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ONTARIO

Department of Education

Courses of Study

Grade 13

THE
TECHNICAL COURSE

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The Minister of Education

THE
GRADE 13 TECHNICAL COURSE

INTRODUCTION OF THE COURSE

The Grade 13 Technical Course is intended to assist industry to secure a supply of persons with training on the technical level. A School Board which contemplates the introduction of this course should first ascertain, through its Advisory Vocational Committee, the nature and extent of the local need for such further vocational training. When the Board has satisfied itself that a Grade 13 Technical Course is needed and desired, the secretary of the Board should apply in writing to the Minister of Education, asking permission to establish the course.

The Minister's approval will be given only in those cases in which he is satisfied of the adequacy of the school staff to undertake the course and of the willingness of local industrial firms to support and co-operate in its development.

ADMISSION TO THE COURSE

Admission to the Grade 13 Technical Course is restricted to those who hold the Secondary School Graduation Diploma of the Industrial Course. A graduate of the Grade 13 Technical Course will be granted the Secondary School Honour Graduation Diploma of the Technical Course by the Department of Education. A graduate of the new course should be able to enter employment at a somewhat advanced level and to make rapid progress in that employment.

SUBJECTS AND TIME ALLOTMENT

	Number of Periods
English	7
*Physical Education	2
Mathematics	12
Science	12
Materials and Processes of Industry	4
Economics	2

*NOTE: For Physical Education the outline provided in Circular *Curriculum S. 29, Physical Education Grades 11, 12 and 13*, should be followed.

GRADE 13 TECHNICAL COURSE

ENGLISH LITERATURE

Through the study of English Literature the pupils should gain a broader and deeper understanding of life. A consideration of the ideas, intentions, and emotions of the authors whose works are being read will enable pupils to comprehend their actual or imagined experiences. Literary forms and techniques are to be studied for their contribution to the total impression.

The increasing maturity and practical experience of the pupils in this grade suggest that their attention be directed to some of the best contemporary works so that discrimination and good taste may be developed and their reading experience enlarged.

It is assumed that much of the material will be read at home before class study begins. Discussion will, as a result, be more profitable, and the significance of selected excerpts read by way of illustration will be more readily appreciated. Papers and reports should be given by the pupils in the co-operative spirit of a common adventure shared by the teacher as well as the class. The methods employed in the effective conduct of seminars and round table discussion groups are recommended.

"School Editions" are to be avoided; the teacher might make selections from the relatively inexpensive paper-back editions where they are available. Teachers are free to make their own selections within the classes indicated.

COURSE OF STUDY

Drama	(a) A play by Shakespeare not previously studied. (b) A modern play.
Novel	A Novel from either (a) or (b) (a) A modern Canadian novel, preferably one dealing with the contemporary scene. (b) A modern novel.
Poetry	*Either* one large anthology *Or* one or two smaller volumes.
Non-Fiction	A collection of essays or stories, or a biography, or a worthwhile, thought-provoking book on any subject.

GRADE 13 TECHNICAL COURSE

ENGLISH COMPOSITION

A course in English Composition should help pupils to make intelligent and accurate observations, to organize their ideas logically, and to communicate their thoughts purposefully and effectively. It should provide opportunities for them to use English clearly, correctly, and pleasingly through a study of correct usage and by constant practice in oral and written exercises.

Emphasis should be placed on writing and speaking with a purpose rather than on exercises in a textbook that is concerned with the mechanics of expression. With pupils of some maturity and often some experience in Industry, the workshop method offers certain advantages over traditional classroom practices.

Pupils should be encouraged to appraise their own or other pupils' writing with regard to one or more specific qualities such as unity, emphasis, clarity, reader interest, or to read with a view to noting errors in grammar, spelling, punctuation, or construction.

Regular, frequent, well-planned practice in writing for every pupil throughout the school year is of supreme importance.

COURSE OF STUDY

The course should include most of the following topics:

Letters: Good form and content: usefulness, propriety and effective style; letters of enquiry and reply, application, complaint, adjustment, collection, etc.

Précis: The principles of précis writing; the pupil's version should be about one-quarter or one-third the length of the original, should be logically developed, and expressed mainly in his own words. Materials chosen should be interesting and challenging, and related to trade and industry.

Paragraphs: A review of the principles of paragraph structure and the variety of treatment for special effect.

Reports: Purpose, form and content; gathering information, recording observations for a specific purpose, and communicating salient ideas clearly and concisely; the use of graphical illustrations, charts, tables; plant-visits reports, research reports; shop directives, production reports, etc.

Exposition and Argument: Essays of sufficient length to give opportunity to organize a considerable body of thought. In Argument, the study of the nature of proof. Topics should be related to current economic developments.

Logic: Some attention may be given to the study of logic; the examination of propositions, deductive reasoning and syllogisms; inductive reasoning, circumstantial and direct evidence; the fallacies.

Public Speaking: The use of a tape recorder is advised to assist in improving the quality of the pupil's oral expression. Techniques of oral reports; the various types of speeches; problems of stating facts and grievances without provocative wording; clarity and perspective. The study of the conduct of meetings, rules of procedure, and the scope and powers of committees.

English Expression: Regular attention should be given to the development of the pupil's vocabulary, reading technique, and correct use of grammar and punctuation.

GRADE 13 TECHNICAL COURSE

APPLIED MATHEMATICS

The courses in mathematics are based on the assumption that the pupil has completed successfully the work in mathematics in the preceding years, and that he has a natural aptitude in this subject.

The work in algebra, trigonometry, and geometry should be studied concurrently, whereas the calculus should be undertaken only when the other mathematics courses are near completion. Because of the length of the course and the necessity for achieving competence in the algebra, trigonometry, and geometry, it may be that little time will be left to do more than introduce the pupil to the basic methods of calculus.

The slide rule should be used for all computations except where a greater degree of accuracy is required.

1. ALGEBRA

A. Quadratic Equations

Review of Grade 12 quadratic equations: Solution by graphic method, factoring method, completing the square, and use of quadratic formula. (See *Curriculum I. and S. 27*).

Solution of equations reducible to quadratics; e.g. $x^4—5x^2 + 4 = 0$; solution of simultaneous quadratic equations; imaginary roots; solution of higher degree equations by (1) factoring method (2) graphical method.

Applications to the solution of equations involving engineering formulas, and to literal problems requiring the construction of the equation.

B. Surds

Review of Grade 11 index laws and Grade 12 surds (see *Curriculum I. and S. 27*).

Solution of surd equations of the type: $\sqrt{2x + 6} + \sqrt{3x + 1} = 8$; transposition of expressions involving roots and surds. Applications to the manipulation of engineering formulas.

C. Variation

Direct, inverse and joint; determination of laws from experimental results, (1) linear laws, (2) laws reducible to linear form. Applications to experimental results.

D. Series

Arithmetic progression; nth term of a series; sum of n terms. Geometric progression; nth term of a series; sum of n terms; sum to infinity. Applications to problems of an engineering and an economic nature: i.e. annuities, bonds, debentures, probability of occurrence of events, basic statistics.

The binomial theorem; expansion of $(a + b)^n$; factorial notation. Application to the calculation of approximate values; e.g. $(1.02)^5$ and $(0.996)^3$ and to approximate percentage errors.

E. Logarithms

Review Grade 11 logarithms (see *Curriculum I. and S. 27*). Logarithms to base 'e'; change of base; solution of exponential equations such as $3^{2x}=5$; graphs of exponential functions.

Applications to the evaluation of engineering formulas.

3. TRIGONOMETRY

Accuracy and significance of numbers should be introduced and stressed. The techniques in handling problems should be discussed thoroughly.

A. Review of Grade 12 Trigonometry (see *Curriculum I. and S. 27*). Simple identities such as $\frac{\sin A}{\cos A}=\tan A$, $\sin^2A+\cos^2A=1$; circular measure in radians; applications to angular velocity and angular acceleration; ratios of angles of any magnitude; graphs of trigonometric functions; solution of the oblique triangle; the law of sines; the law of cosines.

Applications to problems on distances, areas, engineering design, navigation, frameworks and to three dimensional problems.

B. Analytical Trigonometry

Expansion of sin (A ± B), cos (A ± B), and tan (A ± B); formulas for sin 2A, cos 2A and tan 2A; half angle formulas; transformation of sums and differences into products; inverse notation; solution of equations such as 3 sin A = 4 cos A and quadratic types such as $5\sin^2A - \cos A = 2.25$. Applications to problems of an engineering nature.

3. INTRODUCTION TO ANALYTICAL GEOMETRY

Points and distances; the straight-line law; the slope of a line.
The fundamental concept of slope should be stressed.
The equations of the circle, the parabola, and the rectangular hyperbola.
Comparison of the curves of conic sections.
Applications of these equations to algebraic graphs.

4. INTRODUCTION TO CALCULUS

A. Differential Calculus

The functional notation; slope of a curve at a point; limiting value of $\frac{\triangle y}{\triangle x}$; tangents and normals; differentiation from first principles; the meaning of $\frac{dy}{dx}$; the general rule, if $y = ax^n$, then $\frac{dy}{dx} = nax^{N-1}$; successive differentiation; the notation $\frac{d^2y}{dx^2}$;

Applications to problems on rate of change, velocity and acceleration.
Maxima and minima; the turning point of a curve; rules for distinguishing between maximum and minimum values.
Applications to problems on maximum or minimum lengths, areas, volumes and to engineering formulas.
Differentiation of a function of a function.
Applications to problems involving rates of change, and small corrections.
Differentiation of products and quotients.
Differentiation of sin x, cos x and tan x and simple expressions involving products, quotients and powers.

B. Integral Calculus

Integration as the inverse of differentiation; the integration symbol—$\int$; indefinite integrals; the general rule of integration; the constant of integration.

Applications to velocity and acceleration problems.

Definite integrals; areas by integration.

Applications to problems involving areas such as area under a curve, circle and triangle and to work done by expanding gases and extending springs.

Volumes by integration.

Applications to volumes such as sphere, segment of a sphere, cone, and segment of a cone.

Simpson's rule.

Centres of gravity or centroids by integration.

Applications to problems involving centroids of shapes such as semi-circle, triangle, and parabola.

5. COMPLEX NUMBERS

This might be an optional topic for students who have specialized in Electricity.

In addition to the customary drill exercises following the teaching of a lesson, the student should obtain practice in applying the principles learned to problems which he will encounter either in industry or during the course of any advanced technical or engineering training he may follow. In the course of study, reference is made to such applications in general terms.

For more specific examples of suitable technical and engineering problems, the following texts might be consulted:

**Mathematics for Technical Students, Parts I, II and III*
Geary, Lowry and Hayden (Longmans).

**National Certificate Mathematics, Volumes I, II and III*
Abott and Kerridge (English Universities Press).

**Elementary Practical Mathematics, Books I, II and III*
Golding and Green (Pitman).

**Mathematics for Technical Students, Books I, II and III*
Gasson (Cambridge University Press).

**Mathematics for Students of Technology, Junior and Senior Courses*
L. B. Benny (Oxford University Press).

Industrial Algebra and Trigonometry
Wolfe, Mueller and Mullikin (McGraw-Hill).

Mathematics for Electricians
Martin H. Kuehn (McGraw-Hill).

Applied Mathematics for Radio and Communication Engineers
Smith (McGraw-Hill)

Further applications may be found in texts being used for the other subjects of the Grade 13 Technical Course.

*It is suggested that one of these series of texts might be used to cover this course of study.

GRADE 13 TECHNICAL COURSE

SCIENCE

Although the mathematical approach should be stressed, graphical methods should be used where they are applicable.

In order to cover every topic adequately, it will be necessary to lay out the programme for the entire year and budget the time available very carefully.

The courses should be presented with sufficient balance between experiment and theory to hold and increase the interest of the average pupil.

The suggested allotment of periods per week is as follows:

Chemistry	4
Mechanics	4
Heat	2
Strength of Materials	2

See Appendix A for suggestions regarding laboratory work.

See Appendix B for suggested texts.

CHEMISTRY

The Grade 13 Technical Chemistry is a continuation of the course studied in Grades 11 and 12. However, much more emphasis should be placed on the theoretical aspects than was the case in the previous years. Pupils should, of course, perform laboratory experiments where possible and be encouraged to make accurate observations and draw logical conclusions. Pupils should acquire some knowledge of the scientific method with its interdependence of ideas (theories, laws, etc.) and observations.

A variety of good reference books should be available in the classroom, and students should be encouraged to use them.

1. Introduction

Physical and chemical changes; The scientific method.

2. Classifications of Matter

Mixtures and non-mixtures; pure substances, compounds and elements; solutions and mechanical mixtures; states of matter; solids, liquids, gases.

3. Properties of Matter

GASES: Boyle's and Charles' Laws: partial pressure; problems.

LIQUIDS: evaporation and condensation; boiling and freezing points, vapour pressure; kinetic—molecular theory. Unsaturated, saturated and supersaturated solutions; the concept of equilibrium.

SOLIDS: crystalline and amorphous solids.

4. Atomic Theory

The Laws of Chemical Combination; Dalton's atomic theory; atomic and molecular weights and their determinations; gram-atomic and gram-molecular weights; problems.

5. Chemical Formulas and Equations

Symbols; formulas; valence; practice in the use of valence rules. Chemical Reactions:—combination, decomposition, displacement, double decomposition; oxidation and reduction; exothermic and endothermic reactions; practice in balancing equations.

6. Atomic Structure

The nucleus; atomic particles; electron-shells; atomic numbers; bonding; ionic and covalent bonds. Isotopes: radioactivity; nuclear reactions.

7. Acids and Bases

Metals and non-metals and their compounds; acids, bases, and salts; ionization; neutralization and hydrolysis; equivalent weights and normality; problems.

8. The Periodic Table

History of development of the table; its general features (connected with atomic structure); two groups, as examples:—the alkali metals, and the halogens.

9. Equilibrium. Physical equilibrium.

Water—water vapour, iodine—iodine vapour, ice—water, a solid and a saturated solution.

Chemical equilibrium

Discussion of Le Chatelier's principle and the effects of temperature, pressure and concentration on equilibrium, illustrated by actual processes such as the Haber process and the contact method for sulphuric acid.

10. Rate of Reaction

Effect of temperature, concentration, state of subdivision on rate of reaction; catalysts (with examples from industry).

11. Descriptive Chemistry

As much descriptive chemistry as time permits should be given, not at one time, but distributed throughout the course.

(a) The common gases; air, oxygen, nitrogen, hydrogen.
(b) Water and electrolysis
(c) Common compounds of sulphur
(d) Salt and compounds derived from it
(e) Compounds of nitrogen
(f) Compounds of calcium and magnesium
(g) The alkali metals and the halogens as mentioned above.

Suggested Texts:

1. *Essentials of Chemistry*, Graham and Cragg (Clarke, Irwin & Co.).
2. *Chemistry for Our Times*, Weaver and Foster (McGraw-Hill).

MECHANICS

A. Forces

Review of the work of Grades 11 and 12 as applicable (see *Curriculum I. and S. 27*). Bow's notation; polygon of forces; beam reactions; resolution of forces into components; conditions of equilibrium; funicular or link polygon. Applications to framework structures such as roof trusses and cranes. Friction and the inclined plane; angle of repose or angle of friction.

Applications to bodies moving up or down an inclined plane.

B. Work and power

Review of the work of Grade 10 as applicable (see *Curriculum I. and S. 27*). Units; graphical representation of work; torque; turning moment diagrams; horsepower; transmission of power; mechanical equivalent of heat; electrical unit of power.

Applications to problems on machines such as engines, motors, elevators, pumps, belts, and shafts.

C. Machines

Review of the work of Grades 11 and 12 (see *Curriculum I. and S. 27*). The effect of friction; the effect of lubrication; coefficient of friction and its value for various materials.

Applications to problems on mechanical lever machinery, mechanical hoisting machinery, machine drives, pulley systems, the differential pulley, wheel and axle, inclined plane, screw jack, gear drives, belt and chain drives, and worm and wheel.

D. Velocity and acceleration

Units; velocity-time graphs; formulas connecting distance, velocity, acceleration, and time; graphical representation of velocity and acceleration; relative velocity; projectiles.

Applications to problems on moving vehicles, elevators, braking, falling bodies, projectiles, and water jets.

E. Angular motion

Units; the radian; conversion of velocity and acceleration from linear to angular; formulas connecting angular displacement, velocity, acceleration, and time.

F. Force acceleration

Newton's laws; force of gravity; mass and weight; momentum; absolute system of units; engineer's system of units.

Applications to problems involving the force required to produce motion and resistance to motion.

G. Potential and kinetic energy

Units; formulas; conservation of energy; radius of gyration and the kinetic energy of rotation.

Applications to problems on falling bodies, moving vehicles, and the flywheel.

H. Motion in a circular path

Units; formulas for centripetal and centrifugal force; balancing of rotating bodies; magnitude and angular position of balancing forces; simple harmonic motion and the simple pendulum.

Applications to problems on revolving shafts and wheels, vehicles moving in a circular path, and balance weights.

J. Pressure of liquids

Units; pressure in closed vessels; principle of hydraulic machines; pressure due to head of a liquid; pressure at a depth; total pressure; centre of pressure.

Applications to problems on water tanks, dams, lock gates, and hydraulic machines.

K. Flow of liquids

Flow through an orifice, potential and kinetic energy; coefficient of velocity; contraction of area of jet; coefficient of discharge; coefficient of contraction.

Applications to problems on the rate of flow of liquids through tank orifices and to the calculation of orifice dimensions.

HEAT

A. Quantity of heat

Review of the work of Grades 11 and 12 (see *Curriculum I. and S. 27*). Calorific value of fuels.

Mechanical equivalent of heat; electrical equivalent of heat. Applications to problems involving the cost and efficiency of heating systems, the mechanical and electrical equivalents of heat and specific heat calculations.

B. Steam and the steam plant

Sensible heat of water, latent heat of fusion and vaporization; total heat of steam; absolute units; use of the steam tables; dryness fraction of steam; superheated steam.

Layout and function of the steam plant; steam-driven electrical generating plant; steam condensers and boilers; boiler efficiency.

Applications to problems involving the use of steam tables and to the thermal efficiency of a boiler.

C. Expansion and compression of gases

A perfect gas; Boyle's Law; Charles' Law; absolute temperature and pressure; Boyle's Law and Charles' Law combined; normal temperature and pressure; specific heats of a gas.

Applications to problems involving the gas laws, pressure vessels, compressors, and heat engines.

D. Introduction of Heat Engines

Work done in the cylinder; pressure-volume diagrams; mean effective pressure; the indicator diagram; the slide valve; cycle of operations for (1) the steam engine, (2) the internal combustion engine; the Otto cycle; I.H.P., B.H.P., and their measurement; friction horse power; mechanical efficiency; brake thermal efficiency; fuel consumption.

Applications to heat engine tests and to calculations such as B.H.P., mechanical and thermal efficiencies, and fuel consumption.

STRENGTH OF MATERIALS

A. Simple stresses

Units; Hooke's Law; load-extension graph; Young's Modulus; ultimate tensile strength; safety factor; allowable working stress; complete stress-strain diagram; elastic limit; yield point; shear stress; modulus of rigidity; strain energy.

Thin pipes or cylinders: circumferential or hoop stress; longitudinal stress.

Application to laboratory tests on strengths of materials; the calculation of dimensions of and stresses in bolts, rivets, bars, and wires.

B. Beams and bending

Simply supported beams; types of loading; shear force; convention for positive and negative shear force; shear force diagrams for beams with uniform and concentrated loads; bending moments; convention for positive and negative bending moments; bending moment diagrams.

Applications to problems involving simply supported and cantilever beams. Theory of bending; position of neutral axis; bending stress; radius of curvature; moment of inertia or second moment of area; applications to problems involving stresses in beams.

C. Torsion

Units; relationship between torque, angle of twist, and shear stress; polar moment of inertia of a circular section; formulas for stresses in solid and hollow shafts; horsepower transmitted by a shaft; close-coiled springs.

Applications to problems involving rotating shafts and to problems on close-coiled helical springs.

APPENDIX A

Experimental laboratory work by the pupils is an essential part of this course of study. The following experiments should be conducted at the appropriate time in order to verify the leading principles being taught in the classroom:

MECHANICS

1. To determine the reaction of beam supports, i.e. sum of the upward supporting forces = sum of the loads.
2. To verify the Principle of Moments (for a system in equilibrium, the sum of the clockwise moments = the sum of the counter-clockwise moments.
3. To verify the general conditions of equilibrium for coplanar forces:
   (a) the vector polygon closes
   (b) the funicular or link polygon closes.
4. To determine the relationship between the coefficient of friction and the angle of friction using an inclined plane.
5. To verify the laws of static friction for dry surfaces.
   (a) friction force depends on the type of material
   (b) coefficient of friction $= \frac{\text{friction force}}{\text{normal reaction}}$
6. To determine the velocity ratio, mechanical advantage, friction, and efficiency of simple machines such as pulley, wheel and axle, worm and wheel, screw jack, the inclined plane, and gear drives.
7. To determine the centroids of various figures such as triangles, semi-circle, beam sections, and irregular figures.
8. To determine the effect of friction torque:
   (a) comparison of friction in plain and ball bearings;
   (b) efficiency of bearings at various loads;
   (c) work done against friction.
9. To find a value for "g" by the free-fall method.
10. Atwood's machine experiments:
    (a) to show that force produces an acceleration;
    (b) to find the acceleration produced on a mass by a force;
    (c) to verify the formulas for uniformly accelerated motion.
11. Fletcher trolley experiments:
    (a) to show that force produces an acceleration;
    (b) to verify Newton's second law.
12. To determine the kinetic energy and the radius of gyration for various flywheels.

STRENGTH OF MATERIALS

1. To verify Hooke's Law and to determine the Modulus of Elasticity for steel using a steel wire.
2. Commercial test on a mild steel bar to determine the percentage reduction in area, percentage elongation, ultimate stress, and Modulus of Elasticity.

HEAT

1. To determine the specific and latent heats of various substances.
2. To determine the variation of pressure with the boiling point.
3. To determine the dryness fraction of steam.
4. To find the calorific value of fuels.
5. To determine Joule's mechanical equivalent of heat.
6. To verify Boyle's Law.
7. To verify Charles' Law.
8. Boiler efficiency tests.
9. Engine tests to determine I.H.P., B.H.P., fuel consumption, and mechanical and thermal efficiencies.

The following texts are suggested as guides in conducting these experiments:

Engineering Science, Vols. 1 and 2,
Brown and Bryant (Macmillan).

Practical Physics,
White, Manning, Weber, and Cornett (McGraw-Hill).

APPENDIX B

Any one of the following series of texts covers this course of study.

1. *Mechanical Engineering Science, Vols. 1 and 2,*
J. D. Walker (English Universities Press) (Musson).
2. *Engineering Science, Vols. 1 and 2,*
Brown and Bryant (Macmillan).
3. *Engineering Science, 1st year and 2nd year, and Mechanics for Engineering Students*, Bird (Pitman).
4. *Elementary Engineering Science, Mechanical Engineering Science, and Applied Mechanics*, Morley and Hughes (Longmans).
5. *Mechanics and Applied Heat,*
Moorfield and Winstanley (Macmillan).

GRADE 13 TECHNICAL COURSE

MATERIALS AND PROCESSES OF INDUSTRY

It is suggested that a number of well-organized visits to industrial plants be made to familiarize the pupils with various technical and commercial routines.

1. **Iron and steel**
   Iron ores, the blast furnace; cast iron; wrought iron; malleable cast iron; open-hearth steel; Bessemer steel; carbon steel; crucible steel; electric steel; alloy steels; high-speed steels; hot rolling; cold rolling; cold drawing; moulding and casting.
2. **Treatment of iron and steel**
   Heat treatment; furnaces; pyrometers; annealing; normalizing; hardening and tempering; case hardening.
3. **Non-ferrous metals and alloys**
   Aluminum and its alloys; copper and its alloys; bronze; zinc; brass.
4. **Heat processes**
   Hand forging; forging tools; bending; punching; power forging; drop forging; drop stamps and dies; welding processes such as arc, argon, spot, resistance, and gas.
5. **Plating processes**
   Nickel, copper, tin, cadmium, and chrome.
6. **Production machining processes**
   The turret lathe, horizontal and vertical; tooling attachments; automatic lathes, single spindle, multiple spindle; cams and tooling attachments; boring machines, vertical and horizontal, tooling attachments; planing, shaping and slotting machines, tooling attachments; milling machines, horizontal, vertical and universal, tooling attachments; broaching machines, broaches, drilling machines, single and multiple spindle, radial drilling machines, grinding machines, wheels; cylindrical, surface, and centreless grinding.
7. **Automation**
   Modern trends in the use of automatic production machinery.
   This should be studied with respect to:
   (a) basic hydraulics;
   (b) basic electrical circuits;
   (c) types of conveyors and routing parts for assembly;
   (d) maintaining assembly schedules and inventory control.

The following texts are suggested:

1. *Manufacturing Methods*,
   Schaller (McGraw-Hill).
2. *Materials and Processes*,
   Kohn and Starfield (Macmillan).
3. *Workshop Technology, Parts I and II*,
   W. A. J. Chapman (Macmillan).
4. *Production Forecasting, Planning Control*,
   E. H. MacNiece (McGraw-Hill).

GRADE 13 TECHNICAL COURSE

ECONOMICS

The course should be taught so that it will present the student with an economic background which will be useful to him both in the present and in the future. It should be related to business problems which the pupil can understand. References to, and use of, financial newspapers and magazines and actual business reports should be an integral part of the course.

Topics should be selected having in mind the course which the pupil studied in Grade 12, so that unnecessary duplication is avoided.

Introduction

Scope and purpose of Economics.
Problems with which the subject deals.

Business Organization

Kinds of business organizations; securities, speculation and investment; corporate control; monopolies; public utilities.

Production

Supply and demand; factors affecting the location of industry and its effects on the locality; marketing, wholesale and retail; advertising; consumer protection; supply schedule and supply curve; price; taxation and its effects.

Money, Banking, Credit

Functions of money; consumer price index; wages; interest rates; banking systems; Bank of Canada and the structure of Canadian banking; credit and credit control.

National Accounts

A study of Canadian statistics such as the following: national income; productivity; gross national product; distribution of output; population growth and trends.

International Trade

Factors affecting International Trade; balance of payments and exchange rate determination; free trade; tariffs.

Distribution of Income

Personal finances; budgeting; instalment buying; life insurance; wages; rent; interest; profit; annual business reports.

Labour

Labour organizations and unions; relations with employers; unemployment; labour legislation.

Economic Security

Assumption of responsibility by state and by industry; business cycles, history, theories, control; social legislation and services.

Contemporary Economic Issues

These should be selected on the basis of general interest and importance.

REFERENCE BOOKS

Applied Economics, J. H. Dodd (Gage)
Basic Economics, Gayer, Harriss & Spencer (Ryerson)
Banking & Exchange, Steinberg (Pitman)
Economics of Everyday Life, Williams (Penguin)
Canada Year Book (latest edition), Dominion Bureau of Statistics (Queen's Printer, Ottawa)