

Engineering



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VOCATIONAL EDUCATION

ENGINEERING

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INTRODUCTION

RATIONALE

An activity-based engineering environment provides opportunities for students to gain greater knowledge, understanding and experience of different engineering materials and processes and their applications in society.

This course provides a foundation for further study in the area of engineering and contributes to the overall personal development of the students, their preparation for further education/training and for adult and working life.

NUMBER AND SEQUENCE OF MODULES

A student must take four modules. Engineering Core is a mandatory module.

The modules are:

Module 1: Engineering Core (Mandatory)

Module 2: General Engineering

Module 3: Motor Engineering

Module 4: Decorative Metalwork

Module 5: Engineering Systems

DESCRIPTION OF MODULES

MODULE 1: ENGINEERING CORE (Mandatory)

This module provides students with an opportunity to convert raw materials into finished engineering artifacts. Through this process the students are introduced to a selection of engineering hand and machine tools, engineering processes, practical skills and associated knowledge. This module provides a foundation for the three other engineering modules that the students will study, and contributes to the overall development of the students, their preparation for further education/training and for adult and working life.

MODULE 2: GENERAL ENGINEERING

This module provides opportunities for the students to extend their experience of practical engineering skills and processes while at the same time consolidating and refining the skills developed from the engineering core module. It also enables students to develop and demonstrate qualities of co-operation, industriousness and perseverance.

MODULE 3: MOTOR ENGINEERING

This module has been designed for students who have no previous experience in Motor Engineering. The module provides an introduction to a selection of hand tools, work practices and safety measures associated with a garage environment or owning a car. This module will provide a foundation for further study in the area and contribute to the overall development of the students, their preparation for further education/training and adult and working life.

MODULE 4: DECORATIVE METALWORK

This module introduces students to the area of decorative metalwork. Through the production of artefacts each unit is designed to explore, at a basic level, the creative dimension and the decorative aspect of metalwork. The unit will also contribute to the overall development of the students, their preparation for further education/training and adult and working life.

MODULE 5: ENGINEERING SYSTEMS

This module is comprised of five topics and a school must choose any two topics within Engineering Systems to satisfy the requirements of the course.

The five topics are:

Computer Aided Design, Electricity (Domestic), Electronics, Mechanisms, and Pneumatics.

The five topics provide a basic introduction to engineering systems and applications. They will help broaden the student's perception of engineering and expose them to further study and career options in the area.

GENERAL RECOMMENDATIONS

The Teacher Guidelines provide suggestions in relation to classroom practice. The guidelines are not prescriptive. There is scope for teachers to exercise their own professional judgement based on the interests, needs and abilities of the group. However, it is essential that the fundamental principles of the Leaving Certificate Applied be upheld. Teachers are therefore required to adopt a methodology that is student centered, activity based and affirming. It is important that students gain an understanding of safe working practices, when dealing with materials and processes in an activity based engineering environment.

ENGINEERING

MODULE 1

ENGINEERING CORE

MODULE 1:

ENGINEERING CORE

PURPOSE

This module has been designed to cater for students who have, followed a Junior Cycle technology course and those who have not. The potential of the activity-based environment lends itself to the overall personal development of the student by working either independently or as part of a team. A range of learning experiences will provide an introduction to a selection of hand and machine tools, processes, skills and associated knowledge. This will form a foundation for further study in related modules in the engineering specialism, and will contribute to the overall development of the students, their preparation for further education/training and adult and working life.

PREREQUISITES

None.

AIMS

This Module aims:

- to introduce students to a range of practical skills and associated knowledge
- to provide them with opportunities for converting raw materials to finished artifacts
- to develop and demonstrate qualities of cooperation and self-confidence in their everyday lives
- to develop an awareness of the role of graphics as a communication medium in engineering
- to show an understanding of safe working practices in the context of personal health and safety
- to develop and use the specialised vocabulary associated with engineering.

UNITS

Unit 1: Health, Safety and Personal Development

Unit 2: Bench Work and Hand Tools

Unit 3: Machine Tools

Unit 4: The Mechanical Joining of Materials

Unit 5: Thermal Joining of Metals

Unit 6: Properties and Applications of Materials

Unit 7: Design and Graphics

Unit 8: Finishing Processes

Unit 1: Health Safety and Personal Development

LEARNING OUTCOMES

The student will be able to:

1. know and adopt appropriate behaviour and safety measures in the use of all hand/ machine tools and equipment
2. know key safety symbols in relation to workshop safety
3. outline correct procedures to be adopted in relation to accidents
4. list safety precautions to be observed when using power and hand tools
5. show independence, responsibility and perseverance in the completion of module tasks
6. demonstrate the ability to contribute effectively as a team member.

TEACHER GUIDELINES

- ▶ Health and safety issues should permeate all practical activity.
- ▶ Use classroom equipment to demonstrate safe and healthy work practices.
- ▶ Use of protective clothing and eye protection in particular should be mandatory during practical activity.
- ▶ Wall charts and videos indicating safe working practice should be available.
- ▶ Safety signs and symbols should be prominently displayed in the workshop.

Unit 2: Bench Work and Hand tools

LEARNING OUTCOMES

The student will be able to:

1. identify a range of basic hand tools for measuring, marking out, holding, shaping and forming materials
2. use the hand tools in a safe and correct manner in the completion of projects
3. prepare and assemble components using appropriate tools
4. display an understanding of the importance of careful handling and proper storage of tools in order to maintain them in good condition.

TEACHER GUIDELINES

- ▶ Apply to students interests (e.g. career paths: Engineer, Technician, Mechanic, Storekeeper or Toolmaker).
- ▶ Demonstrate the safe use of hand tools.
- ▶ Wall charts and videos indicating good practice should be available.
- ▶ Visit local industry where the processes can be observed.
- ▶ Involve students in a system of storage and maintenance of hand tools.

Unit 3: Machine Tools

LEARNING OUTCOMES

The student will be able to:

1. identify the parts and functions of the pedestal drill
2. display an appreciation of drill speeds appropriate for drill diameters
3. use the pedestal drill as required in the completion of projects
4. identify the main parts and functions of the lathe
5. display an appreciation of spindle speeds suitable to the diameter of the material being machined
6. use the lathe to produce components involving facing off and parallel turning by means of manual feeds
7. list the advantages and disadvantages of Computer Aided Manufacture (CAM).

TEACHER GUIDELINES

- ▶ Apply to students interests (e.g. career paths – Engineer, Technician, Mechanic, Storekeeper or Toolmaker).
- ▶ Demonstrate safe work holding practice and potential danger when using power tools.
- ▶ Visit local industry where the machine tools are in everyday use.
- ▶ Use wall charts to display the main parts of a pedestal drill and lathe.
- ▶ Demonstrate the effect of varying spindle speed on surface finish.
- ▶ Use work cards to identify parts of machines.

Unit 4: Mechanical joining of Materials

LEARNING OUTCOMES

The student will be able to:

1. identify a range of permanent and non-permanent mechanical joining methods and devices and their common applications
2. use taps and dies to produce internal and external threads
3. use riveting equipment to produce pop head and snap head rivet joints
4. Use appropriate adhesives to assemble components
5. demonstrate an understanding of the following terms: tapping drill size; clearance drill size; countersunk hole
6. use mechanical joining methods as required in the completion of projects.

TEACHER GUIDELINES

- ▶ Investigate and examine equipment and objects and show mechanical joining techniques.
- ▶ Show examples of permanent and non-permanent joints as used in articles (e.g. motorcar, bicycles and workshop machines).
- ▶ Use work cards to identify processes.

Unit 5: Thermal joining processes

LEARNING OUTCOMES

The student will be able to:

1. appreciate the safety implications when using hazardous substances and equipment
2. use soldering irons to complete projects
3. explain the function of the component parts of soldering irons and the function of fluxes
4. know the composition and application of solder.

TEACHER GUIDELINES

- ▶ Wall charts and videos indicating good practice should be available.
- ▶ Examine soldered components (e.g. food containers).
- ▶ Use work cards to identify component parts.
- ▶ Students should use either electric or flame heated soldering irons.

Unit 6: Properties and Applications of Materials

LEARNING OUTCOMES

The student will be able to:

1. identify a range of engineering materials to include ferrous, non-ferrous and plastics in the workshop
2. show an understanding of relative properties such as corrosion resistance, tensile strength, hardness, ductility
3. select materials for a given application based on their properties.

TEACHER GUIDELINES

- ▶ Conduct workshop experiments to show the relative properties of common materials.
- ▶ Conduct corrosion tests on ferrous and non-ferrous materials.
- ▶ A selection of common materials, both metallic and non-metallic should be on display.

Unit 7: Design and Graphics

LEARNING OUTCOMES

The student will be able to:

1. know a range of graphic conventions sufficient to interpret orthographic drawings
2. execute and present drawings in orthographic projection and insert key dimensions
3. produce simple sketches of workshop tools
4. communicate basic design ideas using freehand sketches to make projects.

TEACHER GUIDELINES

- ▶ Emphasise drawing and design as a medium of communication.
- ▶ Examine examples of everyday objects and reduce these to basic shapes.
- ▶ An introduction to the notion of the design process should be done in conjunction with project work.

Unit 8: Finishing Processes

LEARNING OUTCOMES

The student will be able to:

1. identify a range of surface finishes used for protective and decorative purposes
2. apply a surface finish to completed projects
3. use draw filing, emery cloth and polishing to produce a smooth and decorative surface finish to projects.

TEACHER GUIDELINES

- ▶ The range of surface finishes should include painting, lacquering and plastic coating.
- ▶ Investigate and identify surface finish as applied to artefacts in their environments.
- ▶ Show examples of corroded and non-corroded components.

Teaching Strategy

It is not necessary that the module be taught in the order in which the units are presented. The order or integration of units is the prerogative of the class teacher in response to the needs or experience of the class group, the workshop facilities available and the nature of module projects used.

This module is designed to be primarily about 'doing'. The basic and introductory nature of the content will require class/group demonstrations of skills and processes so as to establish a foundation of good practice. The duration of demonstrations should be kept to a minimum so as to maximise student activity. Use should be made of brief notes, sketches, and work cards to supplement demonstrations in providing necessary knowledge associated with skills, processes and materials.

The relevance of content can be maximised by relating the module content to particular artefacts familiar, or of particular interest, to students.

RESOURCES

Practical environment/workshop which provides the facilities and equipment required for the module.

Basic hand tools should be provided for each student.

Wall charts/videos relating to areas relevant to the units should be used.

General reference to books containing projects should be available in the workshop.

Visits to and from industry should be encouraged to supplement the workshop activities.

KEY ASSIGNMENTS

MODULE 1: ENGINEERING CORE

CHECKLIST

I produced an artefact using hand and machine tools.

I produced an artefact using mechanical and thermal joining processes.

I produced an artefact as part of a team.

I produced a working drawing of an artefact which included a list of materials and processes.

ENGINEERING

MODULE 2

GENERAL ENGINEERING PROCESSES

MODULE 2:

GENERAL ENGINEERING PROCESSES

PURPOSE

This module will provide learning experiences, which will extend the students' range of practical skills and processes in general engineering while consolidating and refining the skills they experienced during the core module. The potential of an activity-based environment lends itself to the overall personal development of the student while working either independently or as part of a team. It will complement other modules in the engineering specialism and will contribute to the overall development of the students, their preparation for further education/training and adult and working life.

PREREQUISITES

Engineering Core.

AIMS

This Module aims to enable the students:

- to consolidate existing practical skills and knowledge
- to acquire a range of new skills, knowledge and associated vocabulary
- to develop and demonstrate qualities of co-operation, industriousness and perseverance
- to acquire an increased awareness and understanding of health and safety issues
- to encourage responsibility and self-confidence through group interaction and individual practice in the workshop
- to develop their knowledge and skills into a problem solving capability
- to develop an awareness of the role of design and graphics in the engineering industry
- to provide an opportunity for further education or employment.

UNITS

Unit 1: Health, Safety and Personal Development

Unit 2: Bench Work and Associated Procedures

Unit 3: Cutting Tools

Unit 4: Machine Tools- the Lathe

Unit 5: Thermal Joining Processes

Unit 6: Design and Problem Solving

Unit 7: Properties and Applications of Materials

Unit 1: Health, Safety and Personal Development

LEARNING OUTCOMES

The student will be able to:

1. know and adopt appropriate behaviour and safety measures in the use of all hand/ machine tools and equipment
2. know key safety symbols in relation to workshop safety
3. outline correct procedures to be adopted in relation to accidents
4. list safety precautions to be observed when using power and hand tools
5. show independence, responsibility and perseverance in the completion of module tasks
6. demonstrate an ability to contribute effectively as a team member.

TEACHER GUIDELINES

- ▶ Health and safety issues should permeate all practical activity.
- ▶ Use classroom equipment to demonstrate safe and healthy work practices.
- ▶ Use of protective clothing and eye protection in particular should be mandatory during practical activity.
- ▶ Wall charts and videos indicating safe working practice should be available.
- ▶ Safety signs and symbols should be prominently displayed in the workshop.

Unit 2: Bench Work and Associated Procedures

LEARNING OUTCOMES

The student will be able to:

1. develop dexterity, confidence and accuracy in the use of a range of hand tools for measuring, marking out, holding, shaping and forming materials
2. use the vernier callipers to determine dimensional accuracy to the nearest 0.5mm
3. use mechanical joining methods as required in the completion of projects
4. use the pedestal drill as required in the completion of projects
5. select and apply appropriate surface finishes to components
6. prepare and assemble components using appropriate tools
7. demonstrate an understanding of the care and storage requirements of precision marking out and measuring tools.

TEACHER GUIDELINES

- ▶ Use classroom equipment to demonstrate the safe use of hand tools.
- ▶ Apply to students interests and career opportunities in the engineering industry.
- ▶ Wall charts and videos indicating good practice should be available.
- ▶ Visit local industry where the processes are in everyday use.
- ▶ Involve students in good practice in the storage and maintenance of hand tools.

Unit 3: Cutting Tools

LEARNING OUTCOMES

The student will be able to:

1. distinguish between single-point and multi-point cutting tools
2. identify the wedge angle of a range of single point cutting tools
3. identify the factors which influence the life of a cutting tool
4. display an understanding of the importance of careful use and maintenance of power equipment.

TEACHER GUIDELINES

- ▶ Demonstrate safe work holding practice and potential danger when using power tools.
- ▶ Visit local industry where the machine tools are in everyday use.
- ▶ Use wall charts to display the main parts of a pedestal drill.
- ▶ Use work cards to identify parts of the drilling machine.

Unit 4: Machine Tools - the Lathe

LEARNING OUTCOMES

The student will be able to:

1. set-up and use the lathe and ancillary equipment to produce components as required in project work
2. incorporate the following operations: parallel turning, facing-off, knurling, drilling and taper turning
3. have an appreciation of spindle speeds suitable to the diameter and type of material being machined
4. display an understanding of the importance of careful use and maintenance of power equipment.

TEACHER GUIDELINES

- ▶ Demonstrate safe work holding practice and potential danger when using power tools.
- ▶ Visit local industry where power machine tools are in everyday use.
- ▶ Use wall charts to display the main parts of a centre lathe.
- ▶ Demonstrate the effect of varying spindle speed on surface finish.
- ▶ Use work cards to identify parts of the centre lathe.

Unit 5: Thermal Joining Processes

LEARNING OUTCOMES

The student will be able to:

1. identify the components of an electric or Oxy-acetylene welding plant and describe their functions
2. demonstrate the correct procedure for starting-up and shutting-down an electric or oxy-acetylene welding plant safely
3. use the electric or Oxy-acetylene plant to produce welded or brazed joints as required in the completion of projects
4. outline hazards associated with oxyacetylene and electric welding.

TEACHER GUIDELINES

- ▶ Examine welded and brazed machines and components (e.g. bicycles, motorcars).
- ▶ Wall charts and videos indicating good practice should be available.
- ▶ Use of protective clothing and eye protection should be mandatory during any practical activity.
- ▶ Safety signs and symbols should be clearly displayed in the workshop.

Unit 6: Design and Problem Solving

LEARNING OUTCOMES

The student will be able to:

1. display an understanding of the important stages in the design and manufacture of artefacts in response to given problems
2. demonstrate a systematic approach to the solution of basic design problems as presented in projects
3. complete sketches of design solutions and modifications on grid and plain paper using orthographic and isometric drawings
4. prepare as a member of a group, an evaluation of the design of a project.

TEACHER GUIDELINES

- ▶ Examine examples of everyday objects and consider their design and development to eventual manufacture.
- ▶ Use wall charts to demonstrate the main stages of design.
- ▶ Use square and isometric grid paper to represent drawings of projects.
- ▶ Give partially set up drawings and sketches to the students in the initial stages to stimulate interest.
- ▶ Make mock-ups of design ideas from everyday life to encourage visualisation.

Unit 7: Properties and Applications of Materials

LEARNING OUTCOMES

The student will be able to:

1. display an understanding of ductility, malleability, hardness, toughness and magnetic properties of materials
2. anneal, harden and temper high carbon steel
3. differentiate between thermoplastics and thermo-setting plastics
4. select materials for given applications based on their properties.

TEACHER GUIDELINES

- ▶ Use book assignments.
- ▶ Do workshop experiments to show the relative properties of common materials.
- ▶ Demonstrate safe work practice and potential danger when using heating equipment.
- ▶ Use work cards to demonstrate stages of heat treatment and properties.

Teaching Strategy

This module is designed to be primarily about 'doing' where a hands on, student centred approach is envisaged. Class and group demonstrations of skills and processes will be required so as to establish a foundation of good practice and the duration of these should be kept to a minimum so as to maximise student activity. Use should be made of brief notes, sketches, and work cards to supplement demonstrations in providing necessary knowledge associated with skills, processes and materials.

The relevance of content can be maximised by relating the module content to particular artefacts familiar, or of particular interest, to students. Examples suitable for such an approach might be: the bicycle/motorcycle; lawnmower; motor cars; clocks etc. The use of field trips/industrial visits is recommended so as to extend the learning environment and to set the module's activities in a local/national industrial context. Involvement of entrepreneurs/engineering specialists from local industry in providing talks/demonstrations to class groups will further contribute to these ends.

RESOURCES

Practical environment/workshop, which provides the facilities and equipment, required for module.

Basic hand tools should be provided in kits for each student. Additional hand tools and equipment should be wall mounted or available from a store.

KEY ASSIGNMENTS

MODULE 2: GENERAL ENGINEERING PROCESSES

CHECKLIST

I produced an artefact using hand tools.

I produced an artefact using machine tools.

I used either electric welding or oxyacetylene as part of an assembly and applied a surface finish.

I produced a working drawing of an artefact which included details of the tools processes and materials I used.

ENGINEERING

MODULE 3

MOTOR ENGINEERING

MODULE 3:

MOTOR ENGINEERING

PURPOSE

This module has been designed for students with no previous experience in a Motor Engineering environment. A range of learning experiences will provide an introduction to a selection of hand tools, work practices and safety measures associated with a garage environment or owning a car. This will provide a foundation for further study in the area and contribute to the overall development of the students, their preparation for further education/training and adult and working life.

PREREQUISITES

Engineering Core.

AIMS

This Module aims to enable the students:

- to gain an understanding of safe working practices in the context of personal safety
- to develop a range of practical skills and associated knowledge
- to encourage students to have an interest in issues related to the internal combustion engine, its operating principles and its applications
- to identify the need to carry out basic servicing on motor vehicles
- to develop and demonstrate qualities of co-operation, perseverance, responsibility and self-confidence through group interaction and individual practice in the workshop
- to develop an awareness of the industries related to this area of study, both at local and national level and the employment opportunities they provide.

UNITS

Unit 1: Hand tools and Associated Procedures

Unit 2: Principles

Unit 3: Engines

Unit 4: Lubrication

Unit 5: Electrical System

Unit 6: Cooling

Unit 7: Vehicle Check

Unit 1: Hand tools and Associated Procedures

LEARNING OUTCOMES

The student will be able to:

1. identify a range of hand tools and their correct applications
2. demonstrate the correct and safe use of hand tools and garage equipment
3. perform basic maintenance procedures on a range of garage tools and equipment
4. select appropriate tools for a given task
5. appreciate the necessity for correct and safe storage of tools and equipment.

TEACHER GUIDELINES

- ▶ Health and safety issues should permeate all practical activity.
- ▶ Wall charts and videos indicating correct and safe practices should be available.
- ▶ A selection of socket sets, open and ring spanners should be available.
- ▶ Use of stand mounted components such as engines, cooling systems, electrical systems and brake systems in the workshop should be encouraged.

Unit 2: Principles

LEARNING OUTCOMES

The student will be able to:

1. become familiar with the operating principles of a two stroke and four stroke spark ignition engine
2. name and identify the main parts of an engine
3. state the purpose of each of the main parts of an engine
4. state the purpose of a flywheel
5. check the condition of the air filter and replace if necessary.

TEACHER GUIDELINES

- ▶ Use workshop and service manuals.
- ▶ Wall charts and videos indicating principles and good practice should be available.
- ▶ Use of stand mounted components such as engines, electrical systems and brake systems in the workshop should be encouraged.
- ▶ A selection of video material can help to enhance the explanation of engine operation.

Unit 3: Engines

LEARNING OUTCOMES

The student will be able to:

1. dismantle and reassemble an engine, as part of a team to identify the main components
2. measure the bore and stroke of an engine
3. calculate the cubic capacity of an engine
4. state the purpose of gaskets
5. make a variety of new gaskets.

TEACHER GUIDELINES

- ▶ Use workshop and service manuals.
- ▶ Use wall charts to display the main parts of an engine.
- ▶ Use of stand mounted components such as engines, electrical systems and brake systems in the workshop should be encouraged.

Unit 4: Lubrication

LEARNING OUTCOMES

The student will be able to:

1. outline the need for a lubrication system in an engine
2. name the main parts of a wet sump lubrication system
3. replace an engine oil filter
4. drain and refill engine oil.

TEACHER GUIDELINES

- ▶ Visit local garages for pre-arranged demonstrations and talks.
- ▶ Use wall charts and video to display the main parts of an engine and lubrication system.
- ▶ The selection of lubricants for different engine types and working conditions should be available.

Unit 5: Electrical System

LEARNING OUTCOMES

The student will be able to:

1. state the basic function of a coil ignition system and its parts
2. carry out routine maintenance and change spark plugs
3. replace a set of contact breaker points
4. identify and refit light bulbs.

TEACHER GUIDELINES

- ▶ Use of stand mounted components such as electrical systems in the workshop should be encouraged.
- ▶ Use wall charts to display the main parts of an ignition system.
- ▶ Students should have distributor units available in the workshop and mounted in vices to experiment with correct points settings.

Unit 6: Cooling

LEARNING OUTCOMES

The student will be able to:

1. outline the need for an engine cooling system
2. state the basic operating principle of the cooling system
3. identify cooling system types, i.e. air, liquid
4. state the purpose of a thermostat in cooling systems
5. flush out and refill a liquid cooling system
6. add anti-freeze to a cooling system.

TEACHER GUIDELINES

- ▶ Visit local garages for pre-arranged demonstrations and talks or invite a Motor Engineer to give a talk to students in school.
- ▶ Use wall charts to display the main parts of an engine.
- ▶ Stand mounted components such as engines and cooling systems give greater opportunity to the student to understand their functions.

Unit 7: Vehicle Check

LEARNING OUTCOMES

The student will be able to:

1. inspect tyre pressure and tread depth on standard saloon cars
2. examine the condition of foot and handbrake systems
3. identify loose play in steering systems
4. understand the meaning of the gauges on a standard motor vehicle dashboard
5. identify a vehicle using chassis and engine numbers
6. appreciate the level of motor taxation and motor insurance as applied to a variety of vehicles
7. understand the levels of repair and maintenance which require the attention of a professional mechanic.

TEACHER GUIDELINES

- ▶ Health and safety issues should be to the forefront and standards required to maintain vehicles in safe working order should permeate all practical activity (MOT).
- ▶ Service history should be discussed in the context of purchasing a car.
- ▶ Use of stand mounted components such as brake and steering systems in the workshop would reinforce the safety aspects.
- ▶ A selection of insurance quotations for private cars and the influence of horsepower and drivers age would interest students.
- ▶ Use should be made of service history.

Teaching Strategy

It is not necessary that the module be taught in the order in which the units are presented. The order or integration of units is the prerogative of the class teacher in response to the needs or experience of the class group, the workshop facilities available and the nature of projects used.

This module is designed to be primarily about 'doing'. The basic and introductory nature of the content will require class/group demonstrations of skills and procedures so as to establish a foundation of good practice. The duration of demonstrations should be kept to a minimum so as to maximise student activity. Use should be made of brief notes, sketches, and work cards to supplement demonstrations in providing necessary knowledge associated with skills and procedures.

The relevance of content can be maximised by relating the module to particular areas of interest to students.

RESOURCES

Practical environment/workshop that provides the facilities and equipment required for module.

Basic hand tools should be provided in kits form for use by student groups. Additional hand tools and specialist equipment should be wall mounted or available from a store.

Wall charts/videos relating to areas relevant to the units should be used.

Visits to and from local garages should be encouraged to supplement the workshop activities.

KEY ASSIGNMENTS

MODULE 3: MOTOR ENGINEERING

CHECKLIST

I dismantled and assembled an engine component as part of a team.

I carried out an oil change and refitted new oil and air filters.

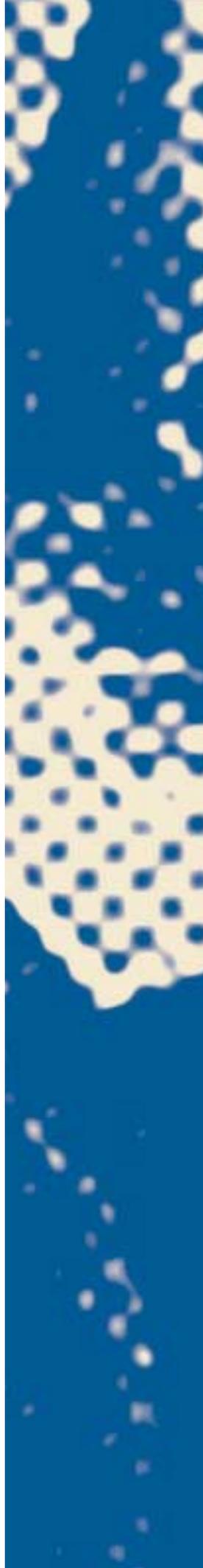
I removed old spark plugs and fitted new ones and replaced a blown light bulb.

I visited a local garage to observe the practical application of the module units.

ENGINEERING

MODULE 4

DECORATIVE METALWORK



MODULE 4:

DECORATIVE METALWORK

PURPOSE

This module provides learning experiences which will extend the students' range of practical skills into the area of decorative metalwork. Each unit is designed to explore, at a basic level, both the creative dimension and the decorative aspect of metalwork, and will contribute to the overall development of the student, their preparation for further education/training and adult and working life.

PREREQUISITES

Engineering Core.

AIMS

This Module aims to enable the students;

- to develop their knowledge of metalwork and a range of practical skills
- to use the specialised vocabulary associated with the area
- to experience the process of converting raw materials to finished artefacts
- to develop an interest in issues relating to the use of engineering raw materials and their conversion to artefacts of a decorative nature
- to develop and demonstrate qualities of co-operation, industriousness, perseverance, responsibility and self-confidence through group interaction and individual practice in the workshop
- to show an awareness of decorative metalwork in a local, home based and in the wider industrial context and the employment opportunities they provide
- to develop an understanding of safe working practices in the context of personal health and safety.

UNITS

Unit 1: Health, Safety and Personal Development

Unit 2: Hand Tools and Associated Procedures

Unit 3: Enamelling

Unit 4: Forge work Hot and Cold

Unit 5: Beaten Metalwork

Unit 6: Surface Finishing

Unit 1: Health Safety and Personal Development

LEARNING OUTCOMES

The student will be able to:

1. know/adopt appropriate behaviour and safety measures in the use of all hand tools and equipment
2. outline key regulatory requirements in relation to workshop safety
3. outline correct procedures to be adopted in relation to accidents
4. show independence, responsibility and perseverance in the completion of module tasks
5. demonstrate the ability to contribute effectively as a team member.

TEACHER GUIDELINES

- ▶ Health and safety issues should permeate all practical activity.
- ▶ Use classroom equipment to demonstrate safe and healthy work practices.
- ▶ Use of protective clothing and eye protection in particular should be mandatory during practical activity.
- ▶ Wall charts and videos indicating good practice should be used.

Unit 2: Hand tools and Associated Procedures

LEARNING OUTCOMES

The student will be able to:

1. identify a range of hand tools for use in a wide variety of tasks
2. use the hand tools in a safe and correct manner in the completion of projects
3. display an understanding of the importance of careful handling and proper storage of tools in order to maintain their condition.

TEACHER GUIDELINES

- ▶ Demonstrate the safe use of hand tools.
- ▶ Wall charts and videos indicating good practice should be used.
- ▶ Involve students in good practice in the storage and maintenance of hand tools.

Unit 3: Enamelling

LEARNING OUTCOMES

The student will be able to:

1. identify the range of equipment, methods and devices, used to successfully complete an enamelling assignment
2. display an appreciation of the procedures and processes exercised in enamelling work
3. use enamelling equipment in the completion of projects.

TEACHER GUIDELINES

- ▶ Investigate and examine equipment and objects and show enamelling techniques.
- ▶ Use work cards to identify processes.
- ▶ A visit to craft shops or fairs will enhance the relevance of this module.

Unit 4: Forge Work (Hot and Cold)

LEARNING OUTCOMES

The student will be able to:

1. identify and use a range of equipment, methods and devices, to successfully complete a simple forging exercise
2. display an appreciation of the procedures and processes exercised in forging
3. use bending, twisting scrolling and rolling in the completion of projects.

TEACHER GUIDELINES

- ▶ Examine hot and cold forged components (e.g. railings, spanners, chains, motorcar parts).
- ▶ Wall charts and videos indicating good practice should be available.
- ▶ Use work cards to identify processes.

Unit 5: Beaten Metalwork/Repousse

LEARNING OUTCOMES

The student will be able to:

1. identify and use the range of equipment and methods to successfully complete projects
2. display an appreciation of the procedures and sequential processes used in beaten metalwork assignments
3. use repousse or hollowing in the completion of artifacts
4. anneal work to enhance its properties.

TEACHER GUIDELINES

- ▶ Do workshop experiments to show the relative properties of common materials suitable for beaten metalwork.
- ▶ Examine objects including ornaments which were made using beaten metalwork processes.

Unit 6: Surface Finishing

LEARNING OUTCOMES

The student will be able to:

1. identify a range of surface finishes used for protective and decorative purposes
2. demonstrate an understanding of the importance of adequate surface preparation prior to the application of surface finishes
3. apply a range of surface finishes to projects.

TEACHER GUIDELINES

- ▶ Examine examples of everyday objects which have decorative and protective finishes.
- ▶ Use of protective clothing and eye protection in particular should be mandatory during finishing processes.

Teaching Strategy

It is presumed that a class group may be made up of students who have followed a junior cycle course in metalwork and some who have not. It is not necessary that the module be taught in the order in which the units are presented. The order or integration of units is the prerogative of the class teacher in response to the needs or experience of the class group, the workshop facilities available and the nature of module projects used.

This module is designed to be primarily about 'doing'. The basic and introductory nature of the content will require class/group demonstrations of skills and processes so as to establish a foundation of good practice. The duration of demonstrations should be kept to a minimum so as to maximise student activity. Use should be made of brief notes, sketches, and work cards to supplement demonstrations in providing necessary knowledge associated with skills, processes and materials used in beaten metalwork.

The relevance of content can be maximised by relating the module content to particular artefacts familiar, or of particular interest, to students such as household ornaments and historical art work.

RESOURCES

A practical environment/workshop that provides the necessary facilities and equipment is required for this module.

Basic hand tools should be provided in kits for each student. Additional hand tools and equipment should be wall mounted or available from a store.

Wall charts/videos relating to areas relevant to the units should be used.

Visits to and from industry should be encouraged to supplement the workshop activities.

KEY ASSIGNMENTS

MODULE 4: DECORATIVE METALWORK

CHECKLIST

I produced an artefact which included forging and surface finishing.

I produced an artefact which included beaten metalwork and I applied a finish.

I produced an artefact which included enamelling.

I compiled a list of tools, processes and materials used in one of my projects.

ENGINEERING

MODULE 5

ENGINEERING SYSTEMS

TOPIC 1

COMPUTER AIDED DESIGN

MODULE 5:

ENGINEERING SYSTEMS

TOPIC 1

COMPUTER AIDED DESIGN (CAD)

PURPOSE

This topic provides a basic introduction to the use of computers in engineering drawing. It will complement other modules in this specialism and contribute to the overall development of the students, their preparation for further education/training and adult and working life.

PREREQUISITES

Engineering Core.

AIMS

This Module aims to enable the students:

- to develop an awareness of the increasing contribution of computers (in draughting) to engineering drawing
- to become familiar with the terminology used in CAD activities
- to use proprietary CAD software efficiently
- to explore the career areas associated with CAD
- to develop an understanding of safe working practices in relation to computers and the ancillary equipment required for CAD activities.

UNITS

Unit 1: Health, Safety and Personal Development

Unit 2: CAD Commands and Terminology

Unit 1: Health, Safety and Personal Development

LEARNING OUTCOMES

The student will be able to:

1. understand and adopt appropriate behaviour and safety measures in the use of equipment
2. identify potential hazards such as eye-strain or posture problems associated with the use of CAD equipment
3. show independence, responsibility and perseverance in the completion of module tasks.

TEACHER GUIDELINES

- ▶ Safety notices and regulations should be displayed.
- ▶ Safe working practices and care of equipment should be central to this module.
- ▶ The classroom should provide a learning environment that reflects good practice with regard to layout and use of equipment.

Unit 2: CAD Commands and Terminology

LEARNING OUTCOMES

The student will be able to:

1. identify the hardware required to run CAD Programmes
2. enter and exit CAD programmes correctly, with and without saving assignments
3. complete 2D CAD drawings on a pre-set template
4. use drawing commands for line, circle, arc, ellipse, polyline, point, polygon and rectangle
5. select and use different colours and linetypes for drawing entities
6. enter text into a drawing in different positions
7. apply basic dimensioning to completed drawings
8. select and apply basic edit commands to existing drawings
9. use drawing aids such as grid, snap, orthogonal modes, zoom and object snap facilities
10. produce hard copies by printing or plotting.

TEACHER GUIDELINES

- ▶ Examples of students work or print outs should be on display.
- ▶ A visit to or from local businesses using CAD would create an awareness of its application in industry and possible career opportunities.
- ▶ Template drawings can provide a lead in so that students can start real drawing with minimal preparatory work.
- ▶ Exercise sheets which students have drawn by hand on to paper can be useful when redrawn using CAD.
- ▶ Students should enter, exit and save drawings using proper procedures.
- ▶ If possible the use of both a printer and a plotter should be used so as to demonstrate the differences between them and their respective uses.

Teaching Strategy

The use of drawings that can be re-used and built-upon, as new procedures and commands are introduced, will result in a more efficient use of time.

RESOURCES

(AutoCAD, Autosketch, Turbo Cad, Visual Cad, Superdraft etc) should be available.

Beginning AutoCAD, by B. McFarlane, ISBN 0340585714

Starting with AutoCAD LT, by B. McFarlane, ISBN 0340625430

AutoSketch for Windows, Supplied with package.

AutoCAD Tutorial Guide (included with Manuals)

AutoSketch for Students by A. Yarwood

A Student's AutoCAD by A. Yarwood, Pub: Longman, Scientific & Technical ISBN 0-582- 07490-8

AutoCAD Release 12 for Students by A.Yarwood, Pub: Longman, Scientific and Technical ISBN 0-582-22682-1

AutoCAD Assignments by P. Whelan, Gill and Macmillan
ISBN 0-7171-2105-4

KEY ASSIGNMENTS

MODULE 5: ENGINEERING SYSTEMS TOPIC 1 (CAD)

CHECKLIST

I executed and plotted/printed 2D CAD drawing where I employed a range of CAD tools and commands from the following list: grid, ortho, snap and object snap modes, line, polyline, circle, polygon, rectangle, erase, copy, trim, mirror, rotate, scale, offset, fillet and array.

I compiled a portfolio of other drawings I completed while doing this half module.

ENGINEERING

MODULE 5

ENGINEERING SYSTEMS

TOPIC 2

ELECTRICITY

MODULE 5:

ENGINEERING SYSTEMS

TOPIC 2

ELECTRICITY

PURPOSE

This topic is designed to develop the students' knowledge and understanding of the principles, practices and materials involved in supplying electricity to domestic dwellings.

It will thus contribute to the overall development of the student, their preparation for further education/training and adult and working life. **It is essential in the interest of safety that students are not allowed to work on or test circuits greater than 9 volts.**

National Rules for Electrical Installations issued by Electro Technical Council of Ireland should be used.

Part 8 of SI (Statutory Instrument) 44, 1993 issued by Health and Safety Authority should be used.

PREREQUISITES

Engineering Core.

AIMS

This Module aims to enable the students:

- to develop an understanding of safe working practices
- acquire a basic knowledge of electricity generation and distribution
- identify various electrical safety devices and their applications
- acquire a basic understanding of the principles underpinning the uses of electricity in the home
- acquire skills in the use of a range of tools and equipment
- consider the possibility of a career in the electrical or plumbing area of work.

UNITS

Unit 1: Health, Safety and Personal Development

Unit 2: Electrical Generation/Distribution

Unit 3: Basic Electrical Installations

Unit 1: Health Safety and Personal Development

LEARNING OUTCOMES

The student will be able to:

1. comply with standard regulations and correct safety procedures in the use of tools and equipment
2. identify electrical hazards and appropriate safeguards including warning symbols
3. outline correct procedures to be taken in the event of accidents
4. show independence, responsibility and perseverance in the completion of projects.

TEACHER GUIDELINES

- ▶ Health and safety issues should permeate all practical activity.
- ▶ It is essential that students are not allowed to work or test circuits greater than 9 volts.
- ▶ Students should recognise when professional help is required.
- ▶ Use of protective clothing should be mandatory during practical activity.
- ▶ Wall charts and videos indicating good practice should be available.

Unit 2: Electrical Generation/Distribution

LEARNING OUTCOMES

The student will be able to:

1. differentiate between the various types of generating stations
2. demonstrate an understanding of how electricity is generated
3. identify the function of transformers and why they are used
4. display an understanding of the important features of the national distribution system for electricity.

TEACHER GUIDELINES

- ▶ Wall charts and videos should be used.
- ▶ Visit a local power station or transformer station.
- ▶ Organise a talk by a local electrical contractor or ESB officer.

Unit 3: Basic Electrical Installations

LEARNING OUTCOMES

The student will be able to:

1. identify a range of domestic outlets and switches
2. understand the need for fuses, MCBs, RCDs, and other safety devices
3. demonstrate the correct procedure for wiring various domestic outlets, switches, plug tops and ceiling roses
4. identify the need for various types and sizes of cables
5. identify the various categories of domestic appliances – motor, heat, light and audio-visual
6. identify a systematic approach to problem solving and recognise when professional help is required.

TEACHER GUIDELINES

- ▶ It is essential that students are not allowed to work or test circuits greater than 9 volts.
- ▶ Demonstrate safe work practices and potential danger when using electrical equipment.
- ▶ Use a domestic consumer board to identify the main components.
- ▶ Use work cards to identify processes.
- ▶ Use Work boards to demonstrate the wiring arrangements for a domestic socket and light circuits.

Teaching Strategy

This topic is designed to be primarily about 'doing'. The basic and introductory nature of the content will require class/group demonstrations of skills and processes so as to establish a foundation of good practice. The duration of demonstrations should be kept to a minimum so as to maximise student activity. Use should be made of brief notes, sketches, and work cards to supplement demonstrations in providing necessary knowledge associated with skills, processes and materials.

The relevance of this topic can be maximised by relating its content to domestic electrical systems which students can find and identify in their own homes.

RESOURCES

Practical environment/workshop that provides the facilities and equipment required for this module.

Basic hand tools should be provided in kits for each student. Additional hand tools and equipment should be wall mounted or available from a store.

National Rules for Electrical Installations by Electro Technical Council of Ireland should be used.

Part 8 of SI (Statutory Instrument) 44, 1993 by Health and Safety Authority should be used.

Use Work boards to demonstrate the wiring arrangements for a domestic socket and light circuits.

Wall charts/videos relating to areas relevant to the units should be used.

Visits to and from industry should be encouraged to supplement the workshop activities.

Visits to building sites can provide relevant applications showing electrical systems under various stages of installation.

KEY ASSIGNMENTS

MODULE 5: ENGINEERING SYSTEMS TOPIC 2 ELECTRICITY

CHECKLIST

I wired a plug top and inserted a fuse of the correct rating.

I produced a display board of the various types of cable used in the home.

ENGINEERING

MODULE 5

ENGINEERING SYSTEMS

TOPIC 3

ELECTRONICS

MODULE 5:

ENGINEERING SYSTEMS

TOPIC 3

ELECTRONICS

PURPOSE

This topic provides a basic introduction to electronics. It will broaden the student's perception of engineering. It will complement other modules in the specialisms and contribute to the overall development of the students. Students should not work on circuits greater than nine volts.

PREREQUISITES

Engineering Core.

AIMS

This Module aims to enable the students:

- to acquire an understanding of the role of electronics in modern engineering,
- to identify a range of electronic components and to build simple electronic circuits
- to develop an awareness of graphic symbols and standards associated with control systems
- to develop an understanding of safe working practices when using electricity and associated tools and equipment.

UNITS

Unit 1: Health, Safety and Personal Development

Unit 2: Electricity and Electrical Circuits

Unit 3: Electronic Components and Circuit Construction

Unit 1: Health, Safety and Personal Development

LEARNING OUTCOMES

The student will be able to:

1. know and adopt appropriate behaviours and safety measures in the use of hand tools and equipment
2. identify commonplace potential hazards associated with electricity
3. outline the correct emergency procedures to be taken in the event of an electrical accident.

TEACHER GUIDELINES

- ▶ Safety notices and regulations should be displayed in the workshop.
- ▶ Safe working practices and care of equipment should be central to this module.
- ▶ The workshop should provide a learning environment that reflects good practice with regard to layout, cleanliness and accessibility of tools and equipment.
- ▶ Students should not work on circuits greater than nine volts.

Unit 2: Electricity and Electrical Circuits

LEARNING OUTCOMES

The student will be able to:

1. have a basic understanding of current flow, voltage and resistance
2. use Ohm's law in calculations to determine values for voltage, current and resistance
3. construct series and parallel circuits
4. use the multimeter to determine values of voltage, current and resistance in a circuit, and to check for circuit continuity
5. know a range of graphic symbols sufficient to interpret diagrams associated with practical electronic circuit construction.

TEACHER GUIDELINES

- ▶ This unit should be done in conjunction with Unit 3 so as to apply theory to practical project work.
- ▶ Electricity can be examined using the analogy of water flowing in a pipe.
- ▶ Use the multimeter to measure voltage, current and resistance to verify calculations using Ohm's law.
- ▶ Investigate series and parallel circuits using simple practical circuits that will compare the brightness of two bulbs.

Unit 3: Electronic Components and Circuit Construction

LEARNING OUTCOMES

The student will be able to:

1. construct basic electronic circuits
2. determine resistor values using the resistor colour code
3. know the function of a transistor
4. know the function of diodes
5. use an electric soldering iron to solder and de-solder components
6. identify the function of components in basic electronic circuits.

TEACHER GUIDELINES

- ▶ Safety notices and regulations should be displayed in the workshop.
- ▶ Safe working practices and care of equipment are central to this module.
- ▶ The workshop should provide a learning environment that reflects good practice with regard to layout, cleanliness and accessibility of tools and equipment.
- ▶ Students should not work on circuits greater than nine volts.

RESOURCES

A practical environment/workshop, that provides the necessary facilities and equipment is required for this module.

Motor car components, and disused domestic appliances.

Shaws electronic kits (optional).

E & L modular boards (optional).

Electronic breadboards.

Power supplies.

Soldering equipment.

Multimeters (both digital and analogue).

Sufficient electronic components and accessories to complete the given assignments.

Books

Unit 5 and 6 New Technologies for the Leaving Certificate Vocational Programme (Department of Education)

KEY ASSIGNMENTS

MODULE 5: ENGINEERING SYSTEMS TOPIC 3 ELECTRONICS

CHECKLIST

I constructed a series
and parallel circuit.

I listed and identified the function of the
components used in an electronic circuit.

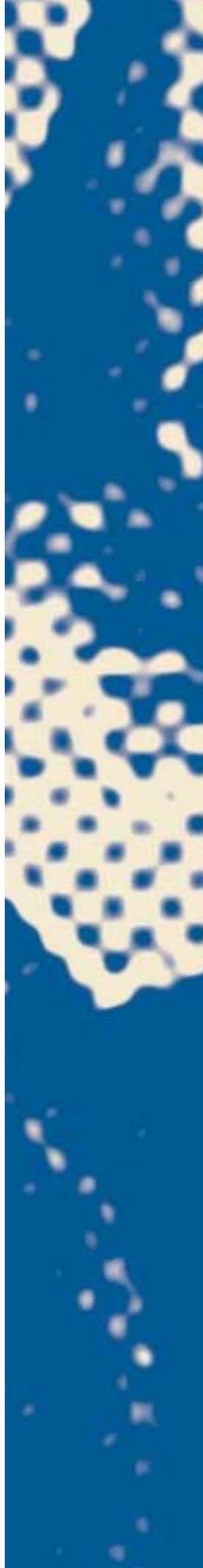
ENGINEERING

MODULE 5

ENGINEERING SYSTEMS

TOPIC 4

MECHANISMS



MODULE 5:

ENGINEERING SYSTEMS

TOPIC 4

MECHANISMS

PURPOSE

This topic provides a basic introduction to mechanisms and their applications in engineering. It will broaden the student's perception of what engineering is about.

It complements other modules in this specialism and contributes to the overall development of the students.

PREREQUISITES

Engineering Core.

AIMS

This Module aims to enable the students:

- to develop an awareness of the role that mechanisms play in engineering
- to model a range of mechanisms using appropriate kits or other materials
- to identify a range of mechanisms, their operating principles, component parts and applications in everyday life
- to develop a systematic approach to the dismantling, recording and reassembling of mechanisms
- to develop an understanding of safe working practices in the use of electricity, compressed air and associated tools and equipment.

UNITS

Unit 1: Health, Safety and Personal Development

Unit 2: Levers and Linkages

Unit 3: Pulleys and Sprockets

Unit 4: Gear and Screw Mechanisms

Unit 5: Cams and Ratchets

Unit 1: Health, Safety and Personal Development

LEARNING OUTCOMES

The student will be able to:

1. know and adopt appropriate behaviours and safety measures in the use of hand tools and equipment
2. identify common hazards associated with mechanisms
3. outline the correct emergency procedures to be taken in the event of an accident.

TEACHER GUIDELINES

- ▶ Safety notices and regulations should be displayed in the workshop.
- ▶ Safe working practices and care of equipment is central to this module.
- ▶ The workshop should provide a learning environment that reflects good practice.

Unit 2: Levers, Linkages, Pulleys and Sprockets

LEARNING OUTCOMES

The student will be able to:

1. identify a range of lever and linkage mechanisms
2. model a range of lever and linkage mechanisms using appropriate kits or other materials
3. calculate the mechanical advantage and velocity ratio of a lever
4. identify and record everyday applications of levers and linkages.

TEACHER GUIDELINES

- ▶ Display mechanisms on wall charts.
- ▶ Examine equipment such as tools, drilling machines, lathes, bicycles, washing machines and motorcars.
- ▶ Simple models of levers and linkages can be produced from strips of plywood and acrylic.

Unit 2: Levers, Linkages, Pulleys and Sprockets (Continued)**LEARNING OUTCOMES**

The student will be able to:

1. identify a range of pulley and sprocket types
2. describe, using diagrams how pulley and sprockets are used in conjunction with belts and chains to alter the relative velocities of rotating shafts
3. construct working models of pulley and sprocket systems using appropriate kits or other materials

TEACHER GUIDELINES

- ▶ Pupils can examine examples of pulley and belt systems in the engineering workshop (lathe, power hacksaw).
- ▶ The bicycle will provide an ideal example of chain and sprocket arrangements.
- ▶ The drilling machine gives a good example of cone pulleys.

Unit 3: Gear, Screw Mechanisms, Cams and Ratchets

LEARNING OUTCOMES

The student will be able to:

1. identify a range of gear types and assemblies
2. calculate the velocity ratio and relative speeds of gears in a simple gear train by means of the number of teeth on the gears
3. construct appropriate gear assemblies for use in conjunction with electric motors in model lifting devices or vehicles
4. describe common uses of the various gear types in everyday life
5. describe using diagrams a range of screw mechanisms and their common uses.

TEACHER GUIDELINES

- ▶ Gear Types to include spur, bevel, rack and worm.
- ▶ The drilling machine gives an example of rack and pinion arrangement.
- ▶ Gears can be examined in the lathe gearbox and carriage.
- ▶ The car gearbox and rear axle can be used as examples of spur and bevel gears.
- ▶ Applications of screw threads can be seen in the workshop, leadscrew, bench vices, fasteners etc.

Unit 3: Gear, Screw Mechanisms, Cams and Ratchets (Continued)

LEARNING OUTCOMES

The student will be able to:

1. describe with the aid of diagrams what is meant by cam action
2. describe using diagrams the action of a ratchet and pawl mechanism
3. use appropriate kits or other materials to construct cam and ratchet mechanisms
4. describe common applications for cam and ratchet mechanisms.

TEACHER GUIDELINES

- ▶ Study should be confined to edge cam type arrangements giving movement to in-line flat and roller followers.
- ▶ Factory visits should be arranged where students can see automated machinery employing cams.
- ▶ Motor car manuals can be useful to show valve-operating details.
- ▶ Sectioned engines provide excellent examples of cam mechanisms for examination by students.

Teaching Strategy

This topic is designed to be primarily about 'doing'. While class/group demonstrations/talks will be required, the duration of these should be kept to a minimum so as to maximise student activity. Use should be made of brief notes, sketches, and work cards to supplement demonstrations in providing necessary knowledge associated with skills, components and materials.

The use of construction kits such as 'Meccano' and 'Fischertechnik' will facilitate easy modelling of mechanisms. Permanent models incorporating control systems may be manufactured, drawing on the skills that were learnt during other half modules. The engineering workshop provides ready access to a broad range of practical applications of mechanisms for examination and observation.

RESOURCES

A practical environment/workshop providing the necessary facilities and equipment is required for this half module.

Meccano and Fischertechnik kits incorporating the relevant component parts.

Motor car components and disused domestic appliances.

Workshop machines provide excellent examples of mechanisms in everyday use.

BOOKS

Mechanisms (GCSE Technology), by Steve Rich and Anthony Edwards, Stanley Thornes Ltd., ISBN 0-7487-0150-8

CD ROMS

How Things Work, by Dorling Kindersley, Pinball Science

KEY ASSIGNMENTS

MODULE 5: ENGINEERING SYSTEMS TOPIC 4 MECHANISMS

CHECKLIST

I constructed a moving model using a range of workshop materials.

I constructed a mechanism using pulley wheels and a belt.

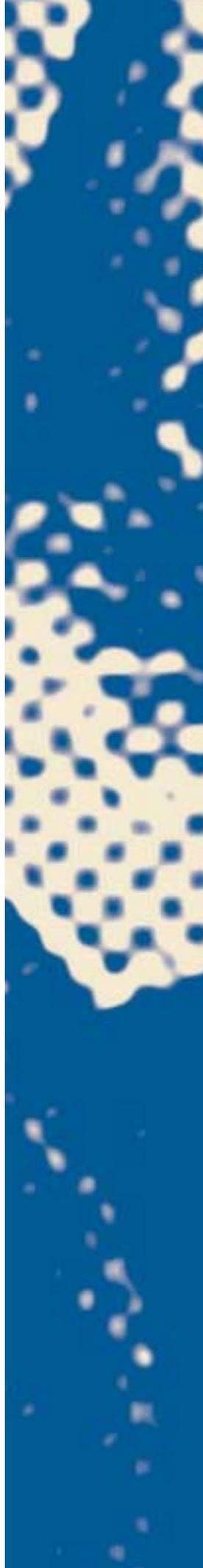
ENGINEERING

MODULE 5

ENGINEERING SYSTEMS

TOPIC 5

PNEUMATICS



MODULE 5:

ENGINEERING SYSTEMS

TOPIC 5

PNEUMATICS

PURPOSE

This topic provides a basic introduction to pneumatics and its applications in engineering. It will broaden the student's perception of engineering. It complements other modules in this specialism and contributes to the overall development of the students.

PREREQUISITES

Engineering Core.

AIMS

This Module aims to enable the students:

- to develop an awareness of the role that pneumatics plays in modern engineering
- to gain a basic understanding of compressed air as a source of power and its use in control systems
- to identify a range of pneumatic components, their function in a pneumatic circuit and everyday applications
- to construct pneumatic circuits from given diagrams using appropriate kits
- to develop an awareness of the range of graphic symbols and standards associated with pneumatics
- to develop an understanding of safe working practices in the use of compressed air and associated tools and equipment.

UNITS

Unit 1: Health, Safety and Personal Development

Unit 2: Compressed Air and Pneumatic Components

Unit 3: Pneumatic Circuit Construction

Unit 1: Health and Safety and Personal Development

LEARNING OUTCOMES

The student will be able to:

1. list the potential hazards associated with compressed air
2. know and adopt appropriate behaviours and safety measures in the use of pneumatic equipment and hand tools.

TEACHER GUIDELINES

- ▶ Use wall charts to display safety notices and symbols.
- ▶ Safe working practices and care of equipment should be central to all activities.

Unit 2: Compressed Air and Pneumatic Components

LEARNING OUTCOMES

The student will be able to:

1. identify common uses for compressed air in control systems and as an energy source
2. describe the operation principles of a reciprocating compressor
3. describe the operation of single acting and double acting pneumatic cylinders
4. describe the operation of 3/2 and 5/2 valves and their air-port layouts
5. describe the operation of 'and' and 'or' logic gates and their air-port layout
6. identify the graphic symbols representing each pneumatic component.

TEACHER GUIDELINES

- ▶ Use wall charts and work cards to identify the components and their ports.
- ▶ Visit local industries to show practical applications of pneumatics.
- ▶ Identify common use of compressed air that the students may come in contact with in their everyday lives e.g. bus doors, truck braking systems, tyre and garage equipment, road breaking pneumatic drills etc.
- ▶ Use overlays on the overhead projector to show the flow of air while the circuit is in different states.
- ▶ Integrate the teaching of this unit with unit 3 (pneumatic circuit construction).

Unit3: Pneumatic Circuit Construction

LEARNING OUTCOMES

The student will be able to:

1. construct pneumatic circuits using a 3/2 valve controlling single-acting spring return cylinder
2. construct a pneumatic circuit using a 2-3/2 valves controlling double-acting cylinder
3. construct a pneumatic circuit using 2-3/2 and 5/2 valves remotely controlling a double-acting cylinder
4. construct a pneumatic circuit using the automatic reciprocating action of a double-acting cylinder
5. construct a pneumatic circuit using speed controlled cylinder movement
6. construct a pneumatic circuit that requires the simultaneous actuation of two valves
7. construct a pneumatic circuit operable by the actuation of any one of two valves
8. identify practical applications for each circuit type constructed
9. draw the circuit diagram for each circuit constructed.

TEACHER GUIDELINES

- ▶ The chosen pneumatic circuits should be of a practical nature.
- ▶ Work cards can be used to display the circuit diagrams.
- ▶ Suitable pneumatic kits may be used for constructing the given circuits.
- ▶ The pneumatic components should be simple to connect and disconnect.
- ▶ Circuit diagrams should be provided to students.
- ▶ Students should be encouraged to show the flow of air on circuit diagrams while the circuit is in different states of control.

Teaching Strategy

This module is designed to be primarily about 'doing'. While class/group demonstrations/talks will be required, the duration of these should be kept to a minimum so as to maximise student activity. Use should be made of brief notes, sketches, and work cards to supplement demonstrations in providing necessary knowledge associated with skills, components and materials.

Pneumatic kits should be used to provide quick and efficient way of constructing and testing circuits. Permanent models incorporating pneumatic control systems may be manufactured, drawing on the skills that were learnt during other modules. Students should be encouraged to identify a number of examples of uses for pneumatic control. The use of field trips/industrial visits is recommended so as to extend the learning environment and to set the module's activities in a local/national industrial context. Involvement of entrepreneurs/specialists from local industry in providing talks/demonstrations to class groups will further contribute to these ends.

RESOURCES

A practical environment/workshop that provides the necessary facilities and equipment is required for this module.

Pneumatics Kits and accessories incorporating all components pertinent to the module outcomes.

Small pneumatic components such as those available in 'Testbed Technology' (Lennox) for project work.

KEY ASSIGNMENTS

MODULE 5: ENGINEERING SYSTEMS TOPIC 5 PNEUMATICS

CHECKLIST

I constructed a pneumatically controlled circuit.

I indicated the direction of airflow for given conditions on circuit diagrams provided.



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