

AN ROINN OIDEACHAIS AGUS EOLAÍOCHTA

THE JUNIOR CERTIFICATE

METALWORK

SYLLABUS

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METALWORK

General Aims.

The course provides an instruction to materials and process engineering in terms of a synthesis of activities and learning experiences. While the main thrust of the course is founded in practical and physical activities, it is also designed to develop extensively the affective and cognitive areas by virtue of integrative, inductive and holistic influences. Additionally the course has educational validity and application with respect to all pupils, independent of academic abilities while simultaneously serving to complement and develop such abilities.

The general aims of the course are to:

- (1) make an essential contribution to general educational development;
- (2) link observation and action with ingenuity and creativity and with problem-solving and higher level responses;
- (3) develop work-related disciplines;
- (4) provide insights into engineering technology at a variety of levels;
- (5) provide a basis for career decision-making and further studies;

Course Structure and Examination

The complete course carries 400 marks and is divided into two main sections

- (1) Techniques and Design which incorporates all of the practical work and is allocated 300 marks; 200 marks for a practical examination and 100 marks for project work;
- (2) Materials and Technology which is the related technical and technological comprehension, examined by written examination, carrying 100 marks

N.B. THE GRADING OF RESULTS IS TO BE BASED ON THE AGGREGATE OF THE MARKS OBTAINED IN THE TWO MAIN SECTIONS

TECHNIQUES AND DESIGN

Health and Safety

Safe handling: use and storage of all materials, tools and equipment used in the school workshop.

Personal protection: protective ware; control of dust and fumes.

Fire hazards: type, location and use of fire extinguishers.

Benchwork

Use of standard marking-out, measuring and gauging equipment according to systematic planned procedures. Simple exercises in setting-up and marking-out using surface plate, surface gauge and vee-blocks

Rapid methods of cutting waste sections from bar and sheet materials – metallics, plastics and, where appropriate, wood.

Preparation and finishing of material profiles using saws, shears, chisels, files and drills.

Drilling

Use of manual and power operated hand drills. Use of column drilling machine, for drilling, reaming and countersinking operations.

Work-holding by means of machine vice, hand vice, simple clamps and vee-blocks

Selection of suitable drilling speeds and feeds

Hot and Cold Forming of Materials

Straight edge bending of sheet materials using folders and formers; formation of straight beaded (safe) edge, wired edge, lap and grooved seam by the use of appropriate sheet metalworking tools.

Beaten metalworking techniques; simple hollowing and planishing operations

Bending, twisting and scrolling of bar and rod sections

Hot metal forming operations including drawing-down, angular bending, eyes and U-bends

Bending, pressing and casting of plastics

Fitting and Assembly

Cold riveting of light gauge steel and aluminium; use of pop rivets: countersunk and snap-head rivets.

Internal and external screw thread formation using hand stocks and dies, identification of screw threads.

Soft soldering of tinfoil, mild steel, copper and brass; butt, lap and "sweated" joints; use of flame heating, soldering bit and electric soldering iron. Simple brazing exercises. Selection and use of fluxes.

Fitting and assembly of parts using pins, rivets, screwed fasteners, soldering, brazing and adhesives.

Heat Treatment

Annealing and normalising of metals.

Hardening and tempering of small tools made from cast steel.

Case-hardening using a patented compound.

Use of water, oil and brine as quenching media.

Decorative finishing of materials

Improvement and variation of metal surfaces by: polishing, knurling, mottling, hammering and punching; simple repousse; etching and engraving.

Removal of, and protection from, oxidation: application of paints and lacquers; plastics dip coating and enamelling of metals; blending of material colours, lines and forms.

Lathework

General construction of centre lathe: movements and arrangements of main parts.

Work-holding by means of self-centring chuck; use of topslide, saddle and tailstock; parallel turning and surfacing; taper turning using topslide; chamfering, centring, drilling and knurling.

Holding and setting of tools: round-nose, side-cutting and knurling tools.

Design

Investigating the design and function of simple engineering components, mechanisms, structures and small-scale systems.

Designing and making applied to small engineering components

MATERIALS AND TECHNOLOGY

Health and Safety

Correct procedures and precautions relating to:

- the organisation and use of workshop, tools and equipment
- related materials and processes;
- personal health and safety

Communications and Planning

Interpretation and preparation of freehand working drawings, design details and diagrammatic illustrations.

Planning of methods, procedures and sequences of work. Basic exercises in research and planning for design purposes.

Materials Technology

Physical, mechanical, thermal and electrical properties of materials: solid, liquid and gas state materials.

Outline knowledge of the production of iron; production of steel by any modern method. Properties and application of: plain carbon steels, high speed steel and stainless steel; common non-ferrous metals and alloys.

Properties applications and sources of plastics: - Thermo-sets and thermo-plastics in common usage. Identification of plastics.

Standard methods and fabrication processes using metallic materials and plastics; use of wood as alternative structural and finishing material. Selection of finishes applied to materials for decorative and aesthetic purposes.

Effects of oxidation in metals: protective coatings.

Purpose of heat-treating metals: annealing. Effects of normalising, annealing, hardening and tempering plain carbon steels, case-hardening mild steel: effects of different cooling and quenching methods.

Tools Technology

Design features and selection of tools for:

benchwork including measuring and gauging; hot and cold forming; cutting and joining.

Design of cutting tools: rake and clearance angles; effects of variations in cutting angle; factors affecting cutting action; functions of cutting fluids.

Machine Tool Technology

Important features of drilling machine and centre lathe.

Methods of holding work for drilling and turning.

Work-holding methods

Basic drilling and turning processes

Selection and calculation of cutting speeds and feeds

Assemblies and Mechanisms

Principles of joining by: means of soft and hard soldering; brazing; heat sources and fluxes.

Joining by means of rivets: screw fastenings and adhesives, screw thread forms, specifications and mechanisms.

Construction: operation and design features of simple systems and mechanisms.