading, search for information, keep abreast of current development and give presentations.

Student Study Effort Expected

Class contact:	
▪ Lectures/Test	30 Hrs.
▪ Laboratory	3 Hrs.
▪ Presentation	6 Hrs.
Other student study effort:	
▪ Further reading and preparing for laboratory session, tests and examination.	45 Hrs.
▪ Mini-project: studying and preparing presentations	25 Hrs.
Total student study effort	109 Hrs.

Reading List and References

1. Andreas F. Molisch, *Wireless Communications,* Wiley – IEEE, 2nd ed., 2010.
2. T. S. Rappaport, Wireless Communication: Principles and Practice, Pearson, 2001.

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