
ENGINEERING DEPARTMENT KEY STAGE 4 CURRICULUM OVERVIEW

The Engineering department key stage 4 curriculum is designed to implement the Academy’s vision of “Deepening Learning, Raising Aspiration”, in line with the OAT curriculum strategy of “Teach, Develop, Change”. Our curriculum is carefully designed to build resilience, aspiration and independence in our learners. We carefully design the KS4 curriculum to further develop and build upon prior learning at KS3.

We have chosen NCFE as the examiner for this subject. We believe that they provide the best course model which will allow our students to achieve and flourish, developing a keen interest in engineering. We hope this encourages them to further study in KS5.

NCFE have clearly defined the content they wish to examine in year 11, and our scheme of work reflects this. This is not solely due to exam board requirements; we feel that their structure provides a comprehensive and engaging approach to the delivery of Engineering. We also feel that aspects of the syllabus allow students to excel through critical thinking and evaluation of the engineering world and its relationship with society.

Year 10		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	Understand Engineering Disciplines Diversity					The Health and Safety Legislation Governing Engineering				Reading and Drafting Engineering Drawings			
	<ul style="list-style-type: none"> How specific engineering projects and products have shaped the modern world How engineering embodies many sectors and the roles they play Applications of disciplines in the world around us. 					<ul style="list-style-type: none"> Health and safety legislation Know and understand the personal safety measures for each engineering discipline. Health and Safety at Work Act RIDDOR COSHH Personal Protective Equipment 				<ul style="list-style-type: none"> Students will be taught to read and understand the major elements which are included in an engineering drawing Systems of Measurement BS 8888 First and Third Angle Projection 			
Spring	Reading and Drafting Engineering Drawings		Environment and sustainability in engineering				Properties of materials			Tools and processes			
	<ul style="list-style-type: none"> Engineering Drawings A freehand sketch 		<ul style="list-style-type: none"> Environment and Sustainability Material origins Extraction of Materials Transportation Carbon Footprint 				<ul style="list-style-type: none"> Mechanical Properties Chemical Properties Aesthetics/Optical Electrical Properties Thermal Properties 			<ul style="list-style-type: none"> Tools Metalwork Woodwork Power Tools Marking Tools CAD/CAM 			
Summer	Synoptic assignment practice and preparation												
	Synoptic Assignment Sample Students will complete a full sample assignment, to prepare them for the standards and expectations they will encounter in Year 11.				Synoptic will continue until the end of the summer term. This is to allow students adequate design and build time as well as producing drawings and analyses.			Synoptic will continue until the end of the summer term. This is to allow students adequate design and build time as well as producing drawings and analyses.			Synoptic will continue until the end of the summer term. This is to allow students adequate design and build time as well as producing drawings and analyses.		

ORMISTON RIVERS ACADEMY– KEY STAGE 4 ENGINEERING OVERVIEW

Autumn Half Term 1

Block 1 – Weeks 1 to 3

Mechanical Engineering

- Hydraulics (Pascal’s principle), gears and pulleys
- Electrical and electronic - power station, household appliances, integrated circuits
- Aerospace - aircraft, space vehicles, missiles
- Communications - telephone, radio and fibre optic
- Chemical - pharmaceuticals, fossil fuels, food and drinks
- Civil - bridges, roads and railways

Block 2 – Weeks 5 to 6

- Automotive - cars, motorcycles and trains
- Biomedical - prosthetics, medical devices and radiotherapy
- Software - applications, systems and computer programming
- Health and Safety in the workplace
- This will include personal protective equipment and an understanding of the relevant health and safety requirements to ensure they comply with the following legislation.
- This must include: Health and Safety at Work Act etc
 - general responsibilities of employers to their employees
 - general responsibilities of employers and self-employed to persons other than their employees
 - general responsibilities of employees at work

Notes/Links/Interleaving

- **Application of principles to the world around us.**
- **Extension of material to include**

Additional Higher Content

- **Extension to allow for application of Health and Safety in specific environments.**

Autumn Half Term 2

Block 3 – Weeks 7 to 9

The Health and Safety Legislation Governing Engineering

- Personal Protective Equipment (PPE) at Work regulations – Assessing a situation, Various protection types for head, face, eyes, ears, respirators, back, knees, feet, full body and identification of danger and justification for PPE
- Manual Handling Operations Regulations
- Control of Substances Hazardous to Health (COSHH) – chemicals, fumes, dust.
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) – report forms, reportable incidents and person responsible.

Block 4 = Weeks 10 to 12

Reading and Drafting Engineering Drawings

- Line types – Visible, hidden, centre, construction and dimension
- Tolerance – Importance of accuracy, measurement, + or – dimensioning, Go/ No Go gauges
- British Standard BS8888 standards – Purpose of the standard, content of title block, materials cutting sheets, scale drawings, system of measurement and projection types
- Drafting skills – 2D projection, first angle projection and third angle projection
- Drafting skills – 3D projection, axonometric, isometric, two-point perspective.

Notes/Links/Interleaving

- **Application of principles to the world around us, practical activities related to manual handling, and role play of situations.**
- **Extension of material to include – Risk assessments of tools and processes in the workshop, school building assessment in relation to PPE, COSHH and RIDDOR**

Additional Higher Content

- **Application of principles to the world around us, reading and producing house plans, and engineering object plans planes, cars etc.**
- **Extension of material to include – further drafting skills, production of cut sections and cutting list for multi component items**

Spring Half Term 1

Block 1 – Weeks 1 to 4

Engineering Drawing

- Rendering of drawings – Colour, direction of light, surface finish, texture
- Annotation – Materials, manufacturing details
- Dimensions – Angles, lengths, radius and diameters
- A3 hand drafted isometric drawing sheet – 3D isometric and oblique views, drawings sheet set up, scale, dimensioning and line types
- A3 hand drafted orthographic drawing sheet - First or third angle projection, drawings sheet set up, scale, dimensioning and line types

Block 2 – Weeks 5 to 6

Environment and Sustainability

- Environment and Sustainability – The world around us and UK and global issues, green house gases, ozone layer, pollution, product cycle to end of life.
- Material origins – detail related to each material, wood production FSC, manufactured boards, metal extraction to recycling, plastic production to end of life, stone/brick production to end of life
- Extraction of Materials
- Transportation – local vs global and how this affects sustainability
- Carbon Footprint - Carbon analysis of individual products and how this can affect material selection.

Notes/Links/Interleaving

- **Application of principles to the world around us, reading and producing house plans, and engineering object plans planes, cars etc.**
- **Extension of material to include – further drafting skills, production of cut sections and cutting list for multi component items**

Additional Higher Content

- **Conduct detailed material analysis on a given product, detail how each material affects the environment from start to end of life. Suggest alternative materials and justify.**

Spring Half Term 2

Block 3 – Weeks 7 to 9

Properties.

- Mechanical Properties – levers, mechanical advantage, cams, gears and bearings
- Chemical Properties -
- Aesthetics/Optical – Design development, investigation into leading designers Dyson, Apple etc, golden ratio, national/ international variations in design
- Electrical Properties – Conductors, insulators identification and justification of use, Ohms law, understanding of Current, resistance, voltage, micro controllers
- Thermal Properties – Conduction and insulation, measurement in Kelvin, Celsius, material justification and selection,

Block 4 - Weeks 10 to 12

Tools

- Detailed knowledge of tools under the headings of application, safety, justification of use and alternative options, tools to include – Metalwork – Woodwork – Power Tools - Marking Tools - CAD/CAM

Notes/Links/Interleaving

- **Detailed analysis of a current product detailing justification of material selection and process of manufacturing this component. Pupil to suggest alternative materials / processes with justification of suggestion.**

Additional Higher Content

- **Further development of knowledge of smart materials, composite materials and alloys.**
- **Practical application of knowledge through the development of parts lists and production plans including flowchart and step by step break down of the manufacturing process.**

Summer Half Term 1

Block 1 – Weeks 1 to 4

- Synoptic project- 1st attempt.
- Material testing
- Existing product analysis
- Material selection and justification
- Sample project to be used.

Block 2 – Weeks 5 to 6

- Synoptic project- 1st attempt
- Design development
- Design testing
- Detailed design development including working drawings
- Production of production plans and risk assessments

Notes/Links/Interleaving

- Synoptic project is intended to cover all previous content in course

Additional Higher Content

- Students can access higher content from previous work and outside sources to address grading criteria. This must be independent work.

Summer Half Term 2

Block 3 – Weeks 7 to 9

- Manufacture and assembly of synoptic project
- Detailed production diary
- Evaluation of assembled product.

Block 4 - Weeks 10 to 12

- First marking and feedback given
- Synoptic project- 2nd attempt

Notes/Links/Interleaving

- Synoptic project is intended to cover all previous content in course

Additional Higher Content

- Students can access higher content from previous work and outside sources to address grading criteria. This must be independent work.

Year 11	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	How science and mathematics is applied in engineering				How the properties and characteristics of engineering materials and why specific materials are selected for engineering applications				Exam Revision	Synoptic Project		
	<ul style="list-style-type: none"> • Application of SI Units of Measurement • Equations used to Describe and Calculate Energy, Forces and Motion, Electrical, Geometry 				<ul style="list-style-type: none"> • Properties and Characteristics of Materials • Testing • Material Applications 				<ul style="list-style-type: none"> • Review all 5 LO's • Exam practice • Long question answering 			
Spring	Synoptic Project (potential exam resit)						Synoptic project					
	Set annually by exam board to be completed as controlled coursework. Evaluated on – AO1 Recall knowledge and show understanding AO2 Apply knowledge and understanding AO3 Analyse and evaluate knowledge and understanding AO4 Demonstrate and apply technical skills and processes AO5 Manage and evaluate the project											
Summer	Synoptic project						Completion of course					
	Set annually by exam board to be completed as controlled coursework. Evaluated on – AO1 Recall knowledge and show understanding AO2 Apply knowledge and understanding AO3 Analyse and evaluate knowledge and understanding AO4 Demonstrate and apply technical skills and processes AO5 Manage and evaluate the project						Course completed					

Autumn Half Term 1

Block 1 – 5 Weeks

In this learning outcome the learner will understand the use of basic SI units of measurement and how mathematical and scientific equations are applied to the products and projects within various engineering disciplines.

2.1 Application of SI Units of Measurement

- SI units of measurement
- Application of basic SI units in projects and products

2.2 Equations used to Describe and Calculate Energy, Forces and Motion, Electrical, Geometry

- Equations for properties
- Application of equations in projects and products

Block 2 – 5 Weeks

In this learning outcome, learners should consider a range of engineered products and be able to explain what they are made from and the properties and characteristics of the materials used in the manufacturing process. Learners should have an ability to draw conclusions about the suitability of the material and why materials have been selected for the manufacture of a variety of products.

4.1 Properties and Characteristics of Materials

- Properties
- Characteristics
- Materials

Notes/Links/Interleaving

- Block one and two to be have mathematical content interwoven where appropriate. Links made to previous units throughout teaching.

Additional Higher Content

- Expansion of materials testing to cover industrial and real-life processes.
- Practice with writing long answer questions.

Autumn Half Term 2

Block 3 – 2 Weeks

Exam revision – to cover all previous syllabus content:

LO1: Understand engineering disciplines

LO2: Understand how science and mathematics is applied in engineering

LO3: Understand how to read engineering drawings

LO4: Understand the properties and characteristics of engineering materials and know why specific materials are selected for engineering applications

LO5: Understand engineering tools, equipment and machines

Block 4 – 1 Weeks

Synoptic project introduction – analysis of sections

AO1 Recall knowledge and show understanding

AO2 Apply knowledge and understanding

AO3 Analyse and evaluate knowledge and understanding

AO4 Demonstrate and apply technical skills and processes

AO5 Manage and evaluate the project

Notes/Links/Interleaving

- All previous taught content to be reviewed in both exam and through synoptic assignment.

Additional Higher Content

- Students can access higher content from previous work and outside sources to address grading criteria. This must be independent work.

Spring Half Term 1**Block 1 – 3 Weeks**

Synoptic project- 1st attempt
Project is a controlled assignment to be attempted independently in lesson times.

Block 2 – 3 Weeks

- Synoptic Project 1st attempt (exam resit revision in drop-down day)

Notes/Links/Interleaving

- Synoptic project is intended to cover all previous content in course

Additional Higher Content

- Students can access higher content from previous work and outside sources to address grading criteria. This must be independent work.

Spring Half Term 2**Block 3 – 3 Weeks**

Synoptic project- 1st attempt.
First marking and feedback given
Verification by exam board

Block 4 - Weeks

Synoptic project- 2nd attempt

Notes/Links/Interleaving

- Synoptic project is intended to cover all previous content in course

Additional Higher Content

- Students can access higher content from previous work and outside sources to address grading criteria. This must be independent work.

Summer Half Term 1**Block 1 – 3 Weeks**

Synoptic project- 2nd attempt

Block 2 – 3 Weeks

Synoptic project- 2nd attempt.
Second and final marking and feedback given
Verification by exam board

Notes/Links/Interleaving

- Synoptic project is intended to cover all previous content in course

Additional Higher Content

- Students can access higher content from previous work and outside sources to address grading criteria. This must be independent work.