
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
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><strong>CAD Amplifier design</strong></td>
<td>Individual</td>
<td>Weds week 9</td>
</tr>
<tr>
<td>Using industry standard software, the performance of a microwave low noise amplifier will be investigated to maximize performance.</td>
<td>Report</td>
<td>[15/60]</td>
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<tr>
<td>A brief getting started demonstration will be given in lectures and a drop in session organised for software trouble shooting</td>
<td>anonymously marked</td>
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**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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Links
[1] mailto: mjc87@cam.ac.uk