

The University of Jordan
School of Engineering
Department of Electrical Engineering
Summer Semester – A.Y. 2019/2020



Course: Communication Electronics - EE0943423 (3 Cr. – Elective Course)
Instructor: Eng. Reem Aldebes
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Course Website: <https://elearning.ju.edu.jo/>

Catalog Data: 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:

- **Communications Electronics, Principles and applications, by Louis Frenzel, 3rd edition, McGraw Hill, 2008.**
- **Modern Communication Circuits by J. Smith, 2nd edition, McGraw Hill, 1998, ISBN-13 9780070592834**

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 & Duration: 8 Weeks, 48 contact hours (75 minutes each) including exams.

Minimum Student Material: Textbook, class handouts, scientific calculator, and an access to a personal Computer.

Course Objectives: The overall objective is to introduce the student to the basics of communications electronics. This course emphasizes:

- Analog modulation and demodulation techniques.
- RF Electronics.
- Design and simulation of transmitter/receiver circuits.
- Building RF transmitter/receiver circuits.

Course Learning Outcomes and Relation to ABET Student Outcomes:

Upon successful completion of this course, a student should:

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| 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] |
| 1. Be able to analyze and identify amplitude, frequency, and phase modulation transmitters and receivers. | [1] |

Course Topics:

	Topic Description	Hrs
1.	Resonant and Tuned circuits	3
2.	Impedance matching and transformation	3
3.	Noise and Noise figure	3
4.	Simulation, transient and small signal AC	3
5.	Small signal analysis of common amplifiers	6
6.	Frequency response of common amplifiers	3
7.	LNA (Cascode and feedback amp)	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	4
14.	AM TX/RX	3
15.	FM TX/RX	3

Ground Rules: Attending the online classes is recommended and highly encouraged. Exams are closed book.

Assessments: Exams, Quizzes, Projects, and Assignments.

Grading policy:

Midterm Exam	30%
Project / Assignments	20%
Final Exam	50 %
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Total	100%

Last Updated: June 2020