Subject Description Form

Subject Code	EIE580
Subject Title	Radio Frequency and Microwave Integrated Circuits for Communication System Applications
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To study and understand the operating principles and design schemes of radio frequency and microwave integrated circuits for communication system applications.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Establish and develop the overall knowledge of RF and microwave integrated circuits and devices for wireless communication applications. b. Model and analyze the performances of communication circuits and subsystems with practical design parameters. c. Design and evaluate the building blocks of communication systems such as wireless transmitter and receiver.
Subject Synopsis/ Indicative Syllabus	1. Overview of Communication Systems and Review of Transmission Line Theory Wireless and radiofrequency systems, communication techniques, receiver and transmitter architectures, waveguides and transmission lines, Smith chart, S-parameters, passive (linear) components, and active (non-linear) circuits. 2. Passive and Linear Components Lumped-element and transmission line elements, impedance transformers, impedance matching techniques, directional couplers, resonators, low-pass, bandpass, bandstop and high-pass filters, diplexers and multiplexers, circulators and isolators. 3. Active and Nonlinear Circuits Diodes and transistors, thermal noise and noise figure, nonlinear and intermodulation distortions, IP3, nonlinear analysis, dynamic range, two- and three-terminal devices, oscillators and frequency synthesizer, low-noise amplifier (LNA), power amplifier (PA), single-ended and balanced mixers 4. Wireless Communication Front-End Subsystems Antenna, modulators, demodulators, communication devices, radar techniques, radiofrequency identification (RFID) techniques, low-noise system design, power amplifier design, linearization techniques, and system simulation.

Teaching/Learning Methodology

Through the lectures and tutorials, students can develop basic knowledge of RF and microwave integrated circuits as well as techniques for analyzing the performance of communication circuits.

Through the mini-project, student can apply the basic knowledge and analytical technique to design and evaluate the building blocks of communication systems.

Teaching/Learning Methodology	Intended Subject Learning Outcomes		
	a	b	c
Lectures	✓	✓	
Tutorials	✓	✓	
Laboratory sessions	✓	✓	✓

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
1. Continuous assessment				
Mid-semester test	10%	✓	✓	✓
End-of-semester test	10%	✓	✓	✓
Laboratory work on instruction of simulator (Keysight Pathwave)	15%		✓	✓
Laboratory work on RF passive circuits	15%		✓	✓
Laboratory work on RF power amplifier	15%		✓	✓
2. Examination	35%	✓	✓	✓
Total	100%			

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

The basic knowledge and modeling of RF and microwave integrated circuits can be assessed through examination, test and laboratory exercises.

The design and evaluation techniques for RF and microwave integrated circuited can be assessed through the laboratory exercises.

Student Study Effort Expected	Class contact:	
	▪ Lecture	15 Hrs.
	▪ Tutorial	12 Hrs.
	▪ Laboratory session	12 Hrs.
	Other student study effort:	
	▪ Self-study	66 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. Bogdanov, G and Ludwig, R.*RF Circuit Design: Theory & Applications*, 2nd edition, Pearson Education Inc., Upper Saddle River, NJ, USA, 2009. ISBN : 978-0-13 135505-7 2. Bowick, C.*RF Circuit Design,* 2nd edition, Newnes, , Burlington, MA, USA, 2008. ISBN : 978-0-7506-8518-4 3. Yip, P.*"High Frequency Circuit Design and Measurements"* Chapman and Hall, London, UK, 1990. ISBN : 0-412-34160-3 4. Pozer, D."*Microwave Engineering*" 2nd edition, John Wiley & Sons, New York, USA, 1998. ISBN : 0-471-17096-8 5. Liao, S. Y. "*Microwave Circuit Analysis and Amplifier Design*", 3rd Edition, Prentice Hall, New Jersey, 1987. ISBN : 0-135-81786-2 6. Steve C. Cripps. "RF power amplifiers for wireless communications", 2nd Edition, Artech House, London, 2006. ISBN-10: 1-59693-018-7	

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