The University of Jordan
School of Engineering
Electrical Engineering Department
2nd Semester – A.Y. 2020/2021

Course: **Communication Circuits – 0943521 (3 Cr. – Elective Course)**

Instructor: Prof. Jamal Rahhal
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Office Hours: Will be posted soon

Course website: http://elearning.ju.edu.jo/

Catalog description: Introduction and overview. Impedance matching and transformations. Oscillators types and circuits. Loop gain analysis. Negative resistance analysis. Voltage controlled Oscillators (VCO). Phase locked loops and applications. FM detection. Frequency synthesis. Mixers: Active mixers, Switching type mixers and 4-diode double balanced mixer. Conversion loss. Nonlinear effects. Mixers applications in modulation and demodulation. Tuner and resonant circuits. RF Filters. RF and IF tuned amplifiers. Power amplifiers. AGC circuits. Design of low noise amplifiers. Case studies. Projects: design, construct, match, and test an RF oscillator and amplifier.

Prerequisites by course: **EE** **0953422** Communications (II) (pre-requisite)

Prerequisites by topic: Students are assumed to have a background in the following topics:
- Analog and digital modulation techniques.
- Electronics, amplifiers and filters.
- Fundamentals of electromagnetics and transmission lines.

Textbook: **Modern Communication Circuits by Jack R Smith, McGraw-Hill, 2nd edition, 1997.**

References:
1. Practical RF Circuit Design for Modern Wireless Systems, Volume II: Active Circuits by Rowan Gilmore and Les Besser, Artech House, 1st edition, 2003.
2. Analog Integrated Circuits for Communication: Principles, Simulation and Design by Donald O. Pederson, Springer, 2nd edition, 2007.
3. The Design of CMOS Radio-Frequency Integrated Circuits by Thomas H. Lee, Cambridge University Press, 2nd edition, 2003.
4. RF Microelectronics by Behzad Razavi, Prentice Hall, 2nd Edition, 2011.
5. Radio Frequency Integrated Circuits and Systems by Hooman Darabi, Cambridge University Press, 1st edition, 2015.

6. High-Frequency Integrated Circuits by Sorin Voinigescu, Cambridge University Press, 1st Edition, 2013.
7. Science and Communication Circuits & Projects by Forrest M. Mims III, Master Publishing Inc, 1st Edition, 2004.
8. Electromagnetics for High-Speed Analog and Digital Communication Circuits by Ali M. Niknejad, Cambridge University Press, 1 edition, 2007.

Schedule: 16 Weeks, 42 lectures (50 minutes each) plus exams.

Course goals: The overall objective is to introduce the student to the basics of communications electronics, including analyzing analog modulation and demodulation circuits, understanding RF electronics, and designing and simulating RF transmitter/receiver circuits.

Course learning outcomes (CLO) and relation to ABET student outcomes (SO):

Upon successful completion of this course, a student will:		[SO]
1.	Be able to analyze and identify amplitude, frequency, and phase modulation transmitters and receivers.	[1]
2.	Perform circuit analysis of basic communication blocks (amplifiers, oscillators, mixers, detectors).	[1]
3.	Design basic communications blocks.	[1, 2]
4.	Model antennas and transistors.	[1]
5.	Perform measurements including spectra and noise.	[1]
6.	Perform complete system simulation of transmitters and receivers.	[1]
7.	Provide system specifications for a communications system design.	[1, 2]

Course topics:		Hrs
1.	Resonant and tuned circuits.	3
2.	Impedance matching and transformation.	3
3.	Noise and noise figure.	2
4.	Simulation of transient and small signal AC circuits.	2
5.	Small signal analysis of common amplifiers.	6
6.	Frequency response of common amplifiers.	3
7.	Low noise amplifier (LNA). Cascode and feedback amplifier.	3
8.	Linearity and distortion (intercept point, compression, distortion).	2
9.	Antennas and transmission lines.	1
10.	Oscillators.	3
11.	Mixers.	3
12.	Power amplifiers.	2
13.	Detectors.	3
14.	AM transmitters and receivers.	3
15.	FM transmitters and receivers.	3

Ground rules:

Attendance is required and highly encouraged. To that end, attendance will be taken every lecture. Eating and drinking are not allowed during class, and cell phones must be set to silent mode. All exams (including the final exam) should be considered cumulative. Exams are closed book. No scratch paper is allowed. You will be held responsible for all reading material assigned, even if it is not explicitly covered in lecture notes.

Assessment & grading policy:

Assignments	0%	Quizzes	0%
First Exam	20%	Projects	10%
Midterm Exam	30%	Lab Reports	0%
Final Exam	40%	Presentation	0%
		Total	**100%**

Last Revised: March 2021