Proposed Graduate Course at ANU: *Overview of Wireless Communications*

Title of the course: Overview of Wireless Communications

Course director: Prof. Rodney Kennedy (RSISE, ANU)

Formal Description of course: This course exposes students to current research and open problems in Wireless Communications. The course covers basic communication channel theory, providing background in modulation, coding and information theory. This theory is then applied to current leading-edge research topics, including multiuser and multi-access channels, multiple antenna channels and mobile networking (including ad hoc networking). The course concludes with an examination of emerging wireless technologies such as Home-RF and Bluetooth.

Informal Description of course: Wireless communication is a burgeoning field, touching a wide range of engineering disciplines including aspects of control theory, software engineering and machine learning. This course provides a solid background in wireless communication theory. It has the dual aims of introducing students to wireless communication theory, and exposing students to current and emerging trends in wireless technology. This course is aimed at non-specialists who are interested in wireless aspects is ICT.

Curriculum: Proposed course outline is as follows:

1. Communication channels

   Channel modelling, basic information theory, diversity, multi-carrier systems

   Transmitter design

   - coding, modulation, multicarrier

Receiver design

- equalisation, decoding

2. Multi-user channels and Multi-access channels

   Multiuser Detection (MUD), interference, multi-access systems.

   Coverage and capacity enhancing techniques, iterative decoding and interference cancellation

3. Multiple antenna channels

   Single user multi-antenna channel, vector channels.

   Capacity of multiple-input multipleoutput (MIMO) channels, modelling for MIMO channels.

   Space-time coding, from Alamouti past Tarohk and beyond

4. Mobile networking

   ad hoc networking (MANET), pervasive computing, mobile satellite systems

   Medium access control (MAC), Resource requirement control (RRC), Network planning

5. Emerging technology

   Ultra-Wide Band (UWB), Multi-band OFDM

   Broadband wireless access (BWA)

   - channel models, system design (including data reception, transmitter design)

   Fixed Wireless Access (FWA), Wireless Networking (WLAN)

   Personal Area Networks

   - Bluetooth, UWB, Home RF, ZigBee

   Evolution of Mobile communications

   - from 1st Generation to 4th Generation

   Standards

- Mobile, WLAN, PAN, MAN, etc..

Presenters: Dr. Leif Hanlen (NICTA, ANU Adjunct), Dr. Dhammika Jayalath (RSISE, ANU), Dr. Tony Pollock (NICTA, ANU Adjunct), Dr. Mark Reed (NICTA, ANU Adjunct) (in alphabetical order)

Dates and Locations: Nominally, `start date`, daily, 10am-12pm in lecture room RSISE building, running for two weeks

Completion date of course: `start date`+3weeks

Notification date of course: `start date`+8weeks

Workload: 20 hours of lectures, 40 hours of assignments reading and preparation for lectures.

Assumed knowledge of course: Basic probability theory (expectation, variance), undergraduate linear algebra (bases, matrix theory), MATLAB™ Some engineering background will be helpful, particularly **S. Haykin**, *Communication Systems*, and **J.G. Proakis** *Digital Communications*

Prerequisites, entry requirements: Undergraduate engineering/ science/ mathematics degree.

Assessment procedures: 5 assignments – one per topic. No formal examination.

Assignment options for the course: Five assignments to be handed out through the course. A pass will be conditional upon satisfactory completion of the assignments.

Examiners: Prof. Rodney Kennedy (RSISE, ANU) and Leif Hanlen, (NICTA, ANU Adjunct)

Fees: Nil