LEVEL 2 ENGINEERING CURRICULUM MAP

FURTHER STUDY

A level Engineering, Apprenticeship in Engineering

CAREER PATHS

Civil Engineer, Aerospace, Electronics and Communication, Software Development

SKILLS

Critical analysis, interpretation, evaluation, problem-solving, mathematics, computer-aided design

Assessment:
R105 (design brief and specification) - external examination in January.
R108 LO3 and LO4 assessment – 3D design realisation
Final assessments of R106 (production analysis and research) and R107 (developing and presenting engineering designs) coursework tasks.

Examination Revision and Preparation

External Examination

- ❑ The Design Cycle, Design Specification and Wider Influences
- ❑ Build and finish the lamp project exploring a range of finishing techniques.
- ❑ Construct a detailed evaluation of the lamp project exploring what areas were successful and which areas could be improved upon.
- ❑ Produce a detailed set of modifications that could be implemented to improve the lamp.
- ❑ Justify these changes in relation to the design brief.
- ❑ Justify any changes to the design specification that may be suitable.
- ❑ Evaluate why particular aspects of the lamp project took either a longer or shorter time than that identified in the manufacturing plan.

Assessment:
Coursework assessed for R108 LO1 (plan by making a prototype)

Applications of the Design Cycle

- ❑ Understand the variety of methods for conducting market research including surveys and focus groups.
- ❑ Know and apply the concept of iconic design. Explain why iconic designs are useful for designers of new products.
- ❑ Use a variety of tools to disassemble a product identifying the main components and suggesting how the components may have been manufactured.
- ❑ The requirements and features of engineering drawings.
- ❑ Use Fusion 360 to draw 3D shapes and apply rendering
- ❑ Know what is meant by DFMA and explain how the design of products is affected by this principle

Principles of Life-Cycle Analysis and Design Brief

- ❑ The stages of the life-cycle of a generalised product.
- ❑ Activities that can extend the useful lifetime of a product. The processes/events that take place to decommission/dispose of a product.
- ❑ Understand the properties of new, emerging materials such as carbon fibre and smart materials

YEAR 11

Project Production

- ❑ Meaning of the terms anthropometrics, ergonomics and how these factors influence the design of new products.
- ❑ Application of knowledge of the design cycle and the wider influences present on designs.
- ❑ Analysis and evaluation of manufacturing plans including identification of parts of the manufacturing process that caused delays.
- ❑ Formulation and use of effective and sensible risk assessments

Assessments focussed on the exam content and exam technique for unit R105.
Regular past papers (1 per fortnight 60 marks each)
Coursework – R108 LO2 assessment (safe working practices when making a prototype)

Design Principles and Processes

- ❑ The four distinct stages in the design cycle – identify, design, optimise and validate.
- ❑ The required content of a design brief and specification.
- ❑ Techniques to develop and enhance sketches showing initial design ideas.
- ❑ Recognise the advantages and disadvantages of different manufacturing scales.
- ❑ The legal and regulatory requirements placed upon a designer (e.g. CE mark, British Standards)

YEAR 10

Assessment:
Coursework assessed for R107 LO2 (develop designs by using engineering drawing techniques) LO3 (CAD) and R106 LO2 (research existing products) and LO3 (analyse an existing product through disassembly)

Assessment:
Assessments take place at regular intervals using exam past paper questions and coursework criteria (R106 and R107)
3 x 20 mark R105 assessments (completed using Google Forms)
Coursework assessed for R107 LO1 (generate design proposal using a range of techniques) and R106 LO1 (commercial production methods)

ENGINEERING SKILL
Computer Aided Design

ENGINEERING SKILL
Planning Manufacturing

ENGINEERING SKILL
Mathematics

ENGINEERING SKILL
Analysis and Evaluation

LEVEL3 ENGINEERING CURRICULUM MAP

FURTHER STUDY

Degree in Engineering, Apprenticeship in Engineering

CAREER PATHS

Civil Engineer, Aerospace, Electronics and Communication, Software Development

SKILLS

Critical analysis, interpretation, evaluation, problem-solving, mathematics, computer-aided design

Revision and Examination Practice

Mechanical Design

- ❑ Operation of Fusion 360 to produce 2d and 3d designs.
- ❑ Design Cycle and the activities that take place during each stage
- ❑ The conventions and symbols for engineering drawings (e.g. standard components, scaling etc)
- ❑ Rendering and freehand drawing techniques to enhance drawings.
- ❑ Analyse existing products through research and disassembly to determine materials used and production methods.

Electrical Engineering

- ❑ The components and sequence of a stabilised power supply.
- ❑ 3 phase power and the relationships between the different phases.
- ❑ The general circuit layout of separately excited and self-excited DC motors and generators.
- ❑ Analyse motors and generators using the defining equations.
- ❑ Understand the structure of a DC power supply.
- ❑ Describe the operation and properties of inverting and non-inverting op-amps.
- ❑ Calculate the gain of the inverting and non-inverting op-amp.

Assessment:
60 mark exam paper in Units 3 and 4
Externally assessed 60 mark exam paper for units 3 and 4
Assessments of LO3 - design components that can be successfully manufactured
and LO4 - optimise design to improve performance
Resits (if required) for Units 1,2,3 and 4

YEAR 13

Maths/Mechanical Engineering

- ❑ understand how to use calculus within the context of engineering
- ❑ be able to use geometry and graphs in the context of engineering problems
- ❑ Use statistics to handle and analyse data including probability calculations.
- ❑ the effect of forces on materials, stress, strain and the Young Modulus

Science Electrical Engineering

- ❑ understand the principles of electrical engineering
- ❑ understand the principles of thermodynamics and heat/energy flow.
- ❑ principles of mechanics and mechanical energy

Computer Aided Design

- ❑ Create assemblies of shapes where different bodies interact with each other
- ❑ how to incorporate animations and moving parts in CAD work

Mechanical Engineering

- ❑ Calculate the volumes of prisms
- ❑ Use the density equation to calculate density, mass and volume of bodies.
- ❑ Calculate the centre of mass of 2d objects and understand the concept of centroid.
- ❑ Mechanical advantage and velocity ratio
- ❑ The three classes of lever and how these can be used to solve engineering problems.
- ❑ Applications of moments to beams.
- ❑ Types of beam and support conditions

Assessment of Units 1 and 2 :
Externally assessed 60 mark paper per unit
Units 3 and 4:
1 x 40 mark assessment per unit
For CAD:
Assessment of LO4 x2
Overall Unit coursework assessment and moderation.

Assessment for units 3 and 4:
2 x 40 mark assessments per unit
2 x 60 mark past papers per unit
For Mechanical Design:
LO1 - use graphical and engineering drawing techniques to communicate design solutions
LO2 - select appropriate engineering materials to achieve design solutions

Computer Aided Design

- ❑ Understand how to create 3D shapes using increasingly complex tools in Fusion 360
- ❑ Rearranging equations and basic algebraic techniques.
- ❑ How to sketch line graphs and calculate gradients and y-intercepts
- ❑ Be familiar with computer aided design tools such as Sketchup, 2D design or Fusion 360.
- ❑ Understand the geometry of simple 2D and 3D shapes (prisms and spheres)

Science Electrical Engineering

- ❑ understand the principles of fluid mechanics
- ❑ prefixes, SI units and base units
- ❑ materials – explain the behaviour of materials

Maths/Mechanical Engineering

- ❑ understand the application of algebra relevant to engineering problems
- ❑ be able to use trigonometry to solve engineering problems
- ❑ understand exponentials and logarithms in the context of engineering problems
- ❑ understand how to use calculus within the context of engineering

YEAR 12

Learning at KS5 is sequenced to integrate mechanical engineering, electrical engineering and mechanical design across the course. This is represented here as topic blocks.

Assessment:
For units 1 (maths/mechanical engineering) and 2 (electrical engineering)
2 x 40 mark assessments 2 x 60 mark past papers

Assessment:
For units 1 (maths/mechanical engineering) and 2 (electrical engineering) 2 x 40 mark assessments past papers
For CAD X2 assessments of LO1 – understand how to create 3D shapes using increasingly complex tools in Fusion 360.

ENGINEERING SKILL — Computer Aided Design

ENGINEERING SKILL — Planning Manufacturing

ENGINEERING SKILL — Mathematics

ENGINEERING SKILL — Analysis and Evaluation