**Timing and Structure**

Lent term. 75% exam / 25% coursework

**Prerequisites**

3B1 (Assumed)

**Aims**

The aims of the course are to:

- Provide a system level overview of RF and Microwave, so that system performance can be predicted and optimised to meet a specification

**Objectives**

As specific objectives, by the end of the course students should be able to:

- Be able to apply network analysis to an RF system
- Understand the effects of noise, linearity and gain in cascaded RF systems
- Be able to optimise impedance match of an amplifier as a tradeoff of noise, linearity, bandwidth and stability
- Understand the operation of passive RF networks (Couplers, splitters, attenuators) and limits on their performance
- Have a knowledge of range of methods to improve amplifier performance
- Understand a range of RF system applications and their performance requirements

**Content**

It is proposed that this module will focus on the *system* aspects of RF design (as opposed to circuits). Therefore the overall aim is that circuits (amplifiers etc) can be reduced to a blocks with a minimum number of parameters from which the system performance can be estimated.

**Preliminary Syllabus**

1. **Network Analysis**

   - 2-port and multi-port devices
   - Impedance, Scattering and Transmission parameters, their relationships and uses
2. Noise and Distortion

- Noise sources in RF systems
- Noise figure
- Noise in passive networks
- Noise of mismatched devices
- Effects of Distortion
- Measures of distortion and intermodulation
- Dynamic range
- Noise and distortion of cascaded devices

3. Impedance Matching Methods

- Limits on achievable matches
- Distributed Impedance matching methods
- Broadband matching

4. Amplifier Design

- Stability
- Conjugate matching
- Design for low noise
- Design for high power and low distortion

5. RF System Architecture

- Zero IF
- Software Defined Radio

6. RF System Applications

- Radar
- Passive RFID
- Radio regulations

Coursework

<table>
<thead>
<tr>
<th>Coursework</th>
<th>Format</th>
<th>Due date &amp; marks</th>
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<tbody>
<tr>
<td>CAD Amplifier design</td>
<td>Individual</td>
<td>Weds week 9</td>
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<tr>
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<td>Report</td>
<td>[15/60]</td>
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Using industry standard software, the performance of a microwave low noise amplifier will be investigated to maximize performance.

A brief getting started demonstration will be given in lectures and a drop in session organised for software trouble shooting.

Learning objective:

- Familiarisation with microwave simulation capabilities
- Design for an amplifier to meet specifications.
Examination Guidelines

Please refer to Form & conduct of the examinations [2].

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Source URL (modified on 17-05-18): http://teaching.eng.cam.ac.uk/content/engineering-tripos-part-iib-4b24-radio-frequency-systems-2018-19

Links
[1] mailto:mjc87@cam.ac.uk