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ONTARIO

Department of Education

Courses of Study

Grade IX

SHOP COURSE IN VOCATIONAL SCHOOLS

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COURSES OF STUDY

FOR

Grade IX (Form I Lower School and Fifth Classes)

IN

Collegiate Institutes, High, Vocational and Continuation Schools
and Public and Separate Schools

SHOP COURSE IN VOCATIONAL SCHOOLS

Pupils enrolled in a Vocational Shop Course are given training in a variety of shops in the first year so that before entering the higher grades they may be able to select a particular shop in which they may complete the preparatory training necessary for admission to the trades and the industries.

Drafting

The aim of the ninth and tenth grade Drafting courses is to develop skill in the reading and making of working drawings and to provide instruction in the principles underlying orthographic projections and pictorial representations.

Freehand sketching and blueprint reading should be introduced early to develop the idea of the two-view or three-view working drawing properly dimensioned. Lessons in lettering should be informal with stress on neatness and legibility.

In the ninth grade all drawings should be done in pencil on light grade drawing paper (sheets not over 10" x 15") with the drafting ruling instruments, simple pencil compass and draftsman's scale (ink work should not be introduced until the tenth grade). Other drafting instruments and materials should be introduced as required. Some equipment for making blueprints is desirable, such as a simple sun-frame.

The work should be presented from objects, or isometric or picture drawings and instruction sheets so that the pupil will acquire skill in seeing things as they are shown on conventional working drawings and appreciate the purpose and positions of plan view, front and side elevations and sectional view. Care should be taken to reduce straight copy work to a minimum.

Projects in formal orthographic projection, constructive or descriptive geometry should be avoided until they have a definite relation to the work that the pupils are about to do.

The blueprint reading side of drafting should be emphasized throughout the course and it should be borne in mind that the drafting department should correlate academic work and shop work.

The selection of the projects and details of the drafting part of the Course will vary with each type of school and locality, but in general the course should include the following:

- (1) Lines. Use of simple instruments in drawing lines to given lengths and layout of rectangles and regular figures to given dimensions.
- (2) Lettering. Plain stroke freehand lettering.
- (3) Angles. Using set squares to draw lines to indicate angles of 30° , 45° , and 60° .
- (4) Dimension lines—the proper placing of dimensions on one-view plain figures.
- (5) Working drawings. Two-view drawings of simple rectangular figures, scale 12 inches = 1 foot.
- (6) Hidden outlines. Two-view or three-view working drawings to introduce the idea of hidden outlines.
- (7) Centre line. Three-view working drawings of rectangular objects with square holes and rectangular holes. Introducing centre lines and layout and dimensioning of simple objects which are symmetrical about a centre line.
- (8) Working drawings. Regular rectangular objects which have slots, rectangular or square holes, combining outlines, hidden outlines, centre lines, dimension lines. Scale of $6'' = 1$ foot may be used.
- (9) Angular objects. Working drawings (using straight lines) of wedge-shaped, tapered or angular objects.
- (10) Working drawings of objects made up of several parts (such as brackets) combining all the above exercises.
- (11) Detail and assembly drawings as applied to objects made up of several parts (such as nail-box, table, etc.). Scale $3'' = 1$ foot may be used.
- (12) Circular objects. Drawing of cylindrical objects and use of compass. Name and relation of parts of a circle.
- (13) Working plans of circular or semi-circular objects with circular holes and methods of locating and dimensioning the holes.
- (14) Sections. Sectional view and method of indicating it. Sectional hatching and typical examples of the use of sectional views.
- (15) Orthographic projection problems.
- (16) Typical sections. Drawings to demonstrate use of sectional views.
- (17) Working drawings of objects in which sectional views are used.
- (18) Profiles of threads. Enlarged profiles of simple threads to illustrate their characteristics.
- (19) Thread conventions. Standard practices for indicating threaded ends and tapped holes.
- (20) Machine parts. Details and assembly drawings of simple mechanical objects or tools with threads, tapped holes, countersunk holes or sections.

Practical Electricity

The course in electricity is designed to make the pupil familiar with some fundamental and practical electrical jobs and to enable him to acquire some of the common skills of the electrician. The principles underlying the operation of simple electrical apparatus should be stressed.

All wiring jobs connected with light, heat and power should conform to the requirements of the Hydro-Electric Power Commission of Ontario. Pupils should be encouraged to study Hydro regulations which apply to their work and to specify from trade catalogues the equipment needed for the various jobs.

(1) Current electricity. Making a simple electric circuit (using dry cells or a 6-volt battery) with switches or push buttons, wire, sockets and lights, or bell and buzzer.

(2) Making a circuit with dry cells in series and lights in series.

(3) Making a circuit using dry cells in parallel and lights in parallel.

(4) The dry cell: where used, construction and care.

(5) Making simple wire joints used in the electrical trade.

(6) Simple bell circuits, using dry cells, buttons and bells.

(7) Switches and push buttons: operation, care and use.

(8) Making (a) a permanent magnet, (b) an electro-magnet, (c) a combined permanent and electro-magnet, showing commercial application of various kinds of magnets.

(9) Magnetic field about permanent magnets illustrated by a wire in an electric circuit and an electro-magnet.

(10) Action of electric bells and buzzers.

(11) Installation of a simple annunciator circuit.

(12) Operation of blow-torch; its use for soldering joints.

(13) How to clean tin, and use soldering iron for soldering joints.

(14) Taping and water-proofing electric joints.

(15) Heating effect of the electric current in metal and non-metal conductors.

(16) Electric fuses: how constructed, where and why used, capacity and voltage.

(17) Conductors and insulators.

(18) Protection of conductors by fuses, including current-carrying capacity of standard wires and cables used in the home.

(19) Splicing flexible cords; repairing extension cords, iron cords, lamp cords, fixture cords, etc.

(20) Lamp sockets: care, types and use.

(21) Construction and use of test lamps for trouble shooting.

(22) Sufficient experimental acquaintance with elementary circuits to gain the concepts of volts, amperes, ohms, watts.

(23) How to read the kilowatt-hour meter and to compute a Hydro bill for light, heat and power.

(24) Cost of operating different electric appliances in the home.

(25) Main rules governing the action of a simple low-voltage motor.

(26) Study and care of small electric motors, electric trains, electro-magnets, Christmas-tree lights, etc.

(27) Studying motored appliances used in the home; their cleaning and repairing.

(28) Care and repairing of heating appliances used in the home.

(29) Study of the 6-volt storage battery used in automobiles, including care, testing and charging.

(30) Action of a D.C. generator and construction of a simple D.C. generator in the shop.

(31) Action of lightning rods; the necessity of perfect grounding.

(32) Installation of radio antennae, lightning arresters and ground wires.

(33) Electrical hazards in and around the home and how to test appliances for ground and live parts.

(34) Starter, ignition, lighting and generator circuits in automobiles.

(35) Complete wiring circuit used in a modern light car.

(36) Measurement of stranded wire sizes.

Machine Shop Practice

The aim of this part of the course in the Machine Shop Practice Course is to develop ability to perform simple machine operations in metal and to learn some of the simple skills common to the use of the ordinary hand-tools and equipment.

Pupil activity should be stressed, as this is to be work of an exploratory nature. Information in regard to construction, names, and functions of parts of machines and hand equipment should receive consideration but should not take precedence over suitable projects by the pupil. Skill in the operations necessary for such projects is essential. Safety precautions should be stressed.

The materials to be used are cast-iron and mild steel. The pupil should be able to recognize their characteristics and advantages.

1. Hand-tools and Bench Work:

(1) Securing work in the vise without injury to finished surface.

(2) The selection and use of files, chisels, soft and hard hammers.

(3) Cutting of materials by means of the hand hack-saw, riveting of parts together, marking of work by means of steel letters and numbers driven by a hammer.

- (4) Introduction to the use of taps and dies.
- (5) Bending and twisting light stock, cutting and working flat stock into shape; polishing.

2. Layout Work:

- (1) Coating of metal surfaces (copper sulphate, chalk, etc.) to facilitate layout.
- (2) Laying off a distance from the steel scale—the reading of the fractional scale of 1-64 inch.
- (3) Use of the scribe.
- (4) Methods of obtaining centres.
- (5) Use of hermaphrodite calipers.
- (6) Use of the centre punch on flat and round work.
- (7) Use of calipers and steel rule in checking work.

3. Machine Operations:

(a) Lathe:

- (1) Setting up work in machine, side facing, rough turning, parting, turning to a shoulder, finished turning and use of calipers in turning to size, knurling and polishing, taper turning by offset method.
- (2) Use of three-jaw and four-jaw universal chucks; end facing of work held in a chuck.
- (3) Belts and gears for the transmission of power, lubrication of machine, feeds and cutting speeds.

(b) Drill-press:

- (1) Operation, lubrication and maintenance of the machine.
- (2) Centre punching location for drilling, securing material in vise or V-block, sizes of drills and method of attachment in chuck, use of cooling and cutting compounds.
- (3) Drilling to a layout, method of drawing holes to a desired location, countersinking.

(c) Grinder:

Safety precautions and use of goggles, rough grinding to remove hard skin of material, rough grinding to bring material to size.

(d) Power hack-saw:

Setting up work, cutting to length, use of lubricants for cutting.

(e) Shaper:

Plain surfacing.

4. Forge Work:

Forging, hardening and tempering work should, when necessary to the project, be taught as an operation only, without any attempt at teaching the science involved.

Motor Mechanics

This part of the Course is intended to teach the pupil the fundamental principles and the construction and mechanical operation of the typical modern automotive vehicle. It should provide training in the simple skills required in dismantling, examining, assembling and in minor repairs and adjustments which can be made with simple hand-tools. The proper use of these tools and correct methods of dismantling and assembling precise mechanisms should be stressed. The courses should enable pupils to recognize dangerous mechanical conditions, to make simple running repairs, and to become careful and intelligent operators.

It is suggested that the name, purpose, construction and operation of each of the major parts be studied by the use of experimental methods. Concurrently with these studies assignments in type jobs should be given. These jobs should be directly related to the part under discussion. The jobs should require the pupil to dismantle, examine, assemble and make simple adjustments to various parts; to remove and replace some unit or group of units; to select, use and care for the simple hand-tools required; to give proper care to delicate or fragile parts and parts with machined and ground finishes. The engine is of more interest to the pupil than the rest of the vehicle and since it has application in other lines, it is recommended that a substantial part of the course be devoted to this unit.

In addition to the tools required it will be necessary to provide working equipment in the form of practice units and parts on which the pupils may carry out their assignments. Complete automobiles take up too much floor space and are not readily accessible to groups of pupils. It is advisable to procure engines, clutches, gear-boxes, drive-shafts, axles, steering-gears and other units and accessories and to mount them on suitable stands. These units should be thoroughly cleaned. Parts boxes should be provided for the dismantling operations.

An outline of this part of the course follows:

- (1) Types of automobiles—steam, electric, gasoline; brief outline of the advantages of each.
- (2) Definition, purpose and location of body-chassis, wheel-base, tread, clearance, frame, engine, transmission, steering-gears, brakes, springs, etc.
- (3) Simple conception of energy; gas and air mixed for combustion, heat expansion and pressure. A simple one-cylinder engine. Pupils should turn engine by hand, identify parts, dismantle and assemble.
- (4) The four-stroke cycle—intake, compression, power and exhaust strokes; position of piston and valves; R.P.M. of crankshaft and camshaft.
- (5) Properties of carbon-monoxide—danger, precautions, artificial respiration.

(6) Lubrication—simple theory, description and examination of one system, dismantling and assembling.

(7) Cooling system—radiator, pump, water-jackets; need for anti-freeze; examining and tracing one system.

(8) Electrical system—simple ignition system, battery, coil, breaker, spark-plug (confined to one-cylinder engine).

(9) Fastenings—identify and distinguish bolts, nuts, cap-screws, threads, rivets, washers, cotters; their use and application.

(10) Gasolene—precautions in its use; method of storing; prohibited for cleaning purposes; methods of extinguishing fire in burning gasolene.

(11) Fuel System—tank, pump, lines, carburetor; carburetor covered in its simplest form; effect of dirt and water in the system.

(12) Clutch—friction; single-plate.

(13) Gear-box—standard positions, effect on drive-shaft, speed, engaging in different positions, simple idea of mechanical advantage.

(14) Drive-shaft—types, universals.

(15) Rear axle—one type, differential, split-axle, revolutions of wheels when turning corner, gear reduction.

(16) Front axles—simple explanation, camber, caster, toe-in.

(17) Steering—one type, Ackerman principle.

(18) Brakes—shoes, drums, linkages, simple application to one wheel.

Printing

Objectives:

(1) A practical working familiarity with the California job case, case stands, type, composing stick, line gauge, slugs, proof press and cleaning materials.

(2) An elementary knowledge of justifying, spacing, centring, simple indentation, punctuation, capitalization, proof reading, word division, poetry indentations, and care of materials.

(3) Skill in setting type (prose and poetry), proofing, cleaning, and distribution.

Course:

(1) The California job case—lower case.

(2) Learning the case—complete layout.

(3) Spaces and quads—character, function, relative sizes.

(4) The composing stick—kinds, parts, adjustment, use.

(5) Pulling a proof in the stick.

(6) Distributing type from the stick.

(7) Justification—simple flush lines.

- (8) Distinguishing difficult letters.
- (9) Type, composition, parts, fontage.
- (10) Type measurements—elementary point system.
- (11) Spacing vs. justifying.
- (12) Paragraph composition.
- (13) Indentation.
- (14) Setting poetry.
- (15) Proof marks and their use.
- (16) The historic background of printing.
- (17) Printing as a vocation—organization, shop conditions, occupational opportunities and requirements.

Sheet Metal Work

The aim of this part of the Course is to teach the use of the common sheet metals and develop some of the fundamental skills of the trade. The metals used are galvanized iron, tin-plate, sheet copper and brass.

Skill should be developed in the use of the tools of this trade in the layout and the carrying out of sheet metal projects which are suited to the needs and interests of the pupils.

The topics to be covered include geometrical layout, fusing of metals, oxidation, reactions of soldering fluxes, alloys, conductivity of metals, manipulation of sheet metal and methods of working and joining the same.

(1) The soldering iron—oxidation of copper, prevention of oxidation, tinning, common use of the soldering iron in industrial and home use.

(2) Soldering—heating the iron, correct position of iron, fusing solder, use of flux.

(3) Galvanized sheet iron—purpose, method of manufacture, common uses, sizes and gauges.

(4) Sheet metal cutting tools—snips, squaring shears, pliers, safety precautions.

(5) Simple pattern development—marking tools, scale, gauges, seam allowances, bend lines.

(6) Folding and forming rectangular objects—adjustable bar folder, bending brake, closing folds, dressing laps, use of mallet, assembling and soldering.

(7) Tin-plate—method of manufacture, purpose and advantages, common uses.

(8) Making cylindrical objects—parallel line method of developing patterns, calculating circumference, use of dividers, cutting curved lines, use of forming rolls, stake, grooving tools, hammer, wired edges, assembling and soldering.

(9) Solders—common solder, component parts, reasons for different alloys.

(10) Soldering fluxes—the materials, purpose and reaction of common soldering fluxes.

(11) Sheet metal finishes—methods of preparing various sheet metals to take protective or decorative coatings.

Woodworking

The aim of this part of the Course is to enable the pupil to gain a knowledge of the fundamental woodworking processes and to develop facility in hand and machine tool operations which will enable him to undertake later courses in cabinet-making, building construction, and pattern-making.

Where offered, the Manual Training in Grades 7 and 8 should be used as a basis for a more intensive development of manipulative skills, accuracy and thoroughness.

Since small popular-priced woodworking machinery has been introduced into many homes, the pupil should be given the advantage of instruction in the care, upkeep and operation of such machinery. Special care should be taken to make the pupil safety conscious when working with motor-driven equipment.

The pupil should be taught the proper methods of finishing various woods, the use of both oil and water stains, shellac, filler for open grain woods and wax. He should be able also to apply a varnish finish rubbed and polished.

Pupils should be taught enough about the nature and structure of woods to appreciate the beauty of the grain of fine woods and to understand the care required to season and prepare the various woods for use in industry. He should be able to recognize common woods, both native and imported, to know something of their characteristics, the limitations of their use, etc., and the qualities that make them suitable for cabinet work, building construction or other commercial uses. In addition, he should know something about millwork and milling machinery, veneer cutting, quarter sawing, etc.

1. Hand Woodworking:

The materials to be used are pine, basswood, whitewood, gumwood, birch, oak. The pupil should become familiar with the hand-tools in the shop, know their applications, make necessary adjustments, and become skilful in sharpening the simpler keen edge-tools.

(1) Crosscut and rip sawing—methods of laying out and sawing material from stock; ability to recognize proper saws.

(2) Planing operations—planing surfaces, planing edges to width, planing ends, planing at an angle to the grain.

(3) Squaring stock—various steps in truing to size; the use of square and back saw.

(4) Chamfering—planing and chiselling a chamfer; stop-chamfering.

(5) Chiselling operations—paring, chiselling curves, perpendicular chiselling, use of mallet.

(6) Shaping outlines involving curves—use of coping-saw, bow-saw; the use of file and spokeshave for finishing.

(7) Common joints—butt, cross half-lap, mitre, dado, mortise and tenon, dowel—where used and why, relative strength, etc.

(8) Boring operations—use of various types of bits, the depth gauge; boring for screws and dowels.

(9) Abrasives—grades of sandpaper and its use; use of steel wool, etc., for sanding finishes.

(10) Fastening—with nails, screws and glue; kinds and sizes of nails and screws in common use; use and care of the screw-driver; glues—kinds, preparation, application, and the clamping of work.

(11) Finishing—staining, shellacking, varnishing and polishing; proper use and care of brushes; study of finishing materials.

(12) Pattern-making—a simple project that will teach the fundamental principles of pattern-making.

2. Machine Operations:

(1) Variety saw—crosscutting and ripping, cutting rabbets and dados.

(2) Band-saw—simple curves.

(3) Jig-saw—simple scrolls.

(4) Jointer—jointing edges.

(5) Lathe—rough and finish turning to size, shoulder and taper turning, simple beads and curves, face-plate turning, use of calipers and templates.

(6) Grinding—sharpening chisels and plane irons.