

Higher National Certificate/Diploma Assessment

Qualification		Pearson BTEC Higher Nationals for England (2024)			
Unit number and title		4001. Engineering Design			
Assignment title		Engineering Design			
Assessor		Engineering Team			
Academic year	1	Unit Code	T/650/9628	Assignment	1 of 1
Internal Verifier	Mohammed Hoq	Verification Date	1 st September 2025		
Issue Date	1 st September 2025	Final Submission Date	No later than 31st August 2026		

Policy on the Use of Artificial Intelligence (AI)

- Students are required to acknowledge the use of AI in the preparation of any assignment.
- AI tools **may be** permissible for use as learning aids, subject to the AI Assessment Scale designation given below.
- AI cannot be used to generate the final, submitted work in its entirety.
- AI cannot be used to substitute for a student's own critical thinking, analysis, and original expression.
- Assignments must reflect the student's original thought and understanding.
- Assignments are checked automatically on submission for AI content, through Turnitin.
- Assignment grades are only confirmed following viva voce examination at the end of each unit.

Artificial Intelligence Assessment Scale (AIAS)

Full details of the Artificial Intelligence Assessment Scale (AIAS) are available at [this link](#).

The AI Assessment Scale (AIAS)

Level	Description	Guidelines
1 NO AI	The assessment is completed entirely without AI assistance in a controlled environment, ensuring that students rely solely on their existing knowledge, understanding, and skills.	You must not use AI at any point during the assessment. You must demonstrate your core skills and knowledge.
2 AI PLANNING	AI may be used for pre-task activities such as brainstorming, outlining and initial research. This level focuses on the effective use of AI for planning, synthesis, and ideation, but assessments should emphasise the ability to develop and refine these ideas independently.	You may use AI for planning, idea development, and research. Your final submission should show how you have developed and refined these ideas.
3 AI COLLABORATION	AI may be used to help complete the task, including idea generation, drafting, feedback, and refinement. Students should critically evaluate and modify the AI suggested outputs, demonstrating their understanding.	You may use AI to assist with specific tasks such as drafting text, refining and evaluating your work. You must critically evaluate and modify any AI-generated content you use.
4 FULL AI	AI may be used to complete any elements of the task, with students directing AI to achieve the assessment goals. Assessments at this level may also require engagement with AI to achieve goals and solve problems.	You may use AI extensively throughout your work either as you wish, or as specifically directed in your assessment. Focus on directing AI to achieve your goals while demonstrating your critical thinking.
5 AI EXPLORATION	AI is used creatively to enhance problem-solving, generate novel insights, or develop innovative solutions to solve problems. Students and educators co-design assessments to explore unique AI applications within the field of study.	You should use AI creatively to solve the task, potentially co-designing new approaches with your instructor.

This assignment is based on the AIAS level indicated by the colour above.
Follow the instructions for that level.

If the submitted work falls outside the scope of the AIAS designation above, the assignment will be failed.

References

- Prepare your references and correctly cite them within the body of your assignment using [zbib.org](https://www.zbib.org).
- Use the Harvard referencing standard of any of the listed UK universities.
- In [zbib.org](https://www.zbib.org), create a 'Link to this Version' and copy it into your References section.
- **Assignments will be rejected if this process is not followed correctly.**

Submission Format

All text elements of your submission should be word processed, mathematical solutions can be handwritten (neatly) and scanned into your document.

Assignment Format

- **Organisation:** Use clear headings, paragraphs, and sub-sections, to ensure clarity and ease of reading. Refer to Task numbers or sections to make it clear which question you are answering. *Assignment Structure*

Your assignment **MUST** include the following sections:

- **Cover Page:** Your Course, Name, Unit Name and Assignment number/name
- **Contents Page:** List tasks or questions with page numbers.
- **References:** Correctly cite and list all sources used, but do not use Wikipedia. Please see the detailed advice on page 1.

Submission Requirements

By submitting your assignment, you confirm the following:

- **Originality:** The work is your own, with all sources properly cited.
- **Plagiarism:** You acknowledge that plagiarism and collusion are forms of academic misconduct and are strictly prohibited.
- **Plagiarism Detection:** Your assignment will be submitted to TurnItIn, a plagiarism detection service, that compares your work against databases, online sources, and other students' work.
- **False Declaration:** Making a false declaration is academic misconduct.

<p>Vocational Scenario or Context</p>	<p>You work as a junior design engineer at an engineering firm. You have been approached with a design project that is closely related to the specific discipline you have studied, making you familiar with the component/system, which leaves you well placed to be the one to tackle the client's brief. You are keen to take on this project which is closely related to your expertise and will bolster your experience by allowing you to conduct planning, design and presentation activities in a self-led project that you can deliver to your team.</p>
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<p>Initial Idea Proposal (AIAS 2)</p>	<p style="text-align: center;">PLEASE READ THIS BRIEF CAREFULLY BEFORE YOU START THIS ASSIGNMENT</p> <p>Before you start this unit, you need to decide on a component or system you want to design. It would be beneficial if this was related to your workplace. It is imperative that your design idea is approved by your unit tutor to ensure that what you're proposing is suitable and achievable and that you have a clear understanding of the requirements.</p> <p>Tips:</p> <ul style="list-style-type: none"> ○ Consider things you encounter in your day-to-day role, this may be something you feel needs upgrading, has poor functionality, breaks down often, is unsafe to use, or generally inconvenient. ○ Preferably, you will keep this narrow to either an aspect of a system or an individual component, so that your report doesn't end up an unmanageable size. ○ With your initial idea in mind – read through Task 2 below and consider whether your design idea offers enough scope to provide all the required details. <p>Employing the AIAS 2 – AI Planning should not be required here as this relates to your workplace. However, AI tools can be used to plan the specific aspect of the chosen project you wish to use and help you narrow your focus.</p> <p><u>Activity to complete: Propose an idea for what you would like to design</u></p> <p>This should be done by completing the first activity on Totara. Your proposal should briefly explain the intended component or system you want to design and your plan.</p> <p>Depending on whether your proposed idea sounds suitable for this unit assignment, this activity will be marked as either Accepted or Not Accepted.</p> <p>Note: If your proposal is accepted, you will unlock the Task 1 activity on Totara. If your proposal is not accepted, you will be provided with details on why we believe this would not work for this assignment and allowed to submit another. Support can also be arranged at this point if this is required.</p>
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Task 1 (AIAS 1)

Task 1 Activity – Project Specification and Planning:

The starting point for a design project is the initial interpretation of the client brief and the development of a working specification that would meet this brief. Once the specification has been established it will be necessary to plan and schedule the activities and resources to deliver the final design.

Firstly, you will assume the role of the client and develop the design brief, then in your role as a design engineer you will develop a detailed design specification, after which you will need to compare your specification with a typical published guide on preparing an industrial design specification.

Finally, you will need to research project management techniques and develop a Gantt chart (indicating the critical path) for the design activities to be undertaken in task 2.

To achieve the above you need to produce a report which addresses the activities detailed in sections 1 to 5 below:

1. Design Brief - Assuming the role of the client you are required to formulate a design brief for the product/system. The design brief will be the main starting point for the design process and will describe in enough detail the essential elements of the design and its main function that the design is intended to address.
2. Design Specification – Develop a detailed design specification, this should typically include the functional & performance requirements, environmental operational conditions and applicable published standards.
3. Comparison with ACCESS-FM - Comment on the similarities or differences between your specification (2.0) and an industry standard method of preparing a specification such as ACCESS-FM. Ask yourself does the specification developed in section 2.0 address (or otherwise) the topics suggested by ACCESS-FM?
4. Planning Techniques - Give a brief overview two different project planning techniques that may be used in the design phase of the project (task 2) and discuss their advantages and disadvantages. Explain which of these two techniques you have chosen for the design phase of your project and justify your reasons for doing so. **(Do not use a Gantt chart as one of your techniques, as it is already required below)**
5. Gantt chart and Critical Path – Create a detailed Gantt chart using ‘Gantt project’ (link below) for the design phase of the project (task 2), your Gantt chart should clearly demonstrate the critical path. Discuss the importance of the critical path when managing a project of this kind.

ON COMPLETION OF TASK 1, PLEASE UPLOAD THIS TO THE SECOND ACTIVITY ON TOTARA. THIS WILL NOT BE MARKED AT THIS STAGE (IT WILL LATER BE MARKED AS PART OF THE WHOLE ASSIGNMENT), THE UNIT TUTOR WILL REVIEW YOUR WORK AND PROVIDE ANY FORMATIVE FEEDBACK TO YOU. PLEASE AWAIT THIS FEEDBACK BEFORE STARTING TASK 2.

Note:

Recommended word-count for task 1: 2000 (this count excludes, contents, references, appendices, diagrams)

Useful links for Task 1

Product Design Specification

<https://studylib.net/doc/18067350/product-design-specifications>

ACCESS-FM

<https://www.excitededucator.com/home/access-fm-examples>

Gantt Project (Ensure you download the free version. This software will also be required for **U4004**)

<https://www.ganttproject.biz>

Task 2 Activity – Formal Design Report:

DURING YOUR COMPLETION OF TASK TWO, IF YOU HAVE ANY QUESTIONS, OR REQUIRE ASSISTANCE PLEASE USE THE ‘NEED HELP?’ REQUEST FORM ON TOTARA. THIS WILL BE FORWARDED TO THE UNIT TUTOR, WHO WILL CONTACT YOU TO ARRANGE SUITABLE SUPPORT.

With the design specification and project plan in place from task 1, it is now time for the practical aspects of the design project to begin. You should now develop the design to completion and produce a detailed design report and presentation.

To achieve the above you need to produce a ‘Design Report’ it is suggested that you base your report on the following structure addressing the topics as detailed below:

Title page, this should feature the project title, your name and assignment title – optionally, a graphic can be included (no page number on this sheet).

Abstract, this is a self-contained summary of the complete report, this should be less than half a page (page number i).

Acknowledgements, this is where you acknowledge support from colleagues, friends, other organisations etc (page number ii).

Contents table, this lists each section in the document and the page number where that section begins (page number iii).

1.0 Introduction - The introduction states the purpose and goals of your report. A few short paragraphs will suffice here (this is always section 1, and numbered page 1).

2.0 Specification - This could be an overview of the specification from task 1, you can also refer to the design specification in task 1.

3.0 Literature Review – In this section you need to demonstrate that you have undertaken researched in the subject area, this could include underpinning theory, books, journals, trade publications, component manufactures web sites, similar work by others etc.

The literature review should enable you to establish three possible design solutions, which are to be presented in section 4.0.

Task 2 (AIAS 1)

4.0 Design Options and Decision Matrix - This should be a shortlist and brief description of **three** potential design options that you have developed, with a final, justified selection of the design you wish to put forward (use a Pugh engineering decision matrix).

5.0 Detail design,

Your detailed design needs to demonstrate:

- Any modelling (physical tests, calculations, software simulations etc) that you have done in developing your design.
- Any evidence of how your design manifests (detailed dimensions, sketches, CAD models/drawings, prototypes etc).
- Verification of decisions that you made such as material selection, component selection etc.
- How the design links back to the design specification, comparing the specification and the design.
- That you have considered how the component/system can be manufactured or installed.
- How the design complies with industry standards, and health and safety policies.
- The risks to the completion of the design phase, this can be evaluated using a 'Cause and Effect Diagram' which should be inserted into appendix A.

6.0 Design Review – Review your final design in terms of both its positives and negatives, consider:

- Are there any limitations to the design that would need future consideration?
- Was the design constrained by the original client brief?
- Areas that you would recommend for further work.

7.0 Conclusion - this needs to be a clear statement towards the fact that in developing the design you have accomplished the requirements of the design brief and specification.

References (no section number), you need to reference all the sources of information that you have used in the report.

Appendices, the appendices can contain any other relevant information you would like to include, you may have as many appendices as you want, each labelled Appendix A, B, C----- etc.

Note

Recommended wordcount for task 2: - 5000 (this count excludes, contents, references, appendices, diagrams)

Task 3 Activity – Presentation and Debrief:

Your manager requires you to present your design report to your colleagues, they are likely to have many questions and suggestions for your design, it is important to be prepared for a Q&A session at the end of your presentation.

- a) Produce a professional engineering presentation for your colleagues (typically 10 slides).
- b) Formally present your work to your colleagues, you are also required to produce a video or videos of yourself presenting, the duration of the presentation should be about 10 minutes plus additional time for Q&A.

NOTE: This Presentation should be treated as the final 'pitch' of your design report, it should include sufficient detail to explain your approach and reasoning for your design choices.

Note: It is important that you can be identified on the video, so please ensure that you can be seen and heard. **MP4** format is preferable, and please ensure that your file size(s) are not overly large (less than 300 MB). If you do need to submit more than one video file, please ensure that the files are labelled appropriately with order number clearly identified. You must also introduce yourself with full name and course studied.

- c) Now that the project has concluded your manager wants a **short debrief report** of the project.

Your debrief report must answer the following:

- i. Is there anything that you would have changed if you had not been restricted by the specification or standards? Why do you think design specifications and industry standards are important when producing a finished product?
- ii. Read and evaluate your own report, how effective do you think your design report is for producing a finished product?
- iii. Explore different methods you could have used to communicate your ideas to the audience and stakeholders. Do you think your presentation was the most effective way to communicate, or would there be a better way to communicate your design to others?
- iv. In future projects would you do anything differently? Based on the feedback given by your colleagues, and your own personal reflection, what recommendations would you make if the project was to carry on further?

TASKS 1 and 3 c) SHOULD BE SUBMITTED ALONG WITH TASK 2. THESE SHOULD BE ADDED AT THE VERY END OF THE FORMAL DESIGN REPORT (Task 2) AFTER THE APPENDICES.

Task 3 (AIAS 1)

**Sources of
information to
support you with
this Assignment**

Textbooks

Budynas, R.G., Nisbett, J.K. and Shigley, J.E., (2020) *Shigley's mechanical engineering design*. Eleventh edition. ed. New York, NY: McGraw-Hill Education.

DUL, J. and WEERDMEESTER, B. (2008) *Ergonomics for beginners*. 3rd Ed. Boca Raton: CRC Press.

DYM, C.L., LITTLE, P. and ORWIN, E. (2014) *Engineering Design: a Project Based Introduction*. 4th Ed. Wiley.

GRIFFITHS, B. (2003) *Engineering Drawing for Manufacture*. Kogan Page Science.

REDDY, K.V. (2008) *Textbook of Engineering Drawing*. 2nd Ed. Hyderabad: British Standard Publications.

Sobot, R. (2022) *Engineering Mathematics by Example*. 1st Ed. Springer.
Stroud, K.A. and Booth, D.J. (2020) *Engineering Mathematics*. 8th Ed. Bloomsbury Publishing

Urbano M. (2019) *Introductory Electrical Engineering with Math Explained in Accessible Language*. Wiley.

Vick B. (2020) *Applied Engineering Mathematics*. CRC Press.

Websites

www.epsrc.ac.uk

Engineering and Physical Sciences Research Council (General Reference)

www.imeche.org

Institution of Mechanical Engineers (General Reference)

<https://www.theiet.org/>

The Institution of Engineering and Technology (General Reference)

Relevant Learning Outcomes and Assessment Criteria

Pass		Merit		Distinction	
LO1	Create a design specification for a given design brief that meets stakeholder's requirements, along with a proposed design solution			LO1	
P1	Create a design specification from a given design brief.	M1	Evaluate potential planning techniques, presenting a case for the method chosen.		
P2	Explain the influence of the stakeholder's design brief and requirements in the preparation of the design specification.	M2	Demonstrate critical path analysis techniques in design project scheduling/planning and explain their use.	D1	Compare and contrast the completed design specification against a formal professional engineering specification.
P3	Produce a design project schedule with a graphical illustration of the planned activities.				
LO2	Analyse possible technical solutions to implement the proposed design specification			LO2	
P4	Analyse industry standard evaluation and analytical tools used in formulating possible technical solutions.	M3	Apply the principles of modelling, simulation and/or prototyping, using appropriate software, to develop an appropriate design solution.	D2	Evaluate potential technical solutions, presenting a case for the final choice of solution.
P5	Use appropriate design techniques to produce a possible design solution.				
LO3	Prepare a design report considering all key aspects including manufacturability (or design for manufacturing and assembly) and environmental impact			LO3	
P6	Prepare a formal engineering technical design report.				
P7	Explain the role of design specifications and standards in the technical design report including environmental impact.	M4	Assess any compliance, safety, and risk management issues contained within the technical design report.	D3	Evaluate the effectiveness of the formal professional engineering technical design report for producing a fully compliant finished product.
LO4	Present the design solution to an audience, including evaluation of feedback and future improvements			LO4	
P8	Present the recommended design solution to the identified audience.				
P9	Explain possible communication strategies and presentation methods that could be used to inform the stakeholders of the recommended solution.	M5	Reflect on the effectiveness of the chosen communication strategy in presenting the design solution.	D4	Justify potential improvements to the design solution and/or presentation based on reflection and/or feedback.