
**Module Leader**

Dr M J Crisp

**Lecturer**

Dr M J Crisp

**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
• Signal Flow Graphs
• Two port power gains

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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</thead>
<tbody>
<tr>
<td>CAD Amplifier design</td>
<td>Individual</td>
<td>Weds week 9 [15/60]</td>
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<tr>
<td>Using industry standard software, the performance of a microwave low noise amplifier will be investigated to maximize performance.</td>
<td>Report anonymously marked</td>
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<td>A brief getting started demonstration will be given in lectures and a drop in session organised for software trouble shooting</td>
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<td>Learning objective:</td>
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<td></td>
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<td>Familiarisation with microwave simulation capabilities</td>
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<td>Design for an amplifier to meet specifications.</td>
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Examination Guidelines

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

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Source URL (modified on 16-01-18): http://teaching.eng.cam.ac.uk/content/engineering-tripos-part-iib-4b24-radio-frequency-systems-2017-18

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