



**University of Tehran**  
**School of Electrical and Computer Engineering**

|                               |  |                                     |                                     |                          |                          |                          |                          |                          |                          |              |                          |
|-------------------------------|--|-------------------------------------|-------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------|--------------------------|
| <b>Course:</b>                | <b>8101000 – Communication Circuit LAB</b>   |                                     |                                     |                          |                          |                          |                          |                          |                          |              |                          |
| <b>Course type:</b>           |  | EE*                                 |                                     |                          |                          |                          | CE*                      |                          |                          | Credit:<br>1 |                          |
|                               |  | Com                                 | E                                   | P                        | B                        | Con                      | D                        | SW                       | HW                       |              | IT                       |
|                               | Required   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |              | <input type="checkbox"/> |
| Elective                      | <input type="checkbox"/>   | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |              |                          |
| <b>Level:</b>                 | Undergraduate <input checked="" type="checkbox"/><br>Graduate <input type="checkbox"/>   |                                     |                                     |                          |                          |                          |                          |                          |                          |              |                          |
| <b>Co-requisite(s):</b>       | Communication Circuit (8101366)  |                                     |                                     |                          |                          |                          |                          |                          |                          |              |                          |
| <b>Prerequisite(s):</b>       | Electronics II Lab   |                                     |                                     |                          |                          |                          |                          |                          |                          |              |                          |
| <b>Prerequisite by topic:</b> | <ol style="list-style-type: none"> <li>1. Semiconductor devices and their high frequency models,</li> <li>2. Single and multistage amplifiers,</li> <li>3. Frequency response of feedback amplifiers,</li> <li>4. Push-pull amplifier,</li> <li>5. Differential pairs,</li> <li>6. Frequency selective networks and transformers,</li> <li>7. Fourier and spectrum analysis.</li> </ol>  |                                     |                                     |                          |                          |                          |                          |                          |                          |              |                          |
| <b>Textbook(s):</b>           | <p>[1] Lab Instrucion.</p> <p>[2] “RF Microelectronics”, Behzad Razavi, 2011.</p> <p>[3] “RF Circuit Design: Theory &amp; Applications”, Reinhold Ludwig, Gene Bogdanov, 2008.</p>   |                                     |                                     |                          |                          |                          |                          |                          |                          |              |                          |
| <b>Coordinator:</b>           | Professor Mahmoud Kamarei  |                                     |                                     |                          |                          |                          |                          |                          |                          |              |                          |
| <b>Goals:</b>                 | <p>Presentation of fundamental analysis and design techniques for subsystem modern communication circuits covering the Frequency range up to microwave.</p> <ul style="list-style-type: none"> <li>• Practical Implementation of communication systems, modulation and detection schemes, transceiver architectures, dynamic range, nonlinearity and distortion, low noise amplifiers, mixers, oscillators, and phase-locked loops.</li> </ul> |                                     |                                     |                          |                          |                          |                          |                          |                          |              |                          |
| <b>Outcome:</b>               | <p>Upon successful completion of the course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Design, simulate and Implement communication systems building blocks such as oscillator, mixer, synthesizer, phase locked loops, etc.</li> <li>2. Design, analyze, and Implement communication systems: receivers and transmitters.</li> <li>3. Understand modulation and detection Practically.</li> </ol>               |                                     |                                     |                          |                          |                          |                          |                          |                          |              |                          |
| <b>Topics:</b>                | 1. RLC tank Circuit  |                                     |                                     |                          |                          |                          |                          |                          |                          |              |                          |

|                              |  |          |     |                |     |                              |     |
|------------------------------|--|----------|-----|----------------|-----|------------------------------|-----|
|                              | <ol style="list-style-type: none"> <li>2. Oscillator (Phase Shifting)</li> <li>3. Oscillator (Differential Pairs)</li> <li>4. Mixer Fundamentals and Circuits,</li> <li>5. AM Modulator and Detectors</li> <li>6. Phase Locked Loops,</li> <li>7. Introduction to Wireless Communication.</li> </ol>   |          |     |                |     |                              |     |
| <b>Computer usage:</b>       | Students must work with circuit simulation software: Advanced Design System (ADS) and HSpice.  |          |     |                |     |                              |     |
| <b>Assignments:</b>          | 6 Pre-Lab and Lab Reports.   |          |     |                |     |                              |     |
| <b>Projects:</b>             | A related Term Project   |          |     |                |     |                              |     |
| <b>Grading:</b>              | <table style="width: 100%; border: none;"> <tr> <td style="width: 80%;">Reports:</td> <td style="text-align: right;">40%</td> </tr> <tr> <td>Final Project:</td> <td style="text-align: right;">20%</td> </tr> <tr> <td>Attendance &amp; Class Activity:</td> <td style="text-align: right;">40%</td> </tr> </table>   | Reports: | 40% | Final Project: | 20% | Attendance & Class Activity: | 40% |
| Reports:                     | 40%  |          |     |                |     |                              |     |
| Final Project:               | 20%  |          |     |                |     |                              |     |
| Attendance & Class Activity: | 40%  |          |     |                |     |                              |     |
| <b>Further readings:</b>     | <ol style="list-style-type: none"> <li>[1] J. Everard, Fundamentals of RF Circuit Design: with Low Noise</li> <li>[2] Oscillators. 2001.</li> <li>[3] D. R. Stephens, Phase locked Loops for Wireless Communications:</li> <li>[4] Digital, Analog and Optical Implementation. 2002.</li> <li>[5] S. C. Cripps, Advanced Techniques in RF Power Amplifier Design.</li> <li>[6] 2002.</li> <li>[7] J. Laskar, B. Matinpour, and S. Chakraborty, Modern Receiver</li> <li>[8] Front-Ends: Systems, Circuits, and Integration. 2004.</li> </ol> |          |     |                |     |                              |     |
| <b>Prepared by:</b>          | Professor Mahmoud Kamarei  |          |     |                |     |                              |     |
| <b>Date:</b>                 | November 10, 2017  |          |     |                |     |                              |     |

|                                    |                |                          |                        |
|------------------------------------|----------------|--------------------------|------------------------|
| <b>*EE: Electrical Engineering</b> |                | CE: Computer Engineering |                        |
| Com                                | Communications | SW                       | Software               |
| E                                  | Electronics    | HW                       | Hardware               |
| P                                  | Power          | IT                       | Information Technology |
| B                                  | Bioelectronics |                          |                        |
| Con                                | Control        |                          |                        |
| D                                  | Digital System |                          |                        |