

Student Assignment Brief

This document is intended for Coventry University Group students for their own use in completing their assessed work for this module. It must not be passed to third parties or posted on any website. If you require this document in an alternative format, please contact your Module Leader.

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The work you submit for this assignment must be your own independent work, or in the case of a group assignment your own groups' work. More information is available in the '[Assignment Task](#)' section of this assignment brief.

Assignment Information

Module Name: Embedded Hardware Engineering

Module Code: 7074CEM

Assignment Title: Coursework

Assignment Due: 27/11/23, 18:00 UK time

Assignment Credit: 15 credits

Word Count (or equivalent): 4000 words +/- 25%

Assignment Type: Percentage Grade (Applied Core Assessment). You will be provided with an overall grade between 0% and 100%. You have one opportunity to pass the assignment at or above 40%.

Assignment Task

You should follow a full development cycle for designing a low cost, portable, PIC based signal generator and produce a full set of firmware and production files. Your final production files may use different components, but you must discuss the differences in your report. The desired specification for the device is listed below:

Output signal specification:

- Output waveforms:
 - Basic: Triangle, Ramp Up Sawtooth, Ramp Down Sawtooth
 - Advanced: Square, Sine, Pulse
- Output frequencies:
 - Basic: 2Hz, 5Hz, 10Hz
 - Advanced: 20Hz, 50Hz, 100Hz
- Output amplitude:
 - Basic: Non-adjustable
 - Advanced: Adjustable
- Output offset:
 - Basic: Non-adjustable
 - Advanced: Adjustable

Interface specification:

- Power:
 - Basic: Powered through a USB port. Device auto power off after one minute of no user interaction.
 - Advanced: Further optimisations for low power consumption.
- User interface:
 - Basic: Physical user interface
 - Advanced: USB control interface

Production specification:

- Physical size:
 - Basic: PCB area smaller than 50cm² (final PCB layout)
 - Advanced: PCB area smaller than 25cm² (final PCB layout)
- Cost per unit:
 - Basic: < 50 GBP (Bill of Materials and PCB only, for a production run of 1000 units)
 - Advanced: < 30 GBP (Bill of Materials and PCB only, for a production run of 1000 units)

You should use the above as a starting point for your design. Consider and realise your best solution to the aspects of the system that are not mentioned above. Design for improved performance and functionality where possible.

You must produce a report based on the following tasks. Aim to have a separate, complete, chapter for parts 1 - 4 of the table below. You should discuss the detailed procedure of each task and critically evaluate all the results. Provide all necessary illustrations such as diagrams of your design(s) and screenshots of your results as evidence. Any figure without discussion is not acceptable and hence will be awarded very low marks. You must include in your report a link with a video demonstration of your hardware prototype to meet the requirements of part 6 below (details in the list above). Include only the important parts of your code (with comments) in the main body of the report. **You must provide links to the complete firmware, Proteus and MPLABX projects, and a video demonstration of your hardware prototype.**

Your mark will consist of the following components:

Part	Assignment Details	Marks
1	Design requirements, i.e. full system specification, identification of relevant technologies and solutions, design approaches and methodology followed for solving this assignment, etc.	10%
2	Hardware development, i.e. component selection and related design considerations including relevant microcontroller features and built-in peripherals, system design and simulation, and resultant circuit schematic and PCB layout, etc.	15%
3	Software development, i.e. conceptual design, flowcharts, languages, libraries and algorithms used, implementation and simulation, debugging, etc.	15%
4	Verification and optimisation, i.e. simulation results, testing, fault-finding and debugging, design optimisations, compliance, future proofing/future improvements, etc.	10%
5	Write a concise report (marks will be deducted for unnecessary information) with main chapters covering the details in Parts 1 – 4.	10%
6	A video showing a working <u>hardware prototype</u> and PCB design. Marks will be awarded for the clear demonstration of each aspect of the required specification listed above. a) Basic performance demo: 2.5% per achieved requirement b) Advanced performance demo: 2.5% per achieved requirement	20% 20%

Submission Instructions:

- Method of submission: The project report shall be electronically submitted via the Turnitin link that will be available on the module's Aula page. Where required, links to supporting files (e.g. video, simulation and design files, etc.) shall be included in the project report.

NB. Ensure any links are accessible to the module team without needing to ask permission.

- Formatting of submission: Microsoft Word (*.doc or *.docx)

NB. Only use Microsoft Word and not PDF.

Marking and Feedback

How will my assignment be marked?

Your assignment will be marked by the module team.

How will I receive my grades and feedback?

Provisional marks will be released once internally moderated.

Feedback will be provided by the module team alongside grades release.

It will be accessible via Turnitin and will be in the form of on-page highlighting and comments and/or additional comments in the designated field.

Your provisional marks and feedback should be available within 2 weeks (10 working days).

What will I be marked against?

Details of the marking criteria for this task can be found at the [bottom of this assignment brief](#).

Assessed Module Learning Outcomes

The Learning Outcomes for this module align to the [marking criteria](#) which can be found at the end of this brief. Ensure you understand the marking criteria to ensure successful achievement of the assessment task. The following module learning outcomes are assessed in this task:

1. Create and assess requirement specifications for advanced embedded applications.
2. Develop hardware systems through component selection, schematic design and PCB (printed circuit board) layout.
3. Use development tools in order to create the low-level firmware required by a microcontroller application.
4. Implement and test embedded systems through prototyping, testing and debugging techniques.
5. Improve system designs to meet regulatory requirements, material and component specifications and process constraints.

Assignment Support and Academic Integrity

If you have any questions about this assignment please see the [Student Guidance on Coursework](#) for more information.

Spelling, Punctuation, and Grammar:

You are expected to use effective, accurate, and appropriate language within this assessment task.

Academic Integrity:

The work you submit must be your own, or in the case of groupwork, that of your group. All sources of information need to be acknowledged and attributed; therefore, you must provide references for all sources of information and acknowledge any tools used in the production of your work, including Artificial Intelligence (AI). We use detection software and make routine checks for evidence of academic misconduct.

Definitions of academic misconduct, including plagiarism, self-plagiarism, and collusion can be found [on the Student Portal](#). All cases of suspected academic misconduct are referred for investigation, the outcomes of which can have profound consequences to your studies. For more information on academic integrity please visit the [Academic and Research Integrity](#) section of the Student Portal.

Support for Students with Disabilities or Additional Needs:

If you have a disability, long-term health condition, specific learning difference, mental health diagnosis or symptoms and have discussed your support needs with health and wellbeing you may be able to access support that will help with your studies.

If you feel you may benefit from additional support, but have not disclosed a disability to the University, or have disclosed but are yet to discuss your support needs it is important to let us know so we can provide the right support for your circumstances. Visit [the Student Portal](#) to find out more.

Unable to Submit on Time?

The University wants you to do your best. However, we know that sometimes events happen which mean that you cannot submit your assessment by the deadline or sit a scheduled exam. If you think this might be the case, guidance on understanding what counts as an extenuating circumstance, and how to apply is [available on the Student Portal](#).

Administration of Assessment

Module Leader Name: Nik Tsanov

Module Leader Email: ab1816@coventry.ac.uk

Assignment Category: Written

Attempt Type: Standard

Component Code: Cw

Assessment Marking Criteria

Mark band	Outcome	Guidelines
90-100% 1st	Meets learning outcomes	1 st - Exceptional work with very high degree of understanding, creativity and critical/analytic skills. Evidence of exceptional research well beyond minimum recommended using a range of methodologies. Exceptional understanding of knowledge and subject-specific theories. Demonstrates creative flair, a high degree of originality and autonomy. Exceptional ability to apply learning resources. Demonstrates well-developed problem-solving skills. Work completed with very high degree of accuracy and proficiency and autonomy. Exceptional communication and expression, significant evidence of professional skill set. Student evidences deployment of a full range of exceptional technical and/or artistic skills.
80-89% 1st		1 st - Outstanding work with high degree of understanding, creativity and critical/analytical skills. Outstanding understanding of knowledge and subject-specific theories. Evidence of outstanding research well beyond minimum recommended using a range of methodologies. Demonstrates creative flair, originality, and autonomy. Outstanding ability to apply learning resources. Demonstrates clear problem-solving skills. Assessment completed with high degree of accuracy and proficiency and high-level of autonomy. Outstanding communication and expression, evidence of professional skill set. Student evidences deployment of a full range of technical and/or artistic skills.
70-79% 1st		1 st - Excellent work with clear evidence of understanding, creativity, and critical/analytical skills. Thorough research well beyond the minimum recommended using methodologies beyond the usual range. Excellent understanding of knowledge and subject specific theories with evidence of considerable originality and autonomy. Excellent ability to apply learning resources. Demonstrates consistent, coherent substantiated argument and interpretation. Demonstrates considerable creativity and clear problem-solving skills. Assessment completed with accuracy, proficiency, and considerable autonomy. Excellent communication and expression, some evidence of professional skill set. Student evidences deployment of a highly developed range of technical and/or artistic skills.
60-69% 2:1		2:1 - Very good work demonstrating strong understanding of theories, concepts and issues with clear critical analysis. Thorough research, using established methodologies accurately, beyond the recommended minimum with little, if any, irrelevant material present. Very good understanding, evidencing breadth and depth, of knowledge and subject-specific theories with some originality and autonomy. Very good ability to apply learning resources. Demonstrates coherent substantiated argument and interpretation. Demonstrates some originality, creativity and problem-solving skills. Work completed with accuracy, proficiency, and autonomy. Very good communication and expression with evidence of professional skill set. Student has a thorough command of a good range of technical and/or artistic skills.
50-59% 2:2		2:2 - Good understanding of relevant theories, concepts and issues with some critical analysis. Research undertaken accurately using established methodologies, enquiry beyond that recommended may be present. Some errors may be present and some inclusion of irrelevant material. Good understanding, with evidence of breadth and depth, of knowledge and subject-specific theories with indications of originality and autonomy. Good ability to apply learning resources. Demonstrates logical argument and interpretation with supporting evidence. Demonstrates some originality, creativity, and problem-solving skills but with inconsistencies. Expression and presentation mostly accurate, proficient, and conducted with some autonomy. Good communication and expression with appropriate professional skill set. Student consistently demonstrates a well-developed range of technical and/or artistic skills.

Mark band	Outcome	Guidelines
40-49% 3 rd Class	Meets learning outcomes	3 rd - Meet the learning outcomes with a basic understanding of relevant theories, concepts and issues. Demonstrates an understanding of knowledge and subject-specific theories sufficient to deal with concepts. Assessment may be incomplete and with some errors. Research scope sufficient to evidence use of some established methodologies. Some irrelevant material likely to be present. Basic ability to apply learning resources. Demonstrates ability to devise and sustain an argument. Demonstrates some originality, creativity, and problem-solving skills but with inconsistencies. Expression and presentation sufficient for accuracy and proficiency. Sufficient communication and expression with basic professional skill set. Student demonstrates technical and/or artistic skills.
30-39% Fail	Fails to achieve learning outcomes	Fail – Very limited understanding of relevant theories, concepts and. Little evidence of research and use of established methodologies. Some relevant material will be present. Deficiencies evident in analysis. Fundamental errors and some misunderstanding likely to be present. Limited ability to apply learning resources. Student's arguments are weak and poorly constructed. Very limited originality, creativity, and struggles with problem-solving skills. Expression and presentation insufficient for accuracy and proficiency. Insufficient communication and expression and with deficiencies in professional skill set. Student demonstrates some deficiencies in technical and/or artistic skills.
20-29% Fail		Fail - Clear failure demonstrating little understanding of relevant theories, concepts, and issues. Minimal evidence of research and use of established methodologies and incomplete knowledge of the area. Serious and fundamental errors and aspects missing. Little evidence of ability to apply learning resources. Student's arguments are very weak and with no evidence of alternative views. Little evidence of originality, creativity, and problem-solving skills. Expression and presentation deficient for accuracy and proficiency. Insufficient communication and expression and with deficiencies in professional skill set. Student demonstrates a lack of technical and/or artistic skills.
0-19% Fail		Fail - Inadequate understanding of relevant theories, concepts, and issues. Complete failure, virtually no understanding of requirements of the assignment. Material may be entirely irrelevant. Assessment may be fundamentally wrong, or with major elements missing. Not a serious attempt. No evidence of research. Inadequate evidence of ability to apply learning resources. Very weak or no evidence of originality, creativity, and problem-solving skills. Students presents no evidence of logical argument and no evidence of alternative views. Expression and presentation extremely weak for accuracy and proficiency. Communication and expression very weak and with significant deficiencies in professional skill set. Student evidences few or no technical and/or artistic skills