

***Department of Electrical Engineering and Electronics***

# **Project Specification Form 2017-2018**

***Final Year BEng (*ELEC340*) and Year 3 MEng (*ELEC440*)***

Student Name: Yang Zhao Module: ELEC340

Supervisor: Dr Xu Zhu Student ID No: 201220049

Project Title: Cross-Layer Optimisation for 4G Broadband Wireless Communication Networks

### Project Specification

**A. Project Description and Methodology:**

(Overall view of the project with proposed route to realization i.e. what are the project aims and objectives and how you are going to do it?)

Focusing on the physical (PHY) Layer and the medium access control (MAC) Layer, this project is intended to build an adaptive cross-layer model for 4G wireless communication systems. It is assumed that the multiuser system to be enhanced is based on orthogonal frequency-division multiplexing (OFDM) technology, and heterogeneous downlink traffic from each client is to be optimized. To indicate the importance and urgency of the packets, the concept of weight is introduced in the design, associated with the delay, packet size and quality of service (QoS) priority. In the PHY layer, the subcarrier and power controller will be allocated to maximize the weighted sum capacity (WSC)for users, while the transmission order of the packets is to be determined by the weight of selected packets in the MAC layer. The user-based algorithm rather than queue-based one is employed to reduce the complexity and improve the efficiency, since the number of users is smaller than that of queues in most cases. In addition, the WSC of selected packets is calculated instead of all packets, to simplify the problem. By choosing packets properly, the algorithm can perform as expected. In addition, various resource allocation schemes like maximum capacity (MC) and proportional fairness (PF) based will be examined, while packet scheduling schemes as largest weighted delay first (LWDF) and packet dependent (PD) scheduling will be tested and compared to reveal the pros and cons of our design. A similar project has been researched by the supervisor, and several significant discoveries and achievements have been derived in the early stage. This project aims to create advanced adaptive model based on the previous one, by allocating weight through a more comprehensive scheme, exploring more efficient algorithm, and comparing diverse resource allocation strategies.

**B. Project Tasks and Milestones:** (indicate the tasks and milestones that should be achieved and their expected dates e.g. understanding of theory, designs of circuits, construction of circuits, software specifications, working demonstrations etc.)

**Tasks:** (a task is a package of work that should be completed during a particular time period)

1 Learning basic knowledge about communication systems (Weeks 1-2)

2 Studying AWGN channel and fading channel models (Week 3)

3 Researching OFDM system (Week 4)

4 Problem formulation (Week 5)

5 Resource allocation (MSC, PF and MWSC) plus MATLAB simulation (Weeks 6-8)

6 Data scheduling (LWDF and PD) plus MATLAB simulation (Weeks 9-11)

7 Scheme and algorithm improvement (Weeks 12-13)

8 Complexity and performance analysis (Weeks 14-15)

9 Result explanation (Weeks 16-17)

10 Thesis writing (Weeks 12-20)

**Milestones:** (an objective that should be achieved by a particular date e.g. the completion of a task)

1 Understanding of fundamental communication model and essential knowledge (Week 3)

2 Review of article in relevant fields (Week 4)

3 Creation of the basic structure of the adaptive cross-layer model with problem formulation (Week 5)

4 Resource allocation in the PHY layer with MATLAB simulation (Week 8)

5 Data scheduling in the MAC layer with MATLAB simulation (Week 11)

6 Performance improvement and complexity reduction (Week 13)

7 Complexity and performance analysis (Week 15)

8 Report writing (Week 20)

**C. Project Deliverables:** (Indicate what should be completed at the end of the project e.g. this list should indicate what will be presented / demonstrated at the final bench inspections)

1 Advanced adaptive cross-layer design for 4G broadband wireless networks

2 MATLAB simulation for resource allocation (MSC, PF and MWSC)

3 MATLAB simulation for data scheduling (LWDF and PD)

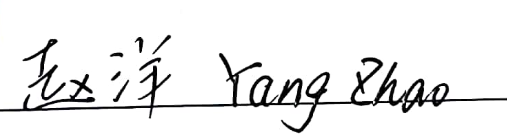
4 Comparison for various resource allocation and data scheduling strategies

5 Explanation about the performance and complexity of the design

6 Comparison about the pros and cons of proposed model with the traditional one

7 Report explaining the theory, method, procedure, algorithm and outcome

**D.** A sectionon Project Rationale and Industrial Relevance must be included in the preliminary report (deadline midnight Friday 14th October 2016). This should explain how and why the project was devised, e.g. it may be a project sponsored by a company or linked to a research project.

Student Signature:  Date: \_\_\_\_\_\_\_\_\_10/10/2017\_\_\_\_\_\_\_\_\_\_

Supervisor’s Signature:  Date: \_\_\_\_\_\_\_\_\_10/10/2017\_\_\_\_\_\_\_\_\_\_

By signing this form, the supervisor and student are confirming that the project is of a sufficiently demanding nature that it is suitable for the individual project component of an accredited engineering degree and that a student, who is capable of producing a first class performance, will be able to demonstrate his/her capabilities in this project.