Course Specification[1]

Please note: there may be some adjustments to the teaching arrangements published in this course specification. Given current circumstances related to the Covid-19 pandemic it is anticipated that some usual arrangements for teaching on campus will be modified to ensure the safety and wellbeing of students and staff on campus; further adjustments may also be necessary, or beneficial, during the course of the academic year as national requirements relating to management of the pandemic are revised.

1. Course Code:

ENG5220

2. Course Title:

Real Time Embedded Programming

3. Academic Session:

2022-23

4. Academic Level (see Scottish Credit and Qualifications Framework Levels):

Level 5 (SCQF level 11)

5. Credits:

20

6. Short Description of the Course:

This course develops in students an understanding of the theory and practice of real-time embedded systems firmware and application programming, and introduces students to the techniques and standards of software design, implementation and development for such systems.

7. Requirements of Entry:

Mandatory Entry Requirements
None
Recommended Entry Requirements
None

8. Co-requisites (courses that must be taken in the same session as this course as a condition of enrolment):

None

9. Excluded Courses:

[1] This specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if full advantage is taken of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each course can be found in course handbooks and other course documentation and online at www.gla.ac.uk

Course Specification[1]

请注意：本课程规范中公布的教学安排可能会有一些调整。鉴于目前与Covid-19大流行有关的情况，预计校园教学的一些通常安排会被修改，以确保校园学生和教职员的安全和福祉；随着国家对大流行管理的要求的修订，在学年期间可能有必要或有益地进行进一步的调整。

1. Course Code:

ENG5220

2. Course Title:

实时嵌入式编程

3. Academic Session:

2022-23

4.学术水平（见苏格兰学分和资格框架水平）：

Level 5 (SCQF level 11)

5. Credits:

20

6.课程简介:

本课程让学生了解实时嵌入式系统固件和应用程序编程的理论和实践，并向学生介绍这些系统的软件设计、实现和开发的技术和标准。

7.入境要求:

强制性入学要求
无推荐入职条件

None

8.共同要求(必须与本课程在同一节课内修读的课程作为入学条件):

None

9. Excluded Courses:

1本规范提供了课程的主要特点和学习成果的简明摘要，如果充分利用所提供的学习机会，典型的学生可能合理地期望达到并证明。有关每门课程的学习成果、内容、教学、学习和评估方法的更详细资料，可参阅课程手册及其他课程文件，亦可于www.gla.ac.uk

None

10. Associated Programmes:

Computer Systems Engineering MSc HG55-5200
Electronics and Electrical Engineering MSc HH56-5200
Mechatronics MSc H313-5200

11. Available to visiting students:

Yes

12. Available to Erasmus students:

Yes

13. Typically offered:

Semester 2

14. Timetable (if known) and length and frequency of teaching sessions:

4 hour teaching and lab sessions per week

15. Course Aims:

The aims of this course are to:

- introduce students to advanced hardware design and development of Linux based real-time embedded systems in C++;
- demonstrate the functional interactions between embedded software, hardware peripherals and communications in real time systems;
- undertake project based design, development, documentation and dissemination of an embedded system meeting a given specification.

16. Intended Learning Outcomes of Course*:*

By the end of this course students will be able to:

- write C++/object oriented programs on a Linux based embedded system (e.g. Raspberry PI) and use suitable tools to optimise and debug them;
- explain the difference between polling, interrupt-driven and collaborative/preemptive real time operating systems programming and select the most appropriate for each application;
- write multi-threaded applications;
- write a GUI in C++ which allows user interaction;
- use industry standards such as RS232, SPI, I2C, I2S, LIN, CAN and Ethernet to interface with peripherals and other systems;
- design and test data acquisition hardware and analogue frontends;
- write code that conforms to industrial coding standards and techniques (such as MISRA-C ISO 26262);
- employ different project management techniques used in developing software for embedded systems;
- document code to industry standards
- deploy open source code and publicise it on social media

None

10. Associated Programmes:

计算机系统工程硕士HG55-5200
电子与电气工程硕士HH56-5200
Mechatronics MSc H313-5200

11.可供访问学生使用:

Yes

12.可供伊拉斯谟学生使用:

Yes

13. Typically offered:

Semester 2

14.时间表（如已知）以及授课时间和频率:

每周4小时的教学和实验课程

15. Course Aims:

本课程的目的是:

- 向学生介绍基于Linux的C++实时嵌入式系统的高级硬件设计与开发;
- 演示实时系统中嵌入式软件、硬件外设和通信之间的功能交互;
- 进行基于项目的设计、开发、文档化和发布符合给定规范的嵌入式系统.

16.课程预期的学习成果:

在本课程结束时，学生将能够:

- 在基于Linux的嵌入式系统（例如RaspberryPI）上编写面向对象的c++程序，并使用合适的工具进行优化和调试;
- 解释轮询、中断驱动和协作抢占式实时操作系统编程之间的区别，并为每个应用选择最合适的;
- write multi-threaded applications;
- 用C++编写一个GUI，允许用户交互;
- 使用RS232、SPI、I2C、I2S、LIN、CAN和以太网等行业标准与外设和其他系统接口;
- 设计和测试数据采集硬件和模拟前端;
- 编写符合工业编码标准和技术（如MISRA-CISO26262）的代码;
- 采用不同的项目管理技术，用于开发嵌入式系统的软件;
- 符合行业标准的文档代码
- 部署开源代码并在社交媒体上发布

17. Learning and Teaching Methods:

Method	**Formal Contact Hours**	**Notional Learning Hours** (including formal contact hours)
Lecture	12.00	24.00
Seminar	0.00	0.00
Tutorial	0.00	0.00
Project Supervision	0.00	0.00
Demonstration	0.00	0.00
Practical Classes and Workshops	18.00	36.00
Supervised time in studio / Workshop	15.00	30.00
Fieldwork	0.00	0.00
External Visits	0.00	0.00
Work Based Learning	0.00	0.00
Guided Independent Study	Not Applicable	110.00
Placement	0.00	0.00
Year Abroad	0.00	0.00
TOTAL	**45.00**	**200.00**

18. Minimum Requirement for Award of Credits:

Students must attend the degree examination and submit at least 75% by weight of the other components of the course's summative assessment.

Students must attend the timetabled laboratory classes.

19. Summative Assessment Methods:

Method	**%**
Written Exam	0.00%
Written Assignment, including Essay	80.00%
Report	0.00%
Dissertation	0.00%
Portfolio	0.00%
Project Output (Other than dissertation)	0.00%
Oral Assessment & Presentation	20.00%
Practical Skills Assessment	0.00%
Set Exercise	0.00%
TOTAL	**100.00**

20. Description of Summative Assessment:

100% from continuous assessment

21. Are reassessment opportunities normally available for all summative assessments in this course?:

Yes

17.学与教方法:

Method	**Formal** 联络时间	名义学习 时间(包括正式联络时间)
Lecture	12.00	24.00
Seminar	0.00	0.00
Tutorial	0.00	0.00
工程监理	0.00	0.00
Demonstration	0.00	0.00
实践课程及工作坊	18.00	36.00
在工作室工作坊监督时间	15.00	30.00
Fieldwork	0.00	0.00
对外访问	0.00	0.00
以工作为本的学习	0.00	0.00
指导性独立研究	不适用	110.00
Placement	0.00	0.00
海外年份	0.00	0.00
TOTAL	**45.00**	**200.00**

18.授予学分的最低要求：学生必须参加学位考试，并按课程总结性评估的其他部分的重量提交至少75%。

学生必须参加时间表规定的实验室课程.

19. Summative Assessment Methods:

Method	**%**
笔试	0.00%
书面作业，包括论文	80.00%
Report	0.00%
Dissertation	0.00%
Portfolio	0.00%
项目成果（论文除外）	0.00%
口头评估及陈述	20.00%
实用技能评估	0.00%
设置练习	0.00%
TOTAL	**100.00**

20.总结性评估的描述:

100%来自持续评估

21.本课程的所有总结性评估是否通常都有重新评估的机会？：

Yes

Reassessments are normally available for all courses, except those which contribute to the Honours classification. For non Honours courses, students are offered reassessment in all or any of the components of assessment if the satisfactory (threshold) grade for the overall course is not achieved at the first attempt. This is grade D3 for both undergraduate students and postgraduate students. Exceptionally it may not be possible to offer reassessment of some coursework items, in which case the mark achieved at the first attempt will be counted towards the final course grade. Any such exceptions for this course are described below.

The grade can only be improved by re-submitting the report which then re-assessed but anything related to practical work cannot be improved because neither the teams will exist by the time of resubmission nor the hardware.

22. Formative Assessment & Feedback:

Feedback will be provided in laboratories.

23. Grading Basis (see University Calendar):

Schedule A

24. Examination Diet:

April/May

25. Total Exam Duration (Excluding in-class tests):

0 minutes

26. Short Title:

Real Time Embedded Programming

27. Independent Work (i.e. the result for this course can be used to meet the generic Honours requirement to achieve a grade D3 or better in a piece of independent work worth at least 20 credits or the generic PGT requirement to achieve a D3 or better in a piece of independent work worth at least 60 credits – normally a Dissertation or Project):

No

28. Subject:

Engineering

29. Location(s):

Main Campus

30. College:

College of Science and Engineering

31. Lead School/Institute:

Engineering [REG30300000]

所有课程通常都有重新评估 但有助于荣誉分类的课程除外。对于非荣誉课程，如果学生在第一次尝试时未能达到整体课程的满意（门槛）成绩，则会在所有或任何评估部分中重新评估学生。这是本科生和研究生的d3级。在特殊情况下，可能无法对某些课程项目进行重新评估，在这种情况下，第一次尝试取得的分数将计入最后课程成绩。本课程的任何此类例外情况如下所述。只有重新提交报告，然后重新评估，才能提高职等，但与实际工作有关的任何事情都无法改善，因为在重新提交时，团队和硬件都不会存在。

22.形成性评估与反馈:

反馈将在实验室提供。

23.评分依据（见大学校历）：

Schedule A

24. Examination Diet:

April/May

25.考试总时长(不包括课堂考试):

0 minutes

26. Short Title:

实时嵌入式编程

27.独立工作（即本课程的结果可用于满足在一项价值至少20学分的独立工作中获得d3或更好的通用荣誉要求，或在一项价值至少60学分的独立工作中获得D3或更好的通用PGT要求–通常是论文或项目）：

No

28. Subject:

Engineering

29. Location(s):

主校区

30. College:

科学与工程学院

31. Lead School/Institute:

Engineering [REG30300000]

32. Cost Centre:

ENG - Micro and Nanotechnology [30305000]

33. Is this course collaborative with another institution?:

No

34. Teaching Institutions:

University of Glasgow

35. Taught wholly by distance learning:

No

36. Open Studies Credit Bearing:

No

37. Represents a work placement or period of study abroad:

No

41. Additional Relevant Information (if applicable):

42. Date of approval:	14/12/2018

32. Cost Centre:

微纳米技术[30305000]

33.这门课程是否与另一所院校合作?:

No

34. Teaching Institutions:

格拉斯哥大学

35.完全由远程教育教授:

No

36.公开研究学分:

No

37.代表工作安排或留学期间:

No

41.其他相关信息（如适用）:

42.批准日期:	14/12/2018